NATIONAL MARINE FISHERIES SERVICE REPORT

National Marine Fisheries Service (NMFS) Northwest Region will briefly report on recent regulatory developments relevant to groundfish fisheries and issues of interest to the Council.

NMFS Northwest Fisheries Science Center will also briefly report on groundfish-related science and research activities.

Council Task:

Discussion.

Reference Materials:

1. Agenda Item H.1.b, Attachment 1: *Federal Register* Notices Published Since the Last Council Meeting.

Agenda Order:

a.	Agenda Item Overview	Kelly Ames
b.	Regulatory Activities	Frank Lockhart
c.	Fisheries Science Center Activities	John Stein and Michelle McClure
d.	Reports and Comments of Advisory Bodies and Management Entities	
e.	Public Comment	
f.	Council Discussion	

PFMC
08/23/12

Groundfish and Halibut Notices
6/2/12 through 8/20/12

Documents available at NMFS Sustainable Fisheries Groundfish Web Site
http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/index.cfm

77 FR 35961. Environmental Impacts Statements; Notice of Availability. EIS No. 20120190, Draft EIS, NOAA, OO, Harvest Specifications and Management Measures for the 2013-2014 Pacific Coast Groundfish Fishery and Amendment 21-2 - 6/15/12

77 FR 45508. Pacific Coast Groundfish Fishery Management Plan; Trawl Rationalization Program. Action: Temporary rule; emergency action - 8/1/12

77 FR 47322. Fisheries off West Coast States; Biennial Specifications and Management Measures; Inseason Adjustments. Action: Final rule; inseason adjustments to biennial groundfish management measures - 8/8/12

Science, Service, Stewardship

Groundfish Science Report

Michelle McClure and John Stein
Northwest Fisheries Science Center

September 16, 2012

NOAA FISHERIES SERVICE

Overview

- Heads ups
- Economics/Social Science
- Surveys and bycatch research
- Joint hake-sardine survey

Upcoming

- Personnel changes -- limited resources near-term
  - Assessment
  - Observer
- National Bycatch Report
- Stock complex analysis

Economic Data Collection (EDC) Program

- 2011 Data – Due September 1, 2012
  - —Received 209 out of 245 forms
  - —All mothership and catcher processor forms are complete
  - —81% of catcher vessel forms are complete
  - —42% of first receiver and shore-based processor forms are complete
- 2009 and 2010 Baseline Data
  - —Wrapping up QA/QC and database development
  - —Have worked closely with industry to complete forms and verify information submitted
- Developing web-based interface for next year
- SSC methods review at November Council meeting
- Data are being incorporating into IO-PAC model, which will also be reviewed by the SSC in November

Pacific Coast Groundfish Fishery Social Study 2012

- Voluntary survey collects social (non-economic) data including social changes and impacts as a result of the catch shares program in relevant fishing communities and industries.
- First post-catch shares data collection effort.
- Data collection began in July 2012 and will end in December 2012.
- Baseline data is from 2010.

For study information or questions contact:

Suzanne Russell

Social Scientist, NWFSC

(206) 860-3274
NWFSC.study@noaa.gov

West Coast Groundfish Bottom Trawl Survey

Pass 1: May 14 – July 25 Completed
(with 3 weather days)
Vessels: F/V *Ms. Julie* and F/V *Noah's Ark*
Fish sales \$21,864; fuel costs \$76,609

Pass 2: Aug. 14 – Oct. 23 Current
vessels: F/V Noah's Ark and F/V Excalibur

Status of Pass Two:

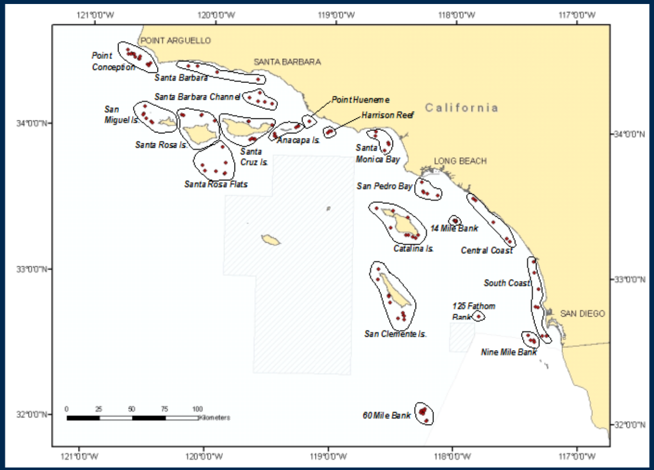
Stations:
752 planned
~536 completed by Sept. 13th

Days-at-sea:
188 planned
134 completed by Sept. 13th

Southern California Shelf Rockfish Hook and Line Survey 2012

<u>2012 Survey</u>

- 9th year in survey time series
- Scheduled Dates: Sept. 21 – Oct. 4 (24 sea-days)
- Chartered Vessels: F/V Aggressor, F/V Mirage
- 121 stations scheduled for sampling



<u>August 2012 NCRWG Meeting</u>

- Presentation to NOAA's national cooperative research working group
- Scientists and vessel captains shared their thoughts on 10 years of successful research collaboration

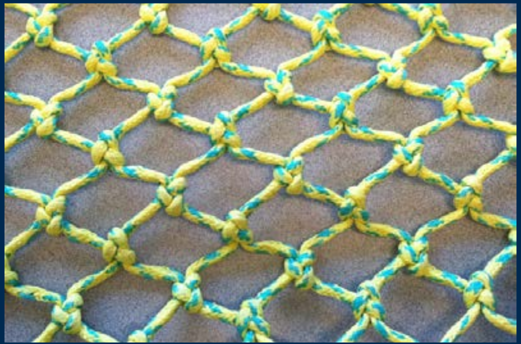
Habitat and Conservation Engineering

- Testing a NMFS/Industry Collaborative Design of a Rockfish Flexible Sorting Grate BRD in the Hake Fishery, conducted Aboard the F/V *Perseverance* in June/July 2012.

- Examining the selectivity of three codends that differ in mesh size and configuration, NMFS Cooperative Research Project, Sept 2012 (NWFSC, PSMFC, ODFW), conducted aboard the F/V *Last Straw* in September 2012.

4.5” diamond mesh

4.5” T-90 mesh



5.5” T-90 mesh

Joint NW, SW, Canada and Industry Hake-Sardine Survey

Goals

- Survey and biomass estimate of Pacific sardine and Pacific hake using the acoustic-trawl method (ATM)

- Pilot study to test feasibility of joint (sardine/hake) survey

- Sample oceanographic, planktonic, and atmospheric environment as possible

Survey Overview

June 24 – Aug. 23, 2012

4 vessels:

—NOAA Ship *Bell M. Shimada*

- Acoustics U.S. hake, US+CAN sardine
- Sardine trawls, net tows, CTD, underway CTD

—F/V *Forum Star*

- Hake trawls, camera

—CCGS *W. E. Ricker*

- Acoustics CAN hake
- Hake trawls, camera, some CTD

F/V *Forum Star*

- June 22 – Aug 12, 2012
- 73 completed trawls
  - Trawls for species ID'd and length for hake survey
  - camera
  - limited acoustics

Tracklines

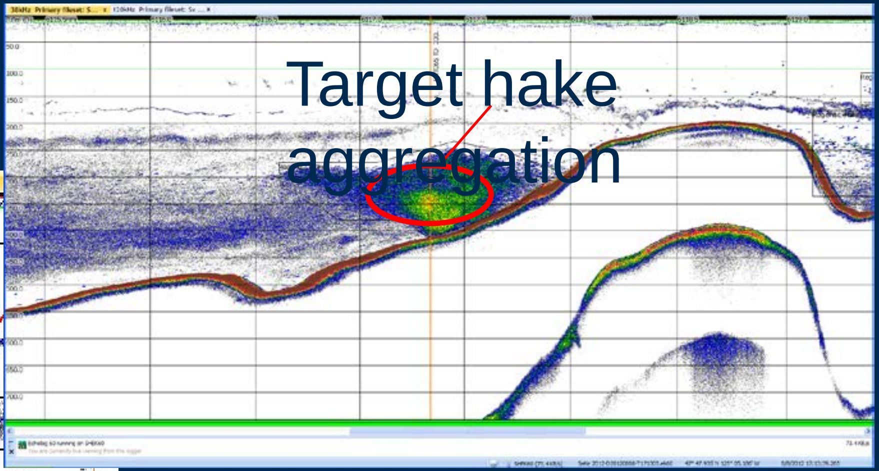
- E-W transects spaced 10 n.mi.
- 40 – 1500 m depth or 35 n.mi. lengths
- Acoustic sampling sunrise to sunset
- Surface trawl, CTD and Bongo sampling during night
- SST, SSS, & Chl-*a* underway
- Four legs:
  - —Leg I: 24 Jun - 6 Jul;
  - —Leg II: 9-25 Jul;
  - —Leg III: 30 Jul - 12 Aug;
  - —Leg IV: 15-24 Aug

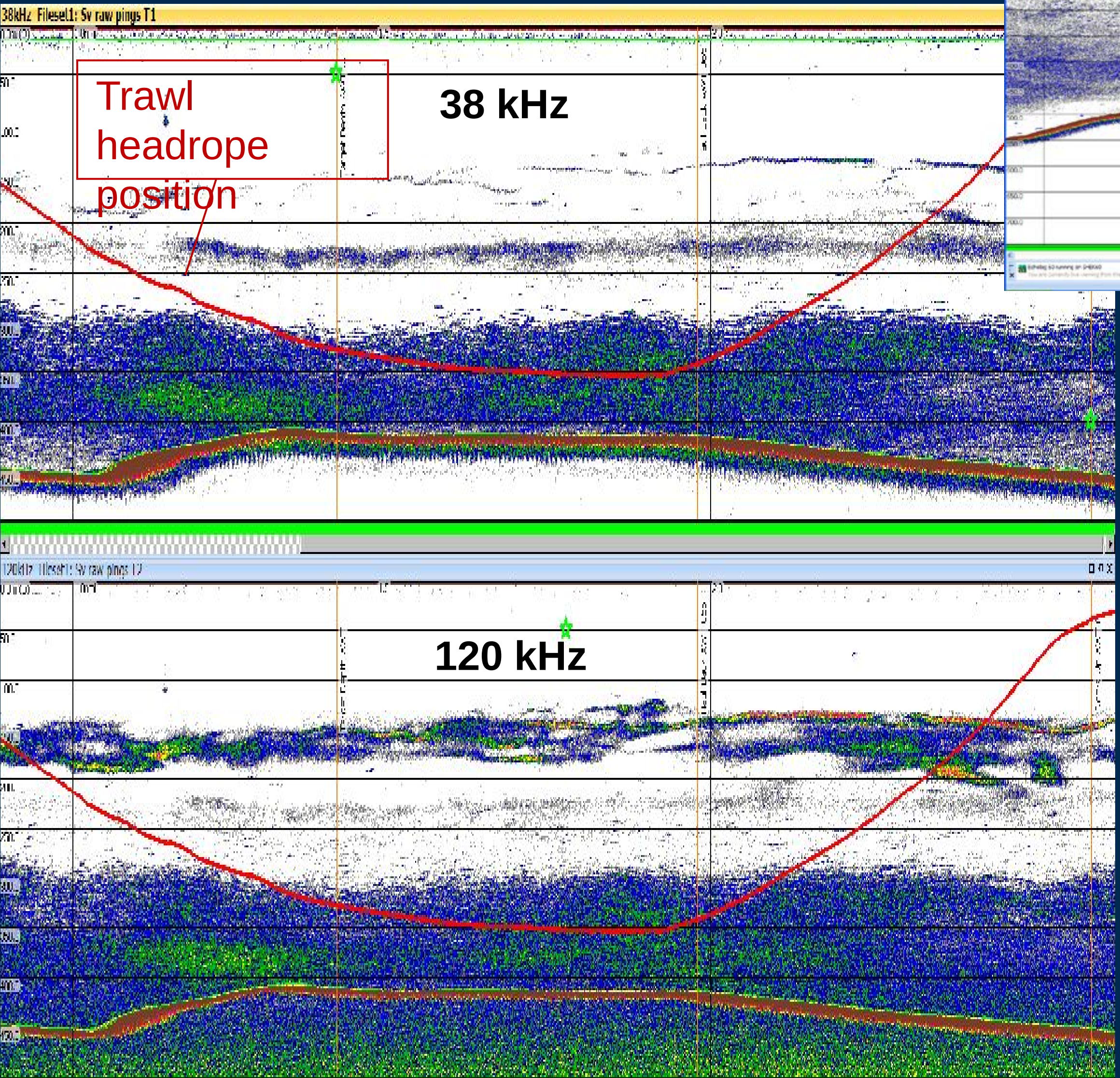
AWT 65
Transect 73
8 Aug 2012

47º 47.92'N, 125º 07.69'W
1322 PDT (2022 GMT)

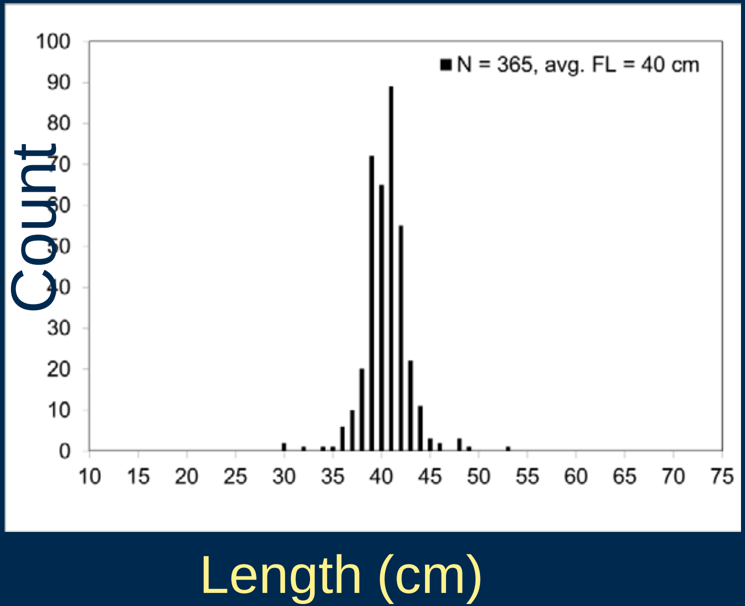
Target Depth ~330 m

576.0 kg total: 95% hake, 4% yellowtail rockfish



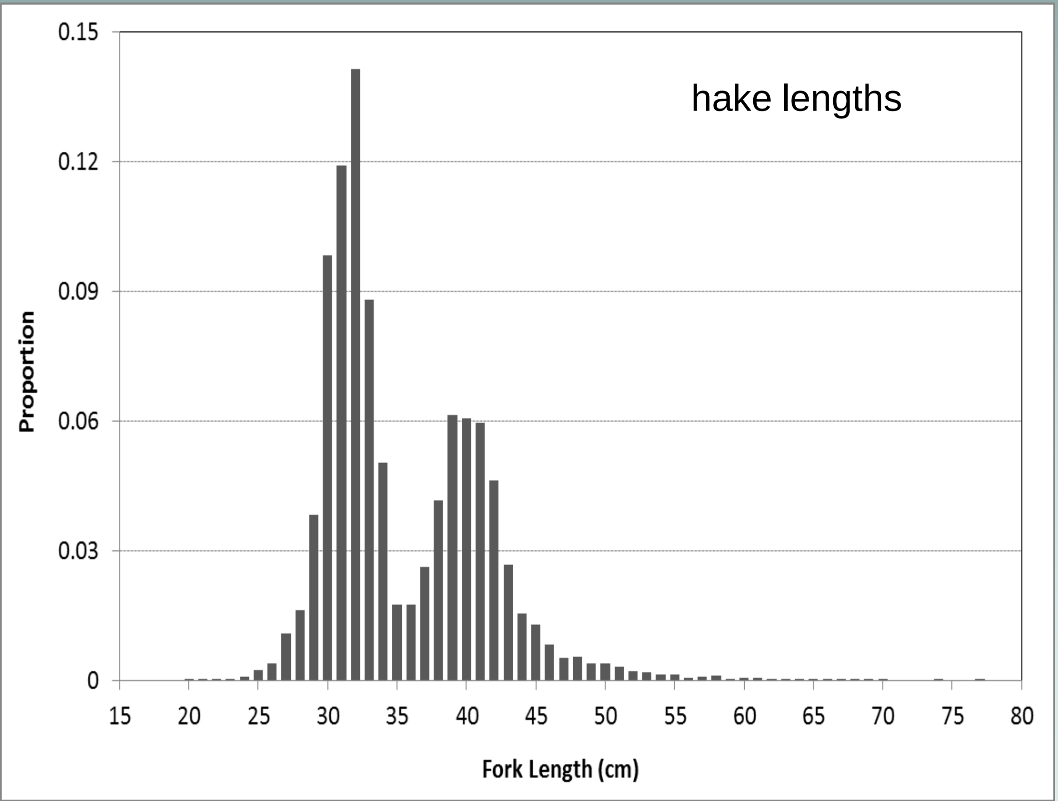


Hake Length Distribution



U.S. Portion – Hake Preliminary Info.

- 80 transects
- 73 successful midwater trawls (65 with hake) on F/V *Forum Star*
- 2,937 otoliths collected
- 757 stomachs collected
- 205 ovaries collected

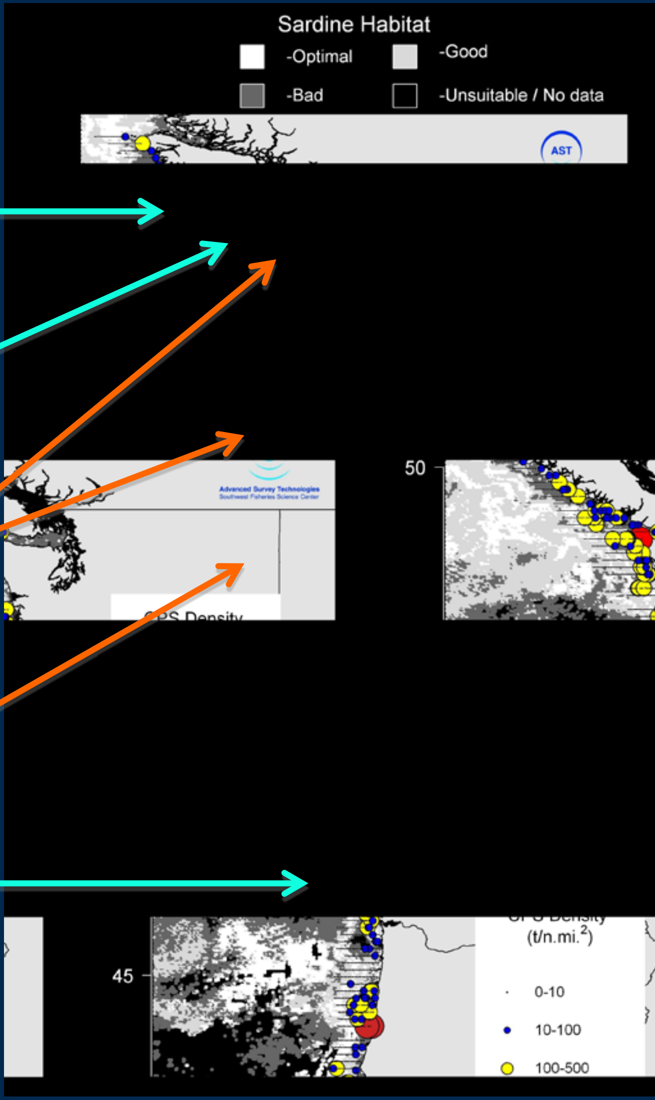


Top 10 Catch Species by Weight (kg):

Pacific hake	17,453 (91%)
yellowtail rockfish	638 (3%)
Pacific herring	357 (2%)
jack mackerel	104 (1%)
brown cat shark	91 (<1%)
chinook salmon	86 (<1%)
eulachon	65 (<1%)
jellyfish	38 (<1%)
chub mackerel	37 (<1%)
lanternfish	37 (<1%)

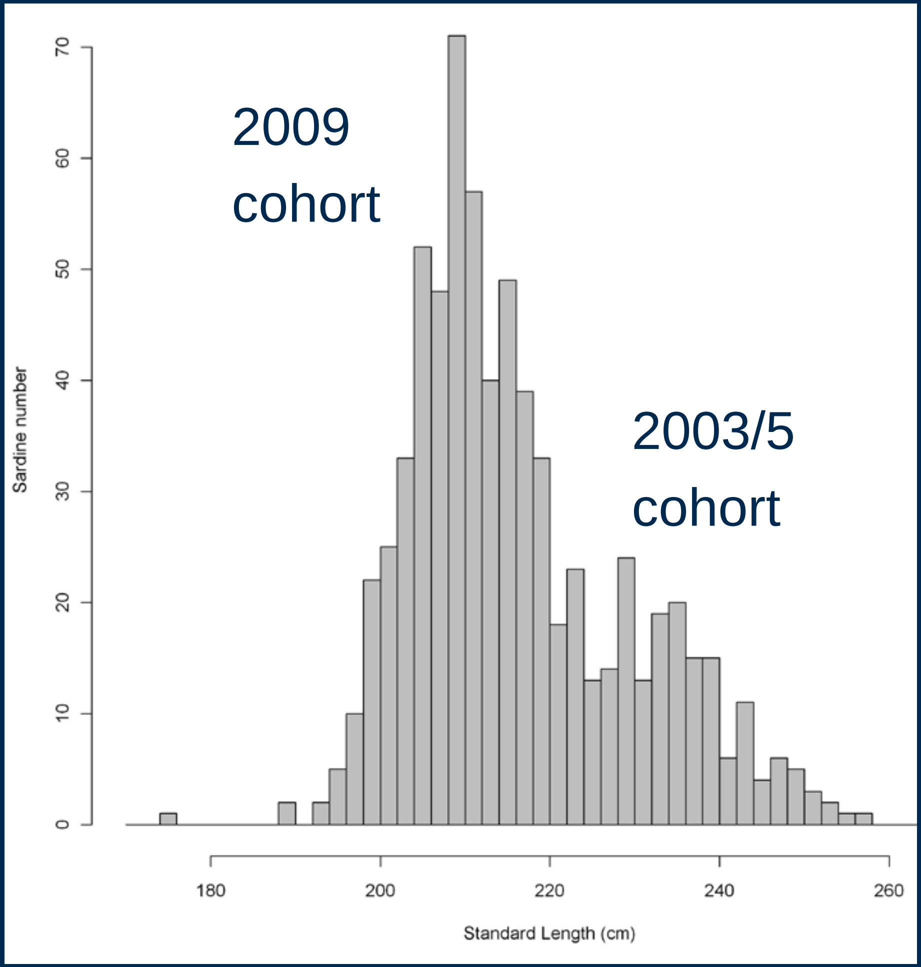
Sardine Preliminary Results

- Sardine habitat bad along VI coast during August
- Relatively uniform but low CPS densities off WA and Vancouver Island (VI)
- Hot spots near
  - —Reedsport &Coos Bay (OR)
  - —Strait of Juan de Fuca
- High CPS densities from central CA to central OR
- Low CPS densities south of Monterey (*Ocean Starr*)



Sardine Preliminary Results

- Total trawls: 98
- Sardine catches: 37
  - —Weight: 1214.7 kg
  - —Number: ~ 8703 fish
  - —Mean weight: 32.8 kg
  - —Mean number: ~ 235)
- Mean weight: 140 g
- Mean length: 216 cm



Successes, Compromises, Next Steps

- Survey **completed** with participation by two SCs, industry and international!

- Some ME70
- Few CTDs & Bongos
- No CUFES/DEPM

- Full debriefings – Centers, NMFS, partners
- Planning out years

Proposed Analysis of Stock Complexes

- Evaluate species for addition to or removal from the FMP
- Identify and evaluate alternative suites of minor-species complexes, based on:
  - Preferred latitude and depth of each species
  - Species vulnerability
  - Catch and OFL scales
  - Species as co-occurrence in observer and survey data
  - Improving safeguards against over-harvest with the least possible increase in sorting categories
- Work collaboratively with the GMT and state agencies
- Complete preliminary analysis of alternatives by January 2013

Data-Moderate Assessments: Candidate Species

Increasing Depth →

Increasing Vulnerability ↑

Vulnerability	Nearshore	Shelf-shallow	Shelf-deep	Slope
Major ($V \geq 2.2$)	*Copper (2.27)* *China (2.23)* *Quillback (2.22)*			Rougheye (2.27)
High ($2.0 \leq V < 2.2$)		*Vermilion (2.05)*	**Rosethorn (2.09)** **Sharpchin (2.05)**	**Redbanded (2.02)**
Medium ($1.7 \leq V < 2.0$)	*Brown (1.99)*	**Ratfish (1.72)**	**Stripetail (1.80)**	
Low ($V < 1.7$)		**English sole (1.19)***	**P. cod (1.34)** **Rex sole (1.28)** **Arrowtooth (1.21)***	

Rockfishes

Flatfishes

Other fishes

*Out-of-date Tier-1 assessment

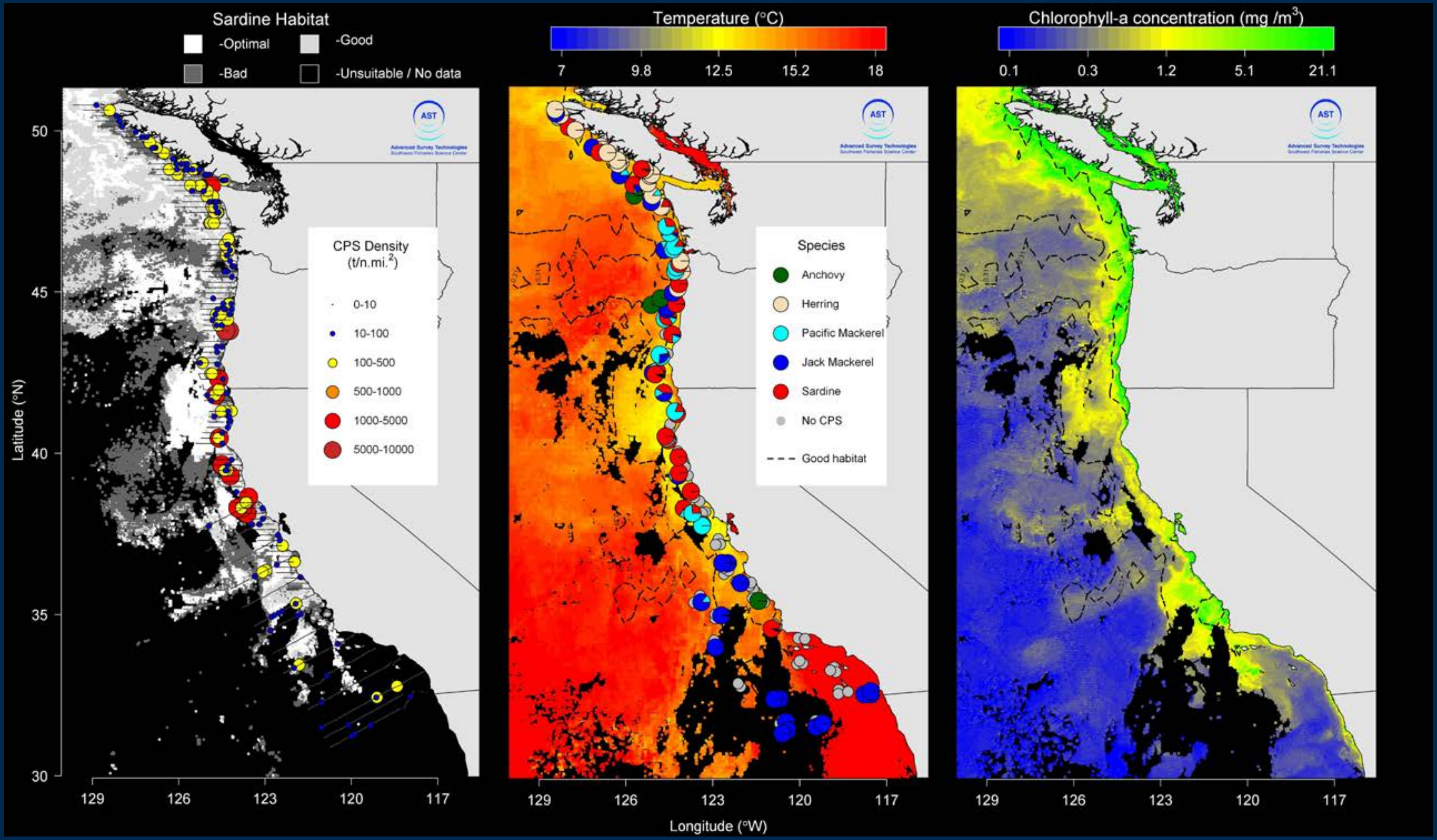
FSSI stock

Primary source for index data:

Trawl Survey

Recreational Fishery

Preliminary Results



TRAWL RATIONALIZATION TRAILING ACTIONS FOR COST RECOVERY AND PROCESS ISSUES

The Council completed work on the structure of the cost recovery program at its September 2011 meeting, specifying that the program start on January 1, 2013 and that the initial amounts to be recovered not exceed more than 3 percent of exvessel revenue for the shorebased sector, 2 percent for the mothership sector and 1 percent for the catcher-processor sector (Agenda Item H.2.a, Attachment 1). The exact amounts to be used will be determined based on the best estimates available at the time the rule is ready to move forward. The details for some program elements such as the ongoing "role of the Council" and "the concept of accounting and adjustment between years" are to be worked out in the regulatory deeming process. A complete description of the Council recommendation on cost recovery is provided here as Agenda Item H.2.a, Attachment 1. Under this agenda item, National Marine Fisheries Service (NMFS) will provide a report explaining its interpretation of the Council recommendations and requesting some clarifications (Agenda Item H.2.a, Supplemental NMFS Report).

A list of trailing actions, completed and those currently on the Council calendar, is provided as Agenda Item H.2.a, Attachment 2. In November, the Council will be considering these issues and setting priorities for the upcoming year. Actions to address one new issue, implementation of the surplus carryover provision for the long term, may potentially involve solutions that affect more then just the trawl sector, and so may not be appropriate as a trawl trailing action. The Council may want to consider the process for moving forward on that issue at this meeting.

Council Action:

1. **Provide recommendations to NMFS on cost recovery.**
2. **Consider whether or not to specify a process for long-term resolution of the surplus carryover provision and consider other process issues, as necessary.**

Reference Materials:

1. Agenda Item H.2.a, Attachment 1, Final Council Cost Recovery Program Recommendations (September 2011).
2. Agenda Item H.2.a, Attachment 2, Status of Trailing Actions and Calendar.
3. Agenda Item H.2.b, Supplemental NMFS Report, Cost Recovery: Process Issues Needing Clarification from the Council.
4. Agenda Item H.2.c, Public Comment

Agenda Order:

a. Agenda Item Overview — Kerry Griffin and Jim Seger
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action**: Provide Guidance for Cost Recovery and Necessary Process Issues

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08/24/12

FINAL COUNCIL COST RECOVERY PROGRAM RECOMMENDATIONS (SEPTEMBER 2011)

The Council supports the limited access privilege program (LAPP) guidelines, as described in Appendix B of the September 2011 Cost Recovery Committee (CRC) Report (http://www.pcouncil.org/wp-content/uploads/G6b_CRC_SEPT2011BB.pdf) and the framework provided in Appendix C of the same report. The Council recommends implementation of a cost recovery program by January 1, 2013 with the structure, cost estimation methods, and cost recovery rates specified below. Retroactive payment requirements should not be part of the program. Fees should be collected from the date the cost recovery provisions are implemented forward and not for time prior to its implementation.

Structure for Cost Recovery Program

Sector-specific programs - Separate cost recovery programs should be developed, one for each of the three sectors (shorebased individual fishing quota (IFQ), mothership, and catcher-processor). Costs will be calculated for each sector, and each sector will be assessed a fee based on the sector-specific cost calculation (see Determination of Sector Costs and Fees, below).

Catcher processors - Each vessel should be charged based on value of whiting harvested by that vessel, with billing to occur and fees to be remitted to the National Marine Fisheries Service (NMFS) in last quarter of the calendar year. For this sector, value will be determined using mothership pricing (prices motherships pay catcher vessels) and at-sea tonnage caught.

Motherships - Each catcher vessel should be charged based on the value of whiting delivered by that vessel; the mothership should bill and collect from the catcher vessel at time of delivery; and collected fees should be remitted to NMFS in coordination with any buyback fees. For this sector, value will be determined using mothership pricing and at-sea tonnage delivered.

Shorebased IFQ - Each catcher vessel should be charged based on the value of IFQ species delivered by that vessel; the first receiver should bill and collect fees from vessels at the time of landing, and collected fees should be remitted monthly to NMFS in coordination with any buyback fees. For this sector, value will be determined from information on buyback forms.

Fee Remittance Linked To Permit/License Renewal - Failure to remit assessed fees should be linked to renewal of the permit or IFQ first receiver site license of the entity responsible for remitting payment to NMFS (i.e., catcher-processor vessel, mothership, and first receiver). However, proof of fee payment would not be a required part of a renewal application. Potential for enforcement action would apply to entities that fail to remit fees in a timely fashion.[1]

Determination of Sector Costs and Fees: Incremental costs will be determined for each sector. "Incremental Costs" means "*the net costs that would not have been incurred but for the implementation of the Individual Fishing Quota program*" (Amendment 20)—see Appendix B to Agenda Item E.6.b, Cost Recovery Committee Report, September 2011. Each sector (shorebased IFQ, mothership, and catcher/processor) will pay an appropriate percentage (not to exceed three percent, see following paragraph for additional constraint on initial fees). The program should include between year accounting and adjustment such that under-collection or over-collection in one year could lead to an adjustment to fees for a following year, but never to exceed the three percent maximum. Such overages and underages might be the result either of collection in excess of the amount expected or program costs that are higher or lower than initially estimated.

The appropriate percentage of the cost would be based on the latest available information relative to actual costs incurred by NMFS and the states at the time the rule package needs to be drafted for implementation for January 1, 2013, provided that the initial percentages do not exceed three percent for the shoreside sector, two percent for the mothership sector, and one percent for the catcher-processor sector. NMFS should use that latest available information relative to actual costs to make the yearly projections to determine fee percentage at the beginning of each fishing year.

Ongoing Council Role: The Council should have an ongoing, periodic role in the cost recovery program, including reviewing cost recovery levels, after the cost recovery program becomes established.

Other Council Requests and Actions Related to Cost Recovery

The Council asks that NMFS consult with National Oceanic and Atmospheric Administration General Counsel (GC) and provide, as soon as available, clarity on the eligibility of state costs recoverable as a portion of the three percent maximum fee with regard to MSA section 303A(e) and 304(d).

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[1] As described by NMFS (Agenda Item G.6.b, NMFS Supplemental Report, September 2011), this linkage provision would work as follows: The primary compliance incentive would be an administrative link between failure to pay the appropriate cost recovery fee and permit/license renewal. If upon initial review of fee payment NMFS determines that the full amount has not been paid, NMFS would notify the individual, and provide an opportunity to respond and to resolve any discrepancies. If full fee payment is not received subsequent to NMFS final administrative determination, the amount would be referred to collections, and if it has not been paid prior to permit or license renewal, NMFS would not renew the mothership permit, catcher-processor permit or IFQ first receiver site license until payment is received. The potential for enforcement action would remain in some cases.

The Pacific States Marine Fisheries Commission (PSMFC) has developed a draft framework for reporting costs (Appendix D to the September 2011 Cost Recovery Committee report, http://www.pcouncil.org/wp-content/uploads/G6b_CRC_SEPT2011BB.pdf). The Council asked that the PSMFC, coastal states, and NMFS continue to work to fill out the framework, modifying it as necessary.

The Council will convene meetings of the Cost Recovery Committee in the future to address opportunities for identifying long term efficiencies.

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08/24/12

STATUS OF TRAILING ACTIONS AND CALENDAR

Council Actions from April 2012, for Implementation in 2013

See Agenda Item I.4, April 2012 for a complete description of action items.

PIE Rule 2, Council list	Council Action
1. Allow fixed gear and trawl permits to be registered to the same vessel at the same time (but do not allow fixed gear freezer vessel participation in the trawl fishery).	Approved FPA
2. Change the opt-out requirement for QP deficits	Approved FPA
3. Eliminate the double filing of co-op reports	Approved FPA
4. Whiting season opening date and southern allocation (also see Agenda Item I.4.a, Attachment 2)	Delay consideration (PPA Remains in place)
5. Chafing gear (also see Agenda Item I.4.a, Attachment 3)	Approved FPA
PIE Rule 2, NMFS list	
1. First receive site license changes	Approved NMFS Proposed Change
2. Catch monitor certification requirements	Approved NMFS Proposed Change
3. Start renewal process 9/15 for LE permit, vessel account, and QS permits	Approved NMFS Proposed Change
4. Remove 12/15-31 ban on QP transfer	Approved NMFS Proposed Change
5. Observer provider certification	Approved NMFS Proposed Change
6. Clarify processor obligation	Approved NMFS Proposed Change
7. Observer program regulatory changes	Approved NMFS Proposed Change
8. Change “permit holder” to “vessel owner”	Approved NMFS Proposed Change
9. Process for changes vessel ownership	Approved NMFS Proposed Change

Status on Other Actions Completed and Moving Forward for Implementation January 1, 2013 (for additional detail see March 2012, Agenda Item F.8.a, Attachment 1)

Cost Recovery – Regulations to be developed for deeming. National Marine Fisheries Service (NMFS) is requesting clarification at this meeting.

Status on Other Delayed Actions (for additional detail see March 2012, Agenda Item F.8.a, Attachment 1)

Risk Pools - Safe Harbor from Control Rules – The Council has finalized action on safe harbors for risk pools. Council transmittal and NMFS decision processes are delayed to prioritize quota reallocation for the whiting fishery.

Lenders - Safe Harbor from Control Rules – The Council has selected a preliminary preferred alternative (PPA) on safe harbors for lenders. Selection of a final preferred alternative (FPA) has been delayed to prioritize quota reallocation for the whiting fishery.

Other Lender Issues – The Council has not selected a PPA for other lender issues. The topics under this category have been narrowed to the question of whether the NMFS quota share (QS) tracking system should include a capability that would allow the QS owner and lender to attach lender information to the QS account. In March, the Groundfish Advisory Subpanel recommended no action on this issue. Further consideration has been delayed to prioritize quota reallocation for the whiting fishery.

Gear Issues – Gear issues include multiple gears on a trip, gear modifications to increase efficiency, and restrictions on areas in which gears may be used. Action on all of gear issues (except chafing gear) was delayed pending the results from a one day gear workshop to be convened by the Enforcement Consultants. That workshop, originally scheduled for the the June Council meeting, has now been tentatively rescheduled for September.

Calendar on Trawl Rationalization Actions and Pending Workload

Table. Council schedule for trawl rationalization related actions.

	Sept	Nov	Mar	Apr	June
Current Trailing Actions					
Lender Issues		FPA			
Gear		Gear Workshop Results	PPA		FPA
Whiting Season Date		FPA			
Widow QS Reallocation Amendment		Range of Alternatives	PPA		FPA
Electronic Monitoring		Scoping	Study Report		
Whiting Fishery Catch Share Reallocation	FPA				
Carry-over –Long Term Solution (likely affects nontrawl sectors too)					
PIE 3 (Implementation in 2014)		Scoping [a/]	PPA	FPA	
Adaptive Management Program QP Distribution Methodology (Implement by 2015)					

a/ Final Action required by April 2013 for implementation by January 1, 2014.

Environmental assessments to be completed:

- Risk pools
- Trawl/Fixed gear permit stacking
- Chafing gear

Other pending tasks:

- Update Appendix E to the Fishery Management Plan to reflect recent regulatory amendments.

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08/24/12

Agenda Item H.2.b
Supplemental EC Report
September 2012

ENFORCEMENT CONSULTANTS REPORT ON TRAWL RATIONALIZATION TRAILING ACTIONS FOR COST RECOVERY AND PROCESS ISSUES

The Enforcement Consultants (EC) reviewed Supplemental NMFS report 3 and has the following comments:

Under the proposed Alternative 2 (Council final preferred alternative) chafing gear is described as covering the "bottom and sides of the codend." This definition may be problematic for field enforcement. Since net and codend designs are variable and evolve for various efficiencies, the EC recommends a numeric value to account for design differences, now and in the future. This is consistent with existing regulations and is enforceable in the field.

In addition to the coverage issue, since there is no minimum mesh size outlined for the chafing gear or codend in the North Pacific Fishery Management Council fishery, making the regulations consistent could be interpreted to mean there is no mesh size minimum for chafing gear. The EC has been told that "industry standard" is to use no less than 3 inch mesh; however, this should be reflected in regulatory language if the Council's intent is to retain the minimum mesh size. Reaffirming the regulatory language outlining minimum mesh sizes *throughout* the net (T50 CFR 660.130 (b)(2) would be advised.

PFMC
09/16/12

GROUNDFISH ADVISORY SUPBANEL REPORT ON TRAWL RATIONALIZATION TRAILING ACTIONS FOR COST RECOVERY AND PROCESS ISSUES

The Groundfish Advisory Subpanel (GAP) received information from Mr. Jim Seger and Ms. Ariel Jacobs regarding chafing gear considerations, cost recovery clarifications, and other trailing action process issues. The GAP offers the following comments and recommendations.

Chafing gear

The GAP discussed the chafing gear issue with Mr. Dayna Mathews and Ms. Jamie Goen. The GAP appreciates the efforts by National Marine Fisheries Service (NMFS) to fix the chafing gear regulations to remedy a problem created when a restriction specific to the use of chafing gear on small footrope trawl gear was applied generally to all trawl gear, including pelagic trawl. This change resulted in chafing gear regulations that conflict with definitions implemented in 1995 ((Federal Register, March 13, 1995, page 13377) and long-standing operational practices in the whiting fishery. The GAP continues to support the final preferred alternative adopted at the April 2012 meeting.

Relative to the NMFS suggestion to add another option for Council consideration, the GAP is not opposed to the NMFS recommendation to add an intermediate alternative, which would apply to pelagic trawl gear (i.e., not specific to whiting trawl gear) and understands the intermediate alternative proposed by NMFS in Supplemental NMFS Report 3 to be as follows:

> NMFS Intermediate Alternative: Chafing gear may encircle no more than 50 percent of the net′s circumference. No section of chafing gear may be longer than 50 meshes of the net to which it is attached. Except at the corners, the terminal end of each section of chafing gear must not be connected to the net. (The terminal end is the end farthest from the mouth of the net.) Chafing gear must be attached outside any riblines and restraining straps. There is no limit on the number of sections of chafing gear on a net.

The GAP also recommends adding an alternative for analysis. This option differs from the above option in the length of chafing gear sections (that is, not limited to 50 meshes) and does not require chafing gear to be attached over riblines:

> New option: Chafing gear may encircle no more than 50% of the codend circumference. Chafing can be one or more sections covering the full length of the codend, but must be unattached at the terminal end or ends (terminal end being the furthest from the mouth of the trawl). A Band of mesh (a skirt) may encircle the codend under transfer cables, lifting or splitting straps (chokers) mesh length can be no wider than 16 meshes, mesh size must be the same as the codend.

The GAP suggests it would also be useful to add a definition for codend for pelagic trawl gear:

The codend is attached to the terminal end of the last tapered section of the pelagic trawl (terminal end is the furthest from the mouth of the trawl). Codend length and circumference is determined by vessel size, deck arrangement, and hold space.

Cost Recovery

All comments in this section refer to Cost Recovery: Issues Needing Clarification from the Council (H.2.b Supplemental NMFS Report, September 2012).

Regarding item 1, the GAP believes that cost recovery should be coordinated with the buyback program to the extent possible. The GAP recommends using the information reported on the buyback form to calculate the cost recovery fee percent, and recommends that a single form be adopted. This will streamline the administrative burden on those required to report.

For the shoreside sector, the GAP supports item 2 which would calculate the ex-vessel value based on the value of all species landed, not just IFQ species. Applying cost recovery to all species rather than just IFQ species will reduce the administrative burden. The GAP further believes that the additional cost will be minimal.

Specific to the NMFS recommendations for the at-sea whiting sectors under Item 2, the GAP strongly recommends NMFS meet with the MS and CP sectors during development of the proposed rule. Many of the issues relative to the at-sea sectors, for example, applying cost recovery to only whiting (the Council action) versus applying cost recovery to whiting and non-whiting species (the NMFS recommendation), are likely more complicated than NMFS may realize. Therefore, the GAP recommends it would be most prudent and more efficient for NMFS to work with the MS and CP sectors to discuss these issues prior to publication of the proposed rule. At this time, the GAP does not support the NMFS recommendation to have the ex-vessel values for the MS and CP sectors based on the value of all groundfish species.

The GAP supports the clarifications in item 3, but requests greater clarity from the agency on its rationale for labeling Catcher Processors as fish buyers.

As one final comment, the GAP suggests delaying cost recovery to phase in at the same time as the new buyback loan terms contained in Congressman Thompson's bill (Revitalizing the Economies of Fisheries in the Pacific Act of 2012). In 2013, the observer cost burden to the fleet is expected to increase significantly, while at the same time cost recovery will be implemented. This presents significant challenges to a fleet that is still learning to access its full complement of target species under the program. Delaying cost recovery until the new loan terms are implemented would give the fleet some breathing room and a greater opportunity to succeed.

Carryover

On carryover generally, the GAP still does not comprehend the problem. Allowing carryover will not lead to overfishing (exceeding the OFL). Moreover, the likelihood of the entire fleet using its full carryover complement and significantly exceeding the ACL is scant. Finally, even if the ACL is exceeded in one year, there will be a comparable underage in the following year.

Of the specific options, the GAP supports Option 5. The GAP further notes that rolling averages could be combined with sector ACLs (Option 3), potentially eliminating impacts on other sectors.

The GAP does not support option 1, option 2, or option 4.

Regarding whiting carryover, the GAP believes the mid to long term fix may present a suite of issues that is too complex for action in November. Industry members would welcome the opportunity to sit down with NMFS to discuss the issue further.

PFMC
09/16/12
1:57 p.m.

Agenda Item H.2.b
Supplemental GMT Report
September 2012

GROUNDFISH MANAGEMENT TEAM REPORT ON TRAWL RATIONALIZATION TRAILING ACTIONS FOR COST RECOVERY AND PROCESS ISSUES

We limit our comments to the "long-term" carryover options presented in Agenda Item H.2.b, Supplemental National Marine Fisheries Service (NMFS) Report 2. We will be speaking to the short-term carryover issues under Agenda Item H.5, Inseason.

Council action under this agenda item is to consider whether to specify a process for long-term resolution of surplus carryover provision. As we stated in June, we understand there are matters of legal interpretation involved in this issue (Agenda Item D.8.b, Supplemental GMT Report, June 2012). Option 5, the multi-year average, is most similar to the way we understand the Council's original intent for the carryover program. The biological rationale is that catch can be carried and borrowed across years while still maintaining the policy objective for which the Council set the annual catch limit (ACL). For instance, the Council's 40-10 and p* policies for the sablefish stock would be achieved as long as the catch remains, on average, at or below the ACL. This is why the Science and Statistical Committee (SSC) said that the carryover was not expected to jeopardize the Council's harvest objectives (Agenda Item I.3.b, Supplemental SSC Report, April 2012). We recommend looking at scenarios and simulations to analyze carryover of quota pounds and harvest in other sectors against the risk of exceeding the relevant harvest specifications over the long term.

As for Options 2-4, they are not truly "carryover" of harvest from one year to the next, as the Council intended. They are more similar to the approach followed now and are likely to take a lot of time for the Council, advisory bodies, and NMFS staff.

Lastly, we would point out that there are common issues involved with the "multi-year averaging" approach. For example, the same issue is at play with rebuilding and is being looked at in terms of "implementation error" in our catch projections (i.e., implementation error and management uncertainty in catch projections for the rebuilding stocks). It is the biological rationale underlying our management of stock complexes (Agenda Item I.3.b, Supplemental SSC Report from April 2012). The multi-year average approach will be of interest of all sectors, not just the shorebased individual fishing quota fishery. We see several opportunities to discuss this core issue in the near future, for example as part of Amendment 24 or the upcoming look at the National Standard Guidelines.

PFMC
09/16/12

Agenda Item H.2.b
Supplemental NMFS Report
September 2012

Cost Recovery: Issues Needing Clarification from the Council

1) <u>Recommendation to implement a Cost Recovery Fee form</u>
(see attachment 1)

<u>Discussion</u>: The Pacific Fishery Management Council (Council) has recommended that information for the calculation and payment of the cost recovery fee should be coordinated with the buyback program. The National Marine Fisheries Service (NMFS or Agency) is developing the cost recovery progra m to be as parallel and similar to the buyback program as possible to reduce the burden on industry. The buyback form reports gross ex-vessel value for all groundfish landed in the reporting month for a fish buyer. NMFS considered using the information reported on the buyback form to calculate the cost recovery fee percent and considered using the buyback form when fees are submitted to the Agency. However, NMFS has concerns with this approach because the buyback program and associated buyback form are temporary, have a different purpose, and provide a less transparent audit trail for the cost recovery fee program.

Among other necessary information, the cost recovery form would request weight in pounds of all landings in a given month, the associated ex-vessel value in U.S. dollars, and the fee amount collected during that month. Requiring a form to be submitted by the fish buyer to NMFS with payment of cost recovery fees provides certification regarding what the submitted fees are for. The cost recovery form would include the aggregate weight in pounds of all landings to a fish buyer that, for the individual fishing quota (IFQ) fishery, could be verified against electronic fish tickets for compliance and, for the at-sea fisheries, could be verified against observer data. Because NMFS has determined that there is a need for a cost recovery form which is separate from the buyback form, NMFS could also use the ex-vessel value reported on the cost recovery form for the fee percentage calculation. The ex-vessel value reported on the cost recovery form should match the ex-vessel value reported on the buyback form if both forms are based on the value of all groundfish species. To determine the fee percentage for the first year of the cost recovery program before there is a year of information from the cost recovery form, NMFS could use the ex-vessel value as reported on the buyback form.

<u>Recommendation</u>:

NMFS requests that the Council concur with the recommendation for all fish buyers (defined as first receiver site license holders in the shorebased sector, motherships (MS) in the MS sector, and catcher/processors (C/P) in the C/P sector) to prepare and submit a separate cost recovery fee form in a parallel and similar process to the buyback program. After the first year of the cost recovery program, NMFS could use the ex-vessel value as reported on cost recovery form, rather than the buyback form, to calculate the cost recovery fee percent.

This issue should be considered in conjunction with and when considering item 2 below.

2) <u>Recommendation to include all groundfish species when determining ex-vessel value</u> (see attachments 1 and 2)

<u>Discussion:</u> The cost recovery fee for the groundfish fishery would be calculated based upon a percentage of ex-vessel value, with the percentage determined on a sector by sector basis. Prior Council guidance (motion 33, June 2011 meeting, and motion 11, September 2011 meeting) indicated that ex-vessel value for the shorebased sector should be based upon IFQ species (a subset of the groundfish species landed), but also advised that the values should be taken from the buyback form. The buyback form sets forth the total value for all groundfish landed, and does not set forth the value for IFQ species separately. In order to streamline the processes between the buyback program and the cost recovery program, to keep the ex-vessel value reported on both the buyback form and the cost recovery form the same, and to reduce the administrative burden on fish buyers of reporting two different values and two different groups of species, NMFS suggests that the ex-vessel value be calculated and paid based on all groundfish species landed on an IFQ trip. The Shorebased IFQ Program, as specified at §660.140, covers all groundfish species managed under the FMP, not just IFQ species. Therefore, the cost recovery fee and calculation of the fee percentage could appropriately be based on all groundfish harvested by participants in the shorebased sector. For the MS and C/P sectors, the Council recommended the fee be calculated and paid on the value of Pacific whiting delivered for the MS sector and processed for the C/P sector. Consistent with the shoreside sector, NMFS recommends that the fee be calculated and paid on the value of all groundfish delivered for the MS sector and processed for the C/P sector.

If the Council chooses to only use IFQ species for the shorebased sector and only whiting for the at-sea sectors, resulting in different species subject to the buyback and cost recovery programs, then NMFS would also need to reconsider how to calculate the cost recovery fee percentage for the first year of the program.

<u>Recommendation</u>:

NFMS requests that the Council concur with the recommendation to have the ex-vessel value for all sectors (IFQ, MS, and C/P) be based on the value of all groundfish species.

3) Recommendation on permit consequences for failure to pay the fee

Discussion: This clarification is to ensure that permit renewals are only withheld if the permit owner is responsible for failure to pay the cost recovery fee.

In the September 2011 meeting, the Council recommended (see Motion 11) a linkage between a failure to pay the cost recovery fee and the renewal of a permit or an IFQ first receiver site license. The motion noted the entity responsible for remitting payment to NMFS would be the C/P vessel, the mothership, and the IFQ first receiver. Similar to what is done for the buyback program, NMFS plans to have the fish buyer be responsible for withholding and remitting cost recovery fees to NMFS. For the shorebased IFQ fishery, the first receiver site license holder is the responsible party to collect and remit cost recovery fees to NMFS. For the MS sector, the responsible party to collect and remit the cost recovery fee is the owner or operator of the vessel registered to the MS permit, and the owner of the MS permit registered to the vessel. For the C/P sector, the responsible party is the owner or operator of a vessel registered to a C/P-endorsed limited entry permit, and the owner of the C/P-endorsed limited entry trawl permit registered to that vessel.

Because in the IFQ fishery, only the IFQ first receiver site license holder is responsible for collecting and remitting payment, non-payment would result in non-renewal of their license. However, in the MS and C/P sectors, multiple parties are defined as the fish buyer and are responsible for collecting and remitting payment, some of which may not be the permit owner. Generally, for MS permits and C/P-endorsed limited entry permits, the vessel owner and permit owner are the same. However, MS permits and C/P-endorsed limited entry (LE) permits are transferrable and, as such, it is possible the owner of the vessel registered to the permit, and the permit owner could be two different parties.

Recommendation:

NMFS requests that the Council concur with the following recommendations which only affect MS permits and C/P-endorsed limited entry permits, both of which are types of LE permits. In situations where there has been a failure to pay, NMFS recommends that if the owner of a vessel registered to the LE permit is the same as the LE permit owner, then the permit renewal should be withheld until such time that full payment is made. If, however, the owner or operator of a vessel registered to a LE permit is not the same as the LE permit owner and the owner or operator of the vessel is found to be responsible for non-payment, then the LE permit could still be renewed.

In addition to renewal, LE permit transfers (i.e., change in permit owner and change in vessel registered to permit) require NMFS authorization. While the cost recovery program is still being developed, at this time NMFS does not plan on withholding permit transfers for failure to pay.

THE FOLLOWING ARE INFORMATIONAL ITEMS:

4) **<u>Calculation of cost recovery fee percentage; timing of NMFS calculation and adjustments between years</u>**

<u>Discussion</u>: The cost recovery fee due will be calculated by multiplying ex-vessel value by the applicable fee percentage. Data from the previous fiscal year can be used to determine the fee percentage to be used and applied to calculate the cost recovery fee amounts for the next calendar year. Generally, once the fiscal year has ended, NMFS plans to calculate the fee percentage in October and November each year and announce the fee percentage to be applied for the next calendar year in November or December before the fee percentage would apply on January 1. The fee percentage by sector would be announced in a Federal Register notice.

Given that the fee percentage to be applied in an upcoming calendar year will be determined based on NMFS incremental costs and ex-vessel revenues from the prior fiscal year, the actual amount collected in a calendar year could differ from the costs NMFS intended to recover. For example, consider the following formula:

(DPC / V) x 100

Where DPC = total net direct program costs for the sector for the previous fiscal year that would not have been incurred but for the implementation of the trawl rationalization program, and

V = total ex-vessel value from the previous fiscal year for that sector

If the incremental costs from fiscal year 2012 were equal to $100,000, and the ex-vessel value from that sector in fiscal year 2012 was $3.75 million, the fee percent to be applied in calendar year 2013 would be 2.67 percent, as calculated by:

(100,000/3,750,000) x 100 = 2.67

In calendar year 2013, fish buyers would determine the fee due by collecting 2.67 percent of the ex-vessel revenue of any given delivery. For calendar year 2013, the total fee amount collected by NMFS will depend on the actual ex-vessel revenues for 2013. To the extent ex-vessel revenues in calendar year 2013 are different from fiscal year 2012;

the amount NMFS collects could be slightly over or under NMFS' costs from fiscal year 2012. Accordingly, NMFS will ensure that the aggregate fees being collected are appropriate by making an adjustment to the following calendar year's fee percentage.

For example, assume that NMFS collected $125,000 rather than the $100,000 in calendar year 2013 because ex-vessel revenue increased in 2013 as compared to fiscal year 2012. In that case, if NMFS incremental costs for fiscal year 2013 remained the same at an amount of $100,000, rather than using $100,000 as the DPC when calculating the fee percentage to be applied in 2014, NMFS would use $75,000. Therefore, the fee percentage in 2014 would be reduced to account for any amount collected in excess.

5) <u>Cost recovery fee payments; restricting payment to on-line transfers</u>

<u>Discussion</u>: NMFS would like to make the Council and the affected public aware that NMFS intends to make payment of the cost recovery fees only payable online, and would not accept checks. NMFS would establish a pay.gov account, similar to that used for the buyback program and the Alaskan cost recovery programs. The portion of the affected public actually responsible for remitting payment to NMFS is limited (fish buyers). By requiring online payment, NMFS hopes to streamline the payment process, make payment of the fee more secure, and reduce the administrative burden associated with processing fee payments, thereby reducing the costs associated with implementing the program. This should not create any additional burden for the fleet since IFQ first receivers are already required to use computers and the at-sea whiting fleet is comprised of businesses that are comfortable with online business transactions.

6) <u>Requirement to remit cost recovery fee when any amount is due</u>

<u>Discussion</u>: NMFS would like to make the Council and the affected public aware that NMFS intends to require payment of any amount due, even if less than $100. The buyback program requires fish buyers to remit payment only when the amount due exceeds $100. If the amount due is less than $100, it is carried forward. This reduces transaction costs because the buyback program accepts checks for payment, and processing checks for amounts less than $100 is inefficient. Since NMFS intends to accept payment only electronically (see item 5 above), implementing a similar $100 threshold for the cost recovery program will have an opposite effect, complicating the administrative process. NMFS prefers no minimum liability triggering a requirement for payment, rather than the $100 threshold in the buyback program.

ATTACHMENTS

Attachment 1: DRAFT Cost Recovery Fee Collection Report

OMB Control # 0648-0### Expires ##/##/20##

Pacific Coast Groundfish

DRAFT Cost Recovery Fee Collection Report

Fee Collector's Name	
Mailing Address	
City	
State	
Zip	
Phone Number	
State Buyer Code	
Month and Year of Landings	

FOR LANDINGS IN	Sub-account	Fee Rate (%)	Weight (lbs)	Ex-vessel Value ($)	Fee Collected ($)
Shorebased IFQ Program	XXXX-###XX	3.0			
MS Coop Program	XXXX-###XX	2.0			
C/P Coop Program	XXXX-###XX	1.0			
Only enter late charges for which you have received a Bill of Collection.				**Late Charges ($)**	
				Total ($)	

Fee Adjustment ☐ By checking this box I certify that this payment is for a fee or price adjustment.

Instructions:

1. Complete the fee collector's name, address, telephone number, state buyer code (fish buyer/processor license number), and month and year of landings (MM/20XX).
2. Record the ex-vessel value and fee collected for each fishery. The fee collected equals the applicable fee rate multiplied by the ex-vessel value of fish landed for each vessel trip.
3. Note that deliveries must occur within the same month. Use a separate report for a different month.
4. Payment of late charges for which you have received a Bill of Collection can be included with the fee payment. Do not pay late charges in advance of receiving a Bill of Collection.
5. Check the fee adjustment box if this payment is for a fee or price adjustment.
6. Use Pay.gov to remit fee collected.

Paperwork Reduction Act Statement:

Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

Attachment 2: Pacific Coast Groundfish Buyback Loan Fee Collection Report

OMB Control # 0648-0376 Expires 05/31/2015

Pacific Coast Groundfish Buyback Loan Fee Collection Report

Fee Collector's Name	
Mailing Address	
City	
State	
Zip	
Phone Number	
State Buyer Code	
Month and Year of Landings	

FOR LANDINGS OF	Sub-account	Fee Rate (%)	Gross Value ($)	Fee Collected ($)
Pacific Coast Groundfish	BBGS-001GF	5.00		
California coastal Dungeness crab	BBGS-001CC	1.24		
California pink shrimp	BBGS-001CS	5.00		
Oregon coastal Dungeness crab	BBGS-001OC	0.55		
Washington coastal Dungeness crab	BBGS-001WC	0.16		
Washington pink shrimp	BBGS-001WS	1.50		
Only enter late charges for which you have received a Bill of Collection.			Late Charges ($)	
			Total ($)	

Fee Adjustment ________ By checking this box I certify that this payment is for a fee or price adjustment.

Instructions:

1. Complete the fee collector's name, address, telephone number, state buyer code (fish buyer/processor license number), and month and year of landings (MM/20XX).
2. Record the gross value and fee collected for each fishery. The fee collected equals the applicable fee rate multiplied by the gross value of fish landed for each vessel trip.
3. Note that deliveries must occur within the same month. Use a separate report for a different month.
4. Payment of late charges for which you have received a Bill of Collection can be included with the fee payment. Do not pay late charges in advance of receiving a Bill of Collection.
5. Check the fee adjustment box if this payment is for a fee or price adjustment.
6. Use Pay.gov to remit fee collected or mail a check payable to: "NMFS Pacific Coast Groundfish Buyback Loan" ir the amount of the total fees collected to: P.O. Box 979059, St. Louis, MO 63197-9000.

Paperwork Reduction Act Statement:
Public reporting burden for this collection of information is estimated to average one hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Paul Marx, Chief, Financial Services Division, NMFS, MB5, 1315 East West Highway, Silver Spring, MD 20910.

Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

Future Carryover Options

The Shorebased Individual Fishing Quota (IFQ) Program includes a carryover provision as specified in the Pacific Coast Groundfish Fishery Management Plan (FMP) at Appendix E, A-2.2.2.b and in the U.S. Codified Federal Regulations (CFR) for groundfish at 50 CFR part 660.140(e)(5). The carryover provision allows for two types of carryover. If an individual catches more fish than is in their corresponding vessel account, but it is within the 10% carryover limit for a deficit, then this overage in one year can be covered by the following year's quota pounds (QP) -- called a deficit carryover. Likewise, the provision also allows unused QP in a vessel account, in amounts of up to 10% of the QP in the account at the end of the year (used and unused) to be carried over into the following year -- called a surplus carryover.

Surplus carryover from 2011 (short-term)

The National Marine Fisheries Service (NMFS) first discussed its concerns with the surplus carryover provision at the September 2011 Council meeting and announced that 2011 surplus carryover might not be issued in 2012. In the spring of 2012, NMFS made the decision on whether or not to issue surplus carryover on a species-by-species basis based on an analysis of the risk of exceeding the ACL. NMFS issued surplus carryover to vessel accounts for individual fishing quota (IFQ) species except whiting and sablefish (NMFS public notice, NMFS-SEA-12-09). After NMFS issued 2011 surplus carryover in May 2012 and announced that decision at the June 2012 Council meeting, NMFS received feedback from the Council and the industry on their frustration with the lack of Council involvement in the decision on the risk of issuing surplus carryover, on the disruption that decision caused industry due to lost opportunity, and on the lack of certainty in business planning. This led the Council to recommend changes to the surplus carryover provision through the 2013-2014 biennial specifications and management measures process. Surplus carryover in 2012 will be further discussed at this meeting under Agenda Item H.5, Inseason Adjustments.

Beginning in 2013 (mid-term)

To improve on the process and issuance of surplus carryover, the Council has recommended through the 2013-2014 biennial specifications and management measures process that the decision on whether or not to issue surplus carryover come through the Council process. Beginning in 2013, the Council would review the preliminary data available from the previous year beginning in the spring and could make recommendations to NMFS after any Council meeting, but likely after the March or April meeting. The Council could recommend the surplus carryover limit be adjusted through an inseason action published in the *Federal Register* to a percentage lower than 10% for any individual IFQ species or all IFQ species (the deficit carryover limit would remain at 10%). If surplus carryover is not issued for any species (i.e., 0%), that would be included in the *Federal Register* notice. The Council's process for surplus carryover being proposed through the 2013-2014 biennial specifications and management measures process has the potential to be drawn out over multiple Council meetings and with multiple releases of surplus carryover, which may complicate management and may not provide certainty or advance planning for the industry. The rulemaking for the 2013-2014 biennial specifications and management measures that would propose these changes is scheduled to publish and be available for public comment in September 2012. The preamble to that rule will further explain the changes to the surplus carryover provision, and request comments on the proposal.

NMFS, the Council, and industry have all expressed concern over the continuing uncertainty with the surplus carryover provision. Therefore, NMFS is providing the following longer term options to increase the certainty regarding surplus carryover. Some of these options were considered but rejected from the 2013-2014 biennial specifications and management measures because of the amount of analysis they would require given Council direction that the specifications and management measures be limited in scope. Option D for whiting is based on a public comment at a previous Council meeting.

Options for Whiting Only (mid-term to long-term)

In 2012, NMFS did not issue 2011 surplus carryover for Pacific whiting, in part, because the Council and the Joint Management Committee (JMC) established under the Agreement with Canada on Pacific Whiting had not considered issuance of surplus carryover within the context of the U.S. total allowable catch (TAC). NMFS explained that the U.S. TAC already has an adjustment provision at the TAC level which is distinct from the surplus carryover provision for the Shorebased IFQ Program, where up to 15% of the unused TAC from the previous year can be carried over and added to the following year's TAC as done in 2012 (see Agenda Item D.8.b, NMFS Report, June 2012).

In order for NMFS to consider issuing surplus carryover for whiting in the future, the Council and the industry could pursue several options for issuing surplus carryover. These options should first be discussed during domestic discussions between the IFQ, mothership (MS), and catcher/processor (C/P) sectors. Options (for discussion only) could include:

Option A: Apportion the adjusted U.S. TAC according to the sectors' allocations (IFQ, MS, C/P), then issue the surplus carryover in addition to the adjusted U.S. TAC. This is inconsistent with the mechanism used by Canada to issue its carryover in the first year of implementation.

Option B: Apportion the unadjusted U.S TAC according to the sectors' allocations (IFQ, MS, C/P), then issue the surplus carryover from the adjustment amount to the IFQ fishery first, then any remaining portion of the adjustment would be issued according to the sectors' allocations (IFQ, MS, C/P).

Option C: Apportion the adjusted U.S TAC according to the sectors' allocations (IFQ, MS, C/P), then issue the surplus carryover from just the shorebased IFQ allocation, then issue the remaining shorebased IFQ allocation to the IFQ fishery.

Option D: If tribal whiting is reapportioned to the non-treaty sectors in the fall, then surplus carryover could be issued to IFQ prior to sector reapportionment (IFQ, MS, C/P).

If, after the domestic discussions, the IFQ, MS, and C/P sectors have agreement and want to pursue Option A above (being able to issue surplus carryover in addition to the adjusted U.S. TAC), then the next step would be to engage the Canadian delegation. It is uncertain whether any of these options could be accomplished prior to the 2013 fishing season.

Options for Consideration (long-term)

There are several options provided below to address the carryover provision for all IFQ species over the long-term. These options are provided as a starting point for discussion and analysis. A table comparing these options is provided at the end.

Option 1: No Surplus Carryover Provision

This option would suspend the surplus carryover provision, while maintaining the deficit carryover provision. The advantage of this option is that it provides certainty for industry, requires less complex regulations, less NMFS and Council time managing fishery, and less complex online account programming. This approach would create an incentive for fishermen to catch all of their QP in the current fishing year. The Council could consider a sub-option to suspend surplus carryover for a few years and reconsider the issue after the five-year review.

Option 2: Holdback Approach

Under this option, the shorebased trawl allocation would be reduced by 10%, reducing the start of the year QP allocated to QS accounts. Part or all of the 10% holdback QP would be issued to vessel accounts for surplus carryover in March/April after the previous year vessel accounts have been reconciled. After that, any remaining amounts of the 10% holdback QP would be issued to QS accounts according to percentages on QS permits. Potential drawbacks to this approach are that QS accounts may get slightly less QP issued because amounts in the “holdback” would go to vessel accounts to issue surplus carryover. Also, for species with limited available QP, even less may be available at the start of the fishing year until surplus carryover is issued. This would also create more administrative burden by creating another calculation during the year (the allocation to QS accounts of any surplus carryover holdback that is not credited to vessel accounts).

Option 3: Sub-ACL

Under this option, a sub-ACL would be set equal to the shorebased trawl allocation for the start of the year. Based on the sub-ACL, NMFS would issue 100% of the QP to QS accounts at the beginning of year. Once data is available and surplus carryover from the previous year can be calculated (in the spring), NMFS would issue surplus carryover to vessel accounts. The amount issued for surplus carryover would be added to the sub-ACL to calculate a new “carryover inclusive” sub-ACL. This approach is similar to what is done for Atlantic sea scallop fishery. This option would need to address how the adaptive management program amount fits in any revised sub-ACL. This option could consider if the overall fishery ACL should be reduced from the ABC to account for any management uncertainty with this approach, especially for species where the ABC=ACL. Additional accountability measures could be developed such as if the ACL is exceeded more than once in 4 consecutive years because of an overage in the new “carryover inclusive” sub-ACL, the Council/NMFS will develop a more conservative process for the IFQ fishery (e.g., buffers, etc.). A potential drawback to this approach and all of the options except for no surplus carryover (option 1) is that if the ACL is exceeded more than once in 4 years, it may trigger more restrictive measures.

Option 4: Buffer/Reserve Approach

Under the buffer/reserve approach, an overall groundfish fishery annual catch target (ACT) (all sectors) for IFQ species is established at an amount below the ACL equivalent to 10% of the trawl allocation. The fishery harvest guideline and resulting trawl allocation would be calculated from this overall fishery ACT. The resulting affect is that both the trawl allocation and nontrawl allocation are reduced by 10%, affecting sectors other than just trawl. Surplus carryover would be issued in March/April after the previous year accounts have been reconciled. The nontrawl allocation could be increased with any remaining amounts after issuance of surplus carryover to the trawl fishery. Similar to the holdback approach, potential drawbacks to this approach are that QS accounts may get slightly less QP issued because of some of the amounts in the buffer/reserve would go to vessel accounts to issue surplus carryover. Also, for species with limited available QP, even less may be available at the start of the fishing year until surplus carryover is issued. However, these drawbacks would be slightly less than the holdback approach because the amount in buffer/reserve is shared among trawl and nontrawl sectors. Also, the nontrawl sector would get less fish than if surplus carryover were not calculated this way.

Option 5: Multi-year Average Approach

Surplus carryover would be evaluated by calculating the average trawl mortality plus all other mortality compared to the average ACL over a multi-year period (for example, a four-year moving average period (two biennia)). The evaluation of the moving average mortality to the average ACL would be conducted annually. The need to invoke accountability measures would be considered in the event the average trawl mortality plus all other mortality for a given year results in an ACL overage more than once in four years. National Standard 1 guidelines mention a multi-year average approach may be used for fisheries with highly variable annual catches and lack of reliable inseason or annual data, which is not the case for groundfish. The Council could consider if this approach might be appropriate for groundfish due to the multi-species nature of the fishery; however, such a use of this provision would likely require review at the national level.

Impacts of Surplus Carryover Option	***2011 carryover in 2012***	***2013-2014 spex proposal***	***Option 1 – no surplus carryover***	***Option 2- holdback***	***Option 3- sub-ACL***	***Option 4 – buffer/reserve***	***Option 5- multi-year ACL***
Certainty for industry	no	no	yes	yes	yes	yes	yes
Affects other sectors	no	no	no	no	no	yes	no
Council involvement	no	yes	no	no	no	no	yes
NMFS administrative burden	medium	medium	none	low	medium	low	medium
Complexity	medium	medium	none	low	low	low	high (initially)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

SEP 12 2012

September 12, 2012

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: Agenda Item H.2. Modifications To Chafing Gear Regulations For Midwater Trawl Gear

At the April 2012 meeting, the Council selected a final preferred alternative for modification of the midwater trawl chafing gear regulations. The final preferred alternative was selected from a range of three alternatives that were to be analyzed in an Environmental Assessment (EA). The range of alternatives were intended to address industry's concern that the midwater trawl gear restrictions are no longer appropriate for the current Pacific whiting fleet. In addition, many whiting vessels also use midwater gear to fish for Pollock in the North Pacific, which has a substantially different set of gear restrictions. The following chafing gear alternatives relative to all midwater trawl gear were considered at the April meeting:

> **No Action** – Restricted to the last 50 meshes of the codend with no more than 50% of the circumference covered. No section may be longer than 50 meshes. The terminal end of each section of chafing gear must not be connected to the net except at the corners. Chafing gear must be attached outside any riblines and restraining straps. There is no limit on the number of sections of chafing gear.
>
> **Alternative 1**: Eliminate all chafing gear restrictions
>
> **Alternative 2 (*Council's final preferred alternative*)**: Allow for greater chafing gear coverage consistent with the North Pacific requirements – May cover the bottom and sides of the codend in either one or more sections. Can only be attached at the open end of the codend and sides. The terminal end or the end of each section must be unattached. The only chafing allowed on the top codend panel would be reinforced netting panels under lifting, and constraining straps. All chafing will conform to codend mesh size regulations.

The National Marine Fisheries Service, Sustainable Fisheries Division (SFD) reviewed the range of alternatives considered by the Council and notes that Alternative 1, to eliminate all chafing gear restrictions, is potentially inconsistent with Council's own bycatch mitigation plan and measures specified in Amendment 18 to the Pacific Coast groundfish fishery management plan (FMP). Although trawl rationalization has reduced concerns about bycatch, concerns about Endangered Species Act (ESA) species bycatch, particularly eulachon, and forage fish escapement remain. The proposed regulatory change would affect all midwater gear, including that used for species other than whiting (i.e., chilipepper, widow, and yellowtail), which may require further analysis regarding the likelihood of bycatch of ESA listed species, forage fish, and impacts to essential fish habitat. Section 6.6.1.2 of the FMP states that for the "success of minimum mesh size restrictions in allowing juvenile fish to escape trawl nets, the Council also developed restrictions preventing trawlers from using a double-walled codend. Further restrictions related to this objective include prohibitions on encircling the whole of a bottom trawl net with chafing gear and restrictions on the minimum mesh size of pelagic trawl chafing gear (16 inches)." Given the Amendment 18 bycatch mitigation, SFD recommends narrowing the scope of the analysis by removing the alternative for unrestricted use of chafing gear.

SFD believes that the current chafing gear requirements have two components that were initially implemented to address different concerns, the length of the codend and the circumference of the codend that can be covered by chafing gear. It is our understanding that industry members were primarily concerned with the length of the codend that can be covered to protect the net from abrasion from contact with the stern ramp and occasional contact with the seabed (i.e., the last 50 meshes). Because the provision regarding the circumference of the codend that can be covered with chafing gear was based on historical studies in other fisheries and pertained to the bycatch reduction of small fish, SFD believes that an alternative that increases the allowance for greater coverage of the bottom of the codend (i.e., greater than the last 50 meshes) while maintaining the 50% coverage of the circumference of the codend should also be analyzed.

In summary, SFD suggests that the Council provide an opportunity at the November meeting for reconsideration of the final preferred alternative when there is a more complete analysis. In addition, SFD requests that the analysis be modified in the following manner: 1) remove the unrestricted alternative; 2) add a new alternative that modifies No Action by removing the 50 mesh restriction and allows the full length of the codend to be covered; and 3) add clarification on whether the gear changes are to be applied to all midwater trawling or would be specific to Pacific whiting. If the Council intends for the change to apply to all midwater trawling, the need for performance standards to limit bottom contact with midwater gear similar to pelagic trawl performance standards used in Alaska Pollock fisheries may need to be considered. NMFS believes that if implementing the Council's final action would not result in significant environmental impacts then the required rulemaking could be completed prior to May 15, 2013.

Sincerely,

Frank Lockhart

Agenda Item H.2.c
Public Comment
September 2012

MORRO BAY

2012 COMMERCIAL FISHERIES

Economic Impact Report

July 2012

LWC

MORRO BAY

2012 COMMERCIAL FISHERIES

Economic Impact Report

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Morro Bay Commercial Fishermen's Organization

CENTRAL CALIFORNIA JOINT CABLE/FISHERIES LIAISON COMMITTEE

LWC

ACKNOWLEDGEMENTS

For the second year, the Morro Bay Commercial Fisherman's Organization (MBCFO) spearheaded an effort to showcase the economic contributions of the Morro Bay commercial fishing industry, and for the second year the effort was sponsored by the Central Coast Joint Cable/Fisheries Liaison Committee (CCJCFLC).

The 2012 Morro Bay Commercial Fisheries Economic Impact Report highlights the economic accomplishments of the commercial fishing industry in the 2011 season. However, each season is the culmination of decades of hard work, risks, ingenuity, and growing collective knowledge of the entire commercial fishing community. As such, it would be impossible to list all of the people who contributed to the gains made in 2011 but we would like to acknowledge the generosity and patience of those that guided the research, analysis and writing of this report. Thanks to Mark Tognazzini, Jeremiah O'Brien, Tom Hafer, Bill Blue, Dave Rose, Chris Kubiak, and all of the members of the MBCFO and Central Coast Sustainable Groundfish Association. We'd also like to thank Giovanni DeGarimore, Giovanni Comin, Chris Batlle, Paul Van Buerden, Brett Cunningham, Rick Algert, and the Morro Bay Harbor Department. A special thanks to Kelli Blue and Lori French of the Central Coast Women for Fisheries. Finally, our work would have been much more difficult and certainly delayed if not for Jana Roberts at the California Department of Fish and Game and Kara McLean at the Pacific Fishery Information Network.

If we have forgotten anyone, it is due to our poor memory and not ingratitude.

The MBCFO is celebrating its 40th anniversary in 2012. The MBCFO represents the men and women of the commercial fishing community and provides a powerful communication and information resource in the community.

INTRODUCTION

The Morro Bay commercial fishing industry has experienced tremendous economic growth for over four years. Between 2007 and 2011 earnings by commercial fishermen at the dock, or ex-vessel value (EVV), rose from a 20-year low of $1.8 million to over $7.4 million, a four-fold increase. The positive economic performance is evidence of the hard work and ingenuity of Morro Bay commercial fishermen, which is supported by key investments and contributions from the community.

Since 1990, the commercial fishing industry in Morro Bay has generated over $110 million at the dock.

The hard-fought gains in the commercial fishing industry in 2011 were evidenced by:

- **Increased employment:**
  - On the boats, at the dock, at the processing facilities, and in baiting services, as evidenced by a 12% rise in commercial fishing activity
- **Direct investment in the commercial fishery:**
  - Three new vessels purchased, and extensive gear and vessel upgrades by Morro Bay commercial fishermen
- **Investment by related businesses:**
  - Two new delivery trucks, new forklifts and totes at off-loading facilities for Morro Bay commercial fish businesses, a 10% -15% increase in inventory at the local marine chandlery
- **Growing capacity and cohesion amongst industry participants:**
  - Membership in the MBCFO at an all time high of 108 (over 120 at the time of the writing of this report)
- **Increased and diverse distribution:**
  - Local buyers and processors and the small boat commercial fleet collaborating with a Community Supported Fishery and new and continued relationships with regional, national and international markets.

Dock worker for Morro Bay Fish Company prepares for offloading.

Source: Lisa Wise Consulting, Inc.

All of these investments and the growth in earnings translate directly to economic vibrancy for the community in wages for skippers, dock workers, crew, bait service providers, and at local processors, as well as increased earnings for ice providers, mechanics, and grocers and local businesses.

The Morro Bay 2012 Commercial Fisheries Economic Impact Report builds on information presented in the *Morro Bay 2011 Commercial Fisheries Economic Impact Report.* This report examines the commercial fishing industry's economic performance through employment and wages, investment in related businesses, establishment of new businesses, and increased capitalization and activity, such as those listed above. Importantly, the report also describes two integral, but often overlooked, components of the industry's success. These include: social gains through growth in leadership and cohesion in the commercial fishing community, and: environmental benefits of commercial fishing operations performing in an area with extensive spatial closures aimed at protection of habitat and rebuilding fish stocks.

The intent of this report is to maintain and enrich the dialogue with the community on the economic significance and contributions of the local commercial fishing industry. The report is also intended to keep commercial fishery participants and stakeholders updated on the key facts of their industry's performance. The work is ultimately aimed at open and substantive communication, a more valuable and resilient community, and better informed decision makers, as well as increasing the demand for locally-caught seafood. The commercial fishing industry, lead by the Morro Bay Commercial Fishermen's Organization (MBCFO) with a generous grant from the Central Coast Joint Cable/Fishery Liaison Committee (CCJCFLC), considers this report an important communication tool and connection between fishermen and industry stakeholders, civic leaders, local businesses, and the citizens of Morro Bay.

Unless otherwise indicated, all monetary figures in the report are adjusted to 2011 dollars.

The commercial landings and earnings data for this report was sourced primarily from the California Department of Fish and Game (CDFG). CDFG is responsible for collecting and reporting on commercial fishing landings and earnings at all California ports. Commercial fish buyers are required to submit the following information, for all commercial fishing landings: species, weight, price per pound, gear type used, geographic area, vessel name, permit/license number, and date of landing. Data on commercial fishing activity was also sourced from the Pacific Information Network or PacFIN, a federal and state partnership focused on fishery data collections and information management on the West Coast. Where possible the data presented in the report is for the Port of Morro Bay unless identified as San Luis Obispo County, which would then include data from Port San Luis and San Simeon. Data was also gathered from personal interviews (phone and in person) with commercial fishery participants, field visits, and over six years of working directly with Morro Bay commercial fishermen.

F/V TKO leaving Morro Bay on a trip aimed at the abundant local groundfish resource.

Source: Lisa Wise Consulting, Inc.

KEY FINDINGS

Employment on the Rise

In 2011, there was an 21% increase in the number of active fishing vessels (vessel ID) in San Luis Obispo County from 160 in 2010 to 194 in 2011 (vessel ID and fishing trip data is only available on the County level). Each vessel carries one skipper and up to two deckhands. The number of fishing trips in the County also increased from approximately 4,243 in 2010 to 4,789 in 2011, up 13% from 2010. Each commercial fishing trip drives employment for skipper and crew, at the offloading facility, fuel dock, ice machine, with the purchase of bait and bait services, supplies and vessel and gear maintenance.

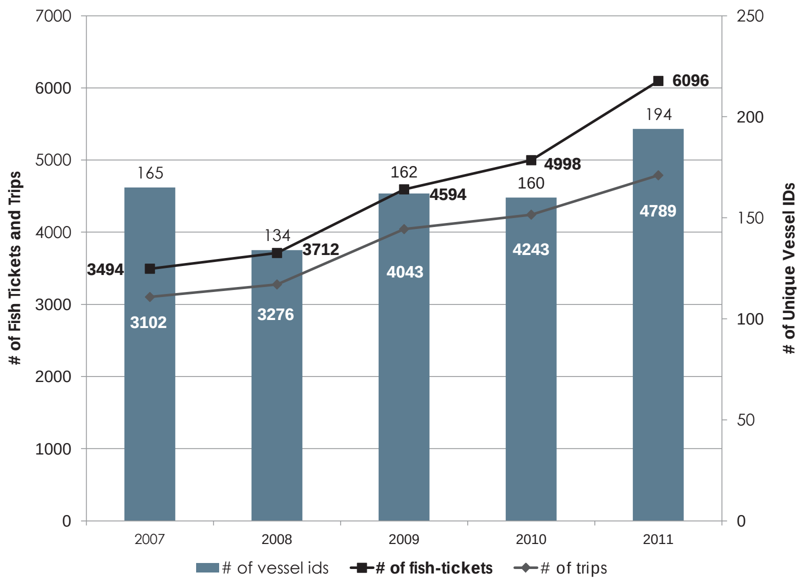
As examples, local processor Central Coast Seafoods hired up to 15 employees to keep up with landings in 2011 (personal communication, June 2012). Morro Bay Fish Company also hired dock employees to keep up with offloading demand and increased ice sales, and all of the fishermen interviewed claimed to have hired additional deckhands and baiting service providers.

Also, one of the local hook and line skippers, a respondent to our survey, claims to have gone from fishing alone in 2008 to employing three deckhands and three seasonal bait service providers in 2011 (personal communication, June, 2012).

Industry Earnings on the Rise

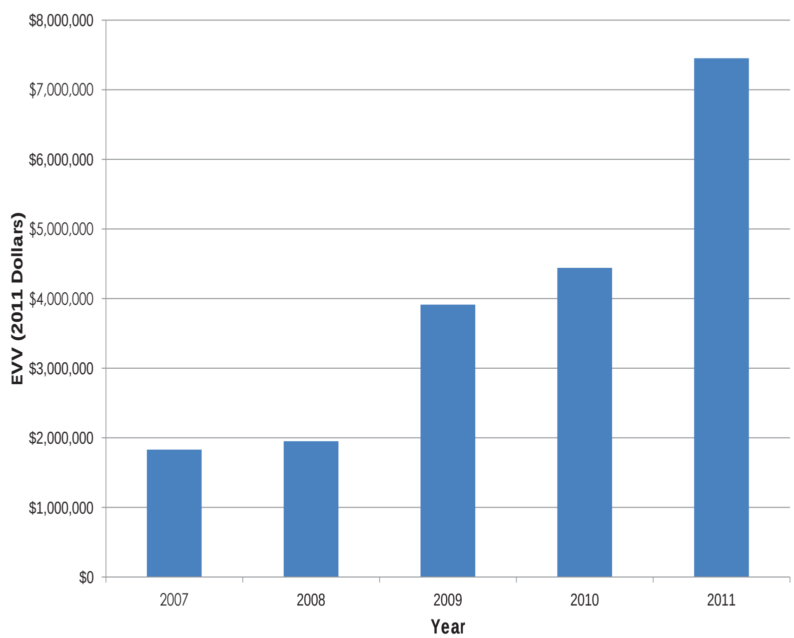
In 2011, Morro Bay commercial fishermen generated over $7.4 million in earnings at the dock, up from $4.4 million in 2010. This represents an approximate 69% increase in income and a more than 400% increase from a 20-year low in 2007. Earnings are reinvested in wages, related expenses, and local discretionary purchases as well as reinvestment in equipment and the vessel.

Figure 1.1. San Luis Obispo County, 2011



Source: pacFIN, 2012

Figure 1.2. Morro Bay Total Revenue, 2007 - 2011



Source: California Department of Fish and Game (CDFG) 2012

According to the 2010 U.S. census, unemployment numbers in the State of California are still high at 9%, unemployment in San Luis Obispo County is lower than the State average at 7.4% and Morro Bay numbers are at 3.7%.

New Businesses and Expansion

In 2011, Morro Bay's commercial fishermen and the related business owners made considerable investments and changes, enhancing the industry substantially.

For example, three local fishermen purchased new vessels in 2011, effectively increasing the size of the fleet, its overall catch, and earnings capacity. In this same year, the only local trawl fishing vessel in Morro Bay underwent a full overhaul and remodel and began fishing in September. Local commercial seafood buyers, Morro Bay Fish Company and Morro Bay Fresh, invested in a forklift and delivery trucks. This has afforded them greater flexibility and options on where and to whom they sell their fish, allowing them to keep more value in the community. Similarly, Tognazzini's Dockside Restaurant and Fish Market purchased a forklift and totes, and increased their ice production capacity by 1000 pounds. SLO Fresh Catch, a community supported fish distribution cooperative, has tripled the amount of locally caught and locally processed fish to local seafood consumers and increased the number of shareholders from 100 to 125.

One of the three new fishing vessels purchased by the Morro Bay fleet makes its way from Nova Scotia to the West Coast of the U.S.

Infrastructure Expansion and Growth Opportunities

In 2011, Tomich Brothers, a Southern California seafood buyer and processor, established a fish pump on the Morro Bay Fish Company dock. The fish pump can be used to offload Dover sole and Coastal Pelagic Species (CPS); squid, sardines, anchovies and mackerel. The CPS fishery entails specialized fishing, offloading and processing equipment, and expertise. Morro Bay has had no CPS activity since 2004, primarily due to lack of offloading infrastructure and consolidation of processing in Ventura-Oxnard, Terminal Island, and Watsonville. However, with the newly installed fish pump, the Port may be able to participate in the CPS fishery, which is the most valuable in the State of California, at approximately $80 million total earnings (2010). Further, the fish pump could attract CPS vessels that follow fish stocks and land at the closest port with the appropriate offloading infrastructure.

Increased Value

In 2011, the Morro Bay commercial fishing industry continued its successful drive to attract more value per pound. In 2011 the overall average price per pound was $2.20, an 11% increase from 2010, and has more than doubled from approximately $1.00 average price per pound in the 1990s. Morro Bay fishermen target spot prawn, one of the State's most valuable species, earning $12.20 per pound at the dock. Sablefish, the top landed species in 2011, fetched an average price of $2.29 per pound. Morro Bay also had a strong swordfish year in 2011, with fishermen earning $4.16 per pound; shortspine thornyhead pricing was at approximately $2.54 per pound and blackgill rockfish at $1.32 per pound in 2011. The near shore fishery continues to successfully take advantage of demand and higher prices. The top three species in that fishery, gopher rockfish, cabezon, and grass rockfish, attracted $6.94/pound, $5.59/pound and $8.69/pound respectively. In 2011, halibut earned $5.33 per pound.

Local Value, Local Spending

Approximately 15 miles east of Morro Bay, Central Coast Seafood continues to purchase seafood directly from commercial fishermen and provide jobs to local skilled fish cutters, drivers, and support staff. Tognazzini's is the sole buyer and processor for SLO Fresh Catch, a significant and growing source of locally-caught, locally-processed seafood. Tognazzini's and Giovanni's Fish Market provide well stocked seafood counters with retail options for local seafood. Locally caught, processed, transported, and consumed seafood makes contributions to the economy at each step in the value chain and keeps jobs and earnings in the community.

Source: Lisa Wise Consulting, Inc.

Newly installed wet fish pump for off loading at Morro Bay Fish Co.

Table 1.1 Price per Pound, Morro Bay Top Species 2011

Species	Price Per Pound
Prawn, spot	$12.20
Rockfish, grass	$8.69
Rockfish, gopher	$6.94
Cabezon	$5.59
Halibut, California	$5.33
Swordfish	$4.16
Thornyhead, shortspine	$2.54
Sablefish	$2.29
Rockfish, blackgill	$1.32
Hagfishes	$0.81

Source: CDFG, 2012

Source: Lisa Wise Consulting, Inc.

F/V South Bay off loading Dover sole in 2011.

Source: Lisa Wise Consulting, Inc.

Newly purchased delivery truck operating in Morro Bay.

Revived Fisheries and Market Power

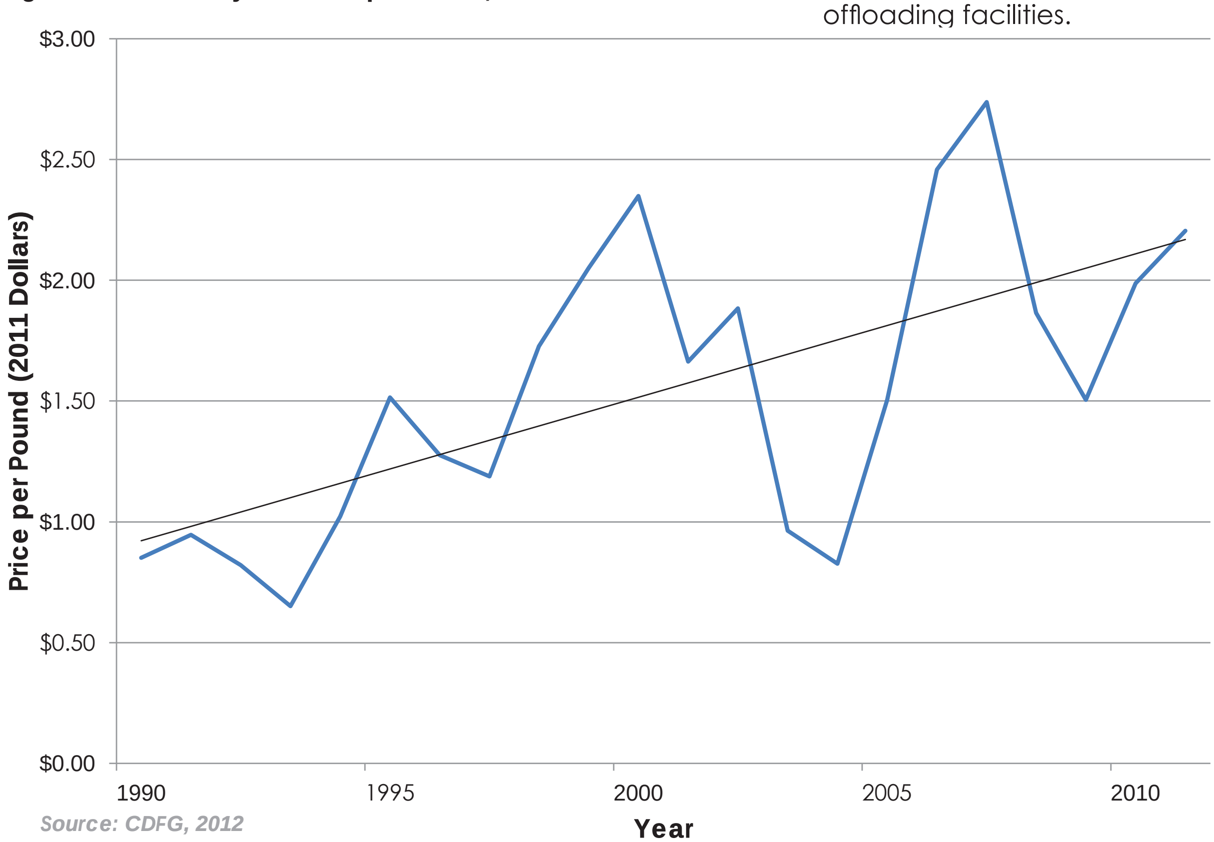
Morro Bay commercial fishermen are constantly coordinating with demand in the market, shifting prices and availability of fish. In 2011, local fishermen began working with one of the largest seafood wholesalers in Washington State. The majority of those transactions were exported to Asian markets. The fleet simultaneously continued relationships with L.A. based American Seafoods, Seaharvest in Moss Landing, and the local buying/offloading stations in Morro Bay.

Sablefish pricing in 2011 was actually higher than reported as several fishermen sold their fish to the buyer-processor at $1.00 per pound, in what is described as "Ocean Run" pricing, and later collect the remainder of the value of the fish based on yield at the plant. CDFG records do not track the second payment.

Financial Partnerships

Commercial fishermen have formed and are maintaining valuable partnerships with financial entities, and feel sufficiently confident and are sufficiently sophisticated to take advantage of long-term, low interest loans, like those offered by the California Fisheries Fund (CFF). Loans from the CFF enabled the purchase of new vessels in 2011 and upgrades and expansion at local offloading facilities.

Figure 1.3. Morro Bay Fish Price per Pound, 1990 - 2011



Source: CDFG, 2012

SOCIAL AND ENVIRONMENTAL IMPLICATIONS

Economic gains in the Morro Bay commercial fishery do not exist in a vacuum; they rely on input from knowledgeable and capable people and the presence of healthy habitat and persistent fish stocks. There is a close and integral relationship amongst social capital, environmental health, and economic stability. All of the elements of a strong, capable and knowledgeable community contribute to and are rewarded by a healthy environmental resource and growth and stability in economic performance. The investment and returns are self-reinforcing

Source: Lisa Wise Consulting, Inc.

Dover sole going through a de-icer upon offloading.

There is a close and integral relationship amongst social capital, environmental health, and economic stability.

Local Leadership and Social Cohesion

Membership in local commercial fishing associations is evidence of the community's confidence in the industry and the interest to participate. Membership of the MBCFO has increased from 66 in 2008 to 108 in 2011 (over 120 at the time of this report). In 2011, the Central Coast Sustainable Groundfish Association (CCSGA), a new commercial fisherman-based marketing association, was formed as a legal entity to assure access to the local commercial fishing resource and take advantage of new federal regulations. The City of Morro Bay has formed a community-based organization, the Morro Bay Community Quota Fund (MBCQF), aimed similarly at maintaining local access under the same federal regulations. The CCSGA is consistently represented at federal regulatory meetings and participates in regional industry dialogue aimed at more efficient harvest and the management of overfished species. The Central Coast Women for Fisheries has grown to over 60 members, provided over $100,000 in educational scholarships to fishermen and their families, and has a working endowment of over $180,000.

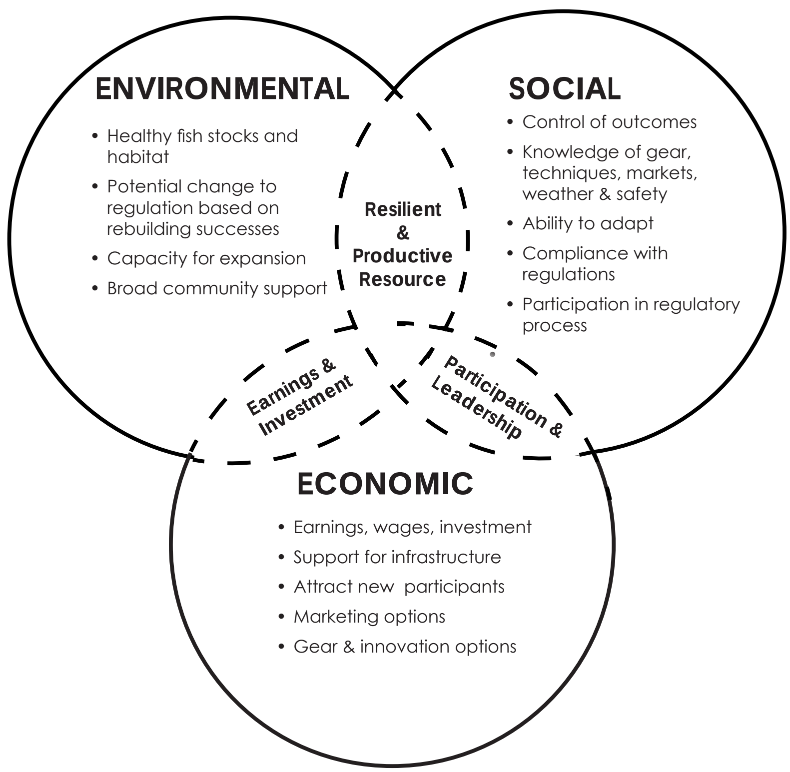
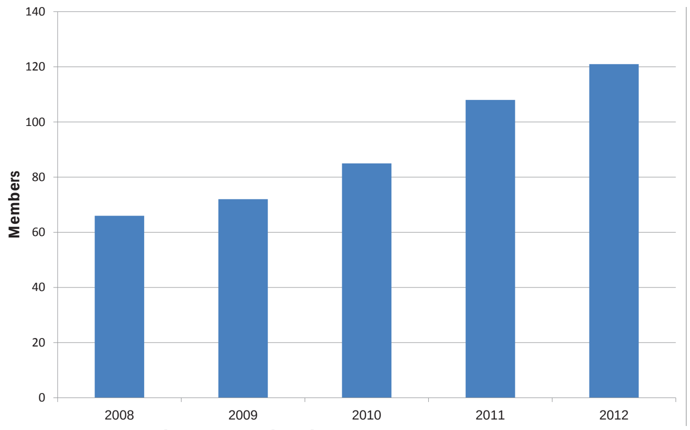
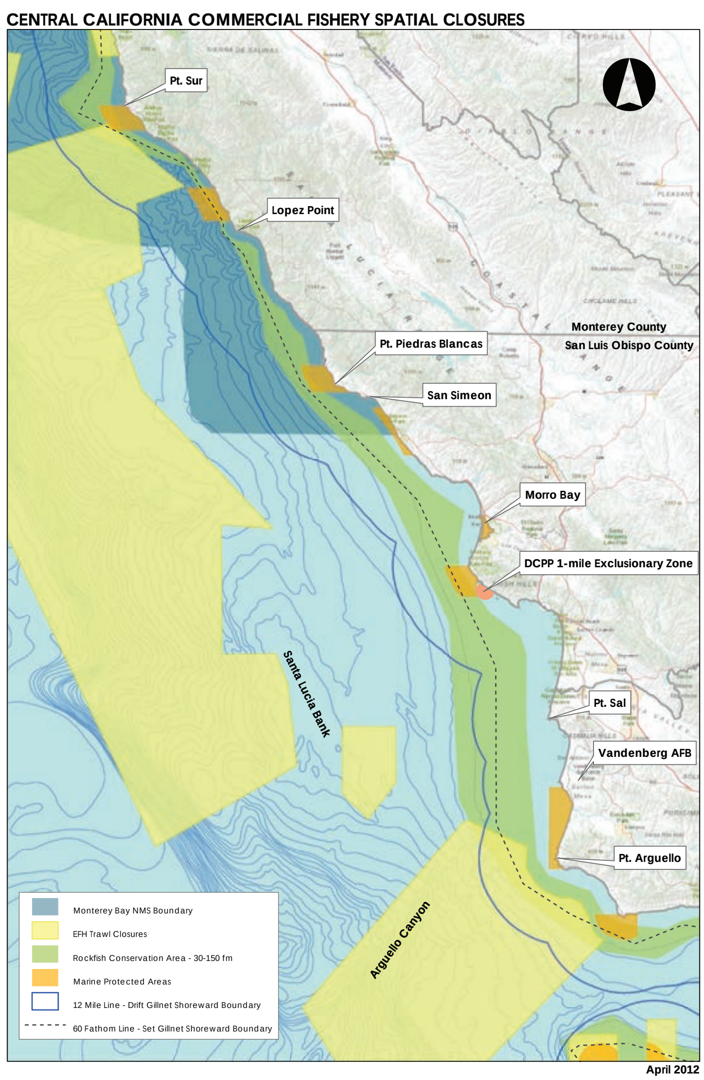


Figure 1.4. MBCFO Membership, 2008 - 2012



Source: Personal Communication



Adaptation to Conservation Measures

Morro Bay commercial fishermen are faced with significant (state and federal) geographic closures on their fishing grounds aimed at protecting habitat and rebuilding fish stocks. The fact that the fleet has increased overall earnings and price per pound, and is successfully engaging in a diversity of fisheries and gear types while constrained by these closures is illustrative of the community's collective knowledge and ability to adapt. The extent of the closures are illustrated in the Central California Commercial Fishery Spatial Closures map and include but are not limited to:

- Southern boundary of the Monterey Bay Marine Sanctuary;
- 3.8 million acres of Essential Fish Habitat where trawling is prohibited;
- Marine Protected Areas where no commercial fishing of any kind is permitted;
- Rockfish Conservation Area (RCA) that spans the length of the State and prohibits the use of hooks and traps (fixed gear) from 30 to 150 fathoms; and
- Trawl RCA that prohibits trawling from 100 to 150 fathoms along the entire coast as well as restricted areas for set gillnets (outside of 60 fathoms) and drift gillnets (outside of 12 miles).

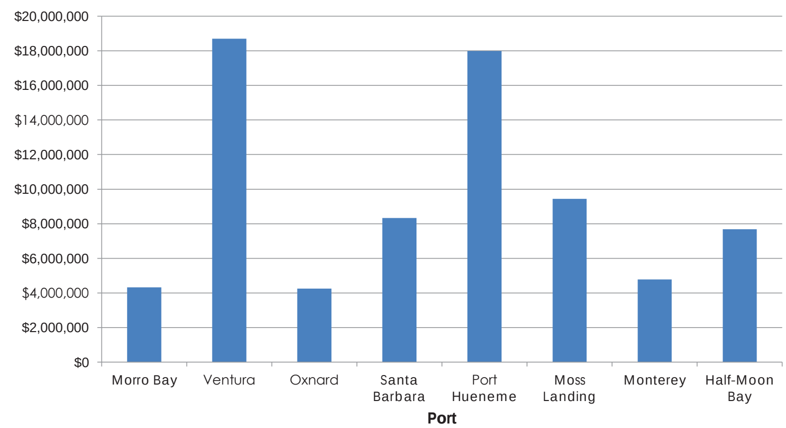
DATA AND TRANSPARENCY

A key component of a well-regulated and valuable fishery is transparency. U.S. commercial fishermen are required to provide detailed information on each and every landing, including earnings per pound, species, time, place, and gear type. Landings and earnings by species by month for the Port of Morro Bay are available to the public on the CDFG and PacFIN websites. A discussion on reporting requirements can be found in Appendix A.

REGIONAL POSITION

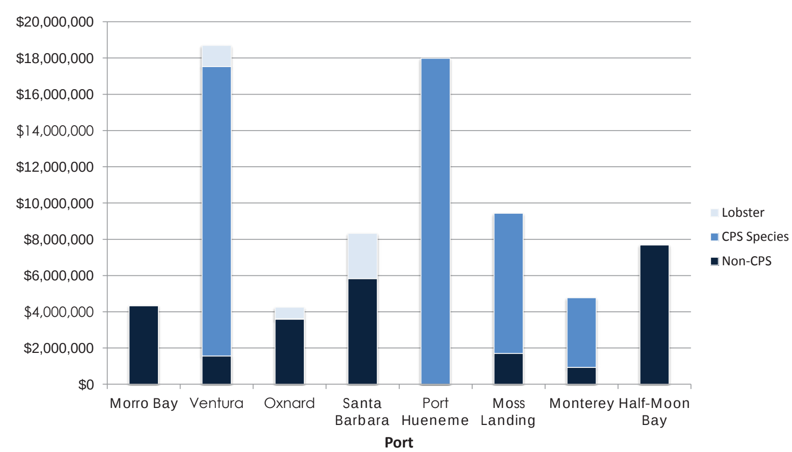
Morro Bay remains one of the top performing ports in the Central Coast region for groundfish, swordfish, spot prawn, hagfish, and the near shore fishery. The Ports of Ventura, Port Hueneme, Oxnard, Moss Landing, and Monterey rely heavily on Coastal Pelagic Species (CPS) landings, squid, sardines, mackerel and anchovies. The CPS fishery engages specialized gear, offloading and processing equipment, and expertise. Morro Bay has had no CPS activity since 2004, primarily due to lack of offloading infrastructure and consolidation of processing in Ventura-Oxnard, Terminal Island, and Watsonville. However, with the newly installed fish pump, Morro Bay may be able to participate in 2012 and beyond. Santa Barbara is one of the top California spiny lobster ports on the West Coast with over $2.5

Figure 1.5. Regional Ports Total Value all Species, 2010



Source: CDFG, 2012

Figure 1.6. Regional Ports Total Value, CPS and Non-CPS Species, 2010



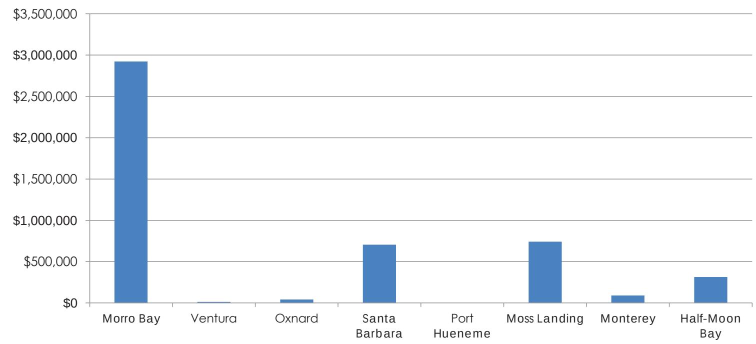
Source: CDFG, 2012

Table 1.2 Value by Species, All Regional Ports, 2010

	Morro Bay	Ventura	Oxnard	Santa Barbara	Port Hueneme	Moss Landing	Monterey	Half-Moon Bay
Port Total	**$4,325,519**	**$18,696,184**	**$4,249,406**	**$8,328,659**	**$17,985,224**	**$9,437,476**	**$4,777,606**	**$7,687,091**
Key Species								
Sablefish	$2,921,400	$13,325	$42,203	$705,906	$0	$740,579	$91,282	$314,054
Swordfish	$125,907	$4,990	$22,683	$16,503	$0	$57,854	$0	$0
Thornyhead	$248,431	$3	$353,444	$26,312	$0	$216,940	$10,399	$2,243
Nearshore Species	$259,032	$1,204	$7,590	$192,022	$0	$23,622	$53,130	$2,520
Hagfish	$246,637	$0	$0	$23,444	$0	$0	$0	$0

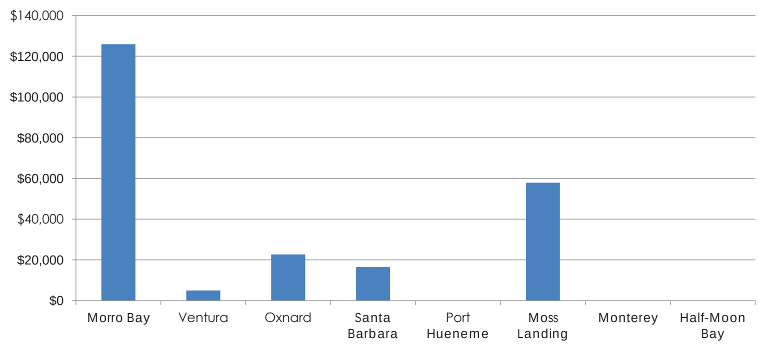
Source: CDFG, 2012

Figure 1.7. Regional Ports Total Value Sablefish, 2010



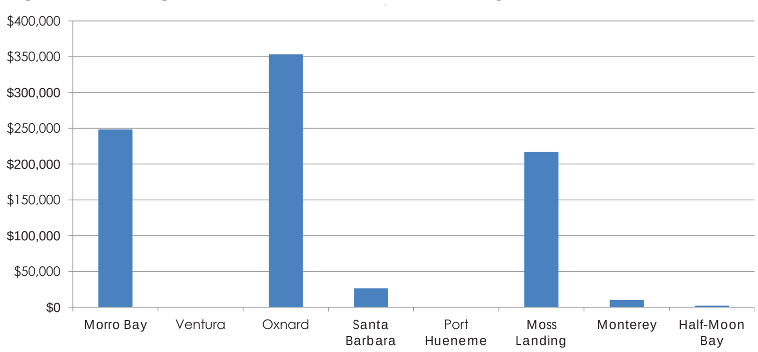
Source: CDFG, 2012

Figure 1.8. Regional Ports Total Value Swordfish, 2010



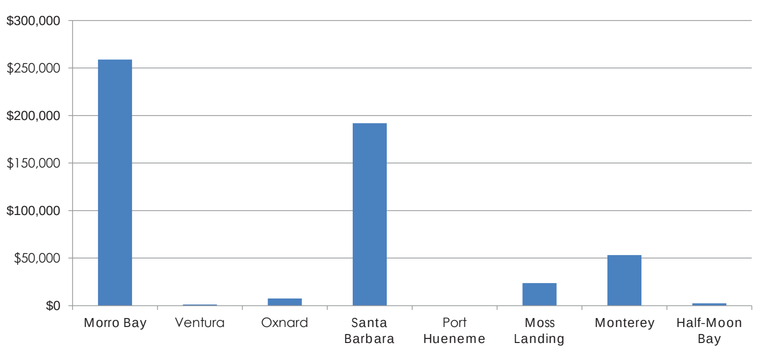
Source: CDFG, 2012

Figure 1.9. Regional Ports Total Value Thornyhead, 2010



Source: CDFG, 2012

Figure 1.10. Regional Ports Total Value Nearshore Species, 2010



Source: CDFG, 2012

million in 2010, and Ventura had approximately $1.2 million in lobster revenue in 2010. Lobster does not occur commercially north of Point Conception. *Note: the most recent available data from other regional ports is for 2010 so the following comparisons are made for the 2010 season.*

SABLEFISH

In 2010, Morro Bay far outperformed all ports in the region in sablefish earnings and remains one of the top sablefish ports in the State.

SWORDFISH

Morro Bay outperformed all regional ports in swordfish earnings and is one of the top swordfish ports in the State.

THORNYHEAD

In 2010, Morro Bay was only exceeded by Oxnard in thornyhead earnings.

NEARSHORE

In 2010, Morro Bay outpaced all of the other regional ports in the near shore fishery.

HAGFISH

Morro Bay was the region's top hagfish port in 2010. Santa Barbara was the only other port in the region to land Hagfish (not shown here).

SPOT PRAWN

Morro Bay outperformed all regional ports in spot prawn earnings and brought in over $9.6 million in total earnings from 1990 to 2011. Specifics on spot prawn landings in Morro Bay and other ports are not reported due to confidentiality (not shown here).

IMPORTANT SPECIES AND FISHERIES

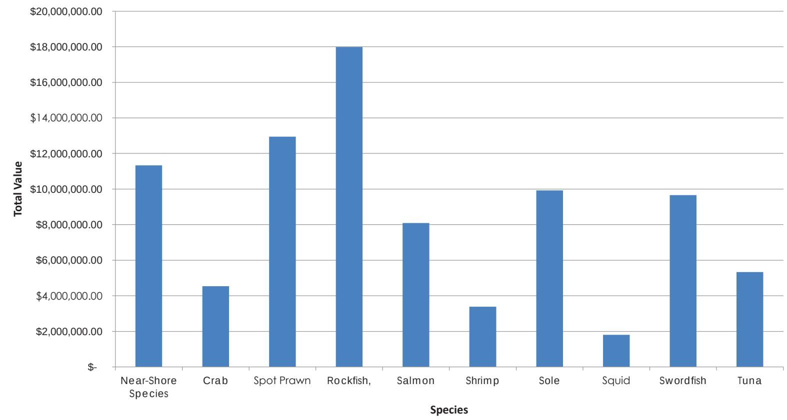
Several fishermen and industry stakeholders called 2011 one of the best years they can remember. They also cautioned that the commercial fishing industry is cyclical, that boom and bust cycles are typical. The industry can, however, in the long run, rely on its participants to apply their collective knowledge and experience, adapt to changing conditions, and take advantage of resources with the highest return. This is the most valuable asset in the entire analysis.

Through the history of the fishery, several key fisheries have contributed to the economic, social, and environmental performance of the Morro Bay commercial fishing industry and the greater community. Below is an assessment of some of these fisheries and the total earnings they generated from 1990 through 2011. A resilient and healthy port relies on a diversity of species and diverse catch methods; this is evidenced in the following paragraphs.

Albacore

Landings of commercial albacore have consistently shifted away from California to Oregon and Washington since the mid to late 90s. The last significant landings of albacore in Morro Bay took place from 2000 to 2002 (2 million pounds in 2001). Morro Bay has several boats that target albacore as their primary fishery, traveling north each summer and returning in October or November. Through these commercial fishing operations, Morro Bay maintains knowledge and capacity of the jig and bait methods and on-vessel freezing and cold storage infrastructure. Between 1990 and 2011, overall albacore EVV in Morro Bay was approximately $4.6 million at an estimated average $1.06 per pound. Albacore makes up more than 93% of all tuna species landed in San Luis Obispo County.

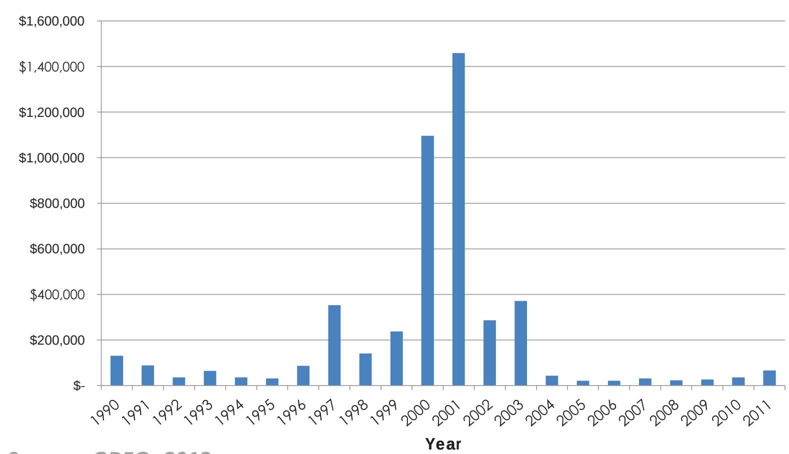
Figure 1.11. Morro Bay Value by Species, 1990 - 2011 Totals



Source: CDFG, 2012

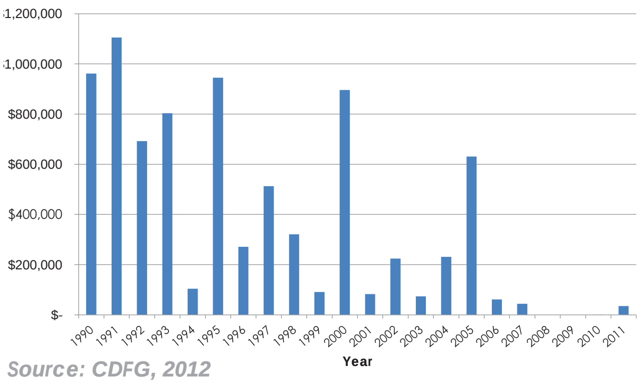
The industry can, however, in the long run, rely on is its participants to apply their collective knowledge and experience, adapt to changing conditions and take advantage of resources with the highest return.

Figure 1.12. Total Value Morro Bay Albacore Landings, 1990 - 2011



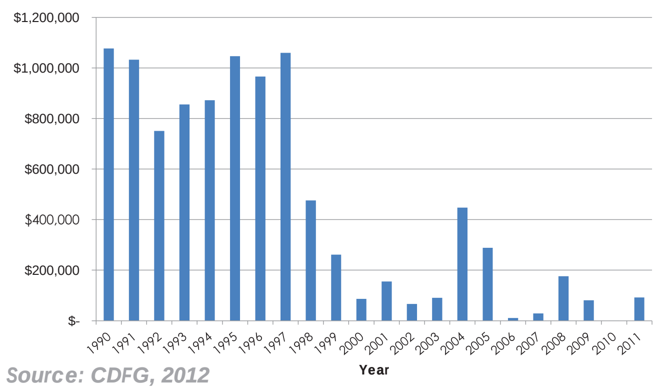
Source: CDFG, 2012

Figure 1.13. Total Value Morro Bay Salmon Landings, 1990 - 2011



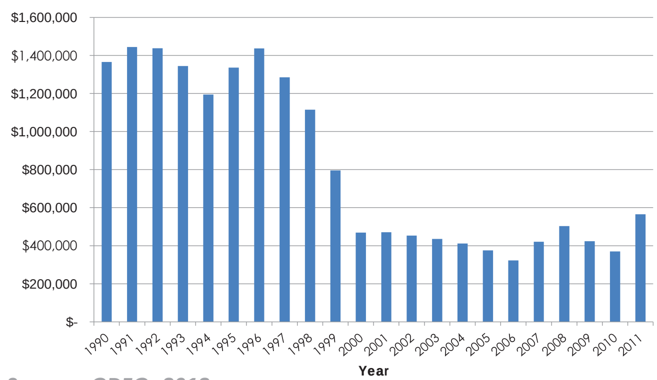
Source: CDFG, 2012

Figure 1.14. Total Value Morro Bay Sole Landings, 1990 - 2011



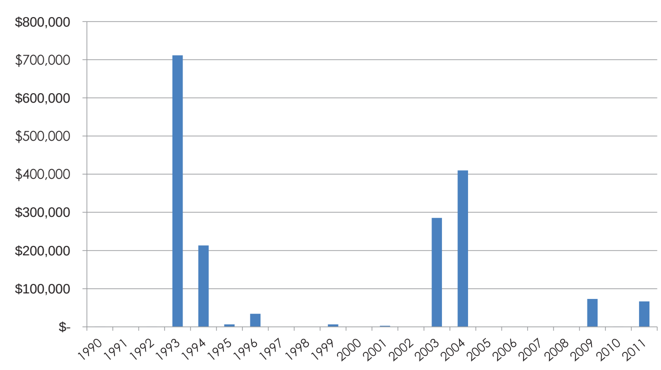
Source: CDFG, 2012

Figure 1.15. Total Value Morro Bay Rockfish Landings, 1990 - 2011



Source: CDFG, 2012

Figure 1.16. Total Value Morro Bay Market Squid Landings, 1990 - 2011



Source: CDFG, 2012

Salmon

Morro Bay has a strong history in the California salmon fishery, generating over $8.1 million between 1990 and 2011 at an average price of $3.56 per pound. 2010 and 2011 were the first (limited) commercial salmon seasons since 2007 due to regulatory closures. In 2011, salmon landings generated a little over $34,000, less than hoped. However, at the time of writing this report, summer of 2012, Morro Bay was engaged in strong landings and earnings and above average price per pound.

Sole

This category is made up of several species and accessed primarily by trawl. Earnings for sole species has dropped in recent years but efforts have been successful in getting one trawler back on the water in 2011. Since 1990, species of sole have brought in almost $9.9 million for the Morro Bay commercial fishing community.

Rockfish

Morro Bay is one of the top rockfish ports in California, bringing in over $17.9 million since 1990. Blackgill, the sixth most valuable fishery for Morro Bay in 2011, brought in over $218,000 in 2011.

Market Squid

One of the State's top fisheries, market squid, saw historically high landings in 2010 and 2011. The last significant landings and earnings in Morro Bay occurred in the 1990s and early 2000s. Market squid, part of the CPS complex, are very common along our coast, but landings have not occurred in Morro Bay due to lack of infrastructure, primarily a squid pump. The presence of a squid pump at the Morro Bay Fish Company dock could mean local participation in this $80 million fishery. Market squid have brought in approximately $1.8 million for Morro Bay since 1990.

Shrimp

While there have been no recent landings in Morro Bay, shrimp has generated approximately $3.3 million in Morro Bay since 1990.

Crab

Crab have brought in over $7 million since 1990 but there hasn't been a strong crab season in Morro Bay since 2006. Morro Bay is on the southern end of the habitat for the most valuable crab species, Dungeness, with greater abundance north of San Luis Obispo County. While not reflected in this report, 2012 will be a better year for Dungeness Crab in Morro Bay, as visiting boats and several fishermen who typically travel to San Francisco for the Dungeness crab season have opted to fish locally due to good fishing conditions.

Swordfish

Since 1990, commercial fishermen in San Luis Obispo County have landed over $9.67 million in swordfish, the third highest EVV in the State, trailing only Los Angeles and San Diego Counties.

Among small ports, Morro Bay leads the State in swordfish landings, ahead of Santa Barbara, Ventura, San Francisco, and Monterey Counties (Source: PacFIN). Earnings in 2011 topped $408,000. See Attachment B, County of San Luis Obispo Swordfish Landings, for a one page information sheet on swordfish earnings in Morro Bay developed for a NMFS meeting in July of 2011.

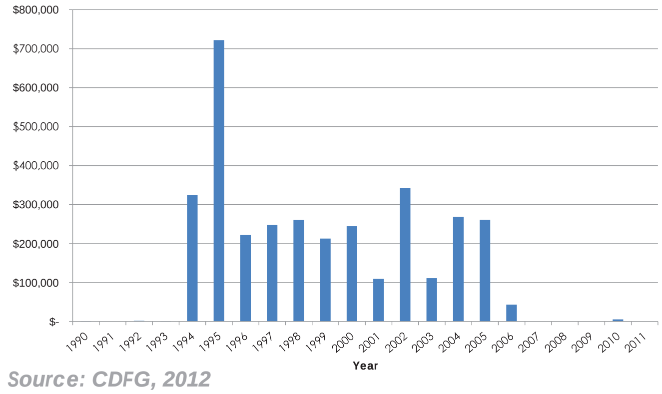
Spot prawn

Steady landings have brought in over $12.9 million since 1990 and at $12.20 per pound (in 2011) contribute to the rising value of the Morro Bay commercial fishing industry (not shown here).

Near shore

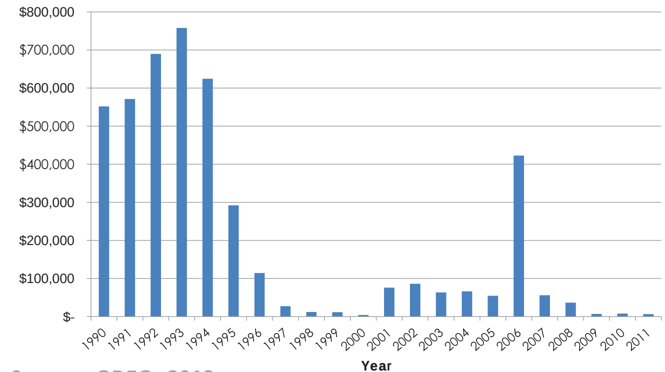
Another low volume, high value fishery, earnings for the top three nearshore species exceeded $360,805 in 2011 and the fishery brought in over $11.3 million since 1990.

Figure 1.17. Total Value Morro Bay Shrimp Landings, 1990 - 2011



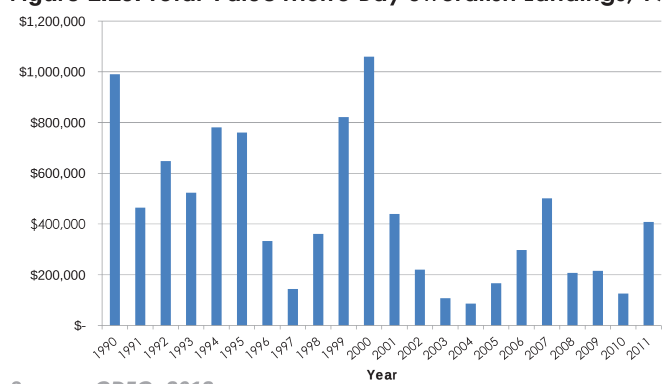
Source: CDFG, 2012

Figure 1.18. Total Value Morro Bay Crab Landings, 1990 - 2011



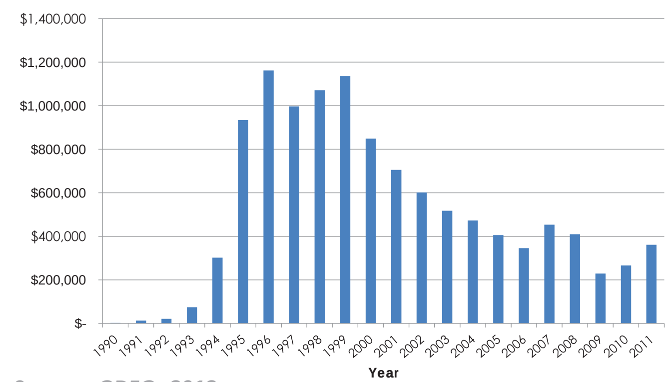
Source: CDFG, 2012

Figure 1.19. Total Value Morro Bay Swordfish Landings, 1990 - 2011



Source: CDFG, 2012

Figure 1.20. Total Value Morro Bay Near Shore Landings, 1990 - 2011



Source: CDFG, 2012

Ice loaded on to a vessel from the City-owned ice machine.

CONCLUSION

The 2011 fishing season saw the continuation of a 4-year positive economic trend for the commercial fishing industry in Morro Bay. About half of the $7.4 million in earnings in 2011 ($3.8 million) can be attributed to the fixed gear fleet targeting sablefish, but strong showings in swordfish, spot prawn, thornyheads, and blackgill rockfish, and continued strong landings in the near shore fishery and halibut attest to the industry's diversity and capability. Increased earnings have strategically driven investment in commercial fishing infrastructure and commercial fishing businesses; new boats, forklifts, totes, ice production capacity, and delivery trucks are persistent and will serve the fleet for years with continued returns. Increased earnings at the dock and increased activity in the fleet (trips, vessel IDs) translate into jobs for skippers and deckhands, and at the offloading facility, processing plant, and related industries, as well as increased spending at local businesses. A successful CSF is an effective promotional tool and strengthens the connection between the commercial fishing industry and the local seafood consumer. Positive effects from higher earnings have spurred participation within the commercial fishing community and membership to key organizations; the MBCFO and CCWF are at all time highs. Membership creates stronger bonds internally as well as with the greater community. Morro Bay commercial fishermen have achieved these gains while observing strict area closures and reporting requirements aimed at protecting habitat and rebuilding fish stocks. The commercial fishing industry is investing in and generating economic, social, and environmental gains which benefit the entire community, and has taken a sophisticated approach to reinvestment in physical and social infrastructure that will facilitate the long-term continuation of economic growth, community participation and support, and robust fish stocks.

APPENDIX

Appendix A

DATA AND TRANSPARENCY

Source: Marigee Bacolod

Reporting protocols that are consistent and transparent, like those in the U.S., are a gauge to a well managed, sustainable commercial fishery.

Commercial fishery data in the United States is transparent, consistent and openly available. Anyone with internet access can find the quantity of seafood landed in Morro Bay or any U.S. port, the price paid to fishermen at the dock, by species, by state, by month and have access to annual aggregate data. This is not true for most U.S. top seafood trading partners, namely; China, Indonesia and Thailand. All commercial vessels that land in Morro Bay or in any U.S. port are required to complete a fish ticket.

In California, CDFG oversees fish ticket requirements and makes the landings data available on their website (http://www.dfg.ca.gov/marine/fishing.asp#commercial). A fish ticket is generated for each landing and includes the landing date, permit number, fisherman's name, buyer name and ID number, port of first landing, geographic code of where the fish where caught, species, weight, type of fishing gear used, price per pound and total earnings. The data is aggregated and posted on the CDFG's website approximately six to eight months after the end of the calendar year. Landings, earnings and commercial fishing data on the U.S. commercial fleet can also be found on the joint State/Federal; Pacific Fishery Information Network or PacFIN (http://pacfin.psmfc.org/). PacFIN houses data for fisheries from Alaska to California. While discrepancies between large scale databases and vessel level data may occur, CDFG and PacFIN currently provide the best commercial fishing data sets. Reporting protocols that are consistent and transparent, like those in the U.S., are a gauge of a well managed, sustainable commercial fishery.

This report also used data from the 2007 U.S. Economic Census, the Economic Development Department for the State of California, and the Bureau of Labor Statistics.

Appendix B

COUNTY OF SAN LUIS OBISPO
S W O R D F I S H L A N D I N G S

STATE-WIDE SIGNIFICANCE

Since 2000, commercial fishermen in San Luis Obispo County have landed over $3 million in swordfish, the third highest EVV in the State, trailing only Los Angeles and San Diego Counties.

Among small ports, Morro Bay leads the State in swordfish landings, ahead of Santa Barbara, Ventura, San Francisco, and Monterey Counties (Source: PacFIN).

County	EVV
Los Angeles	$30.8 Million
San Diego	$13.2 Million
San Luis Obispo	$3 Million
Orange	$1.8 Million
San Francisco	$1.7 Million
Ventura	$1.4 Million
Monterey	$822,000
Santa Barbara	$257,000

COUNTY SIGNIFICANCE

Since 2000, annual swordfish earnings ranged between just under $73,000 and just over $464,000. Swordfish have consistently been in the top ten of all species landed in the County. Since 2005, swordfish EVV has been in the top five, and has regularly ranked in the top three.

In the last decade, the number of vessels landing swordfish ranged from 29 in 2000 to 5 in 2010, with an average of approximately 10 vessels per year. The vessels generated an average of 25 trips and 32 fish tickets per year (Source: PacFIN).

Year	EVV Rank
2000	3
2001	3
2002	6
2003	6
2004	8
2005	4
2006	4
2007	1
2008	2
2009	3
2010	5

CALIFORNIA HARVEST & IMPORTS

In 2010, $2.2 million of swordfish were landed in the State of California. In that same year, the State imported over $16 million of swordfish. The majority of imported swordfish came from Singapore, Indonesia, and Mexico (Source: PacFIN; NMFS Office of Science and Technology, Imports and Exports of Fishery Products).

lisa wise consulting, inc.

planning economics natural resources

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Paul Kujala
F/V Cape Windy
311 SE Galena
Warrenton, OR 97146

August 23, 2012

Chairman Wolford and Council Members
Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: Agenda Item I.1.b Open Comment on Widow Rockfish Reallocation

I am writing today to strongly urge the council to include an option for analysis of the Widow Rockfish reallocation in November that includes more recent history than the 1994-2003 window years. Widow Rockfish is a non-whiting trawl fish that current participants in the non-whiting trawl industry should have an opportunity to share in the harvest.

The trawl industry has drastically changed in the last twenty years with the addition of the ITQ system, multiple EFHs, RCAs, 3 miles line closure in Washington, gear restrictions, as well as drastic cuts in the TACs of multiple species. To pretend that these things have not changed the fleet drastically is wrong. Therefore, I believe that we need to recognize that basing quota allocation almost entirely on fishing practices in the 90's and early 2000's without including recency does not benefit the current fleet and industry.

As we all know, different fish stocks rise and fall. Those of us that are still in the industry have had to adapt to many different changes. Having options is what has kept the dedicated people in the industry around. The ITQ system took away future options for many of us. We no longer have the right to harvest different species as the market changes and conditions and regulations change. Rising costs associated with the ITQ program are again going to change what we can fish. To further compound this by cutting off fisherman with LE Trawl Permits from sharing in the future harvest of a rebuilt trawl species is wrong.

I understand why the window years were chosen and used for initial allocation. However, we did not think the implementation would take until 2011. I don't think that in 2003 anyone thought that ten years later we would still be going back to 1994 without including any history past 2003.

For these reasons I ask the council to include for analysis an option that reflects current and recent participation in the non-whiting trawl fleet. This can be done by using landings of non-whiting trawl fish in recent years, since Widow are a non-whiting trawl fish.

Thank You,

Paul Kujala
F/V Cape Windy

August 23, 2012

Future Council Work
Electronic Monitoring

Pacific Fishery Management Council
Dan Wolford, Chairman,
7700 N.E. Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Dear Chairman Wolford and Council Members

As you may remember, leading up to January of 2011 our main concern before the Council was whether or not we would have the ability to access our target with the limited amount of overfished species. Since that time we have been committed to finding solutions, and by developing strategic partnerships and working with other likeminded fishermen, we built an OFS risk pool that utilizes co-management across fishing ports, cooperative fishing plans, and innovative technology. After almost two years we have reduced the OFS challenge to a manageable risk.

During that time, another challenge was bubbling up and has since raised to the top our concerns – 100% on-board human observer coverage and its associated costs. I commend the Council on its work to identify observer coverage alternatives such as electronic monitoring, and I urge you to continue and to expand your work in that area. These efforts will take several years to develop and forward moving progress are key to providing a sustainable observer program for fishermen and observer companies, especially in small fishing port communities.

In smaller fishing ports like Fort Bragg, profitability for both hinges on the amount of sea days each operation can achieve. The greater number of sea days for the observer company amount to fewer paid land days. The greater number of trips (average 3 sea days) for fishermen amount to increased revenue at the dock.

We have been repeatedly told by our observer company that providing coverage in Fort Bragg simply does not pencil out, and they cannot continue losing money in our port due to lack of sea days and expensive land days. We understand - their business, like fishing operations, are not sustainable with enormous costs.

A successful financial relationship between observer and fishermen is based primarily on achieving the greatest number of at-sea days in a given period. The conditions set forth below have impaired our ability to form such a financial relationship.

- Vessel size – the average Ft. Bragg vessel in the groundfish fleet is small to mid-size which makes it difficult and dangerous to conduct fishing activities in larger seas. This immediately and adversely affects the amount of sea days we are able to achieve in a given period.
- Weather patterns – severe in winter with unpredictable high winds in spring. Our fishing efforts are governed by weather conditions which present extended periods of foul weather where fishing efforts cease.
- Absence of consecutive sea days – irregular fishing efforts brought on by unfavorable weather conditions makes maintaining a permanent observer in the port a financial loss.
- Absence of permanent observers in port – contributes to higher cost per sea day, initiated fisherman paying for observer land days, additional travel costs, weekly vs. annual contracts, and missed fishing trips (sea days).

In addition to many of the naturally occurring challenges I just described, I am also providing actual vessel data for two separate fishing operations out of Fort Bragg that fished in the 2011 West Coast Groundfish Program.

West Coast Groundfish Catch Share Program – Year 1
Two Fishing Operations in Fort Bragg

The data used in Table 1 was taken directly off NOAA's mandatory Economic Data Collection (EDC) Form. To ensure confidentiality of the operations, vessel and owner names are purposely omitted.

Expenses and revenues for the two operations were reviewed and compared to understand the trawl fishery-specific expenses. The two fishing operations varied in size and consisted of two trawl vessels that fished a variety of species and various amounts and trawl QP.

Because value in the "observer world" is derived by achieving the greatest number of at-sea days; the values have been divided by the number of sea days each operation achieved in order to calculate per sea day values for gross revenues, expenses and net revenue.

Table 1 illustrates the two operations and their respective revenues and expenses per sea day in 2011. For each fishing operation, the trawl fishery-specific expenses accounted for approximately 5.8% of total expenses (fixed and variable expenses) in 2011.

Table 1. Groundfish IFQ Fishery 2011 Expenses/Earnings per Sea Day Comparison for Two Vessels[1]

Confidential Vessel #s	**1**	**2**
2011 Total ITQ Gross Revenues [1]	$7,780.22	$9,315.74
2011 Fixed Expenses	$1,267.35	$2,615.45
2011 Variable Expenses	$4,707.26	$6,165.06
Total 2011 Variable & Fixed Expenses	$5,974.61	$8,780.52
IFQ Fishery Specific Expenses Included in Variable Expenses Above		
Pacific Coast Groundfish Trawl Buyback - 5% fee on landings	$338.63	$465.79
Observer Costs (90% covered by NMFS in 2011)	$46.90	$29.25
2011 Trawl IFQ Specific Expenses [2 3]	$385.53	$495.04
2011 Net Revenue per Sea Day [4]	$1,805.61	$535.23
Trawl-Specific Expenses Percentage of Net Revenue per Sea Day	6.45%	5.64%

[1] Figures in table are a proxy value based on actual 2011 expense/earnings and at-sea days.
[2] Observer costs and buyback fees are accounted for in 2011 Variable Expenses figure, but shown here for comparison.
[3] Values are per sea day and based on actual 2011 expenses per sea days for each operation
[4] Values are per sea day and represent net revenue per sea day for each operation in 2011

West Coast Groundfish Catch Share Program – Looking Ahead at Costs

In an attempt to calculate the impacts of future costs, the estimated incremental per sea day expense of these additional fees (e.g. 3% cost recovery and full observer costs) were applied to the 2011 figures (Figure 1) and are illustrated in Table 2.

In Table 2, the estimated per sea day expense of the 3% cost recovery and full observer coverage are provided for comparison and are also included within the variable expenses line item. You will see in Table 2, the trawl fishery-specific expenses accounted for approximately 14.09% of their respective total expenses (fixed and variable combined) compared to just 5.8% in 2011. The estimated net revenue per sea day decreased accordingly and varied between operations with one of the two fishing operations' estimated net revenue per sea day falling below the "break even" point and resulting in net losses.

Table 2. Groundfish IFQ Expenses/Earnings per Sea Day Comparison for Two Vessels at Full Implementation of IFQ Program

Confidential Vessel #s	1	2
2011 Total ITQ Gross Revenues [1]	$7,780.22	$9,315.74
Fixed Expenses	$1,267.35	$2,615.45
Variable Expenses[2]	$5,343.76	$6,865.28
Total Variable & Fixed Expenses	$6,611.11	$9,480.74
IFQ Fishery Specific Expenses Included in Variable Expenses Above		
Pacific Coast Groundfish Trawl Buyback - 5% fee on landings	$338.63	$465.79
Observer Costs - Fully Burdened	$450.00	$450.00
IFQ Costs Recovery-3% fee on landings	$233.41	$279.47
Trawl IFQ Specific Expenses [3]	$1,072.42	$1,195.26
Estimated Net Revenue per Sea	$1,169.11	-$165.00
Trawl-Specific Expenses Percentage of Net Revenue per Sea Day [4]	16.22%	12.61%
Decrease in Net Revenue from 2011 (%)	-35.30%	-130.80%

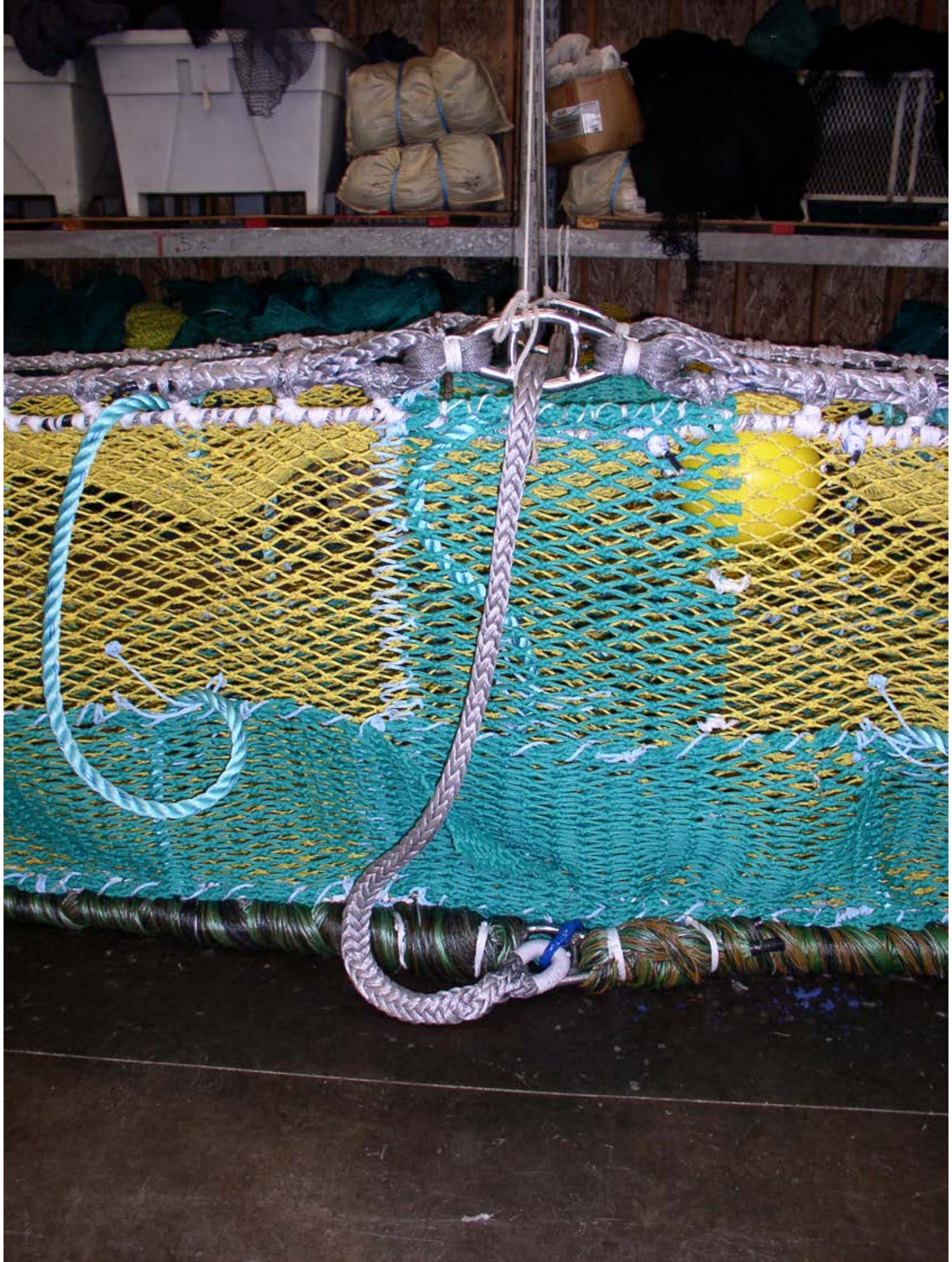
[1] Figures in table are a proxy value based on actual 2011 figures and at-sea days.
[2] Estimates for 3% costs recovery is based on 2011 gross revenues and observer costs are based on estimated per day rates ($450/day) and 2011 actual at sea days. Both are also included in Variable Expenses total line.
[3] Value represents net revenue per sea day for each operation with future full implementation of IFQ program (e.g. costs recovery, buyback and observer costs).
[4] Percentage of loss revenue per sea day at full implementation of IFQ program when compared to year 1 of IFQ (2011)

It should be noted that observer travel expenses were omitted from this analysis but under current contract, one of the vessel owners in this model pays between $125-200 per trip and expects to finish the year with approximately 25 trips/75 sea days. With these current projections, it is unlikely that fishing operation could sustain such losses. Fishermen will either lease/sell quota on the open market, potentially consolidating quota to fewer and larger vessels, causing historic small family fishing operations to disappear.

To that end, I strongly encourage the Council to continue scoping alternative methods for observer/monitor coverage, and continue developing the framework for electronic monitoring.

Sincerely,

Michelle Norvell
Fort Bragg Groundfish Association
mnorvell@mcn.org



Agenda Item H.3
Situation Summary
September 2012

STOCK ASSESSMENT PLANNING

This agenda item concerns planning for new groundfish stock assessments that are anticipated to be done in 2013, which will be used during 2014 to decide the harvest specifications and management measures for 2015 and 2016 groundfish fisheries.

In June, the Council selected a preliminary list of groundfish stocks for full (also known as benchmark) assessment, update assessment, and those where a data report would be developed. Full assessments, where Stock Assessment Review (STAR) Panels are convened to comprehensively review assessments, are proposed for darkblotched rockfish, petrale sole, shortspine thornyhead, longspine thornyhead, cowcod, aurora rockfish, and Pacific sanddabs. With four STAR Panels planned for full assessments and two assessments to be reviewed at each panel, there is room for one more full assessment. The Council recommended either rougheye rockfish or yellowtail rockfish as a candidate for the last full assessment slot.

An update assessment, where the input data for a past full assessment is updated, is proposed for bocaccio. Sablefish is also a candidate for an update assessment, or it will not be done at all next cycle. The National Marine Fisheries Service (NMFS) Northwest Fisheries Science Center was tasked with evaluating recent recruitment information for sablefish to assess whether a sablefish update would be informative (Agenda Item H.3.b, NMFS Report).

Data reports are not assessments, but an evaluation of recent catches to ensure that management is effectively maintaining harvest at or below the limits prescribed in rebuilding plans. Data reports are proposed for canary, Pacific ocean perch, and yelloweye rockfish.

In June, a workshop was convened to review methods for conducting data-moderate assessments. Data-moderate assessments are a refinement over the approved data-poor assessment methods that use catch data to inform harvest specifications (e.g., DCAC and DB-SRA) since abundance trend information is incorporated. Two data-moderate assessment methods were recommended by the review panel to inform harvest specifications, but not to determine stock status (Agenda Item H.3.a, Attachment 1). One STAR panel meeting has been reserved to review a number of data-moderate assessments in the event the Scientific and Statistical Committee (SSC) recommends these data-moderate assessment methods.

In February, a workshop was convened to review methods for conducting groundfish surveys using a Collborative Optical-Acoustic Survey Technique (COAST). The SSC will review the report of the workshop (Agenda Item H.3.a, Attachment 2) and report their recommendations to the Council, NMFS Science Centers, and stock assessment teams on the potential use of the COAST survey in future assessments.

There are three Terms of Reference that guide the stock assessment process: one which specifies how the next assessment process should occur and defines the roles and responsibilities of various entities contributing to this process, one which guides the development of rebuilding analyses that are used to develop harvest specifications and rebuilding plans for overfished species, and one that guides how new methods are reviewed and recommended for scientific activities that inform analyses used in management decision-making. These Terms of Reference have been reviewed by some members of the SSC and others and are included as Agenda Item H.3.a, Attachments 3, 4, and 5, respectively. The Council may want to modify these Terms of Reference for the next assessment cycle.

The Council is to consider the input from the NMFS Science Centers, the advisory bodies, and the public before adopting 2013 stock assessment priorities by species, type of assessment (full, update, data-moderate assessment, or data report), the language for the three draft Terms of Reference, and a proposed schedule for 2013 STAR Panel meetings.

Council Action:

1. **Adopt the List of Stocks To Be Assessed in 2013.**
2. **Adopt the Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014.**
3. **Adopt the SSC Terms of Reference for Groundfish Rebuilding Analysis.**
4. **Adopt the Terms of Reference for the Methodology Review Process for Groundfish and Coastal Pelagic Species.**
5. **Adopt the 2013 Groundfish Stock Assessment Review Panel Meeting Schedule.**

Reference Materials:

1. Agenda Item H.3.a, Attachment 1: Assessment Methods for Data-Moderate Stocks – Report of the Methodology Review Panel Meeting.
2. Agenda Item H.3.a, Attachment 2: Collaborative Optical-Acoustic Survey Technigue (COAST) – Report of the Methodology Review Panel Meeting.
3. Agenda Item H.3.a, Attachment 3: Draft Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014.
4. Agenda Item H.3.a, Attachment 4: Draft Terms of Reference for the Groundfish Rebuilding Analysis for 2013-2014.
5. Agenda Item H.3.a, Attachment 5: Draft Terms of Reference for the Methodology Review Process for Groundfish and Coastal Pelagic Species.
6. Agenda Item H.3.b, NMFS Report: NMFS Report on Groundfish Stock Assessment Planning for 2013.
7. Agenda Item H.3.b, GMT Report: Comments from Members of the Groundfish Management Team to the Scientific and Statistical Committee Regarding the Stock Assessment and Rebuilding Analysis Terms of Reference Documents and Continuing Issues with the Evaluation of Rebuilding Plans.

Agenda Order:

a. Agenda Item Overview John DeVore
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Final Adoption of (1) a List of Stock Assessments (Full, Updates, Data Moderate and Data Reports), (2) Three Terms of Reference (Including Two for Coastal Pelagic Species), and (3) the STAR Panel Schedule.
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PFMC
08/24/12

Agenda Item H.3.a
Attachment 1
September 2012

Assessment Methods for Data-Moderate Stocks

Report of the Methodology Review Panel Meeting

National Marine Fisheries Service (NMFS)
Alaska Fisheries Science Center (AFSC)
Seattle, Washington
26-29 June 2012

Methodology Review Panel Members:
Mathew Cieri, Center for Independent Experts (CIE)
Martin Dorn (Chair), Scientific and Statistical Committee (SSC), NMFS, AFSC
Vladlena Gertseva, SSC, NMFS, Northwest Fisheries Science Center
Cynthia Jones, CIE
André Punt, SSC, University of Washington

Panel advisors:
John DeVore, PFMC Staff
Corey Niles, Groundfish Management Team
Gerry Richter, Groundfish Advisory Panel

Technical Team:
Emil Aalto, University of California, Davis
Linsey Arnold, Oregon State University
Jason Cope, NMFS, NWFSC
Edward Dick, NMFS, SWFSC
Kristen Honey, Stanford University
Alec MacCall, NMFS, SWFSC
James Thorson, NMFS, NWFSC
Chantel Wetzel, NWFSC, University of Washington

Émile Borel (1871-1956)

1. OVERVIEW

A review of data-moderate assessment methods was conducted by a Methodology Review Panel (Panel) at the Alaska Fisheries Science Center, Seattle, WA, during 26-29 June 2012. The review panel included three SSC members and two CIE reviewers. The Panel followed draft Terms of Reference for Stock Assessment Methodology Reviews (March 2012). Dr. James Hastie opened the meeting on behalf of the Northwest Fisheries Science Center, welcomed the participants, and introduced Dr. Martin Dorn, the panel chair. The Panel was provided extensive background material, including a number of primary documents, through an FTP site, two weeks prior to the review meeting. The Technical Team gave several presentations to the Panel during the meeting, and responded to panel requests for additional information.

The Pacific Fishery Management Council (the Council) approved a data-moderate assessment workshop to be held in 2012 at its September 2011 meeting. The workshop was planned as a follow-up to the review panel meeting in April 2011 that reviewed assessment methods for data-poor stocks. At that meeting, the Panel endorsed the use of several catch-only methods (DCAC, DB-SRA, and Simple Stock Synthesis (SSS)) for category 3 stocks, and considered new assessment methods for data-moderate category 2 stocks. The defining distinction between category 3 and category 2 stocks is that stock abundance trend information is incorporated in the assessment. The April 2011 review panel did not endorse any of the methods proposed for category 2 stocks, since these methods were not sufficiently developed at that time. The Panel recommended the following:

> *"To continue the progress that has been made, the Panel recommends that a similar off-year STAR Panel review be scheduled to further develop and finalize methods and to review example applications. The Panel suggests a few common data sets be used across all candidate methods. The meeting would involve participants from at least the NWFSC, the SWFSC, and various academic institutions. Methods should be sufficiently developed by the 2015-16 groundfish management cycle that it would be reasonable to bring forward a number of candidate category 2 stock assessments using simple assessment models for review at a STAR Panel in 2013."*

The goal of this meeting was to review progress in implementing the recommendations of the April 2011 workshop, and further discuss how to best conduct and review data-poor and data-moderate assessments within the Council process. In particular, the Panel evaluated several proposed refinements to catch-only methods, reviewed two proposed methods for category 2 stock assessments that incorporate abundance indices, evaluated performance of both methods in trial applications, and discussed data available to inform abundance trends for category 2 stocks.

The Panel agreed that substantial progress that has been made since the last review panel meeting. The Panel concluded that two data-moderate assessment methods, XDB-SRA and exSSS, are sufficiently well developed to form the basis for category 2 assessments in the next assessment cycle. However, simulation testing was recommended to further evaluate utility of both methods. The Panel also endorsed several refinements to data-poor methods, and provided recommendations on how to further improve inputs for DB-SRA and SSS. A comparison of data-moderate assessments results with outputs from full assessments suggests that data-moderate methods can provide improved results over data-poor approaches, such as DB-SRA and SSS. The Panel recommends that the data-moderate assessments be used for setting OFLs, ABCs, and ACLs. Data-moderate assessments, however, have greater uncertainty than full assessments, and the Panel recommends that a two-stage process be adopted for status determination, in which data-moderate assessments are used to evaluate whether a stock is of concern, followed by a full assessment (if warranted), which would utilize all available information.

The Chair thanked the NWFSC for hosting the meeting, acknowledged the assistance of AFSC in providing a meeting room and helping with meeting logistics, and thanked the participants for the creative and constructive atmosphere during the review, the results of which should help inform the Council and its advisory bodies determine the best available science for the assessment of groundfish.

2. COMMENTS ON THE TECHNICAL MERITS AND/OR DEFICIENCIES OF THE METHODOLOGY

2.1. Refinements to Catch-Only Methods for Category 3 stocks

DCAC and DB-SRA have been used by the Council to estimate OFLs and set harvest specifications for category 3 stocks. Both methods require four types of input, including a ratio of B_{MSY} to B_0, a ratio of F_{MSY} to M, natural mortality (M), and reduction in abundance, or delta parameter (which represents stock depletion). At the meeting, progress with efforts to better inform these inputs was presented.

2.1.1 B_{MSY}/B_0 ratio

Dr. James Thorson presented a meta-analysis that treats the Pella-Tomlinson shape parameter (and by extension B_{MSY}/ B_0) as a random effect while fitting surplus production models to catch time series and stock assessment estimates of spawning biomass from the RAM Legacy Stock Assessment Database. The results demonstrated that B_{MSY}/ B_0 differs among taxonomic orders, and is generally lower for Clupeiformes and higher for Scorpaeniformes. There is also a significant correlation between B_{MSY}/B_0 and maximum body size both within and between taxonomic orders. The estimate of B_{MSY}/B_0 for all stocks pooled was approximately 40%, which corresponds well with assumptions used in the Council process, although the mean values estimated for B_{MSY}/ B_0 for Scorpaeniformes (46%) and Pleuronectiformes (40%) were higher than currently assumed (40% and 25% respectively) by the Council.

The Panel found this analysis to be potentially useful in better informing the prior distribution of B_{MSY}/B_0 used in DB-SRA. To help interpret results of the analysis, the Panel made two requests (*Requests A* and *B*, below).

2.1.2 F_{MSY}/M ratio

Dr. Thorson presented results of Zhou et al. (2012), who assembled a database of F_{TARGET} estimates from assessed bony and cartilaginous species, and compared these estimates with estimates of natural mortality (M) within a hierarchical Bayesian model with measurement error. F/M ratios were estimated separately for different F_{TARGET} methods (i.e., F_{MSY}, F_{proxy}, and F set at 50% of an estimate of the intrinsic growth rate r), and taxonomic groups (bony vs. cartilaginous fishes). The estimate of mean F_{MSY} /M ratio was 0.41 for cartilaginous fish and 0.86 for bony fish before bias-correction. Application of the delta-method (while including bias-correction for M as well as F given M) yielded an estimate of F_{MSY}/M of 0.97 for bony fishes and 0.46 for cartilaginous fishes.

To help interpret results of the analysis, the Panel made one request (*Request C*, below).

2.1.3 M/k ratio

Dr. Thorson presented a new "Meta-analysis using Stock Assessment Software" (MESAS) framework to conduct meta-analyses, with specific application to the life history invariant M/k using the Stock Synthesis software and inputs used for peer-reviewed assessments of 11 stocks on the U.S. West Coast. This framework approximates the posterior distribution for the parameters of the stock assessment except natural mortality M and the von Bertalanffy growth coefficient k using marginal likelihood (while treating M given k as a random effect for each stock), and finds an expected value for M given k of 1.26 for rockfishes, with a coefficient of variation for M given k of 0.68.

The Panel notes that this approach uses the available data in a more appropriate matter, but the coefficient of variation for M given k was not lower than those for other methods which have been used in Council assessments.

2.1.4 Natural Mortality

Dr. Jason Cope gave a brief outline of Dr. Owen Hamel's work on developing a prior distribution for natural mortality (M) to be used in stock assessments. This approach combines existing methods to develop a meta-analytical prior for M. This method appears to be relevant to both full assessment and assessments for data-moderate stocks. The method has been applied in several assessments used by the Council, but has not gone through peer-review, or review by the Council's Statistical and Scientific Committee (SSC).

Complete details of this approach were not available (as Dr. Hamel was away on other work obligations). The Panel was unable to properly evaluate the specifics of the method and, therefore, and was unable to recommend it to be used in catch-only (as well as data-moderate) assessment methods at present. The Panel recommended this analysis be documented and brought for SSC review, ideally before the next assessment cycle.

2.1.5 Delta

Dr. Cope presented a relationship between the Productivity-Susceptibility Analysis (PSA, Patrick et al. (2010)) vulnerability score and depletion for Council-approved assessed species. He showed that the PSA vulnerability scores are correlated with the estimated delta values for the 31 previously-assessed stocks used to evaluate the performance of DB-SRA. This relationship, therefore, can be used to inform the prior distribution on delta (or depletion), and thus improve this input for catch-only models. Drs. E.J. Dick and Alec MacCall used PSA vulnerability scores to improve specification of the delta parameter in DB-SRA, which allowed DB-SRA to use stock-specific delta priors with a potential gain in performance. Although improved performance was demonstrated for a number of stocks, low values of delta (those that correspond to stocks that had declined very little in abundance) tended to result in poorer performance of DB-SRA, and the original fixed value of delta led to better estimates of OFL for those stocks. Drs. Dick and MacCall proposed a modification where the regression value of delta was used for vulnerable stocks, but a minimum delta of 0.5 was used for less vulnerable stocks.

The Panel agreed that using PSA vulnerability scores to inform delta priors is an improvement to catch-only methods, and recommended that this approach be used in both DB-SRA and SSS. The Panel, however, recommended that instead of using a subjectively selected minimal delta value of 0.5 for less vulnerable stocks, three vulnerability bins with breaks at PSA scores of 1.8 and 2.2 (as defined in Cope et al. 2011) be used, and the delta values associated with each bin be set to the mean for the bin. Such an approach allows the use of PSA results already used in the Council process to define bins. This approach should also be used for the extended versions of DB-SRA and SSS where applicable.

2.1.6 Modified Production Function

Emil Aalto presented an analysis of a DB-SRA correction term proposed by Drs. Dick and MacCall to address a misspecification in the original DB-SRA production function. When the biomass has changed between time *t* (when recruitment is produced) and time *t+a* (when that recruitment joins the exploitable stock), the amount of recruitment needed to replace losses due to natural mortality (M) has also changed. For example, if the stock has declined, some of the recruitment produced at the initial higher biomass appears as spurious net production, when it joins an exploitable biomass that is smaller than that which produced it. The proposed correction term eliminates the spurious production due to trends in abundance. The Panel agreed that this modification is an improvement of the method previously used (see also *Request D* below).

2.1.7 Requests by the Panel and Responses by the Technical Team

Request A: For the B_{MSY}/ B_0 analysis (presented by Dr. Thorson), show the fits of outputs from the random effects and meta-analytic models presented to data for West Coast rockfish.
Rationale: To better interpret the results of the analysis, and further evaluate their utility for catch-only methods.
Response: The numbers generated using the global assessment database were found to be different from estimates produced when the database was limited to West Coast and Alaskan species only, probably due to decrease in sample sizes when using only a subset of species.

The Panel did not have sufficient information to thoroughly evaluate how the analyses were conducted and, hence, explore possible reasons for differences (particularly notable for Pleuronectiformes) between results presented and the proxy values currently assumed within the Council process. Therefore, the Panel does not recommend using results of the analysis presented to inform the prior distribution for B_{MSY}/B_0, but encourages further efforts in refining inputs required for catch-only methods.

Request B: Provide summaries of B_{MSY}/ B_0 for West Coast and Alaska stocks, grouping species into rockfish, flatfish, elasmobranches, others.
Rationale: To better interpret the results of the analysis, and further evaluate their utility for catch-only methods.
Response: see response to *Request A*.

Request C: Provide summary of F_{MSY}/M for West Coast and Alaska stocks, grouping species into rockfish, flatfish, elasmobranches, others.
Rationale: To better interpret results of the analysis, and further evaluate their utility for catch-only methods.
Response: The database assembled by Zhou et al. (2012) does not designate data by region so the request could not be fulfilled.

The Panel did not have sufficient information explore possible reasons for differences between results presented and the values currently assumed for DB-SRA and DCAC. Therefore, the Panel does not recommend using results of the analysis presented to inform the prior distribution for F_{MSY}/M, but encourages further efforts in refining the approach. The expected F_{MSY}/M value currently assumed for DB-SRA and DCAC is 0.8, which is reasonably consistent with the results of the Zhou et al. (2012) meta-analysis.

Request D: Calculate OFL distributions for 31 stocks, compare OFLs generated by DB-SRA with assessment results (by species), create bias correction distributions by PSA species groups, apply these bias-correction distributions to each species, generate a distribution of the absolute value of x-1 (where x is a draw from bias-corrected distribution), and compare the results for all four DB-SRA versions presented and discussed: (1) original DB-SRA (with delta of 0.6); (2) version with M correction applied (with delta of 0.6); (3) version with M correction and with three vulnerability bins (as identified in Cope et al. (2011)) used to inform delta; (4) with M correction and delta informed by depletion-vulnerability regression.
Rationale: To further evaluate the modifications proposed to the original DB-SRA, and particularly the use of vulnerability bins (rather than the depletion-vulnerability regression) to inform delta.
Response: The results of the requested runs were presented (Table 1). These results demonstrated that the version of DB-SA with vulnerability bins (version 3) outperformed the other two versions. The Panel recommends that future applications of DB-SRA include the correction for M as well as distributions for delta by PSA vulnerability bin.

2.2. Review and adoption of data-moderate methods

2.2.1 Stock Synthesis using only Catch and Index Time Series (SS-CI)

Dr. Jason Cope presented the Simple Stock Synthesis (SSS) and the extended Simple Stock Synthesis (exSSS) methods. SSS is based on sampling parameters (steepness, natural mortality and depletion) from prior distributions and using SS3 to solve for virgin recruitment (R_0) given inputs for selectivity, growth, and fecundity. ExSSS extends SSS by allowing index data (and potentially length and age data) to be used for parameter estimation. Unlike SSS, parameter estimation for exSSS is either based on maximum likelihood or Bayesian (MCMC) methods. Both SSS and exSSS assume that recruitment is related deterministically to the stock-recruitment relationship. The outputs from SSS and exSSS include biomass trajectories, as well as estimates of (and measures of uncertainty for) the OFL. SSS_V is a variant of SSS in which the prior for depletion is based on the results of a regression of depletion on the PSA vulnerability score. This approach will be replaced in future implementations by the procedure of binning by vulnerability score as described in Section 2.1.5 above. The methods were applied for illustrative purposes to data for seven stocks of west coast groundfish and the results compared to those of the associated full assessments. These applications were intended to show a progression of assessments and data usage from most data-limited (SSS) to full assessment (SS). Five of the seven comparisons were able to replicate the SS dynamics, including the ability to include the more complex treatment of fishery-dependent data in the petrale sole assessment. Two exSSS models (spiny dogfish and sablefish) were unable to replicate the SS model outputs, but were diagnosable as questionable without comparing them to the SS models.

The version of SSS presented to the Panel differs from the one presented to the April 2011 Panel by using a Monte Carlo method for parameter estimation (rather than a MCMC method in which priors are imposed on both depletion and R_0) and by exploring a variant of SSS in which the distribution for depletion is informed by the results of the PSA (SSS_V). The Panel agreed that the revised version of SSS successfully addresses the concerns raised by the previous review panel.

The Panel noted that some assessments adopted by the PFMC (e.g. that for cowcod) were conceptually based on exSSS (MLE version). The Panel therefore agreed that in principle, exSSS was an acceptable method for conducting assessments of data-moderate stocks. However, in common with all assessments that use indices of relative abundance, any assessments based on exSSS would require adequate review of model inputs (see Section 7 below). The Panel recommended that if measures of uncertainty were required for exSSS-based assessments, they should be based on the Sample Importance Resample (SIR) algorithm (perhaps implemented using Adaptive Importance Sampling).

2.2.2 Extended Depletion-Based Stock Reduction Analysis (XDB-SRA); using models with generalized stock recruit relationships

Drs. EJ Dick and Alec MacCall outlined how DB-SRA can be implemented within a Bayesian framework, with the priors for the parameters updated using index data. The additional parameters are "q" (the catchability coefficient) and "a" (the extent of observation variance additional to that inferred from sampling error). The priors for these parameters are respectively a weakly informative log-normal distribution and a uniform distribution. The Panel noted that the uniform prior is not usually the preferred distribution for a variance parameter, but this is unlikely to have a strong influence on the results. Sampling from the posterior distribution is achieved using Adaptive Importance Sampling (AIS). Results presented showed that this algorithm was capable of successfully capturing the posterior. Dr. Dick also outlined the locus of S_{MSY}/S_0 – R_{MSY}/R_0 points for the current Beverton-Holt assumption underlying most Stock Synthesis assessments, along with the (S_{MSY}/S_0--R_{MSY}/R_0) space for the Shepherd stock-recruitment relationship, illustrating the region of the space that cannot be sampled owing to the structural relationships underlying the population dynamics model. Dr. Dick noted that the hybrid production function used in DB-SRA is not constrained in terms of the choices for F_{MSY}/M and B_{MSY}/B_0.

In discussion, the Panel emphasized the importance of showing the transition from the priors for the parameters (and the inferred distributions for quantities such as the OFL) to the posteriors from DB-SRA (the post-model-pre-data distribution), which restrict the parameter space by imposing the constraint that the biomass was not negative in the past, and finally to the posteriors from XDB-SRA which account for index data. Specifically, the Panel was interested to understand whether the change to the prior distribution for M for some stocks was a consequence of imposing the biomass constraint or of fitting to the index data. The Panel felt that it is necessary to be able to understand the reason why some indexes are down-weighted relative to others by XDB-SRA (i.e., the posterior for the parameter "a" emphasized high values). In this regard, the Panel also recommended showing the fits of the model to the index data, for example in the form of posterior predictive distributions for the index data. Such plots should be provided for any XDB-SRA assessment.

The Panel noted the AIS appeared to be performing adequately. Nevertheless, it is still necessary in applications to check that the maximum weight assigned to any parameter vector is low (<<1%). Moreover, if the number of indexes is high, integrating out "q" and "a" should improve the efficiency of XDB-SRA. The application of XDB-SRA to northern lingcod resulted in markedly different posteriors for "a" for the two indexes, but it was not clear why this happened. The Panel recommended that the assessment for lingcod be explored further to better understand why this occurred. It was noted that the results from XDB-SRA are based on a deterministic population dynamics model and that it was possible to include process errors in the dynamics when applying SIR-based assessments. However, this may increase the computational demands of the calculations.

In relation to the form of the production function, the Panel noted that this issue was not limited to assessments for data-moderate stocks, but could be an issue for data-rich stocks assessed using, for example, Stock Synthesis. It was noted that (with the exception of codcod) the posterior distribution for B_{MSY}/B_0 for methods such as DB-SRA and XDB-SRA tend to resemble the priors, which implies that the data provide little information on the value of this parameter. Nevertheless, the posteriors for derived quantities (such as the OFL) capture the uncertainty associated with this parameter. However, estimating the parameters of a generalized stock-recruitment relationship using an approach such as Stock Synthesis could lead to estimates at the boundaries unless priors are imposed as penalties.

Dr. Dick presented XDB-SRA results for spiny dogfish and lingcod. For dogfish, the XDB-SRA estimate of depletion (posterior median 0.44) is somewhat closer to the SS value (0.63) than that from exSSS (0.23). The estimate of OFL (median 1319 t) from XBD-SRA is lower than the SS value (3041t) and higher than that from exSSS (665 t). The XBD-SRA application for northern lingcod was based on the default prior for delta (rather than the PSA value). M was updated substantially by adding the index data (tighter than the post-model-pre-data distribution). However, the XDB-SRA result was poorer than that from exSSS.

The Panel recommended that exSSS and XBD-SRA should be compared for range of actual and simulated species with different biological characteristics and exploitation history.

2.2.3 Progress report on evaluating uncertainty (σ) for category 2 and 3 stocks using simulation modeling

Chantel Wetzel presented a project she plans to do to explore the performance of management strategies based on data-moderate (Tier-2 like) and data-poor (Tier-3 like) assessment and management frameworks. She intends to evaluate SSS, DB-SRA, DCAC and XDB-SRA as well as alternative choices for the parameters which quantify the extent of scientific uncertainty associated with OFL (σ) given choices for P*. The results will be summarized in terms of catches, the probability of overfishing, and lost yield.

The Panel noted that the operating model on which the proposed simulations will be based has a Beverton-Holt stock recruitment relationship. This may unduly favor methods such as SSS which make this assumption. It was suggested that an operating model based on a more general stock-recruitment relationship (e.g. Shepherd) be considered to examine the size of this effect. The Panel has the following additional recommendations:

- Report the bias of the estimates of the OFL.
- Report the probability of the stock dropping below the overfished threshold.
- Explore control rules which set the OFL based on the maximum of the default choice for σ and the amount of uncertainty inferred from the methods such DB-SRA.
- Consider management strategies which set the ACL using a control rule such as 40-10. This will permit an exploration of the ability of methods such as XDB-SRA to estimate stock status.
- Report the multi-year probability of overfishing.
- Report cumulative catches.
- Consider an estimation method which bases the prior for current depletion on a vulnerability score. Testing of such of a method would need to account for the error about the PSA-depletion relationship.
- Consider combining data-moderate methods using model averaging.

2.2.4 General issues

The Panel discussed what constituted an appropriate evaluation of data-moderate methods. Most of the contributions to the workshop evaluated performance in terms of comparisons with the results of data-rich stock assessments. It was noted that care needs to be taken when making such evaluations to ensure that the number of indices included in the assessments reflected the number that would typically be available for data-moderate assessments. Furthermore, the Panel noted that the comparisons were based on predictions for a single year only and recommended that future evaluations be based on simulation testing. The Panel also recommended that the uncertainty associated with OFL estimates be computed using the approach applied by Ralston *et al*. (2011) to evaluate uncertainty in biomass estimates. This will provide guidance regarding the extent of error in OFL estimates which is already present even for Tier 1 assessments.

2.2.5 Requests by the Panel and Responses by the Technical Team

Request E: Plot depletion over time for SSS, $exSSS_{MLE}$, $exSSS_{MCMC}$, SS, SSS_V for the stocks in Table 2 of Dr. Cope's paper.

Rationale: The comparisons presented to the Panel only considered the most recent year of the assessments.

Response: Time-trajectories of depletion from SS, $exSS_{MLE}$, and $exSSS_{MCMC}$ were provided for canary rockfish, greenstriped rockfish, petrale sole, Dover sole, sablefish, lingcod, and spiny dogfish. The results for sablefish were notably poor. This may be attributable to the long sequence of poor recruitments which cannot be captured well by deterministic models such as exSSS. The question arose of how one could diagnose whether exSSS is performing poorly.

Request F: Show the fits of SS and $exSSS_{MLE}$ to the index data for the stocks in Table 2 of Dr. Cope's paper.

Rationale: The Panel wished to assess whether the fits could be used for diagnostic purposes and to understand the causes for the differences in the results for SS and $exSSS_{MLE}$.

Response: The model fits were consistent with the data for five of the six stocks (the fits for Dover sole could not be evaluated as the $exSSS_{MLE}$ model was implemented without a catchability break in the triennial survey, unlike the SS model). The Panel concluded that it would have likely rejected the assessment for sablefish owing to the obvious residual pattern for the Combo survey (Fig. 1). The ability to diagnose poor performance is a positive feature of the exSSS approach.

Request G: Plot depletion over time for SSS, $exSSS_{MLE}$, SS, SSS_V for the stocks in Table 2 of Dr. Cope's paper. Use the revised bin structure for the SSS_V applications.
Rationale: The response to *Request E* did not include results for SSS and SSS_V, and the Panel recommended a change to how the PSA bins are to be treated in catch-only methods.
Response: There was evidence that moving from SSS to exSSS improved estimation performance for five of the seven stocks (the exceptions were sablefish and spiny dogfish).

Request H: Add the relative errors for depletion and the OFL for (a) the original DB-SRA method, (b) the version of DB-SRA selected by Drs. Dick and MacCall, and (c) extended DB-SRA (all not bias-corrected) to Table 2 of Dr. Cope's document.
Rationale: The Panel wished to compare the various data-poor and data-moderate methods for a common set of stocks.
Response: There was insufficient time to run all the analyses during the workshop. The STAT provided XDB-SRA results for dogfish and northern lingcod.

2.3. Developing standardized time series index methods
Dr. Alec MacCall presented a summary of trawl survey and recreational catch/effort data for 65 unassessed West Coast groundfish species, compiled from a variety of fishery-independent and fishery-dependent sources. The purpose of this summary was to outline the data that could be used to generate abundance indices for data-moderate assessments. This summary has been appended to this report (Appendix 4) to assist Council advisory bodies in considering which stocks should be selected for data-moderate assessments.

There have been four primary fishery-independent groundfish bottom-trawl surveys on the West Coast: the AFSC triennial survey, the AFSC slope survey, the NWFSC slope survey and the NWFS shelf-slope survey. The summary combined the NWFSC slope and shelf-slope surveys in one category, denoted the combo survey. All four surveys are commonly used in full assessments, and a number of approaches for treating the survey catch data have become established as best practice, though often without through evaluation or review. For example, it is common for assessments not to use 1977 triennial survey data, due to differences in depth surveyed and the large number of "water hauls," when the trawl footrope failed to establish contact with the bottom (Zimmermann et al. 2001). It has also become common to split the triennial time series between 1992 and 1995 to reflect a change in the survey timing. The Panel noted that it is important that these best practices would be well communicated between West Coast science centers. Virtually all recent assessments use a Generalized Linear Mixed Model (GLMM) method to generate abundance indices. The Panel discussed other options, for example the use of habitat-guild abundances or presence/absence, to analyze survey data within data-moderate stock assessments.

Index development may be most time-consuming part of data-moderate assessments. The technical team estimated that it will take about two weeks to develop abundance indices for a species, but then very little additional time to do the assessment. Multiple abundance indices are likely to be available for data-moderate assessments, and the assessment software should be able to accommodate these multiple indices, as well as to have the flexibility to treat them appropriately.

Recreational fisheries sampling is the major fishery-dependent source of data for abundance indices. Dr. MacCall noted that there are substantial difficulties in interpreting recreational catch rates, since various management measures have been put in place beginning in 2000, including changes to bag limits and closed areas. It is, therefore, unlikely that there will be continuity in the indices before and after 2000. The Panel recommended exploring approaches being used in other areas to account for the effect of management measures on recreational fisheries abundance indices. Other approaches, such as General Additive Models (GAM), could also be considered.

Sampling from party boat trips is likely to be the most reliable data to derive abundance indices from the recreational fishery. These data have been analyzed in some of the assessments, using Generalized Linear Models (GLMs) with county, wave and area as terms. This data source, however, has dockside and onboard sampling records combined, and it is not clear that they can be disaggregated. Nonetheless, the Central California party boat observer survey (though discontinued in 1998) can provide information on catches by site.

A summary presented showed that there is likely to be sufficient data to develop abundance indices for a number of data-poor species, including vulnerable stocks based on their PSA scores, such as china rockfish, copper rockfish, quillback rockfish, rougheye rockfish and aurora rockfish.

2.4. Incorporation of length data in data-moderate assessments

Current development of data-moderate assessment methods has focused on adding abundance indices to catch-only methods. However other types of data could potentially be included in these assessments, such as length composition data. Comparisons were made using sablefish and spiny dogfish data between exSSS models with and without length composition data. These results were compared to the full stock assessment, which was considered to provide the closest approximation to the true status and biomass of the stock. The performance of all exSSS models was generally poor for both species, most likely due to the complexity of the full assessment model and the modeling decisions made to arrive at final model (e.g., weighting of various datasets). The addition of length composition data to exSSS models did not substantially improve the performance of this approach for either sablefish or spiny dogfish. Since these comparisons were made for only two stocks, it is difficult to conclude how general this result is.

The use of length-composition data in data-moderate assessment adds another layer of complexity to the analysis. Appropriate treatment of length-composition data requires estimation of selectivity patterns, which raises additional considerations which are likely to be specific to the species being assessed. A more complex assessment requires detailed evaluation, which would add to the time needed for an assessment review. At present, it is not clear that the benefit of adding length-composition data to an assessment would justify the cost of the additional time needed to prepare and review the assessment. Therefore, for now, the Panel recommended that data-moderate assessments be limited to the use of abundance indices only.

2.5. Evaluating merits, deficiencies, and uncertainty of data-limited methods

Linsey Arnold presented a retrospective analysis comparing the results of canary rockfish assessments in 1984 and 1991 with DB-SRA and DCAC using information that was available at that time. Results indicated that DB-SRA and DCAC were not sufficiently conservative based on current understanding of canary abundance trends, but provided better estimates of sustainable yield compared to the actual assessments that were done in 1984 and 1991. As expected, performance of both methods depended strongly on the assumed level of depletion. Both methods performed extremely well when given the "correct" parameter values, suggesting that, at least in this case, most of the uncertainty in DB-SRA and DCAC is caused by uncertainty in input parameters.

Kristen Honey presented a comparison of DB-SRA and DCAC for a number of different West Coast groundfish species, again using results from full assessments as a yardstick for comparison. Both methods were relatively robust in that they tended to be consistent with full assessments. Overall both DB-SRA and DCAC tended to give lower and more precautionary estimates of the OFL, with DCAC providing the most precautionary results. The Panel recommends these comparative approaches be extended further, for example, by quantitatively comparing estimates of OFL from data-moderate and data-poor methods with estimates full assessments for multiple assessments and multiple stocks. This approach could be used to estimate the additional uncertainty due to using data-moderate or data-poor methods, which would be in addition to the uncertainty for full assessments.

3. AREAS OF DISAGREEMENT REGARDING PANEL RECOMMENDATIONS

There were no areas of disagreement regarding panel recommendations.

4. UNRESOLVED PROBLEMS AND MAJOR UNCERTAINTIES

The unresolved problems and major uncertainties for the data-moderate assessment methods are discussed in detail in Section 2. Here the Panel simply reiterates what it considers the most important issues.

- The methods being developed for data-poor and data-moderate assessments assume known historical catches, but there is considerable uncertainty in the catch estimates. This uncertainty has not been measured, and tools for incorporating this uncertainty in assessments are not well developed. This problem is not restricted to data-poor and data-moderate assessments—it is also a concern for most full assessments.
- Further work is necessary to improve inputs used in data-poor and data-moderate assessments, such as B_{MSY}/B_0 and F_{MSY} /M.
- The Panel endorsed two assessment approaches for data-moderate assessments, XDB-SRA and exSSS. However, their performance was only evaluated by comparing the results with outputs from full assessments, so the question remains of how these methods will perform in real applications. Work involving simulated population dynamics might help answer this question, and is encouraged.
- Data-moderate assessments will likely have greater uncertainty than full assessments for the simple reason that fewer data are used in the assessment. Both approaches use

different assumptions that tend to reduce apparent uncertainty, so comparisons of the estimated uncertainty between different types of assessments may not show this expected difference. For full assessments, parameters such as natural mortality and the stock-recruit steepness parameter are often fixed. For data-moderate assessments, recruitment to the stock is assumed to only to depend on relative stock abundance with no year-to-year variability and selectivity patterns are fixed rather than estimated. The new data-moderate approaches fully recognize uncertainty in natural mortality and the stock-recruit relationship (both steepness and shape). Further work is needed on how to treat uncertainty in both full assessments and data-moderate assessments.

- The Panel expects that data-moderate assessments will fill an important gap in the approaches used for stock assessment in the Council process, but some experience conducting and reviewing data-moderate assessments will be necessary to better evaluate their usefulness and applicability.

5. MANAGEMENT, DATA OR FISHERY ISSUES RAISED BY THE PUBLIC AND GMT AND GAP ADVISORS

The GMT advisor highlighted the GMT's concern regarding uncertainty in historical catch estimates. The Panel agrees that this is an important consideration. The methods being developed for data-poor and data-moderate assessments assume known historical catches, and there is a need to explore sensitivity to that assumption. Since catches are equal to landings plus discard, consideration of uncertainty in discard is also important.

Scenario analysis has been typically used as a way to evaluate the impact of uncertainty in catch estimates, and this should be part of a data-moderate assessment. Ideally, the uncertainty in catch estimates should be propagated through the assessment using Bayesian approaches, though methods to accomplish this are not yet available (it should be noted that DCAC has an option to incorporate uncertainty in catch). Aside from technical difficulties, catch estimation procedures usually do not provide estimates of uncertainty, so it is difficult to gauge the extent of the uncertainty. This concern is not limited to data-poor or data-moderate assessments, though arguably this issue is of greater consequence for these assessments. There was some discussion of potential approaches during the Panel review, but all would require further development before they can be implemented. The previous data-poor review panel recommended a review of the historical catch estimates once estimates from Washington State are available, and this Panel supports that recommendation. The Panel also recommends that this review evaluate the uncertainty of historical catch estimates, including estimates of discard.

The Council staff advisor recommended that the Panel consider how data-moderate assessments should be used in the Council process. At present, category 3 assessments are used to set OFLs and ABCs, usually by aggregating estimates for individual species into stock complexes, but are not used to determine stock status relative to overfished thresholds. Data-moderate assessments should be more reliable that category 3 assessments, but in general will be less reliable than full assessments. One alternative is to use data-moderate as a filter or screening tool to identify stocks of concern that would be a priority for full assessments during the next assessment cycle.

The Council staff advisor also advised the Panel to carefully describe the process for assessing and reviewing data-moderate stocks during the next assessment cycle, including criteria for selecting stocks to be assessed, any pre-assessment activities such as data workshops, recommended elements in the assessment, and the nature of the review process, i.e., whether by a STAR panel, the SSC groundfish subcommittee, or the SSC. The Panel agrees and has provided an outline in Section 7 below and a template for data-moderate assessments in Appendix 3.

6. RECOMMENDATIONS FOR RESEARCH AND DATA COLLECTIONS

6.1 Enhancements to catch-only methods

- Use binned PSA vulnerability scores for assessed stocks to obtain a prior for delta for use in data-poor and data-moderate assessments. Because this approach relies on a PSA analysis that was not developed for this purpose, scoring for the PSA analysis should be re-evaluated to ensure consistent time periods are used for all stocks. The year in which delta is assumed to apply should be consistent with the scoring period.
- Further develop meta-analysis methods for the ratios B_{MSY}/B_0 and F_{MSY}/M. While large-scale meta-analysis provides valuable information, synthesis of assessment results on a regional scale is likely to be more useful in determining priors. This is because the quality of the assessments going into the meta-analysis can be ascertained and consistent definitions for these quantities are used regionally. A comparison of regional results with global results would also be valuable.
- Compare the new 3-parameter stock-recruit relationship implemented in SS (Taylor et al. 2012) with the hybrid production function in DB-SRA and XDB-SRA.
- The prior for natural mortality developed by Dr. Owen Hamel, and used extensively in the previous assessment cycle, should be adequately documented and reviewed.

6.2 Extended DB-SRA and SSS

- XDB-SRA and exSSS are endorsed for use in data-moderate assessments in the next assessment cycle (see table 2 for distinguishing characteristics of the two approaches). The management strategy evaluation described in Section 2.2.3 may be informative about relative merits of the two approaches. A WebEx seminar for interested scientists should be conducted in Spring 2013 to present results from simulation testing comparing XDB-SRA and exSSS.
- The Sample Importance Resample (SIR) algorithm (perhaps implemented using Adaptive Importance Sampling) should be used to quantify uncertainty for exSSS-based assessments, should measures of uncertainty be required.
- The ability to incorporate a prior on depletion may be useful feature of data-moderate assessment that adds robustness to results. exSSS does not currently have this capability. A variant of exSSS should be developed that incorporates a prior for depletion (delta). This variant may be useful bridge between SSS and exSSS as they are currently implemented.
- The uncertainty associated with OFL estimates should be computed using the approach applied by Ralston *et al*. (2011) to evaluate uncertainty in biomass estimates. This will provide guidance regarding the extent of error in OFL estimates which is already present even for Tier 1 assessments. Systematic comparison of OFL estimates from data-moderate and data-poor assessments with estimates from full assessments may allow estimation of the additional uncertainty due to the use of these methods.

6.3 Development of abundance indices for use in data moderate assessment

- Consider alternative ways of developing abundance indices for surveys, such as post-stratification to more closely match the species presence and distribution, or developing indices based on presence/absence or stock distribution.
- It is not necessary to omit all recreational fishery data after 2000 due to regulatory changes. Instead an attempt should be made to account for management changes such as changes to area and bag limits to the extent possible in index development. Conduct a literature review to determine best practices in developing indices from recreational fishery catch and effort data, with particular attention on methods for dealing with potential sources of bias due to regulatory changes, such as closed areas and bag limits. Focus on regions where this expertise is most advanced, such as the Southeast US.

7. RECOMMENDATIONS FOR THE ASSESSMENT AND PEER-REVIEW OF DATA-MODERATE ASSESSMENTS

- The NMFS Science Centers should develop a list of stocks for which the indices of abundance can be justified as likely to be related to abundance.
- The Panel had extensive discussion regarding the number of stocks that should be reviewed during a STAR panel. Arguments for keeping the number low focused on the concern that these assessments are based on new approaches, and there will be some learning involved both in developing the assessment and reviewing it. Arguments for a higher number of assessments included that more assessments are likely to be rejected or not even carried forward for review due to insurmountable difficulties. In addition, there would be more opportunity in learning from more assessments with contrasting features. Perhaps the best way to deal with this issue is to identify 6-12 stocks from the list developed by the NMFS science centers, but plan to drop the most dubious assessments before the STAR panel review.
- The assessments to be presented to the 2013 data-moderate assessment STAR panel should include stocks whose assessments would be based on the NMFS bottom trawl survey, and those for which the primary index of abundance would be a CPUE index derived from recreational catch and effort data. Carrying forward two groups of stocks with similar habitat and fishery characteristics provides both contrast and potential efficiency, since similar analytical approaches are likely to be applicable within each group.
- A data workshop should be held to focus on development of suitable indices for data-moderate assessments. Alternatively (and perhaps preferably), a concerted effort should be made to establish good communication among the core group conducting the data-moderate assessments to share ways of filtering and analyzing data, and promote adoption of consistent modeling approaches.
- The assessments presented to the 2013 data-moderate assessment STAR panel should not use age- or length-data. Assessments which use such data are likely to require more extensive review that is possible during the data-moderate STAR panel.
- Data-moderate stock assessments should follow the template in Appendix 3.
- The first review of data-moderate assessments should be conducted during a STAR Panel, but future reviews could be conducted by the SSC or its groundfish sub-committee. For this cycle, modeling approaches other than XDB-SRA and exSSS should not be used due to lack of time to conduct an adequate review of the method during a

STAR Panel (however refinements to XDB-SRA and exSSS are permissible). The independent panelists at the data-moderate panel should be selected to provide expertise on survey design and analysis of recreational CPUE data.

- At present, both modeling approaches (XDB-SRA and exSSS) are considered appropriate for data-moderate assessments. Comparison of alternative models (both XDB-SRA and exSSS) is encouraged. It is acceptable to present an assessment using a single modeling approach, but the choice of modeling approach should be justified. The STAR Panel will make requests of the STATs, but will not impose an alternative method on the STAT if they believe this is not appropriate for the stock concerned. The STAT may change their best model, but the Panel's job is to review what is presented by the STAT. The Panel will recommend adoption / rejection of the "best model." The STAR Panel will be charged with identifying a preferred approach in the event that both models are presented.
- Data moderate assessments should be used for deriving OFLs, ABCs, and ACLs. In addition, data-moderate assessments should provide estimates of the probability the stock is in each of three categories: less than $B_{25\%}$, between $B_{25\%}$ and $B_{40\%}$, and greater than $B_{40\%}$. The Panel recommends that these results not be used for status determination, but rather to identify whether there is potential concern with stock status, and to prioritize stocks for a full assessment in which all available information is considered.
- The SSC will review the assessment and the STAR Panel report. The key output from this exercise is an OFL and ABC, which addresses possible overfishing. If there is a sizeable probability the stock is in an overfished state (higher than 40%, for example), the SSC will recommend that a full assessment be conducted at the earliest opportunity. The Council may wish to implement management changes in pro-actively.
- The Panel was informed that the NWFSC has a 'stock assessment handbook' which includes a summary of key common assumptions when making assessments and recommended that it be made available to all assessment authors.

8. REFERENCES

Cope, J. M., J. D. DeVore, E. Dick, K. Ames, J. Budrick, D. L. Erickson, J. Grebel, G. Hanshew, R. Jones, L. Mattes, C. Niles, S. Williams. 2011. An approach to defining stock complexes for U.S. West Coast groundfishes using vulnerabilities and ecological distributions. North American Journal of Fisheries Management 31: 589-604.

Patrick, W. S., P. Spencer, J. Link, J. Cope, J. Field, D. Kobayashi, P. W. Lawson, T. Gedamke, E. Cortes, O. Ormseth, K. Bigelow, W. Overholtz. 2010. Using productivity and susceptibility indices to assess the vulnerability of United States fish stocks to overfishing. Fishery Bulletin 1108: 305-322.

Ralston, S., A. E. Punt, O. S. Hamel, J. DeVore, and R.J. Conser. 2011. An approach to quantifying scientific uncertainty in stock assessment. *Fish. Bull*. 109: 217-231.

Taylor, I. G., V. Gertseva, R. D. Methot Jr., M. N. Maunder. 2012. A stock–recruitment relationship based on pre-recruit survival, illustrated with application to spiny dogfish shark. Fisheries Research (in press).

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Zimmermann, M., Wilkins, M.E., Weinberg, K.L., Lauth, R.R., Shaw, F.R. 2001. Retrospective analysis of suspiciously small catches in the National Marine Fisheries Service west coast triennial bottom trawl survey. NOAA Proc. Rep. 2001- 2003.

Table 1. Comparison of four DB-SRA versions conducted per *Request D, Section 2.1.7*: (1) original DB-SRA (with delta of 0.6); (2) version with M correction applied (with delta of 0.6); (3) version with M correction and with three vulnerability bins (as identified in Cope et al. (2011)) used to inform delta; (4) with M correction and delta informed by depletion-vulnerability regression.

Summaries of relative bias-corrected OFL, X

Percentile	no M correction	M correction	PSA regression	PSA bins
2.5%	0.086	0.085	0.069	0.114
25%	0.475	0.482	0.427	0.538
50%	0.999	1.000	1.007	1.006
75%	2.111	2.083	2.383	1.881
97.5%	11.600	11.431	14.934	9.056

Summaries of abs(X-1)

Percentile	no M correction	M correction	PSA regression	PSA bins
2.5%	0.033	0.032	0.039	0.028
25%	0.329	0.323	0.381	0.281
50%	0.650	0.641	0.717	0.568
75%	1.111	1.083	1.383	0.932
97.5%	10.828	10.431	13.934	8.056

Table 2. Comparison of the features of XDB-SRA and exSSS.

	XDB-SRA	*exSSS*	*Comments*
Population dynamics	Biomass difference model	Age-structured	An age-structured model can be adapted to unique stock characteristics.
Stock regeneration	Pella-Tomlinson joined to a Schaefer curve at low stock size	Beverton-Holt SRR	The hybrid production function in XDB-SRA has greater flexibility. Beverton-Holt is the standard approach for full assessments
Leading parameters	B_{MSY}/B_0, F_{MSY}/M, M, delta (depletion), catchability, extra variances	M, steepness, B_0, catchability	XDB-SRA is parameterized using leading management parameters; exSSS uses the same leading parameters as full assessments. XDB-SRA includes a prior on depletion, which may add robustness.
Treatment of uncertainty	Fully Bayesian; posterior distribution obtained using SIR with AIS, estimation of additional variance terms	MLE with Hessian approximation, or MCMC	XDB-SRA has more comprehensive treatment of uncertainty. For exSSS, the samples from MCMC often show signs of poor convergence of the MCMC algorithm, and asymptotic variance based on the Hessian is a questionable approximation.
Software	Purpose-built, coded in R. Long run times to generate posterior distributions with present computing capacity.	Simple stock synthesis model	XDB-SRA has limits on the number of indices that can be used in the assessment, and limits on how catchability can be modeled (e.g.: power relationship, catchability breaks, catchability trends, etc). Some of these problems may be overcome by integrating out the priors for q and a analytically. Stock Synthesis is a well-established software package for stock assessment, with lower likelihood of programming errors, and greater flexibility in modeling catchability and selectivity patterns. SS is not limited in the number of indices that can be used or the modeling choices. Allows a smoother bridge between data-poor assessments and full assessments. Stock synthesis has greater complexity, but much of that complexity is not used in exSSS.

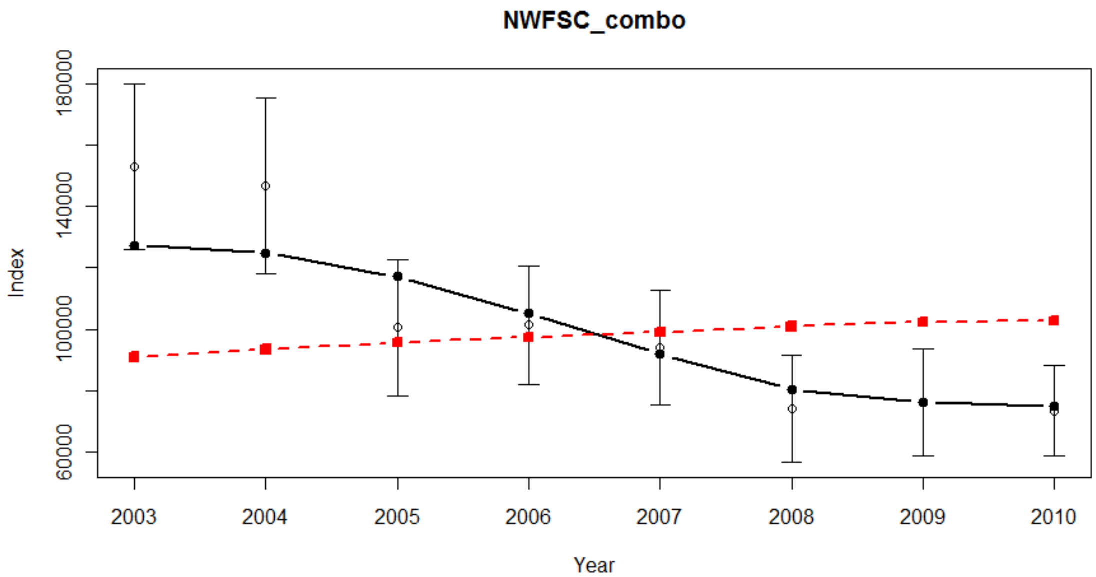

Figure 1. Fit of $exSSS_{MLE}$ (red, solid squares) and SS (block, solid circles) to the NWFSC Combo index for sablefish. Example of an unacceptable residual pattern that would provide a rationale for rejection of a data-moderate assessment.

Appendix 1: List of Participants

Methodology Review Panel Members:
Matthew Cieri, Center for Independent Experts
Martin Dorn (Chair), Scientific and Statistical Committee (SSC), NMFS, AFSC
Vladlena Gertseva, SSC, NMFS, NWFSC
Cynthia Jones, Center for Independent Experts
André Punt, SSC, University of Washington

Panel advisors:
John DeVore, PFMC Staff
Corey Niles, Groundfish Management Team
Gerry Richter, Groundfish Advisory Panel

Technical Team:
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Linsey Arnold, Oregon State University
Jason Cope, NMFS, NWFSC
Edward Dick, NMFS, SWFSC
Kristen Honey, Stanford University
Alec MacCall, NMFS, SWFSC
James Thorson, NMFS, NWFSC
Chantel Wetzel, NWFSC, University of Washington

Others in Attendance:
Mariah Boyle, FishWise
Colby Brady, NFMS, Northwest Regional Office
Jeffrey Brust, New Jersey Division of Fish and Wildlife
Anne Cooper, International Council for the Exploration of the Sea (ICES), Denmark
Alison Dauble, Oregon Department of Fish and Wildlife
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Carey McGilliard, NMFS, AFSC
Melissa Munk, University of California, Santa Cruz
Olav Ormseth, NMFS, AFSC
Joe Petersen, Makah Nation
Theresa Tsou, Washington Department of Fish and Wildlife
John Wallace, NMFS, NWFSC

Appendix 2: Documents reviewed

Aalto, E., E.J. Dick, and A. MacCall. *Separating fecundity and mortality time lags for a data-poor production model.*

Cope, J. M. *Extending catch-only Stock Synthesis models to include indices of abundance.*

Cope J. M.*, Implementing a statistical catch-at-age model (Stock Synthesis) as a tool for deriving overfishing limits in data-limited situations*. Fisheries Research (in press).

DeYoreo, M., E.J. Dick, A. MacCall. *A Bayesian Approach to Estimating Sustainable Yields for Data-Poor Stocks.*

Dick, E. J., A. MacCall, M. DeYoreo, and B. Soper. *Refinements to Depletion-Based Stock Reduction Analysis.*

Dick, E. J., A. MacCall, B. Soper, and M. DeYorio. *Exploration of Bayesian Stock Reduction Analysis for Assessment of West Coast Groundfish.*

Honey, K., A.M. Apel, J. Cope, E.J. Dick, A. MacCall, and R. Fujita. *Rags To Fishes II: Quantitative comparison of data-poor methods for fisheries management.*

MacCall, A., E. J. Dick, B. Soper, and M. DeYoreo. *Sources of Abundance Information For 65 Unassessed Stocks of West Coast Groundfish.*

Thorson, J. T., J. M. Cope, T. A. Branch, and O. P. Jensen. *Spawning biomass reference points for exploited marine fishes, incorporating taxonomic and body size information*.

Thorson, J. T., I. Taylor, I. Stewart, A. E. Punt. *A statistically rigorous framework for testing life history theory, with application to the ratio of natural mortality to the individual growth coefficient in U.S. West Coast species.*

Wetzel C. *Management strategy evaluation for the determination of uncertainty about current biomass for data-limited and data-poor West Coast groundfish stocks.*

Zhou, S., Yin, S., Thorson, J., Smith, T., Fuller, M 2012. *Linking fishing mortality reference points to life history traits: an empirical study*. Canadian Journal of Fisheries and Aquatic Sciences (in press).

Appendix 3. Proposed template for a data-moderate assessments

1. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT).
2. Introduction: Scientific name, distribution, basic biology (growth, longevity, ecology), the basis for the choice of stock unit(s)(no more than 1-2 paragraphs).
3. Development of indices (used and rejected). Novel approaches should be fully documented.
4. Survey of other data available for assessment: sample sizes by year and source of lengths, and ages (read and unread)--in case there is interest in conducting a full assessment in the future.
5. Selection of method (exSSS or XDB-SRA; authors "encouraged" to do both).
6. Assessment reporting
    a. Specification of priors / production function (defaults OK)
    b. Initial runs using catch-only methods (DB-SRA or SSS (or both))
    c. Diagnostics
        i. Evaluation of convergence
        ii. Residual plots
        iii. Posterior predictive intervals (if Bayesian)
        iv. Time-trajectories of biomass, depletion, etc.
        v. Sensitivity analyses using alternative catch streams, alternative priors for depletion, etc.
7. Estimates of OFL (median of the distribution), and the probability that that the stock is in each of three status categories: less than $B_{25\%}$, between $B_{25\%}$ and $B_{40\%}$, and greater than $B_{40\%}$.

Appendix 4:

Sources of Abundance Information

For 65 Unassessed Stocks of West Coast Groundfish

Submitted to Review Panel Meeting on Assessment Methods for Data-Moderate Stocks, 26-29 June, 2012, Seattle, WA

Prepared by Alec MacCall[1], E. J. Dick[1], Braden Soper[2] and Maria DeYorio[2]

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Abstract

This report documents time series of data on abundance of 65 species or stocks of unassessed west coast groundfish managed by the Pacific Fishery Management Council. These data are derived mainly from various fishery-independent bottom trawl surveys conducted since 1977, and various recreational fishery monitoring programs conducted since 1975. By supplementing Depletion-Based Stock Reduction Analyses (previously used for estimation of overfishing limits) with these data on abundance trends, it should be possible to elevate a substantial number of these data-limited stocks to the status of "assessed."

1. Introduction

Of the approximately 90 species or stocks of west coast groundfish managed by the Pacific Fishery Management Council (PFMC), about 60 remain unassessed. In order to provide the PFMC with a basis for setting Annual Catch Limits, Dick and MacCall (2011a,b) were able to calculate overfishing levels for most of these unassessed stocks using a method they called Depletion-Based Stock Reduction Analysis (DB-SRA). By supplementing DB-SRA with data on trends in abundance, it may be possible to upgrade the status of these analyses, thus providing minimal assessments for many of these stocks. This summary describes and quantifies most of the available sources of historical abundance information, and allows an initial evaluation of the feasibility of conducting DB-SRA assessments.

The sources of information considered in this document are summarized in the following table:

Name	Gear	Spatial Resolution	Time Span
Triennial Shelf Survey	Bottom Trawl	Site	1977-2004
Slope Survey	Bottom Trawl	Site	1984-2001
Combo Survey	Bottom Trawl	Site	1998-2010
RecFIN Monitoring	Hook and Line	County	1980-2003
Southern California Partyboat Observers	Hook and Line	Block	1975-78, 86-89
Northern California Partyboat Observers	Hook and Line	Site	1987-1998

There are additional sources of information that may potentially be useful. The Northwest Fisheries Science center has conducted a hook and line survey since 2004 in Southern California for most of the past decade (described by Harms et al. 2010). The California Cooperative Oceanic Fisheries Investigations ichthyoplankton surveys have been conducted in Southern and Central California waters since 1950, and provide abundance information on some species. In Southern California, entrainment estimates by electrical generating stations, and trawl surveys by some sanitation districts may in some cases provide useful time series of information on relative abundance.

2. Sources

We describe the principal surveys and fishery monitoring programs that are of greatest general utility, summarizing them by the number of positive samples for each year. Geographic and temporal coverage, and sample sizes vary substantially, but surveys covering multidecadal time spans are potentially the most informative. Some of the earlier surveys did not identify all relevant species, in which case no positive samples appear in the individual species summaries for those years. The data have been summarized by major west coast fishery management regions: North is Cape Mendocino to Cape Flattery, Central is Pt. Conception to Cape Mendocino, and South is the Mexican border to Pt. Conception. Pt. Conception is defined as 34.55 N Lat (decimal), and Cape Mendocino is defined as 40.167 N Lat (decimal).

3.1 Scientific Surveys

3.1.1 Triennial Shelf Survey

The Triennial Shelf Survey (or "Triennial") conducted by the AFSC and NWFSC utilized chartered commercial trawlers to survey North and Central area waters from 1977 to 2004. Coverage of these areas varied substantially among survey years by latitude (Table 1) and by depth (Figure 1). Years 1980, 1983 and 1986 ended near Monterey and did not extend to Pt. Conception (Lat 34.55N).

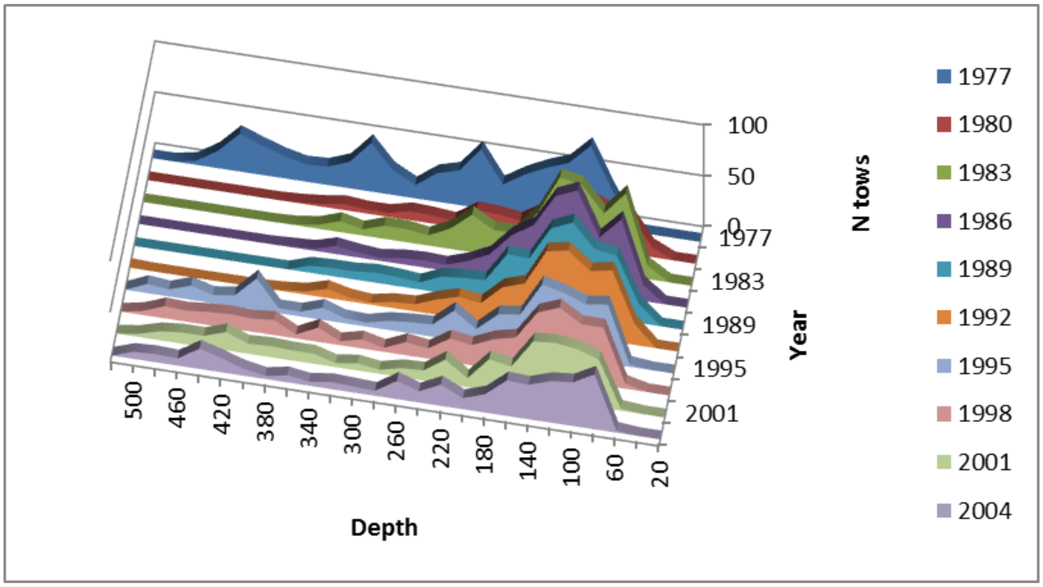

Figure 1. Frequency of Triennial Survey samples by depth (fathoms) and year.

Table 1. Number of trawl hauls conducted by the Triennial Survey.

Year	North	Central
1977	342	323
1980	485	74
1983	468	69
1986	444	71
1989	359	155
1992	356	131
1995	348	151
1998	340	157
2001	290	143
2004	256	127

3.1.2 Slope Survey

The slope survey was conducted irregularly from 1984 to 2001 by the AFSC, but only provides comprehensive coverage of depths and latitudes (Northern and Central Regions) beginning in 1997 (Table 2). The earlier years consisted of local studies (Figure 2). There was an increased sampling of deeper waters (values in fathoms) later in the time series (Figure 3). Earlier years also had an incomplete listing of taxa.

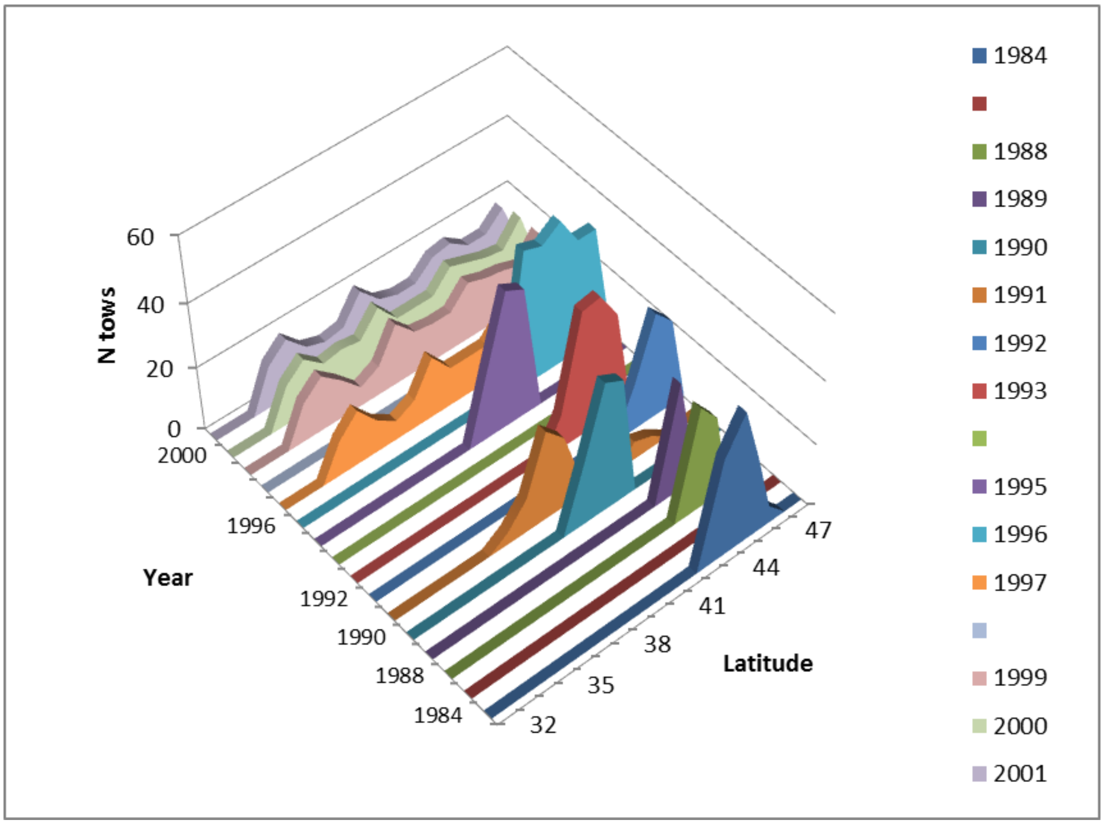

Figure 2. Latitudinal coverage of the Slope Surveys.

Table 2. Number of trawl hauls conducted by the Slope Survey.

Year	North	Central	Year	North	Central
1984	109				
			1995	105	
1988	61		1996	204	
1989	46		1997	107	73
1990	101				
1991	37	52	1999	124	76
1992	78		2000	120	86
1993	124		2001	115	84

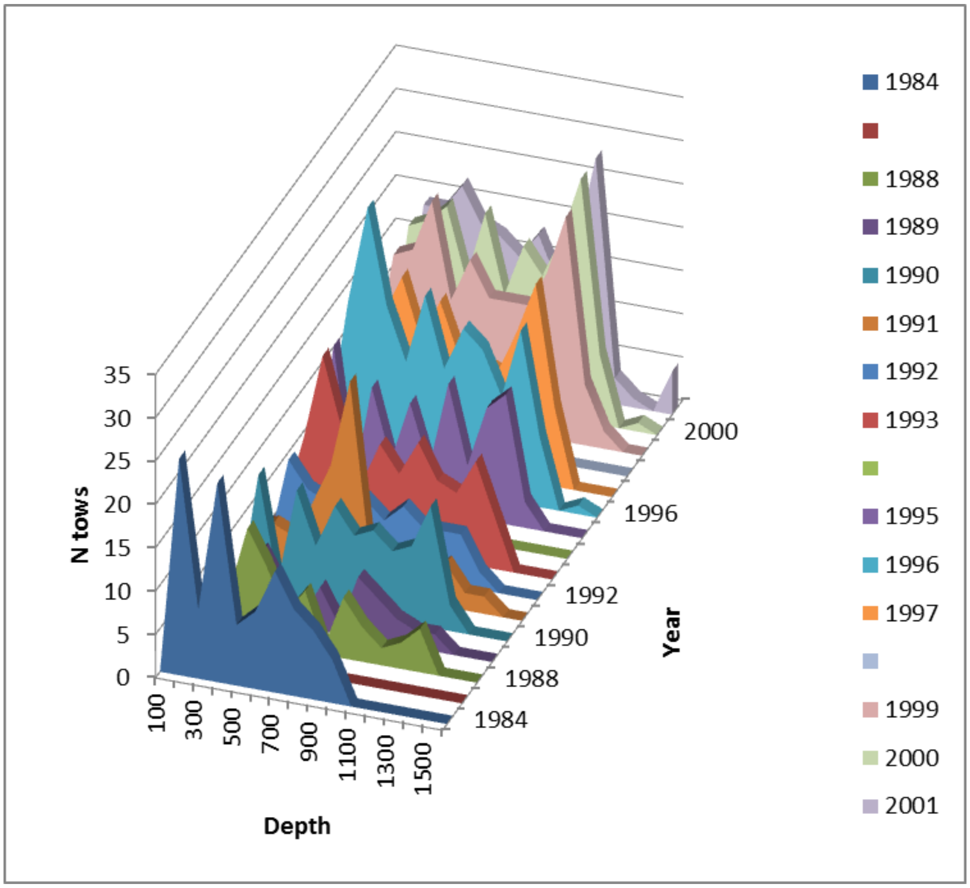

Figure 3. Distributions of depths in the Slope Surveys.

3.1.3 Combo Survey

The West Coast Shelf/Slope Bottom Trawl Surveys (a.k.a, Combo Surveys) were initiated by the NWFSC as a successor to the Slope and Triennial Shelf Surveys that had been inherited from the AFSC (Bradburn et al., 2011). The Combo Surveys achieved a broad and consistent coverage of latitudes and depths (Table 3), and included waters south of Pt. Conception beginning in 2002. The list of identified taxa in 1998 was incomplete.

Table 3. Number of tows by the Combo Survey, by year and latitude. Latitude groups compare approximately to North, Central and Southern Regions.

Lat\Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
50													
49	4		6	3	4	39	22	19	18	24	18	21	22
48	16	23	20	24	20	53	28	36	37	45	45	40	47
47	18	30	18	22	23	39	30	42	33	54	41	40	51
46	25	28	25	31	26	38	41	55	61	62	55	60	52
45	27	28	29	26	30	32	49	66	61	69	68	58	61
44	26	25	26	25	29	26	25	44	51	40	33	43	34
43	24	28	28	24	30	46	27	33	32	38	37	30	34
42	23	30	20	24	29	43	19	38	28	36	36	47	48
41	24	11	29	28	26	31	17	25	28	27	28	28	34
40	25	23	29	27	27	26	18	28	29	15	31	20	26
39	21	30	26	17	29	21	28	27	30	30	30	28	30
38	17	21	18	21	20	19	23	24	32	21	34	45	35
37	24	20	20	26	29	14	15	18	19	22	29	12	24
36	24	26	34	23	29	22	25	42	36	58	52	59	58
35	3	1		12	26	50	52	59	61	57	54	73	66
34					38	28	39	55	66	59	66	56	57
33					10	13	13	24	20	29	22	22	33
32													
40-50	161	162	176	178	263	267	249	340	349	354	382	390	411
36-39	102	109	108	106	115	142	142	198	205	209	193	191	181
32-35	38	53	44	49	47	131	80	97	88	123	104	101	120
total	301	324	328	333	425	540	471	635	642	686	679	682	712

3.2 Recreational Fishery Sampling

3.2.1 Partyboat Trips

The RecFIN database contains data for recreational trips sampled by the MRFSS program beginning in 1980. For most purposes, the most useful samples come from partyboat (a.k.a. "commercial passenger fishing vessels" or CPFVs) trips. The sampling program was conducted in four regions: Washington, Oregon, and north and south of Pt. Conception California. The Washington samples are of little use and are not considered here. The North Region reported here consists of combined samples taken in Oregon and in California north of Cape Mendocino. The Central Region is represented by the remainder of Northern California samples, covering the coast from Pt. Conception to Cape Mendocino (Central Region partyboat data from years 1997 and 1998 are anomalous and have been deleted for the present purpose). Sampling was conducted by two-month "wave" and by county (Tables 4-9). Although recreational fishery sampling is ongoing, the data reported here extend only through 2003 after which the catch rates were severely impacted by restrictive bag limits and area closures. For the present purpose, the unit of sampling is a completed trip (which may have visited multiple fishing sites), and describes the combined catches by all of the sampled fishermen on that trip.

Although the trip-level data used here are based on sample data downloaded from RecFIN (http://www.recfin.org/), these trip-level summaries are not easily reconstructed from that source, and required substantial manipulation of the query results. Sample data from Northern California and Oregon have been examined and edited for problematic entries, and are available from CALCOM (URL 128.114.3.187). Southern California data have yet to be "cleaned-up", but a spreadsheet database can be obtained by request to the senior author (Alec.MacCall@noaa.gov).

3.2.2 On-board Observers

The State of California conducted on-board partyboat sampling in the Southern and Central Regions. Large numbers of Southern California partyboat trips were sampled during 1975-1978, and again during 1986-1989 (sample sizes for individual species are for each four-year period combined). These data are available from the California Department of Fish and Game, but pose some difficulties in defining equivalencies, including locations for the two time periods. The Central Region was sampled from 1987 to 1998, with detailed identification of individual fishing sites, and the data (available from the California Department of Fish and Game) are relatively easy to work with. Because the Central California data are identified by fishing site, there is no convenient general summary statistic for sample size, but the species tables report numbers of fish observed by species.

Table 4. Number of partyboat trips sampled in Northern Region (Northern California and Oregon) by two-month wave.

Year\Wave	1	2	3	4	5	6	Total
1980	15	15		4	24	4	62
1981	7	7		1	21	5	41
1982	7	10	12	1	19	7	56
1983	1	14	23			2	40
1984	4	11	57	2	22	2	98
1985	4	5	38		22	6	75
1986	1	9	45		17	2	74
1987	5	7	19	2	15	10	58
1988	11	27	37		25	5	105
1989	10	21	21	1	46	3	102
1993	11	26	74		31	13	155
1994		58	132	1	54		245
1995		24	71	16	46	6	163
1996	12	22	48	14	39	8	143
1997	7	23	33	75	31	8	177
1998	2	18	64	62	37	2	185
1999	4	21	54	67	49	2	197
2000	8	16	27	20	15	10	96
2001	4	9	24	38	9	12	96
2002	6	19	26	31	23	5	110
2003	6	10	4	34			54
Total	125	372	809	374	545	112	2332

Table 5. Number of partyboat trips sampled in Northern Region (Northern California and Oregon) by county, listed north to south.

Year\County	Clatsop, OR	Tillamook, OR	Lincoln, OR	Lane, OR	Douglas, OR	Coos, OR	Curry, OR	Del Norte, CA	Humboldt, CA	Total
1980		5	45			5	7			62
1981		1	37			2		1		41
1982		4	47			2	2		1	56
1983		6	30				4			40
1984	4	19	34		16	21	4			98
1985	2	13	30		5	17	6	2		75
1986	7	12	26	1	6	15	7			74
1987		8	40			4	4	1	1	58
1988		10	70		6	9	6	3	1	105
1989		1	77		1	11	11		1	102
1993	1	11	117		2	16	8			155
1994	1	36	145	1	2	38	22			245
1995	3	13	79			29	30	4	5	163
1996	6	11	78		1	18	16	2	11	143
1997	3	24	100			25	25			177
1998	5	30	99		3	23	25			185
1999	6	34	114			19	22		2	197
2000	1	27	54		1	4	9			96
2001	7	20	43			8	5	1	12	96
2002	5	13	75		2	9	6			110
2003		1	12		2		3	9	27	54
Total	51	299	1352	2	47	275	222	23	66	2332

Table 6. Number of partyboat trips sampled in Central Region (Pt. Conception to Cape Mendocino) by two-month wave.

Year\Wave	1	2	3	4	5	6	Total
1980	26	17	30	27	31	23	154
1981	7	11	18	16	20	10	82
1982	19	11	31	21	23	6	111
1983	2	8	29	24	18	9	90
1984	38	20	43	48	56	32	237
1985	67	56	80	88	66	41	398
1986		43	58	71	68	33	273
1987	29	19	53	63	67	19	250
1988	17	31	10	72	16	21	167
1989				71	22	31	124
1993	1			1	6	6	14
1994	3	7	1	2	6	1	20
1995		14	23	59		2	98
1996	21	60	89	104	96	19	389
1997	1	14	14	71	44	46	190
1998							
1999							
2000	4	4	22	43	25	14	112
2001	8	10	34	96	50	6	204
2002	47	34	68	247	55	4	455
2003	17	28	62	266	153	37	563
Total	307	387	665	1390	822	360	3931

Table 7. Number of partyboat trips sampled in Central Region (Pt. Conception to Cape Mendocino) by county, listed north to south.

Year\County	Mendocino	Sonoma	Marin	San Francisco	Alameda	Contra Costa	San Joaquin	San Mateo	Santa Cruz	Monterey	San Luis Obispo	Total
1980	8	11	6					15	1	86	27	154
1981	7	11	8	2	1			14	2	23	14	82
1982	30	7	4		1		1	17	7	37	7	111
1983	14	4	3					9	12	41	7	90
1984	21	24	7		6			8	25	89	57	237
1985	25	43	9		13	5		45	36	129	93	398
1986	14	17	7			10		20	35	91	79	273
1987	5	53	15		43	28		22		30	54	250
1988	1	31	9	2	16			26	22	38	22	167
1989	10		18		2	17		29	25	4	19	124
1993											14	14
1994											20	20
1995	21	5	9					8	5	24	26	98
1996	16	91	7		24			68	44	65	74	389
1997		42			12	6		23	15	34	58	190
1998												
1999												
2000	7	10	16	1	7			18	19	6	28	112
2001	11	23	20	20	24			44	40	10	12	204
2002	41	46	20	50	80			67	55	32	64	455
2003	39	79	20	14	63			97	60	82	109	563
Total	270	497	178	89	292	66	1	530	403	821	784	3931

Table 8. Number of partyboat trips sampled in Southern Region, by two-month wave.

Year\Wave	1	2	3	4	5	6	Total
1980	12	25	22	26	24	14	123
1981	25	17	33	24	27	29	155
1982	18	28	45	60	32	22	205
1983	35	46	44	52	41	48	266
1984	52	33	41	53	47	38	264
1985	49	43	50	46	31	33	252
1986	36	48	49	55	37	35	260
1987	8	20	25	30	16	16	115
1988	19	11	22	23	15	12	102
1989			23	30	26	13	92
1993	285	300	442	631	393	344	2395
1994	234	202	450	544	429	188	2047
1995		22	46	49	52	28	197
1996	31	20	71	62	61	39	284
1997	16	18	41	48	47	22	192
1998	38	50	84	84	68	73	397
1999	57	79	117	132	190	136	711
2000	72	90	87	58	66	73	446
2001	50	89	88	77	33	35	372
2002	83	116	102	126	111	72	610
2003	111	119	153	159	136	110	788
Total	1231	1376	2035	2369	1882	1380	10273

Table 9. Number of partyboat trips sampled in Southern Region by county, listed north to south.

Year\County	Santa Barbara	Ventura	Los Angeles	Orange	San Diego	Total
1980	20	19	18	25	41	123
1981	22	16	28	45	44	155
1982	15	19	48	62	61	205
1983	18	26	78	73	71	266
1984	18	28	83	74	61	264
1985	17	28	71	64	72	252
1986	19	28	81	65	67	260
1987	5	3	53	34	20	115
1988	5	8	32	33	24	102
1989	1	14	36	12	29	92
1993	203	304	756	479	653	2395
1994	108	383	507	314	735	2047
1995	14	42	50	32	59	197
1996	10	59	75	75	65	284
1997	2	31	64	39	56	192
1998	16	60	122	52	147	397
1999	22	97	251	96	245	711
2000	11	36	159	62	178	446
2001	12	42	119	80	119	372
2002	14	80	217	108	191	610
2003	16	86	281	142	263	788
Total	568	1409	3129	1966	3201	10273

3. Relative Abundance

The survey and monitoring data require a substantial amount of processing to be useful for stock assessment. Often, filtering the data based on co-occurring species, depth, location, or other consistent habitat attributes (e.g., by the logistic regression method of Stephens and MacCall 2004) allows identification of an appropriate subset of the data for the target species. Although swept-area estimates of abundance are possible and have been produced for some of these trawl surveys, a common statistical approach to developing indexes of relative abundance is to employ a General Linear Model (GLM) with factors such as year, location and season (Maunder and Punt 2004). For sparse data (i.e., containing frequent zeroes), it may be useful to use a delta-GLM approach, where a log-linear model is used for the abundance at positive stations, and a joint logistic (or similar) regression is used to describe the probability of a positive observation. In either case, the values of the “year” effects are a basis for the desired annual indexes, provided interaction terms involving "year" can be ignored. Importantly for the less common species, the data may be too sparse to estimate index values for individual years in which case it may be appropriate to aggregate the abundance data into time-blocks of years.

4. Additional information

Only partyboat-based sampling is included in these summaries, but other sampled segments of the recreational fisheries such as private boats may be useful in some cases such as brown and grass rockfish and kelp greenling. CalCOFI ichthyoplankton surveys may be useful for Mexican rockfish and for several species of flatfishes. For some deep water Southern California rockfishes such as bronzespotted and pink it may be possible to develop an absolute estimate of abundance in recent years based on sightings in submersible surveys conducted for cowcod (Yoklavich et al. 2007). No useful source of information was found for soupfin shark. Dusky rockfish are exceeding rare on the US West Coast which is at the southern end of the species' range, and do not merit consideration. No useful information was found for four small species of rockfishes (chameleon, freckled, harlequin and pinkrose) that are seldom encountered or retained, and may be difficult to identify.

5. References

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6. Acknowledgement

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7. Tables of positive occurrences (pages 17-63)

Common Name Aurora rockfish

Scientific Name *Sebastes aurora*

Region / Source / Year	Triennial	North Slope	Combo	Triennial	Central Slope	Combo	South Combo
			Cape Mendocino			Point Conception	
1975							
1976							
1977	28			73			
1978							
1979							
1980	0			1			
1981							
1982							
1983	4			0			
1984		14					
1985							
1986	0			1			
1987							
1988		13					
1989	0	8		0			
1990		19					
1991		2					
1992	1	7		0			
1993		23					
1994							
1995	45	19		44			
1996		30					
1997		14			22		
1998	46			42			
1999		20	25		24	42	
2000		16	25		20	30	
2001	42	17	44	40	19	33	
2002			41			42	15
2003			26			26	14
2004	34		21	29		22	12
2005			33			34	22
2006			38			27	22
2007			45			28	21
2008			42			45	31
2009			38			38	12
2010			28			41	23

Common Name			**Scientific Name**					
Bank rockfish			*Sebastes rufus*					

	Cape Mendocino				Point Conception			
Region	North		Central			South		
Source	Triennial	Combo	Triennial	Slope	Combo	Combo	RecFIN	Observer
Year								
1975								93
1976								*
1977	1		57					*
1978								*
1979								
1980	2		7				9	
1981							9	
1982							4	
1983	3		6				11	
1984							12	
1985							12	
1986	4		2				2	88
1987							0	*
1988							0	*
1989	1		6				3	*
1990								
1991								
1992	1		10					
1993							6	
1994							31	
1995	4		29				1	
1996							10	
1997				1			4	
1998	1		8				6	
1999		1		4	14		13	
2000		0		3	9		2	
2001	2	1	16	1	3		2	
2002		2			4	0	2	
2003		3			0	1	4	
2004	14	0	0		5	3		
2005		0			3	8		
2006		1			4	6		
2007		2			4	9		
2008		3			10	4		
2009		1			4	7		
2010		1			6	6		

Common Name Black rockfish

Scientific Name *Sebastes melanops*

Region	Central	
Source	RecFIN	Observer
Year		(fish)
1975		
1976		
1977		
1978		
1979		
1980	12	
1981	11	
1982	11	
1983	7	
1984	20	
1985	44	
1986	18	
1987	32	55
1988	14	727
1989	11	736
1990		220
1991		326
1992		366
1993	2	660
1994	1	996
1995	18	586
1996	52	706
1997	44	1235
1998		329
1999		
2000	14	
2001	39	
2002	95	
2003	174	

Common Name	**Scientific Name**
Black and yellow rockfish	*Sebastes chrysomelas*

Point Conception

Region	Central		South
Data Source	RecFIN	Observer	Observer
Year		(fish)	(trips)
1975			40
1976			*
1977			*
1978			*
1979			
1980	2		
1981	1		
1982	0		
1983	0		
1984	1		
1985	5		
1986	2		71
1987	4	4	*
1988	0	26	*
1989	1	10	*
1990		0	
1991		9	
1992		12	
1993	1	9	
1994	1	8	
1995	5	9	
1996	2	10	
1997		8	
1998		18	
1999	6		
2000	6		
2001	7		
2002	10		
2003	19		

Common Name Blackgill rockfish

Scientific Name *Sebastes melanostomus*

Region	North	Central		South
Source	Combo	Slope	Combo	Combo
Year				
1997		12		
1998				
1999	2	13	24	
2000	3	12	23	
2001	6	14	19	
2002	4		24	8
2003	3		14	5
2004	6		9	5
2005	4		13	11
2006	4		15	16
2007	3		14	13
2008	9		17	18
2009	3		24	13
2010	3		22	20

Cape Mendocino (North/Central boundary); Point Conception (Central/South boundary)

Common Name Bocaccio

Scientific Name *Sebastes paucispinis*

Region	North			
Source / Year	Triennial	Slope	Combo	RecFIN
1975				
1976				
1977	50			
1978				
1979				
1980	70			3
1981				1
1982				4
1983	91			1
1984		8		8
1985				6
1986	180			1
1987				2
1988				3
1989	31	3		1
1990		3		
1991		1		
1992	17			
1993		2		11
1994				4
1995	11	3		3
1996		3		2
1997		1		2
1998	14			4
1999		2	2	8
2000		1	0	5
2001	10	2	0	2
2002			1	1
2003			9	1
2004	32		0	
2005			5	
2006			4	
2007			5	
2008			5	
2009			0	
2010			1	

Common Name Brown rockfish

Scientific Name *Sebastes auriculatus*

Cape Mendocino

Region	Central			South	
Source	Combo	RecFIN	Observer	RecFIN	Observer
Year			(fish)		(trips)
1975					199
1976					*
1977					*
1978					*
1979					
1980		17		7	
1981		12		12	
1982		4		14	
1983		8		27	
1984		31		26	
1985		52		19	
1986		27		13	414
1987		27	9	3	*
1988		35	583	10	*
1989		22	641	13	*
1990			210		
1991			365		
1992			323		
1993		4	282	8	
1994		5	321	23	
1995		4	544	11	
1996		55	412	22	
1997				4	
1998				16	
1999		53		33	
2000		18		19	
2001		43		24	
2002		80		36	
2003	5	128		28	
2004	6				
2005	4				
2006	4				
2007	1				
2008	1				
2009	2				
2010	3				

Common Name			**Scientific Name**
Calico rockfish			*Sebastes dallii*

Region	South		
Source	Combo	RecFIN	Observer
Year			(trips)
1975			151
1976			*
1977			*
1978			*
1979			
1980		2	
1981		8	
1982		2	
1983		7	
1984		5	
1985		18	
1986		17	468
1987		1	*
1988		5	*
1989		6	*
1990			
1991			
1992			
1993		8	
1994		8	
1995		6	
1996		6	
1997		2	
1998		11	
1999		23	
2000		4	
2001		1	
2002		2	
2003	2	2	
2004	5		
2005	7		
2006	7		
2007	9		
2008	3		
2009	6		
2010	3		

Common Name — China rockfish

Scientific Name — *Sebastes nebulosus*

Region	North	Central	
Source	RecFIN	RecFIN	Observer (trips)
Year			
1975			
1976			
1977			
1978			
1979			
1980	10	18	
1981	15	8	
1982	9	10	
1983	7	9	
1984	14	9	
1985	19	29	
1986	7	30	
1987	15	34	34
1988	23	18	375
1989	26	27	288
1990			115
1991			111
1992			123
1993	42	3	180
1994	35	5	207
1995	28	25	132
1996	28	57	220
1997	42		149
1998	37		96
1999	52	46	
2000	25	19	
2001	16	34	
2002	22	73	
2003	5	110	

Cape Mendocino (boundary between North and Central)

Common Name Copper (or Whitebelly) rockfish

Scientific Name *Sebastes caurinus*

Region	North	Central				South		
	Cape Mendocino			Point Conception				
Source	RecFIN	Triennial	Combo	RecFIN	Observer (fish)	Combo	RecFIN	Observer (trips)
Year								
1975								154
1976								*
1977		2						*
1978								*
1979								
1980	2	1		32			20	
1981	1			28			19	
1982	0			31			23	
1983	1	4		27			14	
1984	4			40			25	
1985	3			53			28	
1986	4	1		61			18	501
1987	4			20	39		5	*
1988	3			21	498		12	*
1989	12	13		45	713		29	*
1990					300			
1991					208			
1992		5			681			
1993	14			11	803		29	
1994	19			14	470		29	
1995	4	5		20	443		10	
1996	9			106	388		35	
1997	30				396		6	
1998	30	4			221		29	
1999	45			81			76	
2000	20			18			39	
2001	14	2		32			19	
2002	13			39			30	
2003	5		3	62		5	37	
2004		0	4			1		
2005			2			1		
2006			2			1		
2007			0			4		
2008			6			5		
2009			5			2		
2010			5			4		

Common Name Cowcod

Scientific Name *Sebastes levis*

	Cape Mendocino						Point Conception	
Region	North			Central			South	
Source	Combo	Triennial	Slope	Combo	RecFIN	Observer (fish)	Combo	Observer (trips)
Year								
1975								148
1976								*
1977		11						*
1978								*
1979								
1980		2			0			
1981					2			
1982					3			
1983		4			4			
1984					1			
1985					4			
1986		0			3			95
1987					1	5		*
1988					6	2		*
1989		19			3	8		*
1990						5		
1991						6		
1992		3				10		
1993					0	6		
1994					0	13		
1995		21			1	5		
1996					0	0		
1997			3			5		
1998		11				0		
1999	0		4	3	10			
2000	0		2	1	0			
2001	1	8	3	1	0			
2002	1			5	2		2	
2003	1			3	0		3	
2004	0	0		16			5	
2005	2			13			6	
2006	0			5			6	
2007	0			3			6	
2008	0			2			9	
2009	0			7			7	
2010	1			11			17	

Common Name Flag rockfish

Scientific Name *Sebastes rubrivinctus*

Region	Central		Point Conception	South	
Source	RecFIN	Observer	Combo	RecFIN	Observer
Year		(fish)			(trips)
1975					273
1976					*
1977					*
1978					*
1979					
1980	9			19	
1981	6			22	
1982	12			24	
1983	7			30	
1984	15			30	
1985	23			33	
1986	16			32	361
1987	3	10		6	*
1988	3	36		9	*
1989	10	104		16	*
1990		29			
1991		38			
1992		120			
1993	5	84		16	
1994	8	85		19	
1995	6	47		4	
1996	19	56		23	
1997		49		9	
1998		22		25	
1999	29			74	
2000	8			46	
2001	12			18	
2002	6			28	
2003	0		6	17	
2004			7		
2005			5		
2006			8		
2007			12		
2008			7		
2009			9		
2010			7		

Common Name Greenblotched rockfish

Scientific Name *Sebastes rosenblatti*

Region	Central			Point Conception South	
Source Year	Triennial	Combo	RecFIN	Combo	Observer
1975					128
1976					*
1977	0				*
1978					*
1979					
1980	0		0		
1981			0		
1982			0		
1983	1		0		
1984			0		
1985			2		
1986	0		2		113
1987			3		*
1988			11		*
1989	5		4		*
1990					
1991					
1992	7				
1993			0		
1994			0		
1995	1		2		
1996			2		
1997					
1998	3				
1999			2		
2000			1		
2001	3		0		
2002		3	0	1	
2003		1	0	5	
2004	0	1		6	
2005		1		8	
2006		2		12	
2007		4		3	
2008		3		14	
2009		1		10	
2010		3		17	

Common Name			**Scientific Name**				
Halfbanded rockfish			*Sebastes semicinctus*				
		Cape Mendocino		Point Conception			
Region	North		Central		South		
Source	Triennial	Combo	Triennial	Combo	Combo	RecFIN	Observer
Year							(trips)
1975							28
1976							*
1977	0		6				*
1978							*
1979							
1980	0		0			2	
1981						4	
1982						1	
1983	0		0			8	
1984						11	
1985						12	
1986	0		0			12	144
1987						0	*
1988						1	*
1989	2		22			1	*
1990							
1991							
1992	0		44				
1993						5	
1994						17	
1995	1		30			2	
1996						10	
1997						5	
1998	1		27			15	
1999						45	
2000		0		1		13	
2001	1	0	27	1		3	
2002		0		2	1	10	
2003		1		4	16	5	
2004	16	2	0	15	26		
2005		1		19	31		
2006		0		15	30		
2007		1		15	31		
2008		0		19	32		
2009		1		20	38		
2010		0		26	35		

Common Name	**Scientific Name**
Kelp rockfish	*Sebastes atrovirens*

Point Conception				
Region	Central		South	
Source	RecFIN	Observer	RecFIN	Observer
Year		(fish)		(trips)
1975				112
1976				*
1977				*
1978				*
1979				
1980	1		17	
1981	0		11	
1982	0		11	
1983	3		27	
1984	3		24	
1985	0		23	
1986	1		15	350
1987	3	0	2	*
1988	5	2	1	*
1989	0	8	7	*
1990		0		
1991		5		
1992		12		
1993	0	8	25	
1994	1	34	26	
1995	1	30	6	
1996	2	65	16	
1997		34	5	
1998		83	11	
1999	6		23	
2000	2		13	
2001	1		24	
2002	5		27	
2003	9		23	

Common Name	**Scientific Name**
Olive rockfish	*Sebastes serranoides*

Point Conception				
Region	Central		South	
Source	RecFIN	Observer	RecFIN	Observer
Year		(fish)		(trips)
1975				637
1976				*
1977				*
1978				*
1979				
1980	53		38	
1981	16		42	
1982	28		45	
1983	39		42	
1984	44		27	
1985	84		27	
1986	48		53	843
1987	30	130	10	*
1988	11	624	13	*
1989	39	819	26	*
1990		174		
1991		516		
1992		1169		
1993	8	885	60	
1994	4	637	33	
1995	28	1687	6	
1996	106	1175	14	
1997		1274	4	
1998		1177	11	
1999	123		24	
2000	21		6	
2001	23		36	
2002	54		59	
2003	97		36	

Common Name	**Scientific Name**
Pygmy rockfish	*Sebastes wilsoni*

	Cape Mendocino		Point Conception		
Region	North		Central		South
Source	Triennial	Combo	Triennial	Combo	Combo
Year					
1975					
1976					
1977	3		0		
1978					
1979					
1980	9		0		
1981					
1982					
1983	23		0		
1984					
1985					
1986	101		2		
1987					
1988					
1989	38		1		
1990					
1991					
1992	28		3		
1993					
1994					
1995	20		1		
1996					
1997					
1998	12		2		
1999					
2000					
2001	11		2		
2002		1		0	0
2003		11		3	0
2004	0	5	2	0	0
2005		7		1	2
2006		13		0	2
2007		9		0	7
2008		5		1	3
2009		10		4	5
2010		5		1	1

Common Name Quillback rockfish

Scientific Name *Sebastes maliger*

Region	North		Central	
Source	Triennial	RecFIN	RecFIN	Observer (fish)
Year				
1975				
1976				
1977	1			
1978				
1979				
1980	2	5	0	
1981		2	2	
1982		7	2	
1983	4	4	5	
1984		5	3	
1985		7	11	
1986	12	2	8	
1987		4	2	7
1988		5	0	90
1989	3	12	17	89
1990				36
1991				6
1992	9			21
1993		23	1	52
1994		23	0	26
1995	2	14	2	104
1996		15	21	59
1997		41		47
1998	7	44		45
1999		50	27	
2000		26	5	
2001	7	18	7	
2002		26	1	
2003		7	12	
2004	0			

Cape Mendocino divides North and Central regions.

Common Name Redbanded rockfish

Scientific Name *Sebastes babcocki*

Region / Source / Year	Cape Mendocino Triennial	North Slope	Combo	Point Conception Triennial	Central Slope	Combo	South Combo
1975							
1976							
1977	100			40			
1978							
1979							
1980	57			7			
1981							
1982							
1983	86			4			
1984		31					
1985							
1986	37			6			
1987							
1988		14					
1989	67	13		13			
1990		13					
1991		2					
1992	60	15		7			
1993		23					
1994							
1995	83	13		19			
1996		30					
1997		14			4		
1998	73			11			
1999		17	33		6	17	
2000		19	34		5	16	
2001	69	14	26	19	5	13	
2002			31			10	0
2003			52			8	3
2004	13		31	47		6	0
2005			46			4	4
2006			41			7	0
2007			47			5	0
2008			42			10	2
2009			39			13	1
2010			34			3	0

Common Name Redstripe rockfish

Scientific Name *Sebastes proriger*

Region	North				Cape Mendocino Central		
Source Year	Triennial	Slope	Combo	RecFIN	Triennial	Combo	RecFIN
1975							
1976							
1977	31				0		
1978							
1979							
1980	66			1	0		0
1981				0			2
1982				0			2
1983	64			1	1		5
1984		4		3			3
1985				2			11
1986	36			2	1		8
1987				0			2
1988		5		0			0
1989	58	4		0	1		17
1990		3					
1991							
1992	60	2			1		
1993		3		1			1
1994				4			0
1995	29	3		6	1		2
1996		12		2			21
1997		4		0			
1998	41			2	0		
1999		10	4	1		3	27
2000		3	1	1		0	5
2001	23	2	0	1	2	4	7
2002			3	1		1	1
2003			24	1		1	12
2004	8		15		12	0	
2005			17			0	
2006			16			0	
2007			9			0	
2008			9			3	
2009			13			1	
2010			11			0	

Common Name Rosethorn rockfish

Scientific Name *Sebastes helvomaculatus*

				Cape Mendocino						Point Conception
Region	North				Central					South
Source	Trienn	Slope	Combo	RecFIN	Trienn	Slope	Combo	RecFIN	Obs	Combo
Year									(fish)	
1975										
1976										
1977	47				14					
1978										
1979										
1980	67			2	1			15		
1981				0				5		
1982				7				15		
1983	81			3	2			17		
1984		14		8				2		
1985				7				17		
1986	37			5	1			5		
1987				2				0	9	
1988		7		2				6	28	
1989	69	7		1	9			3	48	
1990		3							20	
1991		0							55	
1992	76	11			7				15	
1993		14		12				0	26	
1994				16				0	54	
1995	51	3		20	9			1	43	
1996		22		10				2	47	
1997		6		10		1			22	
1998	58			15	8				12	
1999		9	13	11		5	10	9		
2000		10	16	6		2	8	0		
2001	35	5	10	1	9	3	4	1		
2002			15	4			5	0		5
2003			56	2			1	0		6
2004	42		32		26		4			5
2005			30				3			14
2006			39				6			13
2007			44				4			5
2008			37				5			2
2009			35				6			17
2010			39				2			15

Common Name	**Scientific Name**
Rosy rockfish	*Sebastes rosaceus*

	Point Conception			
Region	Central		South	
Source	RecFIN	Observer (fish)	RecFIN	Observer (trips)
Year				
1975				177
1976				*
1977				*
1978				*
1979				
1980	50		9	
1981	21		12	
1982	23		12	
1983	27		25	
1984	92		28	
1985	141		33	
1986	106		26	319
1987	29	432	2	*
1988	33	1631	5	*
1989	38	2284	18	*
1990		1030		
1991		633		
1992		1534		
1993	11	1526	17	
1994	15	1605	16	
1995	39	1564	3	
1996	137	1646	24	
1997		1372	4	
1998		766	23	
1999	118		85	
2000	31		31	
2001	29		14	
2002	24		20	
2003	29		13	

Common Name Rougheye rockfish

Scientific Name *Sebastes aleutianus*

Region / Source / Year	Triennial	North Slope	Combo	Cape Mendocino Central Triennial
1975				
1976				
1977	72			0
1978				
1979				
1980	22			0
1981				
1982				
1983	36			0
1984		14		
1985				
1986	100			0
1987				
1988		12		
1989	56	5		1
1990		4		
1991				
1992	60	14		0
1993		17		
1994				
1995	88	2		0
1996		27		
1997		10		
1998	70			6
1999		11	18	
2000		15	13	
2001	68	9	21	1
2002			13	
2003			34	
2004	3		27	45
2005			27	
2006			34	
2007			37	
2008			36	
2009			27	
2010			29	

Common Name	**Scientific Name**
Sharpchin rockfish	*Sebastes zacentrus*

Cape Mendocino

Region		North			Central	
Source	Triennial	Slope	Combo	Triennial	Slope	Combo
Year						
1975						
1976						
1977	77			6		
1978						
1979						
1980	83			12		
1981						
1982						
1983	112			5		
1984		16				
1985						
1986	1			10		
1987						
1988		14				
1989	87	13		19		
1990		17				
1991		1				
1992	98	17		13		
1993		29				
1994						
1995	56	15		14		
1996		30				
1997		19			3	
1998	55			10		
1999		19	14		3	10
2000		11	18		5	8
2001	41	14	6	10	5	11
2002			17			3
2003			51			2
2004	14		30	36		3
2005			31			3
2006			34			7
2007			31			4
2008			24			2
2009			30			9
2010			36			5

Common Name Shortraker rockfish

Scientific Name *Sebastes borealis*

Region Source Year	Triennial	North Slope	Combo	Cape Mendocino Triennial
1975				
1976				
1977	10			2
1978				
1979				
1980	2			0
1981				
1982				
1983	3			0
1984		0		
1985				
1986	13			0
1987				
1988		0		
1989	0	2		0
1990		0		
1991		0		
1992	0	4		1
1993		1		
1994				
1995	10	0		0
1996		6		
1997		2		
1998	6			1
1999		5	1	
2000		2	1	
2001	9	4	4	1
2002			4	
2003			1	
2004	0		3	3
2005			2	
2006			0	
2007			0	
2008			0	
2009			0	
2010			0	

Common Name		**Scientific Name**	
Speckled rockfish		*Sebastes ovalis*	

Point Conception

Region	Central		South	
Source	RecFIN	Observer	RecFIN	Observer
Year		(fish)		(trips)
1975				106
1976				*
1977				*
1978				*
1979				
1980	10		10	
1981	3		15	
1982	13		10	
1983	13		29	
1984	27		20	
1985	36		17	
1986	11		9	126
1987	1	60	1	*
1988	1	39	0	*
1989	2	134	3	*
1990		20		
1991		75		
1992		166		
1993	0	93	3	
1994	0	78	32	
1995	5	152	1	
1996	20	104	3	
1997		235	3	
1998		115	9	
1999	38		19	
2000	8		18	
2001	5		3	
2002	2		10	
2003	1		4	

Common Name	**Scientific Name**
Squarespot rockfish	*Sebastes hopkinsi*

	Point Conception			
Region	Central		South	
Source	RecFIN	Observer (fish)	RecFIN	Observer (trips)
Year				
1975				197
1976				*
1977				*
1978				*
1979				
1980	18		3	
1981	15		0	
1982	19		2	
1983	28		1	
1984	38		17	
1985	28		19	
1986	26		2	249
1987	3	98	0	*
1988	6	190	2	*
1989	10	120	0	*
1990		17		
1991		1		
1992		80		
1993	20	55	0	
1994	27	71	1	
1995	4	173	4	
1996	24	64	9	
1997	12	194	34	
1998		168	16	
1999			12	
2000	35		2	
2001	6		0	
2002	18		0	
2003	22		1	

Common Name	**Scientific Name**
Starry rockfish	*Sebastes constellatus*

Point Conception

Region	Central		South	
Source	RecFIN	Observer	RecFIN	Observer
Year		(fish)		(trips)
1975				267
1976				*
1977				*
1978				*
1979				
1980	41		21	
1981	19		20	
1982	21		30	
1983	27		54	
1984	64		48	
1985	105		49	
1986	90		46	533
1987	21	266	9	*
1988	20	625	16	*
1989	29	681	23	*
1990		199		
1991		379		
1992		690		
1993	12	707	40	
1994	16	819	63	
1995	23	749	16	
1996	101	936	34	
1997		721	9	
1998		299	48	
1999	130		136	
2000	26		74	
2001	30		29	
2002	30		53	
2003	22		36	

Common Name Stripetail rockfish

Scientific Name *Sebastes saxicola*

Region	North			Central				South
			Cape Mendocino				Point Conception	
Source / Year	Triennial	Slope	Combo	Triennial	Slope	Combo	RecFIN	Combo
1975								
1976								
1977	48			143				
1978								
1979								
1980	47			30			3	
1981							0	
1982							0	
1983	65			33			1	
1984		14					5	
1985							8	
1986	22			45			8	
1987							0	
1988		2					0	
1989	46	4		97			0	
1990		13						
1991		1						
1992	47	3		73				
1993		7					0	
1994							0	
1995	93	15		81			0	
1996		11					1	
1997		11			9			
1998	55			74				
1999		11	24		10	25	2	
2000		9	17		10	31	0	
2001	53	9	7	59	12	30	0	1
2002			19			29	0	14
2003			41			49	0	32
2004	67		29	38		56		34
2005			40			70		39
2006			56			46		40
2007			62			43		40
2008			30			53		41
2009			46			60		48
2010			47			78		45

Common Name	**Scientific Name**
Swordspine rockfish	*Sebastes ensifer*

Point Conception			
Region	Central	South	
Source	RecFIN	Combo	Observer
Year			(trips)
1975			52
1976			*
1977			*
1978			*
1979			
1980	13		
1981	6		
1982	9		
1983	12		
1984	13		
1985	3		
1986	1		85
1987	3		*
1988	2		*
1989	0		*
1990			
1991			
1992			
1993	0		
1994	0		
1995	0		
1996	0		
1997			
1998			
1999	0		
2000	0		
2001	0		
2002	0		
2003	0	1	
2004		2	
2005		1	
2006		3	
2007		8	
2008		5	
2009		3	
2010		4	

Common Name | **Scientific Name**
Treefish | *Sebastes serriceps*

Point Conception			
Region	Central	South	
Source	RecFIN	RecFIN	Observer
Year			(trips)
1975			181
1976			*
1977			*
1978			*
1979			
1980	2	20	
1981	0	14	
1982	0	22	
1983	0	45	
1984	0	33	
1985	0	27	
1986	0	30	565
1987	0	11	*
1988	1	10	*
1989	2	17	*
1990			
1991			
1992			
1993	0	55	
1994	0	34	
1995	0	28	
1996	1	34	
1997		21	
1998		48	
1999	6	102	
2000	3	51	
2001	3	41	
2002	10	53	
2003	20	52	

Common Name	**Scientific Name**
Vermilion rockfish	*Sebastes miniatus*
Sunset rockfish	*Sebastes crocotulus*

	Cape Mendocino				Point Conception			
Region	North	Central				South		
Source	RecFIN	Triennial	Combo	RecFIN	Observer (fish)	Combo	RecFIN	Observer (trips)
Year								
1975								332
1976								*
1977		2						*
1978								*
1979								
1980	0	0		34			21	
1981	2			16			19	
1982	0			28			19	
1983	0	1		19			34	
1984	1			37			46	
1985	4			58			50	
1986	9	0		52			42	690
1987	2			33	64		11	*
1988	6			37	674		19	*
1989	8	10		39	1274		46	*
1990					583			
1991					388			
1992		9			1173			
1993	7			12	1079		46	
1994	11			17	753		74	
1995	13	2		40	968		9	
1996	14			161	630		37	
1997	30				1278		8	
1998	24	0			662		40	
1999	27			162			167	
2000	12			28			97	
2001	15	6		43			58	
2002	13			108			105	
2003	6		1	178		5	103	
2004		0	2			1		
2005			1			4		
2006			2			3		
2007			1			7		
2008			6			7		
2009			9			6		
2010			5			10		

Common Name		**Scientific Name**	
Yellowmouth rockfish		*Sebastes reedi*	

Region Source Year	Triennial	North Slope	Combo
1975			
1976			
1977	7		
1978			
1979			
1980	7		
1981			
1982			
1983	14		
1984		1	
1985		0	
1986	127	0	
1987		0	
1988		2	
1989	10	2	
1990			
1991		0	
1992	13	1	
1993		1	
1994			
1995	6	2	
1996		1	
1997		1	
1998	4		
1999			1
2000			1
2001	2		1
2002			0
2003			5
2004	1		0
2005			2
2006			0
2007			0
2008			0
2009			0
2010			1

Common Name **Scientific Name**
Yellowtail rockfish *Sebastes flavidus*

Region / Source / Year	Triennial	Central RecFIN	Central Observer (fish)	Point Conception South Observer (trips)
1975				53
1976				*
1977	11			*
1978				*
1979				
1980	4	82		
1981		48		
1982		84		
1983	9	74		
1984		144		
1985		250		
1986	12	149		51
1987		89	1848	*
1988		71	5033	*
1989	9	88	7133	*
1990			2215	
1991			2551	
1992	16		6204	
1993		12	5370	
1994		16	4716	
1995	14	68	6240	
1996		231	4827	
1997			6715	
1998	4		4129	
1999		288		
2000		35		
2001	3	57		
2002		95		
2003		91		
2004	48			

Common Name	**Scientific Name**
Curlfin sole	*Pleuronichthys decurrens*

Region	North		Central		South
		Cape Mendocino		Point Conception	
Source	Triennial	Combo	Triennial	Combo	Combo
Year					
1975					
1976					
1977	0		6		
1978					
1979					
1980	4		6		
1981					
1982					
1983	8		12		
1984					
1985					
1986	1		14		
1987					
1988					
1989	12		47		
1990					
1991					
1992	14		40		
1993					
1994					
1995	12		36		
1996					
1997					
1998	31		51		
1999					
2000					
2001	27		52		
2002					
2003		17		31	8
2004	37	12	12	33	7
2005		30		34	5
2006		13		24	7
2007		14		23	11
2008		22		23	16
2009		23		40	16
2010		19		28	17

Common Name | **Scientific Name**
Pacific sanddab | *Citharichthys sordidus*

		Cape Mendocino				Point Conception			
Region	North		Central				South		
Source	Triennial	Combo	Triennial	Combo	RecFIN	Obs	Combo	RecFIN	Obs
Year						(fish)			(trips)
1975									107
1976									*
1977	30		78						*
1978									*
1979									
1980	100		36		14			14	
1981					4			11	
1982					1			3	
1983	231		48		4			4	
1984					18			18	
1985					41			22	
1986	349		57		19			21	351
1987					4	26		3	*
1988					16	185		9	*
1989	142		129		3	334		14	*
1990						61			
1991						129			
1992	191		135			196			
1993					4	325		11	
1994					2	383		22	
1995	165		86		9	304		4	
1996					46	334		19	
1997						307		8	
1998	206		94			85		15	
1999					37			60	
2000					16			31	
2001	162		89		9			24	
2002					13			53	
2003		65		47	38		22	36	
2004	65	82	77	62			24		
2005		116		71			30		
2006		85		64			31		
2007		95		60			35		
2008		95		66			43		
2009		86		86			48		
2010		114		81			46		

Common Name	**Scientific Name**
Rex sole	*Glyptocephalus zachirus*

		Cape Mendocino		Point Conception	
Region	North		Central		South
Source	Triennial	Combo	Triennial	Combo	Combo
Year					
1975					
1976					
1977	300		249		
1978					
1979					
1980	332		58		
1981					
1982					
1983	433		66		
1984					
1985					
1986	1		72		
1987					
1988					
1989	338		147		
1990					
1991					
1992	363		141		
1993					
1994					
1995	366		148		
1996					
1997					
1998	362	90	160	66	
1999		96		67	
2000		108		68	
2001	339	111	160	59	
2002		111		73	23
2003		236		92	22
2004	92	197	159	89	26
2005		269		113	42
2006		247		111	39
2007		282		105	38
2008		257		107	34
2009		247		115	36
2010		290		115	38

Common Name		**Scientific Name**			
Rock sole		*Lepidopsetta bilineata*			
	Cape Mendocino			Point Conception	
Region Source Year	North Combo	Combo	Central RecFIN	Observer (fish)	South Combo
1975					
1976					
1977					
1978					
1979					
1980			2		
1981			0		
1982			0		
1983			2		
1984			7		
1985			11		
1986			5		
1987			4	12	
1988			6	13	
1989			5	37	
1990				23	
1991				3	
1992				15	
1993			1	8	
1994			0	21	
1995			1	14	
1996			6	19	
1997				12	
1998				9	
1999			6		
2000			4		
2001			2		
2002			2		
2003			12		
2004	13	10			1
2005	19	8			2
2006	14	8			3
2007	19	11			7
2008	14	8			8
2009	14	15			5
2010	17	10			6

Common Name Sand sole

Scientific Name *Psettichthys melanostictus*

Region		Cape Mendocino North		Central	
Source	Triennial	Combo	RecFIN	Combo	RecFIN
Year					
1975					
1976					
1977	0				
1978					
1979					
1980	6		1		3
1981			0		1
1982			0		0
1983	7		1		0
1984			0		1
1985			1		2
1986	61		0		0
1987			0		1
1988			1		2
1989	6		2		0
1990					
1991					
1992	20				
1993			3		0
1994			10		0
1995	3		0		1
1996			1		1
1997			10		
1998	11		5		
1999			1		1
2000			0		1
2001	6		1		3
2002			0		2
2003		4	0	2	3
2004	2	5		1	
2005		6		0	
2006		3		0	
2007		6		1	
2008		6		6	
2009		7		3	
2010		7		3	

Common Name | **Scientific Name**
Big skate | *Raja binoculata*

Region	North		Central		South	
		Cape Mendocino		Point Conception		
Source	Triennial	Combo	Triennial	Combo	RecFIN	Combo
Year						
1975						
1976						
1977	10		0			
1978						
1979						
1980	10		2		0	
1981					0	
1982					3	
1983	28		4		3	
1984					3	
1985					3	
1986	79		6		1	
1987					1	
1988					1	
1989	41		14		3	
1990						
1991						
1992	52		18			
1993					1	
1994					1	
1995	22		22		3	
1996					6	
1997					1	
1998	48		12		3	
1999					14	
2000					13	
2001	24		19		2	
2002					15	
2003		48		14	19	1
2004	25	58	32	26		1
2005		85		15		3
2006		47		19		2
2007		61		17		1
2008		42		13		1
2009		60		24		1
2010		99		28		2

Common Name		**Scientific Name**			
Ratfish		*Hydrolagus colliei*			
		Cape Mendocino		Point Conception	
Region	North		Central		South
Source	Slope	Combo	Slope	Combo	Combo
Year					
1975					
1976					
1977					
1978					
1979					
1980					
1981					
1982					
1983					
1984	40				
1985					
1986					
1987					
1988	22				
1989	16				
1990	9				
1991	2				
1992	22				
1993	31				
1994					
1995	10				
1996	40				
1997	26		21		
1998		41		48	
1999	23	40	19	52	
2000	18	31	18	54	
2001	15	30	15	43	
2002		32		47	22
2003		156		66	33
2004		151		63	33
2005		200		87	44
2006		191		84	53
2007		209		89	53
2008		184		107	58
2009		146		106	58
2010		200		95	55

Common Name	**Scientific Name**
Pacific rattail	*Coryphaenoides acrolepis*
(Pacific grenadier)	*Coryphaenoides spp.*

		Cape Mendocino		Point Conception	
Region	North		Central		South
Source	Slope (multispp)	Combo	Slope (multispp)	Combo	Combo
Year					
1975					
1976					
1977					
1978					
1979					
1980					
1981					
1982					
1983					
1984	21				
1985					
1986					
1987					
1988	59				
1989	23				
1990	152				
1991	57				
1992	104				
1993	154				
1994					
1995	144				
1996	275				
1997	139		101		
1998					
1999	270	103	98	62	
2000	173	98	115	48	
2001	85	92	64	45	
2002		104		58	8
2003		107		17	3
2004		52		18	10
2005		89		23	12
2006		75		41	14
2007		88		42	16
2008		80		38	10
2009		65		52	15
2010		76		36	15

Common Name | **Scientific Name**
California skate | *Raja inornata*

Region Source Year	North Combo	Central Combo	South Combo
2001			
2002			
2003	1	30	19
2004	2	39	17
2005	4	53	21
2006	1	43	20
2007	0	40	18
2008	2	41	19
2009	1	53	19
2010	3	49	22

Common Name | **Scientific Name**
Finescale codling (Pacific flatnose) | *Antimora microlepis*

Region Source Year	North Combo	Central Combo	South Combo
1995			
1996			
1997			
1998	69	73	
1999	110	70	
2000	122	63	
2001	123	59	
2002	118	79	16
2003	108	23	11
2004	53	23	18
2005	71	24	19
2006	70	46	23
2007	74	48	23
2008	51	32	12
2009	23	42	16
2010	35	28	17

	Grass RF *S. rastrelliger*		Honeycomb RF *S. umbrosus*		Mexican RF *S. macdonaldi*	Pink RF *S. eos*
Region	Central	South	South		South	South
Source	RecFIN	Observer	RecFIN	Observer	Observer	Observer
Year		(trips)		(trips)	(trips)	(trips)
1975		94		127	30	75
1976		*		*	*	*
1977		*		*	*	*
1978		*		*	*	*
1979						
1980	0		8			
1981	0		5			
1982	1		15			
1983	0		18			
1984	1		26			
1985	0		30			
1986	1	179	35	391	20	23
1987	2	*	1	*	*	*
1988	4	*	9	*	*	*
1989	0	*	6	*	*	*
1990						
1991						
1992						
1993	0		22			
1994	1		17			
1995	0		6			
1996	0		20			
1997			9			
1998			36			
1999	0		114			
2000	1		50			
2001	6		11			
2002	2		44			
2003	1		46			

	Silvergray RF *S. brevispinis*		Tiger RF *S. nigrocinctus*	Ocean Whitefish *Caulolatilus princeps*	
Region	North		North	South	
Source	RecFIN	Combo	RecFIN	RecFIN	Observer
Year					(trips)
1975					325
1976					*
1977					*
1978					*
1979					
1980	2		0	8	
1981	0		0	7	
1982	3		0	17	
1983	0		0	33	
1984	0		8	34	
1985	0		0	45	
1986	1		1	44	823
1987	0		0	16	*
1988	0		2	9	*
1989	1		3	23	*
1990					
1991					
1992					
1993	2		4	44	
1994	9		4	109	
1995	5		3	34	
1996	3		3	33	
1997	3		7	26	
1998	4		4	44	
1999	4	2	11	97	
2000	2	1	5	95	
2001	0	1	2	57	
2002	0	0	3	69	
2003	0	9	2	67	
2004		3			
2005		6			
2006		3			
2007		8			
2008		5			
2009		5			
2010		8			

	Butter sole *Isopsetta isolepis*		Flathead sole *Hippoglossoides elassodon*	
Region	North		North	
Source	Triennial	Combo	Triennial	Combo
Year				
1975				
1976				
1977	0		43	
1978				
1979				
1980	2		85	
1981				
1982				
1983	2		76	
1984				
1985				
1986	24		279	
1987				
1988				
1989	4		91	
1990				
1991				
1992	6		79	
1993				
1994				
1995	3		87	
1996				
1997				
1998	3		64	
1999				
2000				
2001	10		159	
2002				
2003		6		52
2004	3	3	1	44
2005		6		41
2006		4		49
2007		9		27
2008		11		24
2009		12		39
2010		11		55

	Leopard shark *Triakis semifasciata*		Kelp greenling *Hexagrammos decagrammus*		Pacific cod *Gadus macrocephalus*	
Region	Central	South	Central		North	
Source	RecFIN	RecFIN	RecFIN	Observer (fish)	Triennial	Combo
Year						
1975						
1976						
1977					84	
1978						
1979						
1980	6	6	10		56	
1981	1	2	1			
1982	1	2	2			
1983	2	3	3		85	
1984	1	6	4			
1985	2	4	4			
1986	1	1	6		75	
1987	14	3	4	5		
1988	3	1	3	65		
1989	0	4	6	92	110	
1990				19		
1991				18		
1992				34	96	
1993	5	3	1	56		
1994	7	4	0	40		
1995	3	1	11	56	55	
1996	6	4	23	84		
1997		1	25	62		
1998		4	7	16	69	
1999	1	9	10			2
2000	3	1	6			4
2001	1	2	24		35	3
2002	0	2	6			3
2003	1	8	55			68
2004					1	48
2005						28
2006						14
2007						25
2008						19
2009						20
2010						49

Collaborative Optical-Acoustic Survey Technique (COAST)

Report of Methodology Review Panel Meeting

National Marine Fisheries Service (NMFS)
Southwest Fisheries Science Center (SWFSC)
La Jolla, California
15-17 February 2012

Methodology Review Panel Members:
Martin Dorn (Chair), Scientific and Statistical Committee (SSC), NMFS, Alaska Fisheries Science Center
Stéphane Gauthier, Center for Independent Experts
Luiz Mello, Center for Independent Experts
Gary Melvin, Center for Independent Experts
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Randy Cutter, NMFS, SWFSC
David Demer (Project Leader), NMFS, SWFSC
Kevin Stierhoff, NMFS, SWFSC
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OVERVIEW

A review of the Collaborative Optical-Acoustic Survey Technique (COAST) developed by the Southwest Fisheries Science Center (SWFSC) for estimating the abundances and distributions of rockfishes, and mapping their seabed habitats, was conducted by a Methodology Review Panel (Panel), at the SWFSC Torrey Pines Court Laboratory, La Jolla, CA, from 15-17 February 2012. The SWFSC's Technical Team (Team) presented the COAST to the Panel. The Panel followed the [Draft] Terms of Reference for Stock Assessment Methodology Reviews (January 2012).

Dr. Martin Dorn opened the meeting, after which Dr. Francisco Werner, Director of the SWFSC, welcomed the participants and outlined the background and objectives of the COAST survey. The Panel was provided with extensive background material, including a number of primary documents, through an FTP site, two weeks prior to the review meeting. The Team provided the Panel with a number of presentations including background to rockfish biology relevant to the assessment and management of rockfishes off the US West Coast, the optical and acoustic components of the COAST, as well as analytical methods for processing the resulting data to generate estimates of biomass and their uncertainty. Preliminary estimates of biomass were provided for a portion of the 2007 survey, but the Panel focused on the optical-acoustic methodology rather than these estimates.

The Panel's review was directed towards three components of the COAST: use of acoustics to estimate total rockfish (and some other species found in conjunction with rockfish) biomass; use of optical sampling from a remotely operated vehicle (ROV) to estimate the species and length composition of this biomass; and estimations of rockfish biomasses, by species, and their uncertainties. Although the COAST can be used to address questions of broader ecological interest, such as the behavior and distribution of rockfish species, the focus of the Panel was on estimation of biomass for rockfish species, and the use of such estimates for stock assessment and management purposes. The COAST has been applied to the Southern California Bight (SCB), but could be applied in other areas. However, the Panel only briefly considered the issues which might arise if the COAST was applied outside of the SCB.

The difficulty of surveying fish in, on, or near rocky-reef seabed off the West Coast has long been recognized. Development of appropriate methods for surveying rockfish in such untrawlable areas was identified as a priority research topic in the Pacific Fishery Management Council's Research and Data Needs. Rockfish stock assessments typically use indices from bottom trawl surveys, or catch per unit effort (CPUE) from recreational hook-and-line fisheries and commercial trawl fisheries to calibrate analytical models. The assumption that trends in these indices reflect overall population trends is a strong, but necessary, assumption to obtain consistent assessment results. New survey approaches have the potential to reduce uncertainty and bias in stock assessments, and may result in better management outcomes.

Despite recognition of the problem, progress in developing appropriate survey methods has been limited. Submersible surveys have been used for the assessment of cowcod in the SCB and for yelloweye rockfish in Alaska, but these surveys had a single-species focus and had limited spatial extent. Results needed to be scaled up to total suitable habitat for use in the assessment, and ultimately for providing management advice. Pilot projects using methods similar to the COAST evaluated the feasibility of using acoustics to survey widow rockfish (Stanley et al. 2000, Ressler et al. 2009), and several projects in Alaska are exploring similar approaches (Rooper et al. 2009, Jones et al. in review). None of these projects are close to being implemented on scale that would be useful for stock assessment (or on the scale of the COAST application in the SCB).

The development of the COAST began in 2002. It is now an advanced survey approach that was designed to overcome some of the shortcomings of more traditional survey methods. The COAST uses acoustic data from echosounders to quantify the overall abundance and distribution of rockfishes, and uses optical images from cameras deployed on a remotely operated vehicle (ROV) to estimate fish species and size compositions. The COAST is a non-lethal sampling method, which is advantageous when surveying depleted rockfish species. The Panel acknowledges the time and thought that went into the development of this new technology and analytical methods. Examples include an objective algorithm for filtering non-target acoustic backscatter, an improved acoustic dead zone (ADZ) calculation (Demer et al. 2009), and a new method for characterizing bottom type using multi-frequency acoustic data (Cutter and Demer 2010).

The Panel had no major technical concerns about the acoustics portion of the survey. Because acoustics cannot sample near the bottom, the Panel recommends that extrapolations of biomass in the near-bottom ADZ be provided under range of plausible assumptions. The Panel had a fundamental concern about the optical sampling from the ROV. It found that there was insufficient evidence to conclude that the optical sampling (at least as it is currently conducted) provides an unbiased estimate of species composition. For this reason, the Panel recommends that additional work be done before COAST results are used in stock assessment. Detailed recommendations on further research are given in Section 2.3 and in Section 5.

In the view of the Panel, the COAST appears to be most effective for assessing small schooling pelagic rockfish in the SCB, which make up approximately 85% of the total biomass in the survey area based on preliminary biomass estimates. The Panel also concludes that the survey is not likely to be reliable for those rockfish species that are strongly associated with rocky reef substrate. Relatively common large-bodied predatory rockfish, of which bocaccio may be the best example, could potentially be surveyed effectively if concerns about bias in optical sampling are successfully addressed. The Panel did not attempt to further identify which species could best be surveyed using the COAST. There is considerable expertise to draw on in evaluating rockfish associations with habitat, but that expertise is conditioned on the observational platform, and all survey platforms have potential biases. The Panel sees some utility to convening a group of rockfish experts to evaluate habitat associations as an initial step, but this would not replace the need for quantitative fieldwork.

The Panel's view of the most pressing issues that need to be addressed before results from the COAST can be used for stock assessment are the following. First, a more vertically-structured approach needs to be adopted for optical sampling, such that both near-bottom and off-bottom components are sampled consistently to provide layered estimates of species composition. Second, a quantitative evaluation of fish responses to the ROV is needed to test the assumption of the COAST that off-bottom fish dive into the field of view of the ROV. Projects involving comparisons of two or more survey approaches such as acoustics, ROVs, submersibles, autonomous underwater vehicles (AUVs), or drop cameras are also recommended to improve understanding of the performance (and economics) of alternative survey platforms.

The Chair thanked SWFSC for hosting the meeting and the participants for the excellent and constructive atmosphere during the review, the results of which should help the Council and its advisory bodies determine the best available science for the assessment of rockfish.

1. DISCUSSION AND REQUESTS MADE TO THE TECHNICAL TEAM DURING THE MEETING

A. Provide the algorithm used to allocate raw data on optical observations to estimate species proportions (including how account is taken of unidentified species, observations at different pitch angles, etc.)

Rationale: The documentation provided to the Panel did not include this information.

Response: The equation to apportion the integrated volume backscattering coefficients (s_A) of all rockfishes to the s_A by species is given in Equation 2 under the section 'Target strength Estimation' in the Demer et al. primary COAST document. The weighting factor w_i represents the summed species biomass within the part of the ROV transect that spans the respective depth stratum and TS_i is the average target strength for the i^{th} species. Fish counted as unidentified were assigned to one of five categories (*Sebastomus*, *Sebastes*, Complex 1, Complex 2 and Complex 3; Table 1). Fish not assigned to the *Sebastomus* complex were attributed to the nearest species along the ROV transect that was a member of their complex. The counts of unidentified species were partitioned proportionally to all the fish on the transect when both the previous and the following species counts along the ROV track did not match any of the potential species. Fish counted as *Sebastomus* were apportioned proportionally to the counts of the species assigned to the category. Raw count data are assumed to represent unbiased estimates of species composition.

B. Estimate the biomass in the ADZ for an example bank under the assumption that the density just above the ADZ matches that in the ADZ

Rationale: The density in the ADZ is currently assumed to be zero, and the Panel wished to obtain an impression of the likely size of the negative bias associated with this assumption.

Response: For the 2007 COAST survey of Cherry Bank, distributions of s_A were presented by three classes of ADZ height (Fig. 1). The biomass potentially inside the ADZ was estimated to be ~15% by extrapolating the s_A in the 1m bin above the ADZ throughout the ADZ. In the example provided, rockfish s_A was highest in the 1-2 m immediately adjacent to the ADZ, so an extrapolation based on a trend of increasing rockfish s_A would result in a higher percentage of biomass in the ADZ. However, no information is available on how rockfish density varies within the ADZ.

C. Construct a table of the frequency of the use of the four methods for assigning species proportions to sites (same site and survey, same site different survey, different site same survey, different site and survey)

Rationale: Ideally, the species proportions for each site and survey should be based on optical transects during that survey at that site. However, this does not always occur due to practical considerations such as available ship time or inclement weather. The Panel wished to understand the extent to which extrapolation of species proportions occurred during the COAST 2007 survey, for example.

Response: For the 2007 COAST survey, most of the shallow strata (~90%) had transect information from the same site and survey (Table 2). Only 33% of the deep strata had transect information from the same site and survey, with the remaining information coming from the same site and a different survey (26%), or a different site and the same survey (36%), and from a different site and a different survey (5%).

The Panel recommends that an objective set of rules be developed for deciding how to borrow data from other sites or other surveys, ideally depending on whether variation in species composition is greater between sites or between surveys. Stock assessments typically make the assumption that each survey is independent, and borrowing transect data from other surveys would violate this assumption, but this may be a lesser consideration than improving the precision of the estimates.

D. Provide a histogram of the dead zone height (50 cm bins above the bottom) by stratum (high vs. low density; deeper or shallower than 150 m).

Rationale: The Panel wished to understand the potential amount of ADZ. The provisional algorithm used to analyse the 2007 COAST survey data excludes samples with ADZ height >3 m.

Response: Figure 2 shows the distribution of dead zone heights for the 2007 COAST survey of Cherry Bank (integrated over strata). Figure 3 shows the distribution of ADZ height for the 2007 COAST survey of 43 Fathom Bank. More than 90% of the samples from the 43 Fathom Bank had an ADZ height <3m, with the bulk of the ADZ heights < 1 m. The only stratum in Figure 3 with appreciable amounts of ADZ >5m was the high density deep stratum (~55% of the samples in this stratum), but there was little biomass in this stratum. For the remaining strata, the bulk of the dead zone heights was < 1 m.

E. Provide the estimates of biomass by deep and shallow strata and site categorized by the four methods for assigning species proportions to sites

Rationale: The Panel wished to further understand the implications of having to use data from different surveys or sites to apportion total biomass to species.

Response: During the 2007 COAST survey, 96% of the estimated biomass in all shallow strata came from sites with optical data from the same site and the same survey (Table 3). Biomass for all of the deep strata was approximately 10% of the biomass in the shallow strata. Approximately 66% of that biomass came from strata with borrowed transect data (Table 4).

The Panel concluded that borrowing transect data is likely to have relatively minor impact on overall biomass estimates. However it would still be worthwhile to develop a consistent approach.

F. Provide the equation for the calculation of biomass and variance.

Rationale: The Panel wanted clarification on how biomass and its variance are calculated.

Response: The estimate of biomass is given by:

$$B_y = \sum_i \sum_s d_{i,s,y} A_{i,s,y} \qquad (1)$$

where B_y is the biomass during year (or survey) *y* for a given species,

$d_{i,s,y}$ is the estimated density for stratum *s* site *i* during *y*, and

$A_{i,s,y}$ is the area for stratum *s* site *i* during *y*.

The variance of the biomass estimate is:

$$VAR(B_y) = \sum_s \frac{A_{s,y}^2}{n_{i(s)} - 1} \sum_i [d_{i,s,y} - \bar{d}_{i,s}]^2 \qquad (2)$$

2. SUMMARY COMMMMENTS ON THE TECHNICAL MERITS AND/OR DEFICIENCIES OF THE METHODOLOGY, AND RECOMMENDATIONS FOR REMEDIES

2.1 Survey philosophy and design

The COAST is designed according to well-established principles for conducting acoustic-trawl surveys (Simmonds and MacLennan 2005). Acoustic-trawl surveys are most often used to survey pelagic or semi-pelagic species (e.g., walleye pollock, Pacific hake, sardine, herring, and anchovy) that form single-species midwater aggregations. In acoustic-trawl surveys, data collected along transects are used to quantify the acoustic backscatter, and species and size compositions are estimated from trawl samples. Both parts are essential because acoustic transects alone do not include enough information to estimate biomasses of species from measures of backscatter. The COAST is different than typical acoustic-trawl surveys because optical samples provide information on biological characteristics rather than trawl sampling. Nevertheless the information provided by the optical sampling (e.g., visual estimations of species and size composition) is considered equivalent to that provided by other kinds of verification sampling. As a consequence of the decision to adopt such a survey approach, information on rockfish density in the optical sampling data are not used for abundance estimation. However, current survey design does not preclude estimation of fish density along ROV transects from optical sampling.

The Team pointed out that an analogy could be made between the acoustic-trawl method used for coastal pelagic species (CPS) and the COAST for rockfishes. The Panel recognizes that there are similarities between these two survey methods and objectives, but notes that surveys of rockfish will need to address additional challenges. Although there are important exceptions, rockfish as a group tend to be strongly associated with bottom structure, unlike CPS. Second, in the SCB many rockfish species co-occur in a diverse community. This is less of an issue for CPS surveys, where only a few species are present, and those few species often tend to have relatively disjunct geographic distributions. Therefore, in evaluating the merits of the COAST, it is insufficient to evaluate only whether the survey was conducted according to the principles of acoustic-trawl surveys; the Panel also needed to consider whether these additional challenges have been successfully addressed.

The survey area consists of geographically distinct sites in the SCB identified using records of historical fishing locations kept by charter- and commercial-fishing vessel captains. Each site is surveyed acoustically using parallel transects, and one or more optical transects are conducted. The sites surveyed by the COAST are intended to provide coverage of the large majority of rockfish species in the SCB. The Panel had some concern that the criteria for site identification were not as formalized as they could have been, for example, by using explicit depth limits. Nearshore areas that were not surveyed may have been depleted of economically important rockfish, and are no longer fished (Love et al. 1998). Nevertheless, they may contain high densities of species that are not of interest to fishermen, or they may be recolonised as depleted rockfish begin to rebuild. For COAST to provide a time series of abundance estimates, this issue needs to be addressed more carefully. The Panel recommends that comparisons of COAST results with those from alternative surveys methods (e.g. trawl surveys, hook and line surveys) be made to identify species for which the COAST sites do not provide full coverage. In addition, depth and substrate maps of the SCB should be used to identify areas of suitable rockfish habitat that are not being surveyed by the COAST.

2.2 Acoustic Transects

The acoustic portion of the COAST consists of closely-spaced parallel transects over 47 previously identified sites in the SCB. Analysis of the raw acoustic backscatter included procedures to isolate backscatter associated with rockfish, high resolution (per-acoustic ping) estimation of the ADZ, and the use of phase and range information to determine seabed type. Many of the techniques used for the COAST are novel, and have been recently published by members of the Team. A generalized additive model (GAM) relating rockfish density to seabed properties was used to stratify each survey site into potentially high and low density rockfish habitats. Sites were further stratified into shallow (<150 m) and deep (>150 m) areas. The Panel agreed that these procedures were appropriate.

Acoustic surveys have an inherent limitation due to a very strong acoustic return from the bottom. The ADZ represents the distance above the bottom that is masked by the bottom return. The height of ADZ depends on the shape of the acoustic beam, the slope and roughness of the bottom, bottom depth (due to beam spreading), and sea condition. For the COAST, the ADZ ranged from 0.25 m over shallow and flat bottoms to 3 m and higher over rougher, more sloped seabeds and deeper water depths. Though not considered part of the ADZ, an additional back step of 0.5 m above the ADZ is applied to avoid inadvertent integration of the high-intensity seabed backscatter

Acoustic pings for which the ADZ was estimated to be more than 3 m were excluded from the COAST analyses. It was not clear to the Panel what proportion of the survey area (especially in those with high rockfish densities) had high ADZ heights. Since the analysis assumes that the densities of fish in the areas of high ADZ height are the same as the densities in areas with low ADZ heights, the Panel wanted to evaluate what potential bias this could have on the estimation of rockfish biomass. Requests to the technical team clarified that these areas tended to be on the sides of the banks where the slope was steep. Since these areas were in the deep strata, where there was little rockfish biomass, the impact on the biomass estimates is likely to be minor. However, the Panel did not see a strong rationale for excluding pings with >3 m ADZ, and recommends that all the acoustic data be included in the analysis.

Due to the limitations of acoustics near the bottom, the Panel was interested in evaluating whether a substantial percentage of the biomass occurs in the ADZ. In response to a request by the Panel, the Team produced Fig 1, which indicates that for the 2007 COAST survey of the 43 Fathom Bank, the density of rockfish is highest within 1-2 m of the ADZ. An extrapolation of densities immediately above to the ADZ suggested that 15% of the biomass would be located in the ADZ. This estimate may be biased low because it assumes no further increase in density towards the bottom. Alternative methods for extrapolation should be evaluated. However it must be recognized that these are extrapolations, and should be identified as such and reported separately.

Currently the COAST is using the same target strength (*TS*) to fish length model for all rockfish species based on a model developed by Kang and Hwang (2003) for *Sebastes schlegeli*, an Asian species of rockfish. *In situ TS* estimates for a limited number of rockfish species in the SCB did not suggest wide departures from the Kang and Hwang (2003) model, so the Panel considered this approach acceptable. Nevertheless the Panel recommends that more research be conducted to develop species-specific *TS*-to-lengths models. Rockfish show strong links between habitat use and traits such as body robustness and coloration. It is reasonable to expect that there would be similar adaptation in swimbladder size and morphology.

2.3 ROV Optical Sampling

One or more optical transects were made using an ROV at each survey site. The ROV was lowered on a tether, and steered along a transect approximately 1 m off the seabed. Deployments were assigned to sample the strata within sites, although the transects for any given survey at any given site rarely covered all four strata. Optical transect data were post stratified into deep and shallow areas, but not by high and low rockfish density areas. Data from past surveys or surveys at other sites were used when optical sampling data were unavailable for the strata/site.

Information provided to the Panel was insufficient to determine how species proportions were derived from the raw optical observations. A request was made to the technical team to provide a detailed description of the quantitative methods, including the formulas and assumptions. The information requested was provided, and clarified the procedures used to count and to estimate the relative portions of each species. For any given deployment, most of the video and camera effort was directed at observing the very near bottom (negative pitch), with occasional upward looking observation (positive pitch). Optical observations (after accounting for unidentified species) were added together to obtain species proportions by transect. No weighting was applied to adjust the estimates based on the vertical orientation of the camera, which assumes that fish are distributed randomly in the water column. Even if most species dive toward the bottom in reaction to the optical platform, this may not be a valid assumption. Given these operational practices, any vertical stratification by species could bias the proportional estimates.

The Panel recommends a more structured approach be adopted to ensure adequate sampling of fish through the water column. ROV observations should routinely record and analyze distance above bottom (altitude). The random distribution assumption could be validated by testing for differences in species proportions by ROV tilt angle. If differences are found in species proportions among ROV tilt angles, the species proportions by tilt angle should be weighed by the proportion of time allocated to each tilt angle. For future operations, the Panel recommends distributing the observation effort with the ROV equally across tilt angles, rather than the current procedure which appears to be related to the distribution of scatters observed in the concurrent echograms. Consideration should also be given to changes in the observational depth field and the increasing sample volume as distance from the camera increases. An alternative would be to fly the ROV at different heights above the bottom rather than changing tilt angles. Optical sampling procedures should be directed at providing information on species composition and density in several layers extending from the bottom to a height sufficiently high above the bottom to include major rockfish aggregations.

The objective of the optical sampling is to estimate the proportions of species present in the acoustic backscatter, as well as the estimation of size composition of the various rockfish species present in the study area. A key issue is whether the optical sampling provides an unbiased estimate of the proportions of fish in the water column, which is the working hypothesis that allows estimation of biomass by species. The Panel considered the following information:

1) Analysis of acoustic backscatter indicates that rockfish density is highest near the bottom, but rockfish aggregations can extend up to 30 m above the bottom.
2) Rockfish occur in the ADZ where they are not sampled using acoustics. Estimates of rockfish biomass in ADZ are imprecise, but the proportion of biomass in the ADZ (e.g., 15% from one extrapolation) may not be negligible.
3) In their undisturbed state, the species composition of rockfish differs vertically. Some species are thought to be more common near the bottom, while others are thought to be more pelagic in their distribution. Quantitative estimates of species-specific vertical distributions are not available, but this observation is consistent with substantial information on rockfish habitat associations.

The Team presented a single echogram as an example that fish in the water column dive towards the bottom as the ROV approaches. However, no quantitative analysis of the dive response was provided to the Panel. Any dive response would have to occur before the fish enter the field of view of the ROV camera. If fish are highly reactive to the presence of the ROV, there may also be horizontal avoidance in addition to a vertical response – a differential horizontal response among species would similarly lead to bias in the species proportion estimates. Several species are believed to be relatively abundant on the SCB banks, but were rarely found by the optical sampling. For example, one meeting participant noted that chillipepper rockfish should be fairly abundant at some sites, but was not well represented in the optical data, raising the possibility that it may be available to the acoustic survey, but not to optical sampling. This would be an extreme case of a species that completely avoids the ROV, remaining beyond the observational range of the camera, but the Panel regarded this explanation as needing further inquiry before it could be given much credence.

The COAST depends critically on a dive response that places the fish in an ideal position to be surveyed by the ROV. Some scepticism on the part of the Panel seems justified, and it is reasonable to request that research be conducted to provide adequate support for the assumed dive response. The Panel concluded that the dive response to the ROV had not been sufficiently studied to substantiate that it occurs consistently, and that it does not differ by rockfish species. While these issues are not easy to address, the Panel has a number of recommendations for analysis of current data and further research. The behavior of rockfishes in response to the ROV could potentially be studied by analysis of existing echo sounder data or data from multi-beam sonar, or by use of an acoustic buoy to monitor the reactions of fish as the ROV approaches. More detailed analysis of optical data, such as examining the distribution of each species across the camera field of view, or the outer edges of the images/video to see if fish are moving away, may also be useful. An ideal solution from a technological perspective would be the design of an optical sampling platform that can sample effectively throughout the water column and does not disturb the vertical distribution of fish.

A second major concern is the percentage of the rockfish biomass in the ADZ. Since the ROV optical sampling is focused near the bottom, these fish presumably are included in the optical sampling. Use of an ADZ correction would help to address this issue, but uncertainty in the appropriate correction would strongly affect the biomass estimates for those species that occur primarily in the ADZ, which is likely to include some economically important rockfish species. An ADZ correction also assumes that the biomass in the ADZ is correlated with undifferentiated biomass above the ADZ, which may be suspect if the mix of species in the ADZ differs from that of the species above the ADZ. Adopting a more vertically-structured approach to optical sampling, as is recommended by the Panel, would make it possible to compare species composition at different elevations above the bottom.

The technical team compiled a table to evaluate which species can be surveyed effectively using COAST (and provisionally excluded six species from the analyses). However, it was apparent that a larger body of evidence was available to address this issue than was referenced in the table. Also, the Panel noted that expert opinions differed in terms of the inferences that could be drawn from the various types of information available (e.g. diet, observations of some fish high in the water column, morphology and likely feeding strategy). An initial step would be to convene a group of rockfish experts to develop a more comprehensive view on the depth distribution and responsive behavior of the rockfish species encountered during COAST. At the same time, the Panel was concerned whether inclusion or exclusion of species based on qualitative descriptions of habitat use would be an adequate approach to deal with the issue in the long term, especially since many species of interest are likely to be distributed partially inside and partially outside the ADZ. The Panel instead recommends that quantitative data be collected to assess the vertical distribution of species. For example, use of drop or still cameras would provide useful information on vertical distribution, as would tagging rockfish with pop-up satellite archival tags (PSATs).

Data on fish length is required to estimate *TS*, weight, apportion acoustic backscatter and subsequently biomass for the individual rockfish species. The lengths of rockfish were measured during optical surveys using parallel lasers. Unfortunately, this method proved to be limiting in both the number of accurate samples practically obtainable and the number of species. For many more species, broad size categories were established using visual estimation by the analysts of the optical images. An effort was made to compare the higher-precision length distributions made with the lasers for a small number of species to the relatively coarse measurements made for most species. For the species where both types of length distributions were available, Gaussian distributions were fit to both and compared. These comparisons indicated that the coarse measures of fish lengths produced very similar estimates of the mean and standard deviation as did the more precise laser-based estimates. Gaussian fits to the coarse distributions of fish length were used for all species where such measures were available. This approach seemed reasonable for *TS* estimations, but efforts should be made to improve both the quality and quantity of length measurements, particularly if this survey is to be used for stock assessment. This need has been recognized by the Team, and will be addressed in future surveys with a calibrated stereo camera system that will allow measurement of individual fish over a broad range of orientations.

2.4 Integration, abundance estimation, quantification of uncertainty

The following issues were raised in respect to the integration of the acoustic and optical data:

1) The largest concern and greatest potential source of bias for the COAST is the partitioning of total backscatter to species. The Panel concluded that there was insufficient support for the primary assumption that the species proportions estimated from the ROV optical sampling are representative of the fish surveyed acoustically.
2) The estimation of rockfish lengths used in the COAST is based on Gaussian fits to coarsely-binned visual length measurements. Although these corresponded well to the Gaussian fits to the more precise length measurements that were made using reference stereo-lasers for a few species, more detailed length composition data may be necessary for assessment purposes.
3) Optical data are not available for all strata from several sites in the year in which the acoustic transects took place. In those cases, the optical data were supplemented from another site or survey. The Panel notes that it is unclear whether it is better to use the optical data from the same site but a different survey, or the same survey but at a different site. Site fidelity would suggest that the species proportions should not change much among surveys, and support the “same site different survey” approach, but this would

lead to among-year correlations in abundance estimates, which would be addressed by a "same survey different site" approach. Sensitivity tests which explore the implications of the two approaches should be conducted to evaluate the likely magnitude of the impact on abundance estimates is associated with the choice between these options.

Currently the COAST treats every (stratified) site as an independent sample (i.e., sites in COAST are treated similar to transects in traditional acoustic-trawl surveys). Estimates of density (for each stratum) are averaged over all sites and then multiplied by the entire survey strata areas to obtain biomass estimates. The Panel noted that site-specific biomass estimates may be of interest to management (for example, in terms of trends in abundance for specific locations). It was agreed that further stratification might be warranted, such as inside and outside the Cowcod Conservation Areas.

The Panel also recommends testing whether the species proportions and length distributions differ between high and low density habitats (as defined using acoustics). Currently the analysis method assumes that species proportions are the same in these habitats. While such tests may have low power because of low sample size, they should be conducted and the optical data be properly stratified between high and low density strata if significant differences in species proportions are found.

Temporal and spatial variability in species composition can have implications in the proportional estimates used to apportion the acoustic backscatter at specific sites, especially when limited optical sampling is available. Current protocols utilize the closest optical transect(s) from the same year, and in the case of high rockfish density habitat strata there is generally good correspondence. However, at several sites, and in the low density strata, there may be no optical sampling, and data from another year or site is substituted to apportion backscatter. Furthermore, a single optical survey may be used to estimate species proportions when repetitive sampling over a period of several months (several legs of the survey) at the same site occurs. This could introduce a bias and not account for the temporal and spatial variability expected for some rockfish species. Further investigation on these issues is required.

The current approach to variance estimation is based on between-site variation in density estimates (see request F above). This approach makes it difficult to evaluate the relative contribution of the acoustic transects and the optical sampling to the overall variance, and potentially includes true variation in fish density between sites in addition to estimation error. The Panel recommends that alternative variance estimation methods be considered in which total variance is the sum of variances for each site. Site variances should include the contribution of the acoustic transects and the optical sampling. Well-established geostatistical methods are available for estimation of total biomass from acoustic transects, and variance estimators for line transect or strip transects could be used for optical data. It may be possible to estimate a functional form relating the coefficient of variation of density to site area, effort, etc. Total variances incorporating the relative contribution of acoustic transects and ROV optical sampling would allow objective decisions to be made concerning the allocation of ship time to acoustic transects and ROV transects.

The possibility of using the ROV transects as an independent estimate of species-specific biomass was also discussed by the Panel and should be explored. Direct counts of numbers could be used to estimate fish densities for specific seabed types. A direct comparison between the ROV estimates of abundance with those using COAST could be done by an intensive survey of a small number of sites. Another approach that should be considered is a combined approach that uses both quantitative estimates of near-bottom biomass from optical sampling and acoustic surveys of the off-bottom component of the rockfish biomass. Comparisons of alternative biomass estimation methods would be a good way to validate COAST, and to assess how use of acoustic transects improves precision in comparison to optical-only approaches for different species.

2.5. Applications

2.5.1 Inclusion in stock assessments

To use the data from the COAST in a stock assessment, there needs to be an estimate of biomass, data which can be used to infer what size (or age) component of the population the estimate pertains to (ideally through length-composition data) and measures of precision of the biomass estimate, and any length-frequency information (CVs and effective sample sizes). Data from the COAST could be used in stock assessments as measures of absolute abundance (if there is no substantial bias due to inadequate spatial coverage, species proportion estimates, etc., or if a prior distribution for the average level of bias can be developed) or as a relative index of abundance.

No estimates of abundance for the entire SCB were available for the Panel. The 2007 survey covered 44 sites and preliminary results based on 21 sites were presented to the Panel. The Panel noted that although the estimates provided were provisional and were not based on all sites that the estimates for some species (e.g. shortbelly rockfish) appeared to be much lower than expected given the results of stock assessments (Field et al. 2007).

Most stock assessments for which the COAST is potentially useful extend over a much larger area than is covered by the survey. For example, the stock assessments of bocaccio, chillipepper rockfish, greenspotted rockfish, and shortbelly rockfish all extend at least to the Oregon-California border. This would not necessarily preclude the use of the COAST in these stock assessments, but it would require that the estimate of biomass be used as a relative index of abundance due to partial spatial coverage. There are assessment models for cowcod and vermillion rockfish limited to the SCB, but use of the survey as an absolute biomass estimate would depend on whether survey sites cover the habitat where the species occurs in the SCB. This evaluation would have to be done by species because rockfish show strong differentiation in habitat and depth distribution.

2.5.2. Application of the COAST in other areas

The SCB may be the most challenging area of the West Coast in which to conduct surveys of rockfish. The SCB is the apex of species diversity for rockfish, and potential rockfish habitat is both extensive and spatially complex. Rockfish backscatter is dominated by small pelagic species that hamper estimation of biomass for species of management interest. Pilot projects in Alaskan waters have found much lower species diversity and greater dominance by economically important rockfish (Rooper et al. 2010, Jones et al. in review). At the same time, different challenges are likely to be encountered in areas north of the SCB, such as a greater presence of other fish species in the water column (e.g. Pacific hake) that would need to be filtered from the acoustic backscatter. Different optical sampling approaches may also be required depending on where fish are found in the water column, suggesting some benefit of having several platforms with different capabilities to collect optical data (e.g., ROVs, drop cameras, camera sleds, etc).

3. AREAS OF DISAGREEMENT REGARDING PANEL RECOMMENDATIONS

There were no areas of disagreement regarding Panel recommendations.

4. UNRESOLVED PROBLEMS AND MAJOR UNCERTAINTIES

The unresolved problems and major uncertainties for the COAST are discussed in detail in Section 2. Here the Panel simply reiterates what it considers the most important issues.

1) Rockfish occur in the near-bottom ADZ that cannot be sampled with acoustics. An ADZ correction should be applied, but this is an interpolation into a region of the water column that is not acoustically sampled, and would add additional uncertainty. Species that are of management concern may occur partially or mainly in the ADZ, while species that are sampled acoustically appear to consist primarily of small pelagic schooling rockfish that are not targeted in any fishery.
2) There is currently insufficient support for the assumption that the species proportions estimated from the ROV optical sampling are representative of the fish surveyed acoustically. The Panel identified several research projects to help further examine this assumption.
3) A strong and consistent diving response of rockfish to ROV was assumed to compress pelagic aggregations into the field of view of the ROV. The diving response was not sufficiently well documented. Other types of avoidance responses to the ROV, including species-specific responses, were not considered.
4) All rockfish species are assumed to be equally distributed in the field of view of the ROV cameras. Departures from this assumption would bias estimates of species composition.
5) The undisturbed distribution of different species of rockfish above the bottom is not sufficiently well known to evaluate which species can be effectively sampled using acoustics.

5. RECOMMENDATIONS FOR FUTURE RESEARCH AND DATA COLLECTIONS

1) The estimates presented to the Panel did not include an ADZ correction whereas the species proportions from the ROV optical sampling includes rockfish that would have been in the ADZ. Based on preliminary results presented at the meeting, the proportion of the biomass in the ADZ is likely to be sufficiently large that application of an ADZ correction is justified. Consider additional approaches for calculating the ADZ correction

and evaluate the sensitivity of results to different approaches (including no ADZ correction).

2) Conduct an analysis of whether the species proportions inferred from the optical transects differs among sites within a survey year, among years for a given site, and among the strata used within a site (deep vs. shallow and high vs. low density). Evaluate the power to detect differences.
3) Explore methods to estimate the depth distribution of each rockfish species using techniques that are less disruptive than ROVs and submersibles (such as drop camera and hook-and-line surveys). Taking due account of the likely impact of these techniques on the behavior of the surveyed species, evaluate the depth distribution of the surveyed species and hence determine which species are likely to be adequately surveyed by acoustics. Tagging with depth-recorders may also provide information on depth distribution, behavior, site fidelity, etc.
4) Continue work to estimate species-specific *TS* and employ species-specific estimates if this is supported by the results of analyses.
5) The extent to which rockfish react to the ROV may differ among species. The estimates of species proportions (and hence abundance) will be biased if some species are less likely to be detected optically than others. Explore methods to estimate how the probability of detection (horizontal avoidance) differs among species and correct the species proportions if needed.
6) Test whether the species proportions differ as a function of the height off the bottom. If so, compute species proportions for each transect, weighting the species proportions by depth class by the proportion of effort by depth class. Optical survey efforts should be more equally distributed across camera tilt angles and altitude in future surveys. Alternatively, optical transects could be designed explicitly to sample at different heights above bottom.
7) Conduct an analysis to identify the optimal allocation of acoustic and optical transects to strata and the relative effort by these two methods given a fixed total cost. Account in this analysis for the correlation in density estimates among acoustic transects.
8) Convene a group of rockfish experts to develop a synthesis of the information on the depth distribution and responsive behavior of the rockfish species encountered during COAST. Use this information to develop criteria to select which species to exclude when estimating species proportions from the optical data.
9) Higher resolution data on length composition is needed. Use more accurate methods (e.g. stereographic camera system) to get sufficient length samples for each species in the survey.
10) Synthesize acoustic information on fish response to ROV.
11) Consider alternative variance estimation methods in which total variance is the sum of variances for each site. Site variances should include the contribution of the acoustic transects and the optical sampling. It may be possible to estimate a functional form relating the coefficient of variation of density to site area, effort, etc.
12) Design and evaluation of new optical sampling platforms should consider how to minimize fish response to the platform.
13) Conduct a direct comparison between the ROV estimates of abundance with those using COAST through an intensive survey of a small number of sites. Stratify the comparison

by ADZ height. Compare alternative biomass estimation methods to assess how the use of acoustics improves precision relative to optical-only approaches for different species and to validate COAST approach.

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Table 1. Species groups used to assigning unidentified species to putative species.

Group	Potential species			
Complex 1	*S. hopkinsi*	*S. rufus*	*S. ovalis*	*S. entomelas*
Complex 2	*S. moseri*	*S. wilsoni*	*S. ensifer*	*S. semicinctus*
Complex 3	*S. chlorostictus*	*S. rosenblatti*		
Sebastes	*S. hopkinsi*	*S. moseri*	*S. ovalis*	*S. wilsoni*
Sebastomus	*S. chlorostictus*	*S. constellatus*	*S. rosaceus*	*S. ensifer*

Table 2. Distribution of 2007 COAST ROV surveys by depth strata.

Strata	Same site, same survey	Same site, different survey	Different site, same survey	Different site, different survey
Shallow	30	4	-	-
Deep	11	7	11	5

Table 3. 2007 COAST estimates of total abundance in the shallow stratum, by method of assigning species. Total biomass = 28183.3 t.

Site	Biomass same site, same survey	same site, different survey
S Tanner	3542.473	
Osborn	2148.575	
S Cortes	505.109	
N Cortes	6656.820	
Cherry	1776.978	
S Cortes s.g.	82.755	
E S. Nicolas	2144.645	
NW S Nicolas	1774.177	
Potato	4317.055	
Hidden reef	152.346	
60 mile bank		1106.428
China point reef	870.700	
Del Mar	32.654	
Farnsworth	597.761	
Lasuen	209.495	
Mission beach reef	306.333	
N Cortes s.g.	495.145	
NW S Clemente	507.811	
S Cruz canyon	268.449	
W. S. Clemente	472.632	
43 Fathom	214.952	
Proportion	**96%**	**3.9%**

Table 4. 2007 COAST estimates of total abundance in the deep stratum, by method of assigning species. Total biomass = 3369.8 t.

Site	Biomass			
	same site, same survey	same site, different survey	different site, same survey	different site, different survey
S Tanner			24.375	
Osborn			232.923	
S Cortes				
NCortes	422.613			
Cherry		425.443		
S Cortes s.g.			230.986	
E S. Nicolas			118.779	
NW S Nicolas			97.183	
Potato		66.985		
Hidden reef			470.854	
60 mile bank	601.813			
China point reef			35.751	
Del Mar				
Farnsworth				
Lasuen		221.280		
Mission beach reef	84.941			
N Cortes s.g.		140.727		
NW S Clemente				86.804
S.Cruz canyon				19.074
W. S. Clemente				50.566
43 Fathom		38.773		
Proportion	**32.9%**	**26.5%**	**35.9%**	**4.6%**

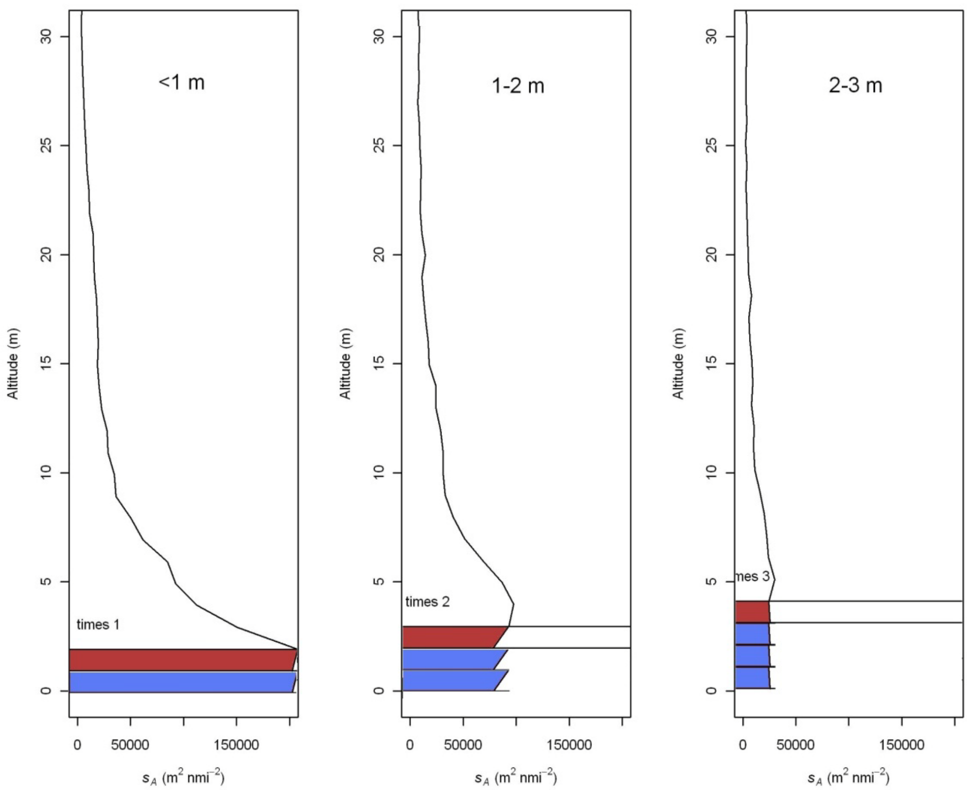

Figure 1. Distribution of s_A by distance from the bottom for the 2007 COAST survey of the Cherry Bank by different acoustic dead zone (ADZ) heights, the s_A in the 1m bin just above the ADZ (red bar) and the s_A assigned to the ADZ (blue bars).

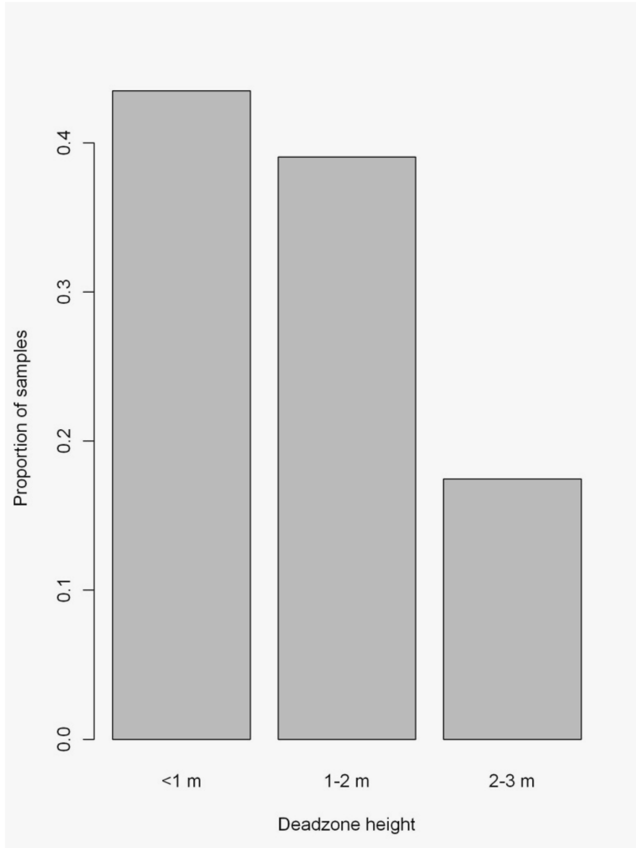

Figure 2. Frequency of acoustic samples by acoustic dead zone height for the 2007 COAST survey of the Cherry Bank.

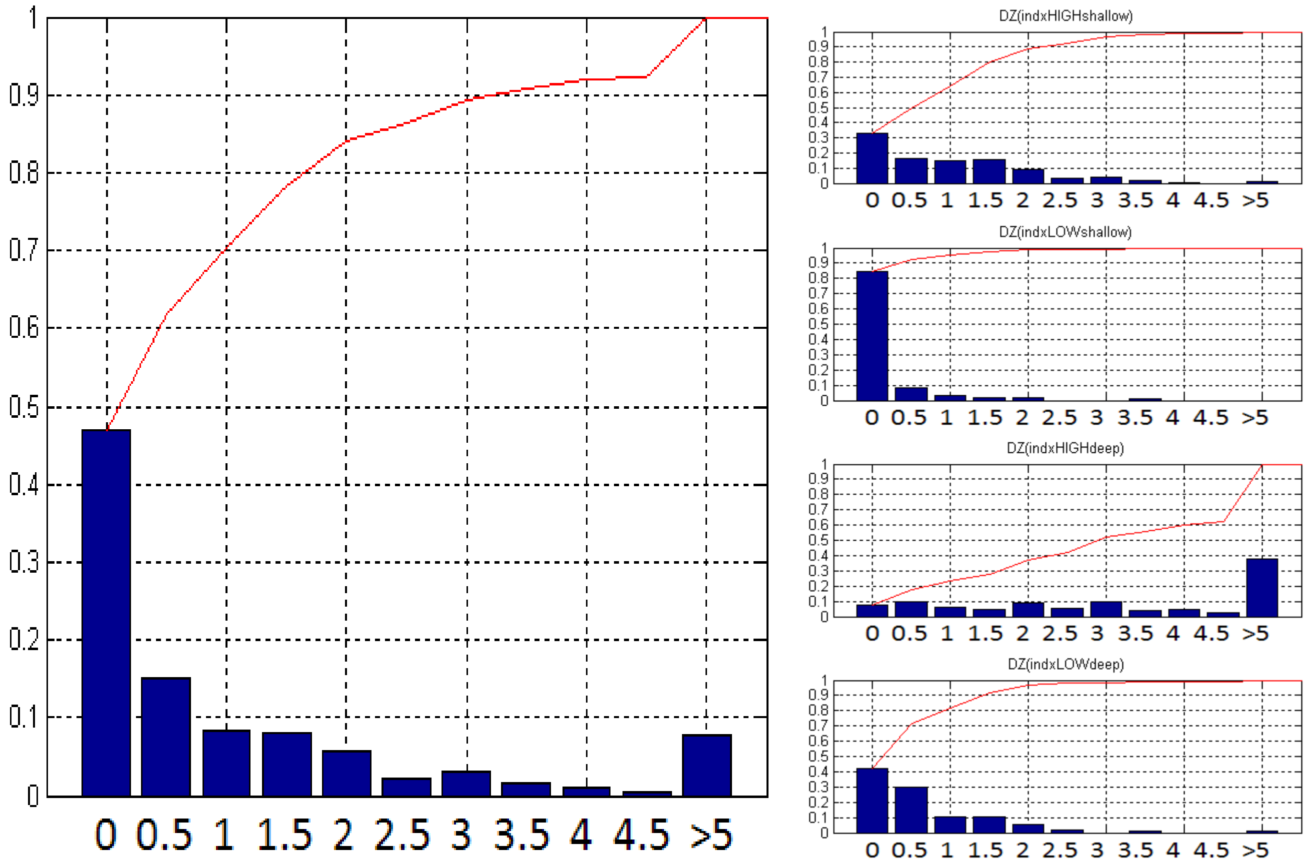

Figure 3. Distribution of acoustic dead zone height for the 2007 COAST survey of the 43 Fathom Bank.

Appendix 1: List of Participants

Methodology Review Panel Members:

Martin Dorn (Chair), Scientific and Statistical Committee (SSC), NMFS, Alaska Fisheries Science Center
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Alec MacCall, NMFS, SFWSC [remote from Santa Cruz]

Appendix 2: Panel Biographical Summaries

Martin Dorn is a Fisheries Research Biologist at the Alaska Fisheries Science Center, NOAA Fisheries, in Seattle, USA. He holds a M.Sc. in Biomathematics and a Ph.D. in Fisheries from the University of Washington. Martin has been involved in research on management strategy evaluations to evaluate impacts of climate and ecosystem change, modelling fishing behavior, and applying Bayesian methods to resource management problems. His current research focuses on the Bayesian meta-analysis of fish populations, and the development of cooperative research programs to address fisheries management issues. Martin leads the stock assessment team for walleye pollock in the Gulf of Alaska. He has been a member of the ICES working group on the ecosystem effects of fishing activities (WGECO) and the ICES study group on the use of acoustics on fishing vessels. He is Chair of Scientific and Statistical Committee (SSC) of the Pacific Fisheries Management Council and is an Affiliate Associate Professor at the School of Aquatic and Fishery Sciences at the University of Washington, Seattle.

Stéphane Gauthier is a Research Scientist at the DFO Institute of Ocean Science in Sidney, British Columbia, Canada. He received a B.Sc. and M.Sc. from the University of Montreal and a Ph.D. from Memorial University of Newfoundland (2001) where he worked on the acoustic properties and shoaling behavior of Atlantic redfish (*Sebastes* sp.). Stéphane did postdoctoral research at the School of Aquatic and Fisheries Science at the University of Washington and at the University of Montreal. Before joining Fisheries and Oceans Canada in 2011, he spent 5 years as a fisheries scientist at the National Institute of Water and Atmospheric research (NIWA) in New Zealand where he worked on a wide range of projects spanning from the Antarctic Ocean to the Arabian Sea. Stéphane has considerable experience using acoustics and complementary technologies to address ecological issues in both marine and freshwater habitats.

Luiz Mello is a biologist at the DFO Northwest Atlantic Fisheries Centre in St. John’s, Newfoundland, Canada. He holds degrees in Oceanography (B.Sc., Un. of Rio Grande), Marine Resources Management (M.Sc., Un. of Quebec) and Biology (Ph.D., Memorial University of Newfoundland). Since the early 1990s he has conducted research in fisheries biology and resource assessment, as a graduate student, post doctoral fellow and professionally. Most of his research has focused on relating life history traits of fishes (e.g., reproduction, feeding, distribution and migration) to (1) population dynamics and techniques used in stock assessment (fisheries acoustics, bottom trawl surveys, electrofishing) and (2) fisheries conservation. He has conducted this research with important commercial fish species in Atlantic Canada including cod, herring, capelin and salmon, as well as marine fish species considered at risk of extirpation or extinction including different skates and wolffish species.

Gary D. Melvin is a Research Scientist at the DFO St Andrews Biological Station in St Andrews, New Brunswick Canada. He holds a M.Sc. from Acadia University and a Ph.D. in Fisheries Biology from the University of New Brunswick. Melvin is currently involved in acoustic research and stock assessment of small pelagic species. Currently he is Chair of the ICES North Sea Technical Review group and a member of the Advice Drafting group for all North Sea assessed fish stocks. Between 2004 and 2006 he was a scientific advisor on stock assessments and acoustics to the New Zealand Seafood Industry Council. He is also an associate partner in the EU multi-institutional forage initiative (FACTS). His recent research efforts are focused on the improvement of biomass estimates using split-beam and multi-beam acoustic technology, and the adaptation of acoustic technology to monitor the distribution and abundance of fishes in the vicinity of submerged turbine structures for environmental impact assessment and for compliance and effects monitoring. He has been a long standing member of the ICES Fisheries Acoustics Science and Technology (FAST) working group, and a major contributor to the ICES and the FAO report on the use of acoustic on commercial fishing vessels as scientific platforms.

André E. Punt is a Professor and Associate Director of the School of Aquatic and Fishery Sciences at the University Washington, Seattle. He received his B.Sc, M.Sc and Ph.D. degrees in Applied Mathematics at the University of Cape Town, South Africa. Before joining the University of Washington, André was a Principal Research Scientist with the CSIRO Division of Marine and Atmospheric Research. His research interests include the development and application of fisheries stock assessment techniques, bioeconomic modelling, and the evaluation of the performance of stock assessment methods and harvest control rules using the Management Strategy Evaluation approach. He has published over 190 papers in the peer-reviewed literature, along with over 400 technical reports. André is currently a member of the Scientific and Statistical Committee (SSC) of the Pacific Fishery Management Council and chair of its Coastal Pelagic Species subcommittee, the Crab PLAN Team of the North Pacific Fishery Management Council, and the Scientific Committee of the International Whaling Commission.

Appendix 3: Primary documents reviewed

Documents prepared for the meeting

Demer, D.A., J.P. Zwolinski, G.R. Cutter, Jr. K.A. Byers., K.L. Stierhoff, D. Murfin, J.S. Renfree, S. Mau, T.S. Sessions, K. Franke, and J.L. Butler. The Collaborative Optical-Acoustic Survey Technique (COAST) for estimating the abundances and distributions of rockfishes, and mapping their seabed habitats.

Demer, D.A. (Ed.) 2003 Survey of Rockfishes in the Southern California Bight using the Collaborative Optical–Acoustic Survey Technique. COAST03.

Demer, D.A. (Ed.) 2004 Survey of Rockfishes in the Southern California Bight using the Collaborative Optical–Acoustic Survey Technique. COAST04.

Demer, D.A. (Ed.) 2007 Survey of Rockfishes in the Southern California Bight using the Collaborative Optical–Acoustic Survey Technique. COAST07.

Agenda Item H.3.a
Attachment 3
September 2012

TERMS OF REFERENCE

FOR THE

GROUNDFISH AND COASTAL PELAGIC SPECIES STOCK ASSESSMENT AND REVIEW PROCESS FOR 2013-2014

DRAFT

MAY, 2012

Published by the Pacific Fishery Management Council

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of this document is to outline the guidelines and procedures for the Pacific Fishery Management Council's (Council) groundfish and coastal pelagic species (CPS) stock assessment review (STAR) process and to clarify expectations and responsibilities of the various participants. This document applies to assessments of species managed under the Pacific Coast Groundfish Fishery Management Plan and Management Plan for the CPS. The STAR process has been designed to provide for peer review as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (RMSA), which states that "the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery (see Magnuson-Stevens Act section 302(g)(1)(E))." This peer review process is designed to investigate the technical merits of stock assessments and other scientific information used by the Council's Scientific and Statistical Committee (SSC). The process outlined here is not a substitute for the SSC, but should work in conjunction with the SSC. This document is included in the Council's Statement of Organization, Practices and Procedures as documentation of the review process that underpins scientific advice from the SSC.

The review of stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods employed to produce stock assessments. The extended time frame required for such reviews is not suited to the routine examination of assessments that are, generally, the primary basis for harvest recommendations. The SSC has developed a separate terms of reference for reviewing new methods that might be used in stock assessments, including methods and tools to incorporate ecosystem processes.

The STAR process is a key element in an overall procedure designed to review the technical merits of stock assessments and other relevant scientific information. This process allows the Council to make timely use of new fishery and survey data, analyze and understand these data as thoroughly as possible, provide opportunity for public comment, assure that the results are as accurate and error-free as possible, and identify the best available science for management decisions. Parties involved in implementing the STAR process are Council members, Council staff, members of Council Advisory Bodies, including the SSC, the Groundfish and CPS Management Teams (GMT and CPSMT), the Groundfish Advisory Panel (GAP) and CPS Advisory Subpanel (CPSAS), the National Marine Fisheries Service (NMFS), state agencies, and interested persons.

This current version of the STAR terms of reference (TOR) reflects recommendations from previous participants in the STAR process, including STAR panel members, SSC members, stock assessment teams (STATs), Council staff, and Council advisory groups. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and address new issues as they arise.

Stock assessments are conducted to assess the abundance and trends of fish stocks, and provide the fundamental basis for management decisions regarding appropriate harvest levels. Assessments use statistical population models to integrate and simultaneously analyze survey, fishery, and biological data. Environmental and ecosystem data may also be integrated in stock assessments. Hilborn and Walters (1992)[1] define stock assessments as "the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices." In this document, the term "stock assessment" includes activities, analyses and reports, beginning with data collection and continuing through to scientific recommendations presented to the Council and its advisors. To best serve their purpose, stock assessments should attempt to identify and quantify major uncertainties, balance realism and parsimony and make best use of the available data.

There are three distinct types of assessments, which are subject to different review procedures. A "full assessment" is a new assessment or an assessment that may be substantially different from the previously conducted assessment. A full assessment involves a re-examination of the underlying assumptions, data, and model parameters previously used to assess the stock. Full assessments are reviewed via the full STAR process. There is a limit on the number of full assessments that can be conducted and reviewed during an assessment cycle. Some assessment models have relatively few modeling or data issues and provide relatively stable results as new data are added, such that it is not necessary to develop a completely new assessment every time the species is assessed. In these cases, an "update assessment" may be preferable. An "update assessment" is defined as an assessment that maintains the model structure of the previous full assessment and is generally restricted to the addition of new data to previously evaluated time series that have become available since the last assessment. Update assessments are reviewed by the relevant subcommittee of the SSC (Groundfish or CPS) rather than by a STAR panel. A "catch report" is a third type of assessment product that applies when only limited new information is available to inform the assessment. Catch reports are reviewed by the relevant subcommittee of the SSC (Groundfish or CPS).

The RMSA recently changed the terminology and process for determining harvest levels. The previous Allowable/Acceptable Biological Catch (ABC) has been replaced by the Overfishing Limit (OFL). However, the largest allowable harvest level is still the ABC (now "Acceptable Biological Catch"), which is buffered from the OFL based on the risk of overfishing adopted by the Council (which must be less than 50%). The P* approach uses a probability of overfishing (which the Council has set to be less than or equal to 45% or 0.45) and a measure of uncertainty in the assessment of current stock status (σ, the standard error of the biomass estimate in log space) to determine the appropriate buffer with which to reduce the harvest level from the OFL to the ABC (Ralston et al. 2011[2]). The Annual Catch Limit (ACL) is equivalent to what the Council previously called the Optimum Yield (OY). For groundfish species, the upper limit for the ACL is calculated using the 40:10 harvest control rule (and 25:5 rule for flatfish species) while for CPS, each species has a specific control rule to calculate the Harvest Guideline (HG), which is the upper limit for the ACL for CPS. The Annual Catch Target (ACT) is the targeted catch level, representing a further reduction from the ACL to account for management/implementation uncertainty. The OFL must be given in the stock assessment (along with, in some cases, σ). The ABC is determined from the OFL given σ and P*. For CPS, the assessment reports the application of the HG control rule. The OFL, ABC, ACL, any ACTs, and (for CPS) the HGs are reported in the Council's Stock Assessment and Fishery Evaluation (SAFE) report.

[1] Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. Chapman and Hall.
[2] Ralston, S., Punt, A.E., Hamel, O.S., DeVore, J. and R.J. Conser. 2011. An approach to quantifying scientific uncertainty in stock assessment. *Fishery Bulletin* 109: 217-231.

2. STOCK ASSESSMENT PRIORITIZATION

Stock assessments for Pacific sardine and Pacific mackerel are conducted annually, with full assessments occurring every third year, and update assessments during interim years. Assessments for groundfish species are conducted every other year as part of the biennial harvest specification cycle. A relatively small number of the more than 90 species in Council's Groundfish Fishery Management Plan are selected each cycle for full or update assessments. To implement the RMSA requirements to establish ABCs and OFLs for all species in fishery management plans, simple assessment methods such as Depletion-Corrected Average Catch (DCAC)[3] and Depletion-Based Stock Reduction Analysis (DB-SRA)[4] have now been applied to the majority of groundfish species. It is the goal of the Council to substantially increase the number of groundfish stocks with full assessments.

In April 2006, the SSC recommended, and the Council adopted, a new approach to prioritize groundfish species for full and update stock assessments based on: 1) economic or social importance of the species, 2) vulnerability and resilience of the species, 3) time elapsed since the last assessment (NMFS advises assessments to be updated at least every five years), 4) amount of data available for the assessment, 5) potential risk to the stock from the current or foreseeable management regime, and 6) qualitative trends from surveys (when available). It was also recommended that overfished groundfish stocks that are under rebuilding plans be evaluated each assessment cycle to ensure adequate progress towards achieving stock recovery.

The proposed stocks for full and update assessments should be discussed and finalized by the Council at least a year in advance of a new assessment cycle to allow sufficient time to assemble relevant data and arrange STAR panels.

3. STAR GOALS AND OBJECTIVES

The goals and objectives of the groundfish and CPS STAR process are to:

1) ensure that stock assessments represent the best available scientific information and facilitate the use of this information by the Council to adopt OFLs, ABCs, ACLs, (HGs), and ACTs;
2) meet the mandates of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements;
3) follow a detailed calendar and fulfill explicit responsibilities for all participants to produce required reports and outcomes;
4) provide an independent external review of stock assessments;
5) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;
6) identify research needed to improve assessments, reviews, and fishery management in the future; and
7) use assessment and review resources effectively and efficiently.

[3] MacCall, A. D. 2009. Depletion-corrected average catch: a simple formula for estimating sustainable yields in data-poor situations. *ICES Journal of Marine Science* 66: 2267-2271.
[4] Dick, E. J. and A. D. MacCall. 2011. Depletion-Based Stock Reduction Analysis: A catch-based method for determining sustainable yields for data-poor stocks. *Fisheries Research* 110: 331-341.

4. ROLES AND RESPONSIBILITIES OF STAR PARTICIPANTS

4.1. Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS, as the designee of the Secretary of Commerce, must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine that the information on which it bases its recommendations represents the best available science. Scientists and fishery managers providing technical documents to the Council for use in management need to assure that their work is technically correct.

The Council, NMFS and the Secretary of Commerce share primary responsibility to create and foster a successful STAR process. The Council oversees the process and involves its standing advisory bodies, especially the SSC. For groundfish, NMFS provides a stock assessment coordinator (SAC) to facilitate and assist in overseeing the process, while for CPS a designated SWFSC staff member performs this role. Together NMFS and the Council consult with all interested parties to plan and prepare TOR, and develop a calendar of events with a list of deliverables for final approval by the Council. NMFS and the Council share fiscal and logistical responsibilities and both should ensure that there are no conflicts of interest in the process[5].

The STAR process is sponsored by the Council, because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was three-fold: to limit the number of advisory committees; to ensure that advisory committees fairly represent affected parties; and to ensure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the Sustainable Fisheries Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

4.2. STAR Panel Responsibilities

The role of the STAR panel is to conduct a detailed technical evaluation of a full stock assessment to advance the best available scientific information to the Council. The specific responsibilities of the STAR panel are to:

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[5] The proposed NS2 guidelines state: "Peer reviewers who are federal employees must comply with all applicable federal ethics requirements. Peer reviewers who are not federal employees must comply with the following provisions. Peer reviewers must not have any real or perceived conflicts of interest with the scientific information, subject matter, or work product under review, or any aspect of the statement of work for the peer review. For purposes of this section, a conflict of interest is any financial or other interest which conflicts with the service of the individual on a review panel because it: (A) Could significantly impair the reviewer's objectivity; or (B) Could create an unfair competitive advantage for a person or organization; (C) Except for those situations in which a conflict of interest is unavoidable, and the conflict is promptly and publicly disclosed, no individual can be appointed to a review panel if that individual has a conflict of interest that is relevant to the functions to be performed. Conflicts of interest include, but are not limited to, the personal financial interests and investments, employer affiliations, and consulting arrangements, grants, or contracts of the individual and of others with whom the individual has substantial common financial interests, if these interests are relevant to the functions to be performed. Potential reviewers must be screened for conflicts of interest in accordance with the procedures set forth in the NOAA Policy on Conflicts of Interest for Peer Review subject to OMB's Peer Review Bulletin."

1) review draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel reports, when available);
2) discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting, work with the STATs to correct deficiencies, and when possible suggest new tools or analyses to improve future assessments; and
3) develop STAR panel reports for all reviewed species to document meeting discussion and recommendations.

The STAR panel chair has, in addition, the responsibility to: 1) develop a STAR panel meeting agenda; 2) ensure that STAR panel participants follow the TOR; 3) guide the STAR panel and the STAT to mutually agreeable solutions; and 4) coordinate review of revised stock assessment documents before they are forwarded to the SSC.

Groundfish and CPS STAR panels include a chair appointed from the relevant SSC subcommittee (Groundfish or CPS), and three other experienced stock assessment analysts knowledgeable of the specific modeling approaches being reviewed. Of these three other members, at least one should be appointed from the Center for Independent Experts (CIE) and at least one should be familiar with west coast stock assessment practices. Selection of STAR panelists should aim for balance between outside expertise and in-depth knowledge of west coast fisheries, data sets available for those fisheries, and modeling approaches applied to west coast groundfish and CPS. Expertise in ecosystem models or processes, and knowledge of the role of groundfish and CPS in the ecosystem is also desirable, particularly if the assessment includes ecosystem models or environmental processes. Reviewers should not have financial or personal conflicts of interest, either current to the meeting, within the previous year (at minimum), or anticipated. For groundfish, an attempt should be made to identify one reviewer who can consistently attend all STAR panel meetings in an assessment cycle. The pool of qualified technical reviewers is limited, therefore staffing of STAR panels is a subject to constraints that can make it difficult to meet the conditions above.

STAR panel meetings also should also include representatives of the relevant management team (MT) and advisory panel (AP), with responsibilities as laid out in these TOR, and a Council staff member to help advise the STAR panel and assist in recording meeting discussions and results. The STAR panel, STATs, the MT and AP representatives, and the public are all legitimate meeting participants who should be accommodated in discussions. It is the STAR panel chair's responsibility to coordinate discussion and public comment so that the assessment review is completed on time.

A STAR panel normally meets for one week. The number of assessments reviewed per panel should not exceed two, except in extraordinary circumstances if the SSC and NMFS agree that it is advisable, feasible, and/or necessary. When separate assessments are conducted at the sub-stock level (i.e., black rockfish), each assessment is considered an independent full assessment for review purposes. Contested assessments, in which alternative assessments are brought forward by competing STATs using different modeling approaches, would typically require additional time (and/or panel members) to review adequately, and should be scheduled accordingly. While contested assessments are likely to be rare, they can be accommodated within the STAR process. The STAR panel should thoroughly evaluate each analytical approach, comment on the relative merits of each, and, when conflicting results are obtained, identify the reasons for the differences. The STAR panel is also charged with selecting a preferred base model.

STAR Panel Requests for Additional Analyses

STAR panel meetings are not workshops. In the course of a meeting, the panel may ask the STAT for a reasonable number of sensitivity runs, request additional details on the proposed base model presented, or ask for further analyses of alternative runs. It is not unusual for the review to result in a change to the initial base model (given that both the STAR panel and the STAT agree). However, the STAR panel is not authorized to conduct an alternative assessment representing its own views that are distinct from those of the STAT, nor can it impose an alternative assessment on the STAT. Similarly, the panel should not impose their preferred methodologies when this is a matter of professional opinion. Rather, if the panel finds an assessment to be inadequate, it should document its opinion and suggest potential remedial measures for the STAT to take to rectify perceived shortcomings of the assessment. For groundfish species, the SSC reviews the STAR panel report and recommends whether an assessment should be further reviewed at the so-called "mop-up" panel meeting, a meeting of the SSC's Groundfish subcommittee that occurs after all of the STAR panels, primarily to review rebuilding analyses for overfished stocks. If a recommendation on whether to send the assessment to the mop-up panel meeting is needed before the full SSC is able to review the STAR panel report, the SSC Chair, Vice Chair, and Groundfish subcommittee Chair will make preliminary decision. This recommendation is subject to confirmation by the full SSC at its next scheduled meeting. For CPS, if an assessment is found not to be acceptable for use in management, a full assessment would be conducted the following year.

The STAR panels are expected to be judicious in their requests of the STATs. Large changes in data (such as wholesale removal of large data sets) or in analytical methods often result in such great changes to the assessment that they cannot be adequately reviewed during the course of the STAR panel meeting. Therefore caution should be exercised in making such changes, and in many cases such changes should be relegated to future research recommendations and/or methodology review. If a groundfish STAR panel agrees that significant changes are necessary, and the assessment is not otherwise acceptable, a recommendation for further review at the mop-up panel is warranted. Similarly, if the STAR panel agrees that the assessment results strongly indicate that current F_{MSY} value or management target and threshold are inappropriate, it should identify this in its report and recommend further analysis to support a change to more appropriate values.

STAR panel requests to the STAT for additional model runs or data analyses must be clear, explicit, and in writing. They should reflect the consensus opinion of the entire panel and not the minority view of a single individual or individuals. The STAR panel requests and recommendations should be listed within the STAR panel's report along with rationale and STAT response to each request.

To the extent possible, analyses requested by the STAR panel should be completed by the STAT during the STAR panel meeting. It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize requests for additional analyses. In situations where a STAT arrives with a well-constructed, thoroughly investigated assessment, it may be that the panel finishes its review earlier than scheduled (i.e., early dismissal of a STAT). If follow-up work by the STAT is required after the review meeting (such as MCMC integration of an alternative model created during the STAR panel meeting), this should be completed before the briefing book deadline for the Council meeting at which the assessment is scheduled for review. It is the STAR panel responsibility to track STAT progress. In particular, the chair is responsible for communicating with the STAT to determine if the revised stock assessment document is complete. Any post-STAR drafts of the stock assessment must be reviewed by the STAR panel chair. The assessment document can only be given to Council staff for distribution after it has been endorsed by the STAR panel chair, and when it is accompanied by a complete and approved STAR panel report. Likewise, the final draft that is published in the Council's SAFE document must also be approved by the STAR panel chair prior to being accepted by Council staff.

For some stocks selected for full assessments, the available data may prove to be insufficient to support a category 1 assessment. In such cases, the STAT should consider whether simpler approaches appropriate for a category 2 assessment can be applied. Simpler approaches usually make stronger assumptions and estimate fewer parameters, but are less demanding of data. It is the responsibility of the STAR panel, in consultation with the STAT, to consider the strength of inferences that can be drawn from analyses presented, and identify major uncertainties. If useful results have been produced, the STAR panel should review the appropriateness and reliability of the methods used to draw conclusions about stock status and/or exploitation rates, and either recommend or reject the analysis on the basis of its ability to provide useful information into the management process. If the STAR panel agrees that important results have been generated, it should forward its findings and conclusions to the SSC and the Council for consideration in setting of OFLs, ABCs, and ACLs (for groundfish) and HGs (for CPS). A key section of the assessment is that on research needed to improve the assessment. Highlighting research priorities should increase the likelihood that future stocks assessments can be raised to category 1.

Uncertainty and Decision Tables in Groundfish Stock Assessments

The STAR panel review focuses on technical aspects of the stock assessment. It is recognized that no model or data set is perfect or issue free. Therefore, outputs of a broad range of model runs should be evaluated to better define the scope of the accepted model results. The panel should strive for a risk-neutral perspective in its deliberations, and discuss the degree to which the accepted base model describes and quantifies the major sources of uncertainty in the assessment. Confidence intervals for model outputs, as well as other measures of uncertainty that could affect management decisions, should be provided in completed stock assessments and the reports prepared by STAR panels. The STAR panel may also provide qualitative comments on the probability of results from various model runs, especially if the panel does not consider the probability distributions calculated by the STAT capture all major sources of uncertainty. However, as a scientific peer review body, the STAR panel should avoid matters of policy. Assessment results from model runs that are technically flawed or questionable on other grounds, should be identified by the panel and excluded from the alternatives upon which management advice is to be developed.

During the review meeting, the STAR panel and the STAT should strive to reach a consensus on a single base model. Once a base model is agreed upon, it is essential that uncertainty around the base model be captured and communicated to managers. One way to accomplish this objective is to bracket the base model with what is agreed to be the major axis of uncertainty (e.g., spawner-recruit steepness, the virgin level of recruitment, the natural mortality rate, survey catchability, etc.; and, less often, recent year-class strength, weights on conflicting CPUE series, etc.). Alternative models should show contrast in their management implications, which, in practical terms, means that that they should result in different estimates of current stock size and status, and the OFL. Markov chain Monte Carlo (MCMC) integration, where possible, is an acceptable method for reporting uncertainty about the base model. However, point estimates from the Maximum Likelihood Estimation (MLE) method should be used for status determinations even when MCMC outputs are available.

Once alternative models, which capture the overall degree of uncertainty in the assessment, are formulated, a 2-way decision table (alternative models versus management actions) should be developed to illustrate the repercussions of uncertainty to managers. The ratio of probabilities of alternative models should be 25:50:25, with the base model being twice as likely as the low and high stock size alternatives. Potential methods for assigning probabilities to alternative models include using the statistical variance of the model estimates of stock size, posterior Monte Carlo simulation, or expert judgment, but other approaches are acceptable as long as they are fully documented. An ideal bracketing of the base model is one for which the geometric mean of the high and low stock size alternative model final biomass levels approximates the base model biomass level. This is because the distribution of possible stock sizes is necessarily bounded at the low end, while the right tail can extend much further from the point estimate, and thus the probability density should look more log-normal than normal. If the bracketing models are far from this ideal (e.g. if the base model is closer to the upper bracketing model in absolute terms than to the lower bracketing model), the three levels should be reconsidered and either one or more of them adjusted (such that in certain cases, if there is a great deal of confidence in the bracketing models, the base model could be reconsidered), or a justification for the severely non-lognormal structure of alternatives be given. Similarly, if more than one dimension is used to characterize uncertainty, resulting in, for example, a 3-by-3 decision table, careful consideration of how the complete table brackets the uncertainty should be undertaken.

Areas of Disagreement

STATs and STAR panels are required to make an honest attempt to resolve any areas of disagreement during the meeting. Occasionally, fundamental differences of opinions may remain between the STAR panel and STAT that cannot be resolved during the STAR panel meeting. In such cases, the STAR panel must document the areas of disagreement in its report. While identifying areas of disagreement the following questions should be discussed at the meeting:

1) Are there any differences in opinion about the use or exclusion of data?
2) Are there any differences in opinion about the choice of the base model?
3) Are there any differences in opinion about the characterization of uncertainty?

The STAT may choose to submit a supplemental report supporting its view, but in that case, an opportunity must be given to the STAR panel to prepare a rebuttal. These documents would then be appended to the STAR panel report as part of the record of the review meeting. In some cases STAR panel members may have fundamental disagreements among themselves that cannot be resolved during the review meeting. In such cases, STAR panel members may prepare a minority report that would also become part of the record of the review meeting. The SSC would then review all information pertaining to STAR panel and STAR panel/STAT disputes, and issue its recommendation.

STAR Panel Report

The STAR panel report should be developed and approved by the full panel shortly after the STAR panel meeting. The STAR panel chair appoints members of the panel to act as rapporteurs and draft the report (or specific sections thereof) according to the STAR panel chair guidance on format and level of detail. The STAR panel chair is responsible for preparing the final draft of the panel report, obtaining panel approval, providing a copy for STAT review and comment, and submitting it to the Council in a timely fashion (i.e., by briefing book deadline).

The STAR panel report should include:

- Summary of the STAR Panel meeting:
    - Names and affiliations of STAR panel members, STAT and STAR panel advisors;
    - Brief overview of the meeting (where the meeting took place, what species was assessed, what was the STAR panel recommendation, etc.);
    - Brief summary of assessment model and the data used;
    - List of analyses requested by the STAR panel, the rationale for each request, and a brief summary of the STAT response to the request;
- Description of the base model and, for groundfish species, the alternative models used to bracket uncertainty;
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies;
- Areas of disagreement regarding STAR panel recommendations:
    - Between the STAR panel and STAT(s).
    - Among STAR panel members (including concerns raised by MT and AP representatives);
- Unresolved problems and major uncertainties, e.g., any special issues that complicate assessment and/or interpretation of results.
- Management, data, or fishery issues raised by the MT or AP representatives during the STAR panel.
- Prioritized recommendations for future research and data collection, including methodology and ecosystem considerations for the subsequent assessment.

For groundfish species, the STAR panel also makes a recommendation on whether the next assessment of the same species should be full or update, and explain reasons for its recommendation.

The STAR panel report should be made available for review by the STAT with adequate time prior to the briefing book deadline (i.e., a week in most circumstances, but at minimum a full 24 hours, in cases when the time between the STAR panel and the deadline is particularly compressed) so that the STAT can comment on issues of fact or differences in interpretation. If differences of opinion come up during review of the STAR panel report, the STAR panel and STAT should attempt to resolve them. Otherwise, the areas of disagreement must be documented in the STAR panel report.

The chair will also solicit comment on the draft report from the MT and AP representatives. The purpose of this is limited to ensuring that the report is technically accurate, and reflects the discussion that occurred at meeting, and should not be viewed as an opportunity to reopen debate on issues. The STAR panel chair is the final arbiter on wording changes suggested by STAT and the MT and AP representatives as the report is the panel's report of the meeting. Any detailed commentary by MT and AP representatives should be drafted separately, reviewed by full advisory body, and included in the briefing book.

The STAR panel chair is responsible for providing the Council staff with the final version of the STAR panel report. The STAR panel chair is also expected to attend the SSC meeting and, if requested, MT meetings and the relevant portions of the Council meetings, where stock assessments and harvest projections are discussed, explain the reviews and provide technical information and advice.

4.3. Stock Assessment Team Responsibilities

The stock assessment team (STAT) is responsible for conducting a complete and technically sound stock assessment that conforms to accepted standards of quality, and in accordance with these TOR. The STAT is responsible for preparing three versions of the stock assessment document:

1) a "draft" for discussion during STAR panel meeting;
2) a "revised draft" for presentation to the SSC, the Council, and relevant MT and AP; and
3) a "final version" to be published in the Council's SAFE document.

The draft assessment document should follow the outline in Appendix A with an executive summary as in the template in Appendix B. In the draft document, the STAT should identify a candidate base model, fully-developed and well-documented, for STAR panel to review. For CPS, the STAT should submit a draft assessment document to the STAR panel chair and Council staff two weeks prior to the STAR panel meeting. For groundfish, a draft assessment document should be submitted by the STAT to the STAR panel chair, Council staff, and the NMFS Stock Assessment Coordinator (SAC) three full weeks prior to the STAR panel meeting, to determine whether the document is sufficiently complete to undergo review. If the draft assessment is judged complete, the draft assessment and supporting materials would be distributed to the STAR panel and relevant MT and AP representatives two weeks prior to the STAR panel meeting. If the assessment document does not meet minimum criteria of the TOR, the review would be postponed to a subsequent assessment cycle or to the mop-up panel. The mop-up panel generally is not able to review more than two assessments. Therefore, the review options are limited for assessments not completed on time. The STAT is also responsible for bringing model files and data (in digital format) to the STAR panel meeting so that they can be analyzed on site.

In most cases, the STAT should produce a revised draft of the assessment document within three weeks of the end of the STAR panel meeting. The revised draft must include a point-by-point response of the STAT to each of the STAR panel's recommendations. The revised draft must be finalized before the briefing book deadline for the Council meeting at which the assessment is scheduled for review. Post-STAR drafts must be reviewed and approved by the STAR panel chair prior to being submitted to Council staff. This review is limited to editorial issues, verifying that all required elements are included, and confirming that the document reflects the discussion and decisions made during the STAR panel.

The final version of the assessment document is produced after the assessment has been reviewed by the SSC. Other than changes recommended by the SSC, only editorial and other minor alterations should be made to the revised draft for the final version. Electronic versions of the final assessment document, model files, and key output files should be submitted by the STATs to Council staff (for CPS) and to Council staff and the SAC (for groundfish) for inclusion in a stock assessment archive. Any tabular data that are inserted into the final documents in an object format should also be submitted in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

A STAT for which no base model was endorsed by a STAR panel should, in most cases, provide the pre-STAR draft assessment (or corrected/ updated version thereof, as agreed upon with the STAR panel) to the Council by the briefing book deadline. If the STAR panel, nonetheless, recommends using outputs of certain sensitivity runs to bracket uncertainty in the assessment, the results of those runs should be appended to the draft assessment and provided to the Council and its advisory bodies.

STATs are strongly encouraged to develop assessments in a collaborative environment by forming working groups, holding pre-assessment workshops, and consulting with other stock assessment and ecosystem assessment scientists. STAT meetings with Integrated Ecosystem Assessment (IEA) teams are strongly encouraged to evaluate alternative models and analyses that incorporate ecosystem considerations and cross-FMP interactions that may affect stock dynamics. When new data sources or methods, which could be used in many assessments or are likely contentious, are planned for inclusion in the assessment they should ideally be reviewed by a methodology panel. STATs should identify whether such new data sources or methods will be proposed for inclusion in assessments as early as feasible so that it is possible to hold a methodology review panel if one is needed. Irrespective of whether a methodology review panel takes place, the STAR panel should be provided with model runs with and without the new data sources so that it can evaluate the sensitivity of model outputs to these data sources.

STATs should coordinate early in the process with state representatives and other data stewards to ensure timely availability of data. STATs are also encouraged to organize independent meetings with industry and interested parties to discuss data and issues. The STAT should initiate contact with the AP representative early in the assessment process, keep the AP informed of the data being used and respond to any concerns that are raised. The STAT should also contact the MT representative for information about changes in fishing regulations that may influence model structure and the way data are used in the assessment. The STAT should be well represented at the STAR panel meeting to ensure timely completion of the STAR panel requests. Barring exceptional circumstances, STAT members, who are not attending the STAR panel meeting, should be available remotely to assist with responses when needed. Each STAT conducting a full assessment should appoint a representative to attend the Council meeting where the assessment is scheduled to be reviewed and give presentations of the assessment to the SSC and other Council advisory bodies. In addition, the STAT should be prepared to respond to MT requests for model projections for the MT's to develop ACL alternatives.

For stocks that are estimated to be below overfished thresholds (or those previously declared overfished and not yet rebuilt), the STAT must complete a rebuilding analysis according to the SSC's TOR for Rebuilding Analyses and prepare a document that summarizes the analysis results. For groundfish, it is recommended that this rebuilding analysis be conducted using the software developed by Dr. André Punt (University of Washington). Groundfish rebuilding analyses are reviewed at the mop-up panel.

4.4. National Marine Fisheries Service Responsibilities

The NMFS Northwest Fisheries Science Center (NWFSC) and the Southwest Fisheries Science Center (SWFSC) assist in organizing stock assessment reviews of groundfish and CPS, respectively. For groundfish, the NMFS provides a stock assessment coordinator (SAC) to facilitate and assist in overseeing the STAR process.

The NMFS (through the SAC for groundfish and a designated SWFSC staff member for CPS) works with the STATs and other STAR process participants to develop a proposed list of stocks to be assessed for the consideration by the Council. NMFS also develops a draft STAR panel schedule for the Council review. NMFS identifies STAR panel members based on criteria for reviewer qualifications, and, for groundfish, makes every effort to designate one independent reviewer who can attend all STAR panel meetings to provide consistency among reviews. The costs associated with these reviewers are borne by the NMFS. The NMFS also helps organize STAR panel meetings and develops meetings' schedules.

The NMFS (along with the Council staff and the STAR panel chair) coordinates with the STATs to facilitate delivery of required materials by scheduled deadlines and in compliance with the TOR. The NMFS also assists Council staff and the STAR panel chair in a pre-review of assessment documents, to assure they are received on time and complete, and in a post-STAR review of the revised assessment document for consistency with the TOR.

4.5. Council Staff Responsibilities

The role of Council staff is to coordinate, monitor and document the STAR process to ensure compliance with these TOR.

Council staff coordinates with the STAR panel chair and the NMFS (the SAC in the case of groundfish; a designated SWFSC staff member for CPS) in a pre-review of assessment documents, to assure they are complete and received on time. If an assessment document is not in compliance with the TOR, Council staff returns the assessment document to the STAT with a list of deficiencies, a notice that the deadline has expired, or both. Council staff also coordinates with the STAR panel chair, STAT and the NMFS in a post-STAR review of the revised assessment document for consistency with the TOR. When inconsistencies are identified, the STAT is requested to make appropriate revisions in time for briefing book deadlines.

Council staff attends and monitors all STAR panel meetings to ensure continuity and adherence to the TOR and the independent review requirements of Council Operating Procedure 4. If inconsistencies with the TOR occur during STAR panel meetings, Council staff coordinates with the STAR panel chair to develop solutions to correct the inconsistencies. Council staff also attends and monitors the SSC review of stock assessments to ensure compliance with the TOR.

Council staff is responsible for timely issuance of meeting notices and distribution of stock assessments and other appropriate documents to relevant groups. Council staff also collects and maintains electronic copies of assessment documents, STAR panel, SSC, MT and AP reports as well as letters from the public and any other relevant documents. These documents are typically published in the Council's SAFE document.

4.6. Management Team Responsibilities

The management team (MT) is responsible for identifying and evaluating potential management actions based on the best available scientific information. Particularly, the MT uses stock assessment results and other information to make ACL and ACT recommendations to the Council.

A MT representative, usually appointed by the MT chair, is responsible to attend the STAR panel meeting and serve as advisor to the STAT and STAR panel on changes in fishing regulations that may influence data used in the assessment and the nature of the fishery in the future. The MT representative does not serve as a member of the STAR panel.

Successful separation of science (e.g., STAT and STAR panels) from management (e.g., MT) depends on assessment reviews being completed by the time the MT meets to discuss preliminary ACL and ACT recommendations. The MT should not seek revision or additional review of the stock assessments, after they have been endorsed by the STAR panel. The MT chair should communicate any unresolved issues to the SSC for consideration. The MT, however, can request additional model projections from the STAT, to fully evaluate potential management actions.

4.7. Advisory Panel Responsibilities

An Advisory Panel (AP) representative, usually appointed by the AP chair, is responsible to attend the STAR panel meeting and serve as advisor to the STAT and STAR panel. The AP representative should review the data sources being used in the assessment prior to development of the stock assessment model and insure that industry concerns regarding the adequacy of data used by the STAT are communicated and addressed early in the assessment process. The AP representative does not serve as a member of the STAR panel, but, as a legitimate meeting participant, may provide appropriate information and advice to the STAT and STAR panel during the meeting.

The AP representative (along with STAT and STAR panel chair, if requested) is expected to attend the MT meeting at which preliminary ACL and ACT recommendations are developed. The AP representative is also expected to attend subsequent MT and Council meetings where the relevant harvest recommendations are discussed.

4.8. Scientific and Statistical Committee Responsibilities

The Council’s Scientific and Statistical Committee (SSC) plays multiple roles within the STAR process and provides the Council and its advisory bodies with technical advice related to the stock assessments and the STAR process. The SSC assigns a member of its relevant subcommittee (Groundfish or CPS) to act as the STAR panel chair. The STAR panel chair attends the assigned STAR panel meeting and fulfills responsibilities described in the section “STAR Panel Responsibilities”.

The STAR panel chair presents the STAR panel report at the SSC and Council meetings at which stock assessments are reviewed. If requested, the STAR panel chair also attends the MT meeting, at which preliminary ACL and ACT recommendations are developed, to discuss the STAR panel report and assist with interpreting the assessment results.

The full SSC conducts a final review of the stock assessment. This review should not repeat the detailed technical review conducted by the STAR panel. The SSC also reviews the STAR panel recommendations and serves as arbitrator to resolve disagreements between the STAT and the STAR panel if such disagreements occurred during the review meeting. The SSC is responsible to review and endorse any additional analytical work requested from the STAT by the MT after the stock assessment has been reviewed by the STAR panel. To insure independence in the SSC review, the SSC members who served on the STAT or STAR panel for the stock assessment being reviewed are required to recuse themselves; their involvement in the review being limited to providing factual information and answering questions.

The SSC is responsible for making OFL recommendations to the Council. The SSC is also responsible for assigning groundfish species managed by the Council to a specific category (or tier) based on definitions of species categories in Appendix C. It is also the SSC's responsibility to determine when it is appropriate to make changes to proxies or the use of estimated values of F_{MSY} and B_{MSY}.

5. UPDATE ASSESSMENTS

For CPS, update assessments typically occur during two years out of every three. For groundfish, the initial recommendation whether the next assessment should be full or update is made by the STAR panel during the STAR panel meeting. The final recommendation is made by the SSC.

An update assessment is generally restricted to the addition of new data that have become available since the last full assessment. It must carry forward the fundamental structure of the last full assessment reviewed and endorsed by a STAR panel, the SSC and the Council. Assessment structure here refers to the population dynamics model, data sources used as inputs to the model, the statistical platform used to fit model to the data, and how the management quantities used to set harvest specifications are calculated. Particularly, when an update assessment is developed, no substantial changes should be made to:

1) the particular sources of data used;
2) the software used in programming the assessment;
3) the assumptions and structure of the population dynamics model underlying the stock assessment;
4) the statistical framework for fitting the model to the data and determining goodness of fit; and
5) the analytical treatment of model outputs in determining management reference points.

Major changes to the assessment should be postponed until the next full assessment. Minor alternations to the input data and the assessment can be considered as long the update assessment clearly documents and justifies the need for such changes. A step-by-step transition (via sensitivity analysis) from the last full assessment to an update assessment under review should be provided. Minor alternations can be considered under only two circumstances: first, when the addition of new data reveals an unanticipated sensitivity of model, and second, when there are clear and straightforward improvements in the input data and how it is processed and analyzed for use in the model. Examples of minor alterations include a) changes in how compositional data are pooled across sampling strata, (b) the weighting of the various data components (including the use of methods for tuning the variances of the data components), and (c) changes the time periods for the selectivity blocks, d) correcting data entry errors, e) bug fixes in software programming. This list is not meant to be exhaustive, and other alternations can be considered if warranted. Ideally, improved data or methods used to process and analyze data would be reviewed by the SSC prior to being used in assessments.

Review of Update Assessments

Update assessments are reviewed by members of the relevant SSC subcommittee (Groundfish or CPS), during a single meeting. Review typically requires one or two days with an option of early dismissal of a STAT. The STAT is responsible for producing the update assessment document and submitting it to Council staff in a timely manner, before the relevant SSC subcommittee reviews the assessment. The document should follow the outline in Appendix A. The STAT, however, can reference the last full assessment (or other relevant documentation) for description of methods, data sources, stock structure, etc., given that they have not been changed. Any new information to the assessment must be presented in sufficient detail for the subcommittee to determine whether the update meets the Council's requirement to use the best available scientific information.

The document must include a retrospective analysis illustrating the model performance with and without the most recent data (new to the update assessment) and discuss whether the new data and update assessment results are sufficiently consistent with those from the last full assessment. The assessment document should include a detailed step-by-step transition from the last full assessment to the update under review. The updated decision table, if there is one, should be of the same format as in the last full assessment; it should highlight differences among alternative models defined using the same axes of uncertainty as those of the last full assessment.

In additional to the update assessment document, Council staff will also provide the subcommittee with a copy of the last full stock assessment reviewed via the STAR process and the associated STAR panel report. The chair of the subcommittee designates a lead reviewer from the subcommittee members for each update assessment to document the meeting discussion, produce a review report, and ensure that each review is conducted according to the TOR. MT and the AP representatives also participate in the review.

The review of update assessments is not expected to require additional model runs or extensive analytical requests during the meeting, although changes in assessment outputs may necessitate some model exploration. The review focuses on two main questions:

1) Does the assessment meet the criteria of a stock assessment update?
2) Can the results of the update assessment form the basis of Council decision making?

If the answer to either of these questions is negative, a full stock assessment for the species would typically be recommended for the next assessment cycle (for groundfish) or the next year (for CPS). For groundfish, if the subcommittee agrees that the update assessment results require additional, but limited exploration before being endorsed for management use, further review at the mop-up meeting, in the end of the assessment cycle, could be recommended. In cases like this, the subcommittee needs to develop a list of requests for the STAT to address before the mop-up meeting.

Shortly after the meeting, the subcommittee issues a review report that includes: 1) comments on the technical merits and/or deficiencies of the update assessment; 2) explanation of areas of disagreement between the subcommittee and STAT (if any); and 3) recommendations on the adequacy of the update assessment for use in management. The report may also include subcommittee recommendations for modifications that should be made when the next full assessment is conducted.

The report is reviewed by the full SSC at the next Council meeting. If the subcommittee review concludes that it is not possible to use the update assessment, the SSC is responsible for evaluating all model runs examined during the review meeting and providing recommendations on appropriate fishing level to the Council.

6. CATCH REPORTS

In certain cases (e.g., cowcod) only limited new data are available to inform the assessment. In such cases, it is appropriate for the STAT to provide a catch report, which documents recent removals and compares them to the ACLs established for the stock. For a catch report, the STAT does not need to conduct model runs, since if the estimated removals of a species are near the value projected by the previous assessment/rebuilding analysis, no new insight would be obtained by rerunning the assessment model.

Catch reports are reviewed by the relevant SSC subcommittee (Groundfish or CPS), during a single meeting (that during which update assessments are reviewed). The STAT is responsible for producing the catch report and submitting it to Council staff in a timely manner, before the relevant subcommittee reviews it. The report should be brief, but provide enough details on how total removals were estimated. It should provide only essential information about the stock and refer to the last assessment (or other relevant documentation) for full description of methods, data sources, model structure, etc. used to estimate the status of the stock and generate projections.

In common with a review of an assessment update, Council staff will provide the subcommittee with the catch report, along with a copy of the last full stock assessment reviewed via the STAR process, and the associated STAR panel report. The chair of the subcommittee will designate a lead reviewer from the subcommittee members for each catch report to document the meeting discussion, produce a review report, and ensure that each review is conducted according to the TOR. The report is reviewed by the full SSC at the next Council meeting. The MT and AP representatives also participate in the review.

APPENDIX A: OUTLINE FOR STOCK ASSESSMENT DOCUMENTS

This is a general outline of elements that should be included in stock assessment reports for groundfish and CPS managed by the Pacific Fishery Management Council. Not every item listed in the outline is relevant (or available) for every assessment. Therefore, this outline should be considered a flexible guideline on how to organize and communicate stock assessment results. Items with asterisks (*****) are optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document.

A. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and secondary authors.

B. Executive Summary (should follow the template in Appendix B).

C. Introduction
   1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
   2. A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata.
   3. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography).
   4. Ecosystem considerations (e.g., ecosystem role and trophic relationships of the species, habitat requirements/preferences, relevant data on ecosystem processes that may affect stock or parameters used in the stock assessment, and/or cross-FMP interactions with other fisheries). This section should note if environmental correlations or food web interactions were incorporated into the assessment model. The length and depth of this section would depend on availability of data and reports from the IEA, expertise of the STAT, and whether ecosystem factors are informational to contribute quantitative information to the assessment.
   5. Important features of current fishery and relevant history of fishery.
   6. Summary of management history (e.g., changes in mesh sizes, trip limits, or other management actions that may have significantly altered selection, catch rates, or discards).
   7. Management performance, including a table or tables comparing Overfishing Limit (OFL), Annual Catch Limit (ACL), Harvest Guideline (HG) [CPS only], landings, and catch (i.e., landings plus discard) for each area and year
   8. Description of fisheries for this species off Canada, Alaska and/or Mexico, including references to any recent assessments of those stocks.

D. Assessment
   1. Data
      a. Landings by year and fishery, historical catch estimates, discards (generally specified as a percentage of total catch in weight and in units of mt), catch-at-age, weight-at-age, abundance indices (typically survey and CPUE data), data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variation (CVs) or variances if available. Include complete tables and figures and date of extraction.
      b. Sample size information for length and age composition data by area, year, gear,

market category, etc., including both the number of trips and fish sampled.
   c. All data sources that include the species being assessed, which are used in the assessment, and provide the rationale for data sources that are excluded.
   d. Clear description of environmental or ecosystem data if included in the assessment.
2. History of modeling approaches used for this stock – changes between current and previous assessment models
   a. Response to STAR panel recommendations from the most recent previous assessment.
   b. Report of consultations with AP and MT representatives regarding the use of various data sources in the stock assessment.
   c. If environmental or ecosystem data are incorporated, report of consultations with technical teams that evaluated ecosystem data or methodologies used in the assessment.
3. Model description
   a. Complete description of any new modeling approaches.
   b. Definitions of fleets and areas.
   c. Assessment program with last revision date (i.e., date executable program file was compiled).
   d. List and description of all likelihood components in the model.
   e. Constraints on parameters, selectivity assumptions, natural mortality, treatment of age reading bias and/or imprecision, and other fixed parameters.
   f. Description of stock-recruitment constraints or components.
   g. Description of how the first year that is included in the model was selected and how the population state at the time is defined (e.g., B_0, stable age structure, etc.).
   h. Critical assumptions and consequences of assumption failures.
4. Model selection and evaluation
   a. Evidence of search for balance between model realism and parsimony.
   b. Comparison of key model assumptions, include comparisons based on nested models (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities).
   c. Summary of alternate model configurations that were tried but rejected.
   d. Likelihood profile for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration over one or more key parameters (e.g., M, h, Q) to show consistency among input data sources.
   e. Residual analysis for the base-run configuration (or proposed base-run model in a draft assessment undergoing review) e.g., residual plots, time series plots of observed and predicted values, or other approaches. Note that model diagnostics *are* required in draft assessments undergoing review.
   f. Convergence status and convergence criteria for the base-run model (or proposed base-run).
   g. Randomization run results or other evidence of search for global best estimates.
   h. Evaluation of model parameters. Do they make sense? Are they credible?
   i. Are model results consistent with assessments of the same species in Canada and Alaska? Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?
5. Point-by-point response to the STAR panel recommendations**.* Not required in draft assessment undergoing review**.
6. Base-model(s) results

a. Table listing all explicit parameters in the stock assessment model used for base model, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model.
b. Population numbers at age × year × sex (if sex-specific *M*, growth, or selectivity) (May be provided as a text or spreadsheet file).* **Not required in draft assessment undergoing review**.
c. Time-series of total, 1+ (if age 1s are in the model), summary, and spawning biomass (and/or spawning output), depletion relative to B_0, recruitment and fishing mortality or exploitation rate estimates (table and figures).
d. Selectivity estimates (if not included elsewhere).
e. Stock-recruitment relationship.
f. OFL, ABC and ACL (and/or ABC and OY or HG) for recent years.
g. Clear description of units for all outputs.
h. Clear description of how discard is included in yield estimates.
i. Clear description of environmental or ecosystem data if included in the assessment.

7. Uncertainty and sensitivity analyses. The best approach for describing uncertainty and the range of probable biomass estimates in groundfish assessments may depend on the situation. Important factors to consider include:
   a. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles for important assessment parameters (e.g., natural mortality). This also includes expressing uncertainty in derived outputs of the model and estimating CVs using appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC). Include the CV of spawning biomass in the first year for which an OFL has not been specified (typically end year +1 or +2).
   b. Sensitivity to data set choice and weighting schemes (e.g., emphasis factors), which may also include a consideration of recent patterns in recruitment.
   c. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
   d. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
   e. Historical analysis (plot of actual estimates from current and previous assessments).
   f. Subjective appraisal of the magnitude and sources of uncertainty.
   g. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely
   h. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses.

E. Harvest control rules (CPS only)

The OFL, ABC and HG harvest control rules for actively managed species apply to the U.S. (California, Oregon, and Washington) harvest recommended for the next fishing year and are defined as follows:

- OFL = BIOMASS * FMSY * U.S. DISTRIBUTION
- ABC = BIOMASS * BUFFER * FMSY * U.S. DISTRIBUTION
- ACL LESS THAN OR EQUAL TO ABC
- HG = (BIOMASS-CUTOFF)* FRACTION * U.S. DISTRIBUTION
- ACT EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS

where FMSY is the fishing mortality rate that maximizes catch biomass in the long-term.

Implementation for Pacific Sardine

1. BIOMASS is the estimated stock biomass (ages 1+) at the start of the next year from the current assessment,
2. CUTOFF (150,000 mt) is the lowest level of estimated biomass at which harvest is allowed,
3. FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries. Given that the productivity of the sardine stock has been shown to increase during relatively warm-water ocean conditions, the following formula has been used to determine an appropriate (sustainable) FRACTION value:

   FRACTION = 0.248649805(T_2) - 8.190043975(T) + 67.4558326,

   where T is the running average sea-surface temperature at Scripps Pier, La Jolla, California during the three preceding years. Under the harvest control rule, FRACTION is constrained and ranges between 5% and 15% depending on the value of T.
4. U.S. DISTRIBUTION is the percentage of BIOMASS in U.S. waters (87%).

Implementation for Pacific Mackerel

1. BIOMASS is the estimated stock biomass (ages 1+) at the start of the next year from the current assessment,
2. CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed,
3. FRACTION (30%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and
4. U.S. DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters.

The CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on simulations published by MacCall et al. in 1985.

F. Reference points (groundfish only)

1. Unfished spawning stock biomass, summary age biomass, and recruitment, along with unfished spawning stock output.
2. Reference points based on $B_{40\%}$ for rockfish and roundfish and on $B_{25\%}$ for flatfish (spawning biomass and/or output, SPR, exploitation rate, equilibrium yield).
3. Reference points based on default SPR proxy (spawning biomass and/or output, SPR, exploitation rate, equilibrium yield).
4. Reference points based on MSY (if estimated) (spawning biomass and/or output, SPR,

exploitation rate, equilibrium yield).
5. Equilibrium yield curve showing various B_{MSY} proxies.

G. Harvest projections and decision tables (groundfish only) *** Not required in draft assessment undergoing review**.
   1. Harvest projections and decision tables (i.e., a matrix of alternative models (states of nature) versus management actions) should cover the plausible range of uncertainty about current stock biomass and a set of candidate fishing mortality targets used for the stock. See section "*Uncertainty and Decision Tables in Groundfish Stock Assessment*" (this document, pp.12-13) on how to define alternative states of nature. Management decisions in most cases represent the sequence of catches including estimate of OFL based on F_{MSY} (or its proxy) and those obtained by applying the Council 40-10 harvest policy to each state of nature; however other alternatives may be suggested by the GMT as being more relevant to Council decision making. OFL calculations should be based on the assumption that future catches equal ABCs and not OFLs.
   2. Information presented should include biomass, stock depletion, and yield projections of OFL, ABC and ACL for ten years into the future, beginning with the first year for which management action could be based upon the assessment.

H. Regional management considerations.
   1. For stocks where current practice is to allocate harvests by management area, a recommended method of allocating harvests based on the distribution of biomass should be provided. The MT advisor should be consulted on the appropriate management areas for each stock.
   2. Discuss whether a regional management approach makes sense for the species from a biological perspective.
   3. If there are insufficient data to analyze a regional management approach, what are the research and data needs to answer this question?

I. Research needs (prioritized).

J. Acknowledgments: include STAR panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team. *** Not required in draft assessment undergoing review.**

K. Literature cited.

L. An appendix with the complete parameter and data in the native code of the stock assessment program. (For a draft assessment undergoing review, these listings can be provided as text files or in spreadsheet format.)

APPENDIX B: TEMPLATE FOR AN EXECUTIVE SUMMARY

Items with asterisks (*****) are optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document.

Stock	Species/area, including an evaluation of any potential biological basis for regional management.
Catches	Trends and current levels - include table for last ten years and graph with long term data.
Data and assessment	Date of last assessment, type of assessment model, data available, new information, and information lacking.
Stock biomass	Trends and current levels relative to virgin or historic levels, description of uncertainty-include table for last 10 years and graph with long term estimates.
Recruitment	Trends and current levels relative to virgin or historic levels-include table for last 10 years and graph with long term estimates
Exploitation status	Exploitation rates (i.e., total catch divided by exploitable biomass, or the annual SPR harvest rate) - include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).
Ecosystem considerations	A summary of reviewed environmental and ecosystem factors that appear to be correlated with stock dynamics, e.g., variability in the physical environment that directly or indirectly affects the vital rates (growth, survival, productivity/recruitment) of fish stocks, and/or trophic interactions that affect predators and prey. Note what, if any, ecosystem factors are used in the assessment and how.
Reference points (groundfish)/ Harvest control rules (CPS)	Groundfish: Management targets and definition of overfishing, including the harvest rate that brings the stock to equilibrium at $B_{40\%}$ (the B_{MSY} proxy) and the equilibrium stock size that results from fishing at the default harvest rate (the F_{MSY} proxy). Include a summary table that compares estimated reference points for SSB, SPR, Exploitation Rate and Yield based on SSB proxy for MSY, SPR proxy for MSY, and estimated MSY values. CPS: Results of applying the control rule to compute the harvest guideline, including specification of each of the quantities on which the harvest guideline is based (BIOMASS, CUTOFF, FRACTION, U.S. DISTRIBUTION)
Management performance	Catches in comparison to OFL, ABC, [HG], and OY/ACL values for the most recent 10 years (when available), overfishing levels, actual catch and discard. Include OFL (encountered), OFL (retained) and OFL (dead) if different due to discard and discard mortality.
Unresolved problems and major uncertainties	Any special issues that complicate scientific assessment, questions about the best model scenario, etc.
Decision table (groundfish only)*	Projected yields (OFL, ABC and ACL), spawning biomass, and stock depletion levels for each year. OFL calculations should be based on the assumption that future catches equal ABCs and not OFLs.
Research and data needs	Identify information gaps that seriously impede the stock assessment.
Rebuilding Projections*	Reference to the principal results from rebuilding analysis if the stock is overfished. For groundfish, see Rebuilding Analysis terms of reference for detailed information on rebuilding analysis requirements.

APPENDIX C: DEFINITIONS OF SPECIES CATEGORIES FOR GROUNDFISH ASSESSMENTS

Category 3: **Data poor**. OFL is derived from historical catch.	**a**	No reliable catch history. No basis for establishing OFL.
	b	Reliable catches estimates only for recent years. OFL is average catch during a period when stock is considered to be stable and close to BMSY equilibrium on the basis of expert judgment.
	c	Reliable aggregate catches during period of fishery development and approximate values for natural mortality. Default analytical approach DCAC.
	d	Reliable annual historical catches and approximate values for natural mortality and age at 50% maturity. Default analytical approach DB-SRA.
Category 2: **Data moderate**. OFL is derived from model output (or natural mortality).	**a**	M*survey biomass assessment (as in Rogers 1996).
	b	Historical catches, fishery-dependent trend information only. An aggregate population model is fit to the available information.
	c	Historical catches, survey trend information, or at least one absolute abundance estimate. An aggregate population model is fit to the available information.
	d	Full age-structured assessment, but results are substantially more uncertain than assessments used in the calculation of the P* buffer. The SSC will provide a rationale for each stock placed in this category. Reasons could include that assessment results are very sensitive to model and data assumptions, or that the assessment has not been updated for many years.
Category 1: **Data rich**. OFL is based on F_{MSY} or F_{MSY} proxy from model output. ABC based on P* buffer.	**a**	Reliable compositional (age and/or size) data sufficient to resolve year-class strength and growth characteristics. Only fishery-dependent trend information available. Age/size structured assessment model.
	b	As in 1a, but trend information also available from surveys. Age/size structured assessment model.
	c	Age/size structured assessment model with reliable estimation of the stock-recruit relationship.

Agenda Item H.3.a
Attachment 4
September 2012

TERMS OF REFERENCE

FOR THE

GROUNDFISH REBUILDING ANALYSIS FOR 2013-2014

DRAFT

MAY, 2012

Published by the Pacific Fishery Management Council

TABLE OF CONTENTS

1. INTRODUCTION

Amendment 11 to the Groundfish Fishery Management Plan (FMP) established a default overfished threshold equal to 25% of the unexploited female spawning output[1] (B_0), or 50% of B_{MSY}, if known. By definition, groundfish stocks falling below that level were designated to be in an overfished state ($B_{25\%} = 0.25 \times B_0$[2]). To reduce the likelihood that stocks would decline to that point, the policy specified a precautionary threshold equivalent to 40% of B_0. The policy required that the ACL, when expressed as a fraction of the allowable biological catch, be progressively reduced at stock sizes less than $B_{40\%}$. Because of this linkage, $B_{40\%}$ has sometimes been interpreted to be a proxy measure of B_{MSY}, i.e., the female spawning output that results when a stock is fished at F_{MSY}. In fact, theoretical results support the view that a robust biomass-based harvesting strategy for most rockfish (*Sebastes* spp.) would be to maintain stock size at about 40% of the unfished level (Clark 1991, 2002). In the absence of a credible estimate of B_{MSY}, which can be very difficult to estimate (MacCall and Ralston 2002), $B_{40\%}$ is a suitable proxy to use as a rebuilding target for most groundfish.

The recently revised Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires that U.S. fishery management councils avoid overfishing by setting annual catch limits (ACLs). Stock assessments now will provide overfishing level (OFL) estimates, and an acceptable biological catch (ABC) will be derived from the OFL by reducing the OFL to account for scientific uncertainty. The ACL cannot exceed the ABC.
Following the 2008 assessment season, the Pacific Fishery Management Council ("Council") revised the reference points for flatfish, as separate from other groundfish species. The new reference points include an MSY proxy fishing rate of $F_{30\%}$, a target spawning output of $B_{25\%}$ and an overfished threshold of $B_{12.5\%}$. Similarly, the 40:10 policy has been replaced by a 25:5 policy for flatfish.

Under the MSA, rebuilding plans are required for stocks that have been designated to be in an overfished state. Amendment 12 of the Groundfish FMP provided a framework within which rebuilding plans for overfished groundfish resources could be established. Amendment 12 was challenged in Federal District Court and found not to comply with the requirements of the MSA

[1] The absolute abundance of the mature portion of a stock is loosely referred to here in a variety of ways, including: population size, stock biomass, stock size, spawning stock size, spawning biomass, spawning output; i.e., the language used in this document is sometimes imprecise. However, the best fundamental measure of population abundance to use when establishing a relationship with recruitment is spawning output, defined as the total annual output of eggs (or larvae in the case of live-bearing species), accounting for maternal effects (if these are known). Although spawning biomass is often used as a surrogate measure of spawning output, for a variety of reasons a non-linear relationship often exists between these two quantities (Rothschild and Fogarty 1989; Marshall *et al*. 1998). Spawning output should, therefore, be used to measure the size of the mature stock when possible.
[2] Estimates of stock status are typically obtained by fitting statistical models of stock dynamics to survey and fishery data. In recent years, the bulk of stock status determinations have been based on Stock Synthesis 3, an age- and size-structured population dynamics model (Methot 2005, 2007). Stock assessment models can be fitted using Maximum Likelihood or Bayesian methods. For both types of estimation methods, a stock is considered to be in an overfished state if the best point estimate of stock size is less than 25% (rockfish and roundfish) and 12.5% (flatfish) of unfished stock size. This corresponds to the maximum likelihood estimate for estimation methods based on Maximum Likelihood methods, to the maximum of the posterior distribution (MPD) for estimation methods in which penalties are added to the likelihood function, and to the mode of the posterior distribution for Bayesian analyses. The median of the Bayesian posterior is not used for determination of overfished status.

because rebuilding plans did not take the form of an FMP, FMP amendment, or regulation. In response to this finding, the Council developed Amendment 16-1 to the Groundfish FMP which covered three issues, one of which was the form and content of rebuilding plans.

The Council approach to rebuilding depleted groundfish species, as described in rebuilding plans, was re-evaluated and adjusted under Amendment 16-4 in 2006 so they would be consistent with the opinion rendered by the Ninth Circuit Court of Appeals in *Natural Resources Defense Council, Inc. and Oceana, Inc.* v. *National Marine Fisheries Service, et al.,* 421 F.3d 872 (9th Cir. 2005), and with National Standard 1 of the MSA. The court affirmed the MSA mandate that rebuilding periods "be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem" (Section 304(e)). The court opinion also recognized that some harvest of overfished species could be accommodated under rebuilding plans to avoid severe economic impacts to West Coast fishing communities dependent on groundfish fishing. Under Amendment 16-4 rebuilding plans, more emphasis was placed on shorter rebuilding times and the trade-off between rebuilding periods and associated socioeconomic effects.

Rebuilding Plans include several components, one of which is a rebuilding analysis. Simply put, a rebuilding analysis involves projecting the status of the overfished resource into the future under a variety of alternative harvest strategies to determine the probability of recovery to B_{MSY} (or its proxy) within a pre-specified time-frame.

2. Overview of the Calculations Involved in a Rebuilding Analysis

This document presents guidelines for conducting a basic groundfish rebuilding analysis that meets the minimum requirements that have been established by the Council's Scientific and Statistical Committee (SSC), those of Amendment 16-1 of the Groundfish FMP, and those arising from the 9th Circuit Court decision. It also outlines the appropriate documentation that a rebuilding analysis needs to include. These basic calculations and reporting requirements are essential elements in all rebuilding analyses to provide a standard set of base-case computations, which can then be used to compare and standardize rebuilding analyses among stocks. The steps when conducting a rebuilding analysis are:

1. Estimation of B_0 (and hence B_{MSY} or its proxy).
2. Selection of a method to generate future recruitment.
3. Specification of the mean generation time.
4. Calculation of the minimum and maximum times to recovery.
5. Identification and analysis of alternative harvest strategies and rebuilding times.

The specifications in this document have been implemented in a computer package developed by Dr André Punt (University of Washington). This package can be used to perform rebuilding analyses for routine situations. However, the SSC encourages analysts to explore alternative assumptions, calculations and projections that may more accurately capture uncertainties in stock rebuilding than the default standards identified in this document, and which may better represent

stock-specific concerns. In the event of a discrepancy between the generic calculations presented here and a stock-specific result developed by an individual analyst, the SSC groundfish subcommittee will review the issue and recommend which results to use.
The SSC also encourages explicit consideration of uncertainty in projections of stock rebuilding (see Section 8 below).

2.1. Estimation of B_0

B_0 is defined as mean unexploited female spawning output. The default approach for estimating B_0 for rebuilding analyses is to base it on some form of spawner-recruit model because most of the recent assessments of west coast groundfish have been based on stock assessments that integrate the estimation of the spawner-recruit model with the estimation of other population dynamic parameters. These stock assessments therefore link the recruitments for the early years of the assessment period with the average recruitment corresponding to B_0.

Stock assessment models that integrate the estimation of the spawner-recruit model also provide estimates of B_{MSY}. However, at this time, the SSC recommends that these estimates not be used as the target for rebuilding because they may not be robust. Rather, the rebuilding target should be taken to be the agreed proxy for B_{MSY} (e.g. $0.4B_0$ for most groundfish stocks) in all cases.

The recruitment process depends on the environment in addition to female spawning output. For example, the decadal-scale regime shift that occurred in 1977 (Trenberth and Hurrell 1994) is known to have strongly affected ecosystem productivity and function in both the California Current and the northeast Pacific Ocean (Roemmich and McGowan 1995; MacCall 1996; Francis *et al*. 1998; Hare *et al*. 1999). With the warming that ensued, West Coast rockfish recruitment appears to have been adversely affected (Ainley *et al*. 1993; Ralston and Howard 1995). In principle, B_0 and the approach used to generate future recruitment (see below) could take account of regime-shift effects on productivity. However, this would need to be justified (and the assumptions used for projection purposes would need to be consistent with those on which the assessment was based).

2.2. Selection of a Method to Generate Future Recruitment

One can project the population forward once the method for generating future recruitment has been specified, given the current state of the population from the most recent stock assessment (terminal year estimates of numbers at age and their variances) and the rebuilding target. The current default approach for generating future recruitment is to use the results of a fitted spawner-recruit model (e.g., the Beverton-Holt or Ricker curves), in particular because SS3-based assessments all assume a structural spawner-recruit model, either estimating or pre-specifying the steepness of the curve[3]. Moreover, this approach is consistent with that recommended above for setting B_0. This approach can, however, be criticized because stock productivity is constrained to behave in a pre-specified manner according to the particular spawner-recruit model chosen, and there are different models to choose from, including the

[3] The "steepness" of a spawner-recruit curve is related to the slope at the origin and is a measure of a stock's productive capacity. It is expressed as the proportion of virgin recruitment that is produced by the stock when reduced to $B_{20\%}$, and ranges between 0.2 and 1.0.

Beverton-Holt and Ricker formulations. These two models can produce very different reference points, but are seldom distinguishable statistically. Moreover, there are statistical issues when a spawner-recruit model is estimated after the assessment is conducted, including: (1) time-series bias (Walters 1985), (2) the "errors in variables problem" (Walters and Ludwig 1981), and (3) non-homogeneous variance and small sample bias (MacCall and Ralston 2002). Thus, analyses based on a spawner-recruit model should include a discussion of the rationale for the selection of the spawner-recruit model used, and refer to the estimation problems highlighted above and whether they are likely to be relevant and substantial for the case under consideration. A rationale for the choice of spawner-recruit model should also be provided. In situations where steepness is based on a spawner-recruit meta-analysis (e.g., Dorn 2002), the reliability of the resulting relationship should be discussed.

2.3. Specification of the Mean Generation Time

The mean generation time should be calculated as the mean age of the net maturity function. A complication that can occur in the calculation of mean generation time, as well as B_0 (see above), is when growth and/or reproduction have changed over time. In such instances, the parameters governing these biological processes should typically be fixed at their most recent, contemporary, values, as this best reflects the intent of "prevailing environmental conditions" as stated in the NMFS Guidelines for National Standard 1. Exceptions may occur if there are good reasons for an alternative specification (e.g., using growth and maturity schedules that are characteristic of a stock that is close to B_{MSY}).

2.4. Calculation of the Minimum and Maximum Times to Recovery

The minimum time to recovery (denoted T_{MIN}) is defined as the median time (i.e. 50% probability) for a stock to recover to the target stock size, starting from the time when a rebuilding plan was actually implemented (usually the year after the stock was declared overfished) to when the target level is first achieved, assuming no fishing occurs.

Although no longer used directly in Council decision-making for overfished stocks, rebuilding analyses should report the maximum time to recovery (denoted T_{MAX}). T_{MAX} is ten years if T_{MIN} is less than 10 years. If T_{MIN} is greater than or equal to 10 years, T_{MAX} is equal to T_{MIN} plus one mean generation. Likewise, rebuilding analyses should report an estimate of the median number of years needed to rebuild to the target stock size if all future fishing mortality is eliminated from the first year for which the Council is making a decision about[4] ($T_{\text{F=0}}$). This will typically differ from T_{MIN}.

Finally, when a stock rebuilding plan has been implemented for some time and recruitments have been estimated from an assessment, it may be that explicit, year-specific estimates of recruitment are available for the earliest years of the rebuilding time period. In such instances, rebuilding forecasts should be conducted setting the recruitments from the start of the rebuilding plan to the current year based on the estimates from the most recent assessment, rather than through re-sampling methods (see above) because this reflects the best available information regarding the recruitment during the rebuilding period.

[4] This year will generally not be the current year, but rather the year following the current two-year cycle.

2.5. Alternative Harvest Strategies during Rebuilding

The Council is required to rebuild overfished stocks in a time period that is as short as possible, but can extend this period to take into account the needs of fishing communities. The simplest rebuilding harvest strategy to simulate and implement is a constant harvest rate or "fixed F" policy. Such strategies should also mean that encounter rates with overfished species remain relatively constant over time, which is unlikely to be the case for constant catch strategies. All rebuilding analyses should, therefore, minimally consider fixed F (or SPR) strategies. However, many other strategies are possible, including constant catch and phase-in strategies, in which catch reductions are phased-in. In these latter cases, analysts should always assess whether fishing mortality rates exceed F_{MSY} (or its proxy), as this would constitute overfishing.

Analysts should consider a broad range of policy alternatives to give the Council sufficient scope on which to base a decision. The following represent the set of harvest strategies which have been identified by the GMT – all rebuilding analyses should minimally include these strategies:

1) eliminate all harvest beginning in the next management cycle (i.e., estimate $T_{F=0}$),
2) apply the harvest rate that would generate the ACL specified for the current year (i.e., the latest year specified in regulations),
3) apply the spawning potential ratio[5] or relevant harvest control rule in the current rebuilding plan,
4) apply the harvest rate that is estimated to lead to a 50% probability of recovery by the current T_{TARGET},
5) apply the harvest rate that is estimated to lead to a 50% probability of recovery by the T_{MAX} from the current cycle,
6) apply the harvest rate that is estimated to lead to a 50% probability of recovery by the T_{MAX} from the previous cycle,
7) apply the default (e.g. 40-10 or 25-5) harvest policy, and
8) apply the ABC harvest rate (i.e., F_{MSY} less the uncertainty buffer).

For all of these strategies, except for numbers 1 and 8, the median catch streams from each run should be used as the harvest strategy in a follow-up run to evaluate the result of following the actual catch advice from the harvest policies above. In other words each of strategies 2-7 should be run twice; once with a given sequence of harvest rates and then using the median catches obtained from the first run. If the catch for a given year under one of the harvest strategies exceeds the ABC for that year, the catch should be set to the ABC (this is done automatically in the rebuilding software).

These polices should be implemented within the projection calculations in the year for which the Council is making a decision. For example, for assessments conducted in 2013 (using data up to 2012), the harvest decisions pertain to OFLs, ABCs and ACLs for 2015 and 2016. In this case, the catches for 2013 and 2014 should be set to the ACLs established by the Council for those years.

[5] The Spawning Potential Ratio (SPR) is a measure of the expected spawning output-per-recruit, given a particular fishing mortality rate and the stock's biological characteristics, i.e., there is a direct mapping of SPR to *F* (and *vice versa*). SPR can therefore be converted into a specific fishing mortality rate in order to calculate ACLs.

Many other harvest policies could be implemented by the Council. Consequently, analysts should be prepared to respond to requests by the Council for stock-specific projections on an individual case-by-case basis.

3. EVALUATING PROGRESS TOWARDS REBUILDING

There are no agreed criteria for assessing the adequacy of the progress towards rebuilding for species that are designated to be in an overfished state and are under a Rebuilding Plan. The SSC currently reviews each stock on a case-by-case basis, considering the following two questions: (1) have cumulative catches during the period of rebuilding exceeded the cumulative ACL that was available, and (2) what is the difference between the year in which recovery is predicted to occur under the current SPR (T_{REBUILD}) and the currently-adopted T_{TARGET}? If the difference between T_{REBUILD} and T_{TARGEST} is minor, progress towards rebuilding is considered to be adequate. In contrast, if the difference between T_{REBUILD} and T_{TARGET} is major, it will be necessary to define a new T_{TARGET}. As an initial step in this direction, a new maximum time to rebuild T_{MAX}^{N} will be computed based on the specifications outlined in Section 5. Analysts will be asked to assess whether the currently-adopted SPR will readily rebuild the stock before T_{MAX}^{N}.

Adequacy of progress will be evaluated when the SSC groundfish subcommittee reviews the draft rebuilding plans. Analysts should provide the information needed to address the two questions listed above. If the SSC agrees that progress is not sufficient, the draft rebuilding analysis documents will need to be updated to include T_{MAX}^{N} and the probability that the currently adopted harvest rate (SPR) will rebuild the stock before T_{MAX}^{N}.

4. DECISION ANALYSES / CONSIDERING UNCERTAINTY

The calculation of T_{MIN} and the evaluation of alternative harvest strategies involve projecting the population ahead taking account of uncertainty about future recruitment. There are several reasons for considering model and parameter uncertainty when conducting a rebuilding analysis. For example, if several assessment model scenarios were considered equally plausible by the assessment authors or, alternatively, one model was preferred by the assessment authors and another was preferred by the STAR Panel. Accounting for implementation uncertainty (i.e. the realized catch differing from the set ACL) is needed for cases in which the catch of the overfished stock is likely to differ appreciably from the set ACLs.

The uncertainty associated with parameters, such as the rate of natural mortality and the current age-structure of the population, can also be taken into account. This can be achieved in a variety of ways. For example, if the uncertainty relates to the parameters within one structural model, this uncertainty can be reflected by basing projections on a number of samples from a distribution which reflects this uncertainty (such as a Bayesian posterior distribution or bootstrap samples). Alternatively, if there are multiple models (e.g. different structural assumptions regarding data weights, use of data sources, etc.) projections can be conducted for each model and the results appropriately weighted when producing the final combined results if the uncertainty pertains to alternative structural models. In the case of assessments for which a decision table has been produced, the weights assigned to each model on which the decision table is based would be those assigned by the STAR Panel (and endorsed/modified by the SSC). Implementation uncertainty can take many forms. Two common ways to model implementation uncertainty are (a) the realized catch is distributed about the ACL (i.e. the catch equals the ACL on average), and (b) the realized catch is distributed about the ACL, but the expected catch is less [or greater] than the ACL. The latter case is appropriate if past data suggest that ACLs will be undercaught given management arrangements.

5. DOCUMENTATION

The analysts are responsible for conducting a complete and technically sound rebuilding analysis that conforms to accepted standards of quality, and in accordance with these TOR. It is important for analysts to document their work so that any rebuilding analysis can be repeated by an independent investigator at some point in the future. Therefore, all stock assessments and rebuilding analyses should include tables containing the specific data elements that are needed to adequately document the analysis. Clear specification of the exact assessment scenario(s) used as the basis for the rebuilding analysis is essential. Linkages with the most recent stock assessment document should be clearly delineated (e.g., through references to tables or figures). This is important because assessments often include multiple scenarios that usually have important implications with respect to stock rebuilding. The rebuilding analysis document should follow the outline below.

1) Title page and list of preparers – the names and affiliations of the analysts either alphabetically or as first and secondary authors.
2) Summary – condensed overview and results of the rebuilding analyses.
3) Introduction – scientific name; years when species declared overfished; summary of assessment efforts (when first assessed, brief overview of subsequent assessments and rebuilding analyses).
4) Overview of the most recent stock assessment – main assumptions, estimated stock status, sources of uncertainty, alternative states of nature used in the decision table, median and 95% intervals for: (a) summary / exploitable biomass, (b) spawning output (in absolute terms and relative to the target level), (c) recruitment, (d) catch, (e) landings (if different from catch), (f) OFL, (g) ABC, and (h) SPR for the actual harvest strategy selected by the Council.
5) Management performance under rebuilding – brief overview and a table comparing Overfishing Limit (OFL), Annual Catch Limit (ACL), and catch (i.e., landings plus discard) for each year of the rebuilding period.
6) Rebuilding calculations
   - Specifications for the software used for the analysis (including the version number); date on which the analysis was conducted; the program's input files (should be included as an Appendix).
   - The rationale for the approach used to estimate B_0 and to generate future recruitment.
   - The biological information on which the projections are based (e.g. natural mortality rate by age and sex, individual weight by age and sex, maturity by age, fecundity by age, selectivity-at-age by sex (and fleet), population numbers (by age and sex) for the

year the rebuilding plan commenced, population numbers (by age and sex) for the present year).

- Description of how fishing mortality is allocated (and selectivity applied) to each fleet for rebuilding analyses based on multiple fleets.
- Description of how uncertainty in input parameters from the stock assessment in the rebuilding analysis is accounted for.
- List and description of alternate rebuilding strategies analyzed.

7) Results
   - Summary of rebuilding reference points. For each alternative model, a table (see Table 1 for an example based on canary rockfish) should be produced which lists: (a) the year in which the rebuilding plan commenced, (b) the present year, (c) the first year that the evaluated harvest policy calculates the ACL, (d) T_{MIN}, (e) mean generation time, (f) T_{MAX}, (g) $T_{F=0,}$ (h) the estimate of B_0 and the target recovery level, (i) the current SPR, (j) the current T_{TARGET} and (k) the estimate of current stock size.
   - Results of harvest policy projections (see, for examples, Tables 2-5; Figures 1-3). The following information should be provided for each harvest policy evaluated: (a) the first year in which recovery to the target level occurs with at least 0.5 probability, (b) the SPR for the first year of the projection period, (c) the probability of recovery by the current T_{TARGET}, (d) the probability of recovery by the current T_{MAX}, (e) probability of the stock dropping below the female spawning biomass in the present year and the year the stock was declared overfished, (f) tables of median time-trajectories (from the present year to T_{MAX}) of: (i) spawning output relative to the target level, (ii) probability of being at or above the target level, (iii) OFL, and (iv) ABC. Median time-trajectories of SPR should be provided for the projection based on the 40:10 rule (as applied to the ABC) and any phase-in harvest policies that have been specified.
8) Acknowledgements
9) Literature cited

The software and data files on which the rebuilding analyses are based should be archived with the stock assessment coordinator. Much of the biological information will be stored in the input file for the projection software and does not need to be repeated unless there is good reason to do so. For cases in which the projections take account of uncertainty about the values for the biological parameters (e.g., using the results from bootstrapping or samples from a Bayesian posterior distribution), some measure of the central tendency of the values (e.g., the mode or median) should be provided and the individual parameter values should be archived with the stock assessment coordinator. Rebuilding analyses may be based on selectivity-at-age vectors constructed by combining estimates over fleets. If this is the case, the rebuilding analysis needs to document how the composite selectivity-at-age vector was constructed.

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Table 1. Summary of rebuilding reference points for canary rockfish (based on Stewart (2007)).

Parameter	Values
Year declared overfished	2000
Current year	2007
First ACL year	2009
T_{MIN}	2019
Mean generation time	22
T_{MAX}	2041
$T_{F=0}$ (beginning in 2009)	2019
B_0	32,561
Rebuilding target ($B_{40\%}$)	13,024
Current SPR	0.887
Current T_{TARGET}	2063
SB_{2007}	10,544

Table 2. Results of rebuilding alternatives for canary rockfish (based on Stewart (2007)). (This table should include the OFL, ABC and ACL).

	Run #			
	1	2	3	4
50% prob. recovery by:	2019	2021	2035	2041
SPR_{TARGET}	100%	88.7%	62.0%	59.2%
2009 ACL (mt)	0.0	155.2	636.9	700.0
2009 ABC (mt)	936.9	936.9	936.9	936.9
2010 ACL (mt)	0.0	155.0	623.1	683.1
2010 ABC (mt)	941.4	935.4	916.7	914.2
Probability of recovery				
2071 (T_{MAX})	97.1%	84.6%	73.5%	70.0%
2048 (T_{MIN})	76.4%	75.0%	64.8%	56.9%
2053 ($T_{F=0}$ from 2007)	79.4%	75.3%	67.9%	61.3%
2063 (T_{TARGET})	91.4%	78.8%	72.0%	66.8%

Table 3. Probability of recovery for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	0.250	0.250	0.250	0.250
2008	0.250	0.250	0.250	0.250
2009	0.250	0.250	0.250	0.250
2010	0.250	0.250	0.250	0.250
2011	0.250	0.250	0.250	0.250
2012	0.250	0.250	0.250	0.250
2013	0.250	0.250	0.250	0.250
2014	0.250	0.250	0.250	0.250
2015	0.250	0.250	0.250	0.250
2016	0.251	0.250	0.250	0.250
2017	0.284	0.257	0.250	0.250
2018	0.407	0.288	0.250	0.250
2019	0.550	0.366	0.250	0.250
2020	0.660	0.473	0.256	0.251
2021	0.702	0.561	0.260	0.256
2022	0.732	0.633	0.267	0.261
2023	0.742	0.681	0.279	0.267
2024	0.746	0.707	0.290	0.275
2025	0.749	0.725	0.309	0.281
2026	0.749	0.735	0.321	0.293
2027	0.749	0.742	0.341	0.300
2028	0.750	0.746	0.358	0.313
2029	0.750	0.746	0.376	0.324
2030	0.750	0.747	0.402	0.336
2031	0.750	0.749	0.424	0.348
2041	0.750	0.750	0.586	0.500
2051	0.781	0.751	0.671	0.601
2061	0.895	0.776	0.714	0.660
2071	0.971	0.846	0.735	0.700

Table 4. Median spawning biomass (mt) for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	10,544	10,544	10,544	10,544
2008	10,841	10,841	10,841	10,841
2009	11,073	11,073	11,073	11,073
2010	11,258	11,197	11,010	10,985
2011	11,383	11,260	10,880	10,831
2012	11,463	11,274	10,701	10,627
2013	11,524	11,268	10,501	10,403
2014	11,607	11,280	10,318	10,197
2015	11,751	11,351	10,186	10,041
2016	11,987	11,508	10,133	9,964
2017	12,328	11,765	10,163	9,969
2018	12,738	12,089	10,251	10,029
2019	13,181	12,432	10,357	10,113
2020	13,685	12,838	10,520	10,247
2021	14,236	13,293	10,721	10,419
2022	14,773	13,731	10,909	10,583
2023	15,350	14,210	11,130	10,775
2024	15,941	14,674	11,345	10,966
2025	16,500	15,133	11,515	11,105
2026	17,015	15,536	11,679	11,251
2027	17,517	15,959	11,852	11,391
2028	18,045	16,348	11,999	11,515
2029	18,600	16,811	12,211	11,699
2030	19,093	17,183	12,329	11,799
2031	19,528	17,519	12,432	11,877
2041	23,511	20,635	13,491	12,751
2051	26,282	22,743	14,238	13,357
2061	27,862	24,058	14,655	13,689
2071	28,903	24,832	15,097	14,073

Table 5. Median catches (mt) for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	0.0	44.0	44.0	44.0
2008	0.0	44.0	44.0	44.0
2009	0.0	155.2	636.9	700.0
2010	0.0	155.0	623.1	683.1
2011	0.0	157.5	621.9	680.2
2012	0.0	163.7	635.4	693.4
2013	0.0	171.5	654.9	713.1
2014	0.0	179.7	675.9	734.4
2015	0.0	186.9	691.6	750.1
2016	0.0	193.4	705.3	763.1
2017	0.0	198.7	713.8	770.8
2018	0.0	205.1	724.3	780.5
2019	0.0	210.6	733.9	789.5
2020	0.0	216.8	744.3	798.9
2021	0.0	222.0	753.8	807.8
2022	0.0	228.3	765.2	818.8
2023	0.0	234.0	769.3	821.3
2024	0.0	239.0	778.8	830.7
2025	0.0	245.3	786.9	837.4
2026	0.0	250.0	795.2	845.3
2027	0.0	257.0	807.6	856.9
2028	0.0	261.7	814.0	862.9
2029	0.0	267.3	821.5	868.6
2030	0.0	272.3	830.5	877.2
2031	0.0	276.5	836.3	882.5
2041	0.0	318.0	897.1	938.2
2051	0.0	346.9	937.3	972.9
2061	0.0	365.2	967.1	1,002.9
2071	0.0	377.7	985.9	1,019.3

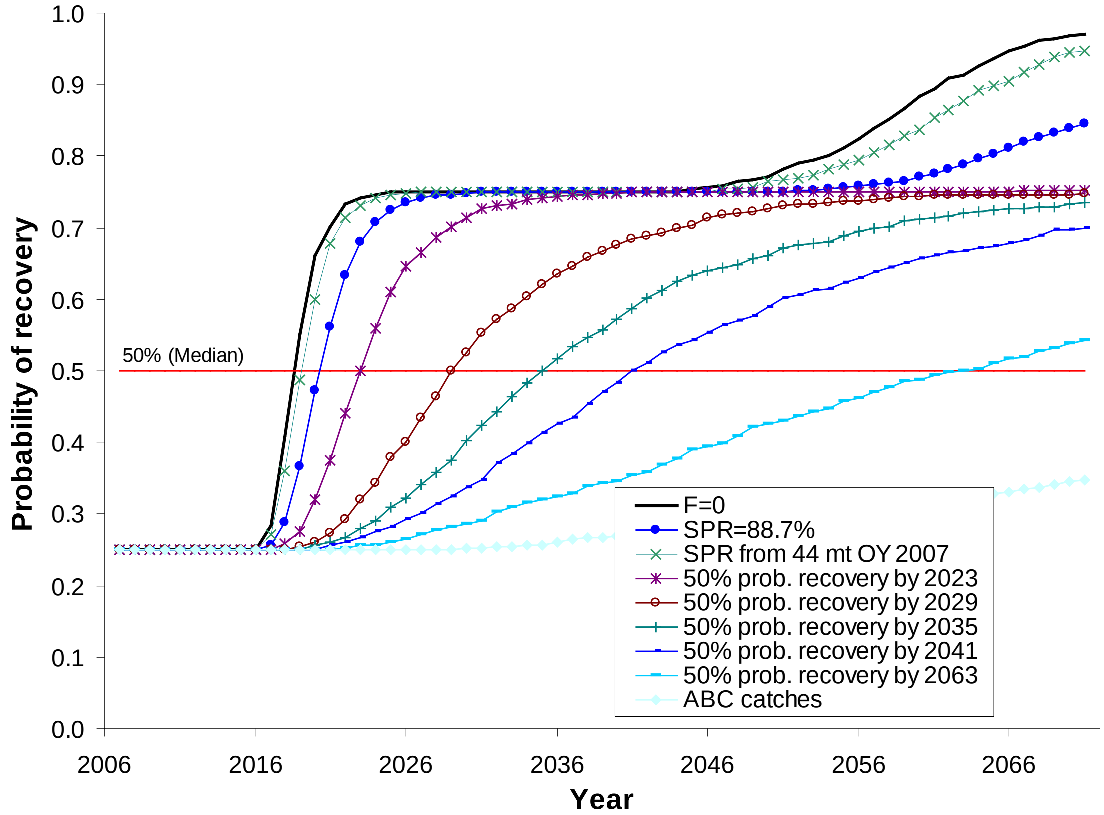

Figure 1. Probability of recovery for nine rebuilding alternatives for canary rockfish.

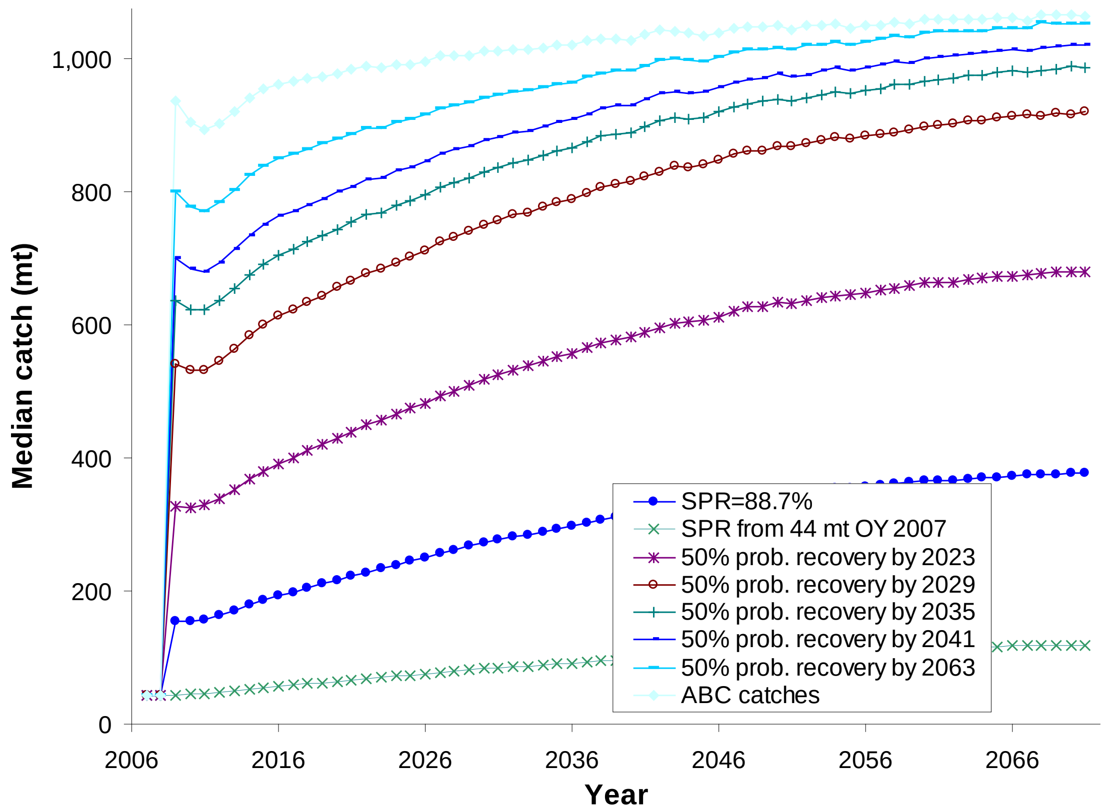

Figure 2. Projected median catch (mt) for nine rebuilding alternatives for canary rockfish.

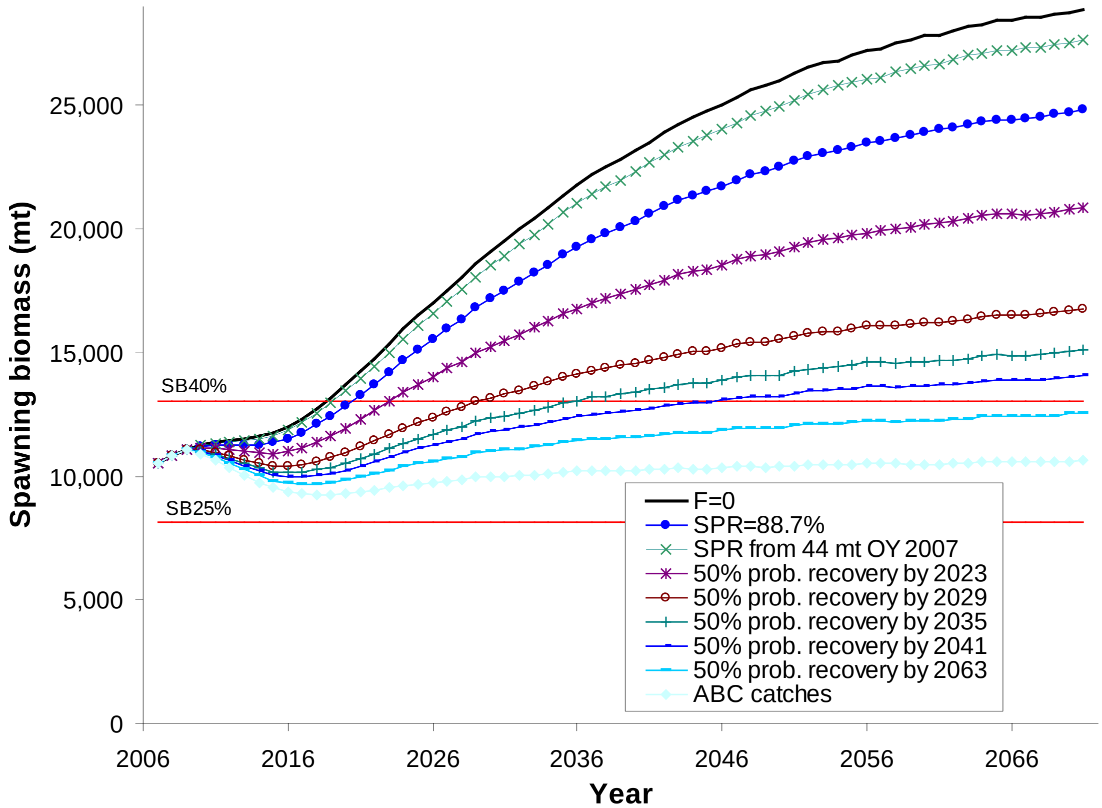

Figure 3. Projected median spawning biomass (mt) for nine rebuilding alternatives for canary rockfish.

Agenda Item H.3.a
Attachment 5
September 2012

TERMS OF REFERENCE

FOR THE

METHODOLOGY REVIEW PROCESS FOR GROUNDFISH AND COASTAL PELAGIC SPECIES

DRAFT

MARCH 13, 2012

Published by the Pacific Fishery Management Council

Introduction

This document lays out general procedures for methodology and data reviews related to the assessment and management of coastal pelagic species (CPS) and groundfish by the Pacific Fishery Management Council (Council). It clarifies the responsibilities of the proponents of new methods or data sets proposed for use in CPS or groundfish stock assessment and the responsibilities of participants in the review process. Each review is likely to have additional requirements that will be defined in a set of Specific Terms of Reference (TOR), which should conform to the general terms defined in this document. Although these General Terms of Reference focus on methodology and data reviews for CPS and groundfish stock assessments, they may be applied to methods in other areas, including economic analyses and ecosystem-based fishery management. In the text below the term "methodology review" should be understood to mean "methodology and data review".

The methodology review process provides for peer review as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA), which states that "the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery" (MSRA section 302(g)(1)(E)). The peer review process is not a substitute for the Council's Scientific and Statistical Committee (SSC), and should work in conjunction with the SSC. This document will be included in the Council's Statement of Organization, Practices and Procedures as documentation of part of the review process that underpins the SSC's scientific advice.

Parties involved in implementing the peer review process described here are the Council; Council staff; members of Council Advisory Bodies, including the SSC; the relevant Management Team and Advisory Panel (CPSMT and CPSAS for CPS, and GMT and GAP for groundfish); the National Marine Fisheries Service (NMFS); state agencies; and interested persons (including external reviewers).

Unlike Stock Assessment Review (STAR) Panels, methodology review panels do not occur on a regular timetable but are instead established by the Council to provide peer and in-depth review of major changes to the methodology on which stock assessments are based. Consequently, the outcomes from a methodology review are recommendations regarding whether a particular methodology should be applied in future stock assessments, and on recommended (or required) improvements and modifications. Existing methodologies could be reviewed, particularly if they are key to stock assessments and have not been reviewed for many years or if incremental changes in how the methodology is applied have occurred.

Methodology reviews may be appropriate when a major new data source is introduced or when a major change in the stock assessment modeling is contemplated. In both cases, a methodology review is needed when the change(s) from how assessments have been conducted in the past are deemed to be more than what a STAR Panel can reasonably be expected to handle. The introduction of a new survey will generally require a methodology review, as will a change to a new stock assessment modeling platform. However, changes to the structure of a previously reviewed assessment model (e.g., changes in selectivity year-blocking) fall within the scope of a standard STAR Panel review.

No explicit guidelines for what topics can be covered in a methodology review are provided here, but typical examples would be evaluation of: (a) proposed major new data types which if included in an assessment could change its outcomes markedly (e.g., the aerial survey for

Pacific sardine), (b) proposed changes to the design of existing surveys, (c) existing data inputs to assessments which have not been reviewed in depth by a Council-sponsored peer-review panel for many years (e.g., the egg production method for Pacific sardine), (d) data or model results that contribute to ecosystem-based management of CPS and groundfish stocks, and (e) proposed major changes to stock assessment methods that fall outside the scope of a normal STAR Panel review (for example, a change to the stock assessment modelling platform).

Changes to harvest control rules could also be considered by a methodological review. Care must be taken to separate the scientific analysis supporting the change (e.g. the structure and technical aspects of simulation studies used to compare a revised control rule against the *status quo*) and the management objectives used to measure performance (e.g. minimize year-to-year catch variance, maximize long-term average catch, etc.). The former are amenable to methodological review (provided adequate background analyses have been completed), but the latter are management decisions – not well suited to a methodological review.

These TOR reflect how previous methodology reviews have been undertaken. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and address new issues as they arise.

Methodology Review Goals and Objectives

The general goals and objectives for the methodology review process are to:

1. Ensure that research surveys, data collection, data analyses and other scientific techniques in support of CPS and groundfish stock assessments are the best available scientific information and facilitate the use of information by the Council.
2. Provide recommendations regarding whether, and if so, how a particular methodology can be applied in future stock assessments.
3. Meet the MSRA and other legal requirements.
4. Follow a detailed calendar and fulfil explicit responsibilities for all participants to produce required outcomes and reports.
5. Provide an independent external review of survey and analytical methods used to develop data to inform CPS and groundfish stock assessments.
6. Increase understanding and acceptance of CPS and groundfish research methodologies and review by all members of the Council family.
7. Identify research needed to improve assessments, reviews, surveys, analyses, and fishery management in the future.

Responsibilities of Methodology Review Participants

Shared Responsibilities

All parties have a stake in ensuring adequate technical review of stock assessments and the information on which they are based. The National Marine Fisheries Service (NMFS), as the designee of the Secretary of Commerce, must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses statements from the SSC to determine whether the information on which it will base its recommendation represents the "best available" science. Fishery managers and scientists providing technical documents to the Council for use in management need to ensure their work is technically correct.

The Council, NMFS, and the Secretary of Commerce share primary responsibility to create and foster a successful peer review process. The Council will oversee the process and involve its standing advisory committees, especially the SSC. The SSC will designate a member to coordinate, oversee, and facilitate each methodology review. Together, NMFS and the Council will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events for each methodology review and a list of deliverables for final approval by the Council. NMFS and the Council will share fiscal and logistical responsibilities and both should ensure that there are no conflicts of interest in the process[1].

The peer-review process is sponsored by the Council, because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was to limit the number of advisory committees; ensure that advisory committees fairly represent affected parties; and ensure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the Sustainable Fisheries Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

Management Team Responsibilities

The Management Team (MT) is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the MT makes Annual Catch Limit (ACL) and Annual Catch Target (ACT) recommendations to the Council.

A representative of the relevant MT may be appointed by the MT chair and, if appointed, will serve as a liaison to the methodology review panel meeting and will participate in discussions. The MT representative will not serve as a member of the panel. The MT representative should be prepared to advise the panel on fishing regulations or practices that may influence data used in assessments and the nature of the fishery in the future (this will be more relevant for some of the topics which are considered by methodology reviews than others).

Advisory Panel Responsibilities

It is the responsibility of the AP representative to ensure that AP concerns regarding the issue being reviewed are conveyed to the panel. The chair of the AP may appoint a representative to participate in a methodology review. If appointed, the AP representative will serve as an advisor to the review meeting. The AP representative will participate in review discussions as

[1]The proposed NS2 guidelines state: "Peer reviewers who are federal employees must comply with all applicable federal ethics requirements. Peer reviewers who are not federal employees must comply with the following provisions. Peer reviewers must not have any real or perceived conflicts of interest with the scientific information, subject matter, or work product under review, or any aspect of the statement of work for the peer review. For purposes of this section, a conflict of interest is any financial or other interest which conflicts with the service of the individual on a review Panel because it: (A) Could significantly impair the reviewer's objectivity; or (B) Could create an unfair competitive advantage for a person or organization. (C) Except for those situations in which a conflict of interest is unavoidable, and the conflict is promptly and publicly disclosed, no individual can be appointed to a review Panel if that individual has a conflict of interest that is relevant to the functions to be performed. Conflicts of interest include, but are not limited to, the personal financial interests and investments, employer affiliations, and consulting arrangements, grants, or contracts of the individual and of others with whom the individual has substantial common financial interests, if these interests are relevant to the functions to be performed. Potential reviewers must be screened for conflicts of interest in accordance with the procedures set forth in the NOAA Policy on Conflicts of Interest for Peer Review subject to OMB's Peer Review Bulletin."

an advisor to the panel, in the same capacity as the MT advisor. The AP representative may provide appropriate data and advice to the review meeting and will report to the AP on the meeting.

Scientific and Statistical Committee Responsibilities

The SSC will assign at least one member to each methodology review. This member will chair the review meeting, and present the report of the meeting to the SSC and the Council. The SSC will review any additional analytical work arising from the review meeting, will serve as arbitrator to resolve disagreements that arose during the review meeting, and will make recommendations to the Council (e.g. whether the reviewed methodology provides the "best available science", and hence could be used for stock assessment and developing conservation and management measures).

Council Staff Responsibilities

Council staff will be assigned to coordinate, monitor and document the review process. Council staff will be responsible for timely issuance of meeting notices and distribution of appropriate documents. Council staff will coordinate with the panel chair and NMFS to assure that all documents are received on time, and are complete. Council staff will coordinate materials and presentations for Council meetings relevant to Council decision making. Council staff will also collect and maintain file copies of reports from each methodology review, the documents considered during the review, SSC, Management Team, and Advisory Panel comments and reports, letters from the public, and any other relevant information.

A primary role for Council staff assigned to each methodology review will be to monitor review meetings and SSC activities to ensure compliance with these TOR. Council staff will identify inconsistencies with the TOR that occur during review meetings and work with the panel chair to develop solutions and to correct them. Council staff will work with the panel chair to finalize the panel report and provide it to the Council.

National Marine Fisheries Service Responsibilities

NMFS will assign a coordinator to work with the Council, other agencies, groups, or interested persons that carry out assessment work to assist in organizing methodology reviews. The NMFS coordinator will identify independent panellists following criteria for reviewer qualifications. The costs associated with these reviewers will be borne by NMFS. The NMFS coordinator will work with methodology proponents to facilitate delivery of materials by scheduled deadlines and in compliance with other requirements of these terms of reference, to the extent possible and with the assistance of the assigned Council staff officer and the panel chair.

General Review Panel Responsibilities

The objective of a methodology review panel is to complete a detailed evaluation of a topic selected by the Council which could have a major impact on stock assessments or the provision of scientific advice and to make a recommendation regarding whether the methodology represents the best available scientific information for the Council. The general responsibilities of the panel are to:

1. review documents pertinent to the topic under consideration;
2. evaluate the technical merits and deficiencies of the proposed method(s) during the panel meeting and work with the proponents to correct deficiencies;

3. provide recommendations for alternative methods or modifications to proposed methods, or both, as appropriate during the panel meeting;
4. provide recommendations on application of the methods to the stock assessment and/or management process;
5. document meeting discussions;
6. provide complete panel reports.

The panel chair has, in addition, the responsibility to:

7. review revised documents and panel reports before they are forwarded to the SSC.

Review panels may have additional responsibilities that are defined in the Specific Terms of Reference for the review.

Panel Composition

Methodology review panels normally include a chair, at least one "external" member (i.e., who is outside the Council family and not involved in management or assessment of West Coast fisheries, often designated by the Center for Independent Experts [CIE]), and at least two additional members. Selection of the external and independent panellists should aim for balance between outside expertise of the topic being reviewed and in-depth knowledge of West Coast fisheries, data sets available for those fisheries, and relevant modelling approaches. Reviewers should not have financial or personal conflicts of interest, either current to the meeting, within the previous year (at minimum), or anticipated. Panellists should be knowledgeable about the specific approaches being reviewed. In addition to panel members, methodology review meetings will include Council staff to help advise the panel and assist in recording meeting discussions and results, and may include MT and AP representatives with responsibilities as laid out above. The length of a methodology review meeting will be selected by the SSC and could range one to five days.

The panel chair is responsible for: 1) developing an agenda and a list of the major issues to be addressed by the review panel, 2) ensuring that the panel follows the TOR, 3) guiding the participants in the review (proponents and panel) to mutually agreeable solutions, 4) coordinating review of documents, and 5) providing Council staff with a camera ready and suitable electronic version of the panel report. The panel, those proposing the methodology, the MT and AP representatives, and the public are legitimate meeting participants that should be accommodated during discussions. It is the panel chair's responsibility to manage discussions and public comment so that work can be completed.

Conduct of a Review

The panel's review solely concern technical aspects of the method. It is therefore important that the panel strive for a risk neutral perspective in its reports and deliberations. Methods or results that have a flawed technical basis, or are questionable on other grounds, should be identified by the panel and a recommendation made that they should excluded from consideration in developing management advice. The panel should comment on the degree to which the uncertainty associated with the method being reviewed is quantified (e.g. through confidence or prediction intervals) because uncertainty is taken into account during the management process.

Recommendations and requests to the proponents for additional or revised analyses must be clear, explicit, and in writing. Panel recommendations and requests to the proponents should reflect the consensus opinion of the entire panel and not the minority view of a single individual or individuals on the panel. A written summary of discussion on significant technical points and lists of all panel requests and recommendations and requests to the proponents are required in the panel report, which should be completed (at least in draft form) prior to the end of the review meeting. It is the chair and panel's responsibility to carry out any follow-up review of work that is required.

The panel's primary duty is to conduct a peer review of the proposed methodology. Methodology review panel meetings are not workshops, although the involvement of the panel in shaping the methodology is greater during methodology reviews than during STAR Panels. This is particularly the case when the outside reviewers have considerably more experience with a given methodology than the proponents and the reviewers from within the Council family. In the course of this review, the panel may ask for a reasonable number of additional analyses, as well as for additional details of the proposed methodology. It would not be unusual for this evaluation to result in a change to the initial methodology, provided both the panel and the proponents agree. Panels are expected to be judicious in their requests of the proponents, recognizing that some issues uncovered during a review are best flagged as research priorities (and use of the methodology possibly deferred until those issues are resolved). The panel should not impose as a requirement their preferred methodologies when such is a matter of professional opinion. Rather, if the panel finds that a method is inadequate, it should document and report that opinion.

Panels and proponents are required to make an honest attempt to resolve any areas of disagreement during the review meeting. Occasionally, fundamental differences of opinion remain between the panel and the proponents that cannot be resolved by discussion. In such cases, the panel must document the areas of disagreement in its report. In exceptional circumstances, the proponents may choose to submit a supplemental report supporting its view, but in the event that such a step is taken, an opportunity must be given to the panel to prepare a rebuttal. These documents will then be appended to panel report as part of the record of the review meeting. Panel members may have fundamental disagreements that cannot be resolved during the meeting. In such cases, panel members may prepare a minority report that will become part of the record of the review meeting. The SSC will then review all information pertaining to panel or panel/proponent disputes, and issue a recommendation.

Additional analyses required by the panel should be completed by the proponents during the review meeting. It is the obligation of the panel chair, in consultation with other panel members, to prioritize requests for additional analyses. If follow-up work by the proponents is required after the review meeting, then it is the panel's responsibility to track progress. In particular, the chair is responsible for communicating with proponents (by phone, e-mail, or any other convenient means) to determine if the revised analyses and documents are complete and ready to be presented to the SSC.

Review Panel Report

The panel chair is responsible for preparing the final draft of the panel report, obtaining the panel's approval, and providing the report to the Council for inclusion in the Briefing Book. The chair will appoint members of the panel (the "external" members and other members) to act as rapporteurs who will draft the report according to guidance by the panel chair on format and level of detail. The aim of the report is to provide information to the SSC on whether it should recommend the methodology for use in Council assessments and, if necessary, what additional work must be completed before the methodology can be used. The report is not meant as a detailed summary of the methodology, nor is it meant to be the minutes of the meeting. The report may include Appendices which summarize work presented to the panel in response to requests. The chair will solicit comment on the draft report from the proponents and the MT and AP advisors. The purpose of this review is limited to ensuring that the report is technically accurate, and reflects the discussion that occurred at the meeting, and should not be viewed as an opportunity to reopen debate on issues. The chair will be the final arbiter on wording changes suggested by proponents and the MT and AP advisors—i.e., the report is the panel's report of the meeting. Any detailed commentary by MT and AP advisors should be drafted separately, reviewed by full advisory body, and included in the Briefing Book.

Suggested Template for Methodology Review Panel Report

- Summary of the Methodology Review Panel meeting, containing:
  - names and affiliations of panel members;
  - topic(s) being reviewed; and
  - list of analyses requested by the panel, the rationale for each request, and a brief summary the responses to each request.
- Comments on the technical merits and/or deficiencies of the methodology and recommendations for remedies. Depending on the methodology being reviewed comments may address the following issues:
  - What are the data requirements of the methodology?
  - What are the situations/stocks for which the methodology is applicable?
  - What are the assumptions of the methodology?
  - Is the methodology correct from a technical perspective?
  - How robust are results to departures from the assumptions of the methodology?
  - Does the methodology provide estimates of uncertainty? How comprehensive are those estimates?
  - Will the new methodology or data set result in improved stock assessments or management advice?
- Areas of disagreement regarding panel recommendations:
  - among panel members (including concerns raised by the MT and AP representatives); and
  - between the panel and proponents.
- Unresolved problems and major uncertainties, e.g., any issues that could preclude use of the methodology.
- Management, data or fishery issues raised by the public and MT and AP representatives during the panel review.
- Prioritized recommendations for future research and data collection.

General Responsibilities Proponents of New Methodology or Data Sets

New methods or data sets will be used in producing CPS or groundfish stock assessments (or in providing management advice) if there is a reasonable expectation that doing so will result in an improved assessment relative to a status quo assessment that did not use the new method or data set.

Proposing a New Methodology for Review

The proponents of new methods or data sets for use in CPS or groundfish stock assessments will submit a 1-2 page proposal for consideration by the SSC and the Council. The proposal should be submitted by the briefing book deadline of the appropriate Council meeting, and should address the following:

- Title
- Name of proposers (including the researchers who will participate at the methodology review and will be expected to conduct analyses during that review).
- How the proposed methodology will improve assessment and management for the stock(s) in question.
- Outline of methods (field and analytical).

Proponents of methods to be reviewed should be prepared to present their proposal to the SSC, the relevant MT, and the full Council. Proponents should also include a description of the funding, logistics, or other factors that would indicate the likelihood of success of the proposed methodology

The proposed methodology should be field tested, and preferably there will be available data for one or more years. Untested or experimental methods are typically not appropriate for this type of review.

Methodology reviews are intended for methods or data sets that apply to a range of stocks. A STAR Panel would be more appropriate for reviewing methods or data sets that apply to only one or to a small number of related stocks.

Responsibilities of Methodology Proponents

If the Council recommends review of the methodology, the proponents will appoint a representative to coordinate work with the panel and attend the panel meeting. A representative of the proponents should attend the SSC meeting at which the outcomes from the panel review are discussed.

The proponents are responsible for preparing two versions of the methodology review document:

1) a "draft", including an executive summary, for discussion during the review meeting; and
2) a "final" version for presentation to the SSC, the Council, and the relevant Management Team and Advisory Panel.

The proponents will distribute "draft" documents fully describing the methodology to the panel, Council staff, and the MT and AP representatives at least two weeks prior to the review meeting. The proponents are responsible for bringing analysis methods and relevant data (in digital format) to the review meeting so that data can be analyzed on site and sensitivity analyses conducted. In most cases, the proponents should produce a revised document outlining the methodology (and preliminary results / responses to the panel recommendations) three weeks after the end of the panel meeting (including any internal agency review).

The proponents and the panel may disagree on technical issues, but “final” documents must include a point-by-point response by the proponents to each of the panel recommendations.

The draft and final reports on the methodology should include information that addresses the following:

- Data requirements of a new methodology or documentation of how information in a new data set was collected.
- The situations/stocks for which the methodology or data are applicable.

- The assumptions of the methodology and whether those assumptions are likely to be satisfied by data sets to which the method would be applied.
- An evaluation of robustness of the methodology to departures from the underlying assumptions.
- An application of a new methodology to real or simulated data, including an evaluation of the bias and accuracy of the results.
- An evaluation of how the new method(s) or data set(s) would improve stock assessments or the provision of management advice.

REPORT ON THE MEETING OF SCIENTIFIC AND STATISTICAL COMMITTEE GROUNDFISH AND ECONOMIC SUBCOMMITTEES AND GROUNDFISH MANAGEMENT TEAM

The Groundfish and Economic Subcommittees of the Pacific Fishery Management Council's Scientific and Statistical Committee (SSC) met with Council's Groundfish Management Team (GMT) on April 2, 2012 in Seattle, WA to address questions raised by the GMT regarding rebuilding analysis.

Rebuilding plans, developed based on rebuilding analyses, reflect a complex interplay of legal issues, economic effects, and biological constraints. The meeting started with Ms. Mariam McCall of NOAA General Counsel providing a brief overview of a series of legal challenges to the Council's rebuilding plans, with Court decisions (in compliance with Magnuson-Stevens Act and National Standard 1) requiring stocks to be rebuilt as fast as possible, but allowing for minimal bycatch to provide access to healthy stocks. Dr. André Punt of the SSC gave an overview of rebuilding software (also known as the "Puntalizer") which is currently used to conduct rebuilding analyses for West Coast groundfish species. Mr. Corey Niles then presented the GMT issues regarding rebuilding analysis. These issues were initially described in a GMT Report developed for the November 2011 Council meeting (Agenda item J.4.b).

The GMT concerns were distilled to three science-related topics: (1) long-term economic effects of rebuilding plans, (2) criteria to evaluate adequacy of rebuilding plans, and (3) alternative strategies for rebuilding. The discussion on these three topics is summarized below:

(1) **Long-term economic effects of rebuilding plans**

The GMT expressed concern regarding whether current rebuilding plans properly balance conservation goals and economic needs of fishing communities. Mr. Corey Niles presented an analysis of petrale sole rebuilding alternatives and showed that the total yield of petrale sole between 2011 and 2021 would be lower when rebuilding takes place as fast as possible than when some fishing is allowed (14,700 versus17,519-19,624mt).

To evaluate whether the same would be true for other species, Dr. André Punt developed a Schaefer model-based simulator at the meeting. This simulator compares long-term (100 year) yield from a stock that was fished at F_{MSY} for the entire time period (Alternative 1) with the same stock, but with no fishing allowed until the stock recovers to B_{MSY} (Alternative 2). In most cases explored, the long-term yield under Alternative 2 exceeded that of under Alternative 1, indicating that the GMT result is unlikely to be true in general. It should be noted that in contrast to the simulator, the GMT analysis accounts for "transient" effects, such as the initial age-structure, which a Schaefer model ignores.

The SSC agreed that a proper evaluation of the trade-off between the short-term needs of fishing communities and long-term conservation benefits requires a long-term analysis. Such an analysis, however, would need to acknowledge the multi-species nature of the fishery, since rebuilding stocks restrict access to healthy populations, and economic costs and benefits of rebuilding are primarily measured in changes in access to healthy populations. Also, such an analysis would have to include a measure of fishing community needs and an evaluation of how fishing community needs change over time. Existing technical tools are inadequate for such an analysis. Two potential projects were discussed that would contribute to understanding community effects.

Dr. André Punt agreed to explore an extension of the rebuilding software to enable a multi-species rebuilding analysis. A trial ("proof of concept") version of the revised software, to be developed this year, would include a limited number of species. John DeVore agreed to work with Dr. Punt to select species for a trial version and provide information needed as input for the analysis.

Dr. David Sampson, Ms. Cindy Thomson and Dr. Andi Stephens recently received two years of funding to develop an improved version of a generalized bioeconomic simulator (the initial version of which already exists, Sampson and Scott 2010). This bioeconomic simulator could be used to evaluate trade-offs between conservation and economic benefits by mimicking multiple stocks occupying multiple spatial regions, with harvesting by multiple fishing fleets. One of the proposed applications is to evaluate the socioeconomic effects of rebuilding strategies for overfished groundfish. The SSC would be willing to review the bioeconomic simulator once it is fully developed and tested.

The SSC Groundfish and Economic Subcommittees agreed that the "Puntalizer" should be modified to calculate indicators which might help evaluate the probability of species extinction. These indicators would be the probability of dropping below the spawning output when the stock was first declared overfished and at the start of the current cycle. None of the groundfish rebuilding stocks is listed as threatened or endangered under the ESA. The fishing on overfished stocks has been severely restricted, and it is likely that probability of extinction will be negligible in all cases. The software already computes the probability of spawning output dropping below $0.01B_0$. Nevertheless, additional outputs that quantify whether any decline below the initial level is likely to occur would help the Council consider the issue.

It was also suggested that rebuilding analyses should report streams of annual catches associated with different rebuilding options, so that subsequent revenues could be calculated and appropriate discounting applied, to facilitate the economic analysis of trade-offs. A constant F scenario, which maintains the stock at its current status, could also be provided for contrast with rebuilding plans. This may better enable evaluation of potential yield lost due to rebuilding. However, it should be recognized that a single-species analysis would only allow the evaluation of the yield of a rebuilding species, and would not account for the yield of targeted species that produce fishery revenue, and access to which is limited by the species under rebuilding.

The SSC Groundfish and Economic Subcommittees also agreed that the "Puntalizer" should be modified to enable projections with actual catch being different from the expected, which is currently set to the Annual Catch Limit (ACL), to enable exploration of implications of "implementation error", when catch of overfished species is generally lower than the ACLs.

(2) **Criteria to evaluate adequacy of rebuilding plans**

Most rebuilding analyses incorporate uncertainty from several sources, including (a) uncertainty propagated from a stock assessment, and (b) uncertainty in future recruitment. Therefore, some departures from the median rebuilding trajectory should be expected, as a result of changes in assessment models, whether recruitment was different from generated, and whether the rebuilding plan was (or was not) closely followed. The SSC was asked to provide recommendations on criteria to determine whether progress in rebuilding can be considered adequate, given uncertainty associated with rebuilding analysis.

Current practice is to consider revisions to rebuilding plans every 2-year assessment cycle, when new assessments and rebuilding analyses are conducted. At this time scale, uncertainty in rebuilding analysis is dominated by assessment uncertainty and, therefore, revisions are mostly tracking the variation in rebuilding trajectory due to changes in the assessment model, and not due to actual changes in stock status. Revisions to rebuilding plans cause stress to the management system and can produce economic disruption; therefore development of objective criteria to evaluate adequacy of the rebuilding plans (to separate "signal" from "noise") and determine whether rebuilding plans should be revised is a worthwhile goal.

As a solution, a meta-analysis of successive rebuilding analyses was discussed as a means to empirically evaluate uncertainty in rebuilding trajectories and estimates of T_{TARGET}. To separate "natural" variability in T_{TARGET} estimates (caused by recruitment uncertainty or by deviation from the rebuilding plan) from that caused by assessment uncertainty, rebuilding analyses from successive update assessments could be used for retrospective comparison, since update assessments, by definition, only differ from one another in the amount of data used and not in the assessment model. No timeline was set for such a meta-analysis at the meeting.

(3) **Alternative to constant SPR rate strategies for rebuilding**

Currently, many rebuilding analyses use catch streams from applying a constant spawning potential ratio (SPR) to generate projections as it is the simplest approach to follow, and constant SPR rate projections have become a default standard for Council rebuilding analyses. There are also legitimate reasons for using a constant SPR rate policy instead of a constant catch strategy, since the latter is expected to lead to higher rates of encounter of overfished [rebuilding] species over time, which would require increasingly constraining management actions. The SSC has recommended projections based on constant SPR as a reasonable default practice, and has also recommended this default be used as a point of departure for developing more complex rebuilding approaches. The choice of harvest streams to use while rebuilding is a policy decision. Potential alternatives to a constant SPR rate policy include phase-in strategies, or allowing catches to change every 5-10 years. Performance of alternative approaches should be compared to that when the catch stream is generated from a constant SPR rate. The SSC will revise the rebuilding Terms of Reference (TOR) to reflect this recommendation.

Summary of recommended additions to the "Puntalizer" and rebuilding analysis TOR

To facilitate evaluation of trade-offs between the short-term needs of fishing communities and long-term conservation goals, as discussed earlier in this document, it was recommended to modify the "Puntalizer" to output the following:

- The probability of dropping below the spawning output when the stock was first declared overfished and at the start of the current cycle, to help the Council consider the issue of species extinction probability;
- A stream of annual catches associated with different rebuilding options, so that subsequent revenues could be calculated and appropriate discounting applied, to facilitate the economic analysis of the trade-offs;
- A constant F projection scenario, which would maintain the stock at its current status, in contrast to when rebuilding plan is followed, to evaluate yield lost due to rebuilding;
- Projections with actual catch being different from the expected (currently set equal to the ACL), to enable exploration of implications of "implementation error", when catch of overfished species is below the ACL.

The rebuilding analysis TOR should also be revised to include these new recommended outputs from the "Puntalizer". It was also suggested that the rebuilding analysis TOR encourages evaluation of alternatives to a constant SPR rate projection, with performance of alternative approaches compared to the current constant SPR rate default.

References

Sampson, D.B., Scott, R.D. 2010. Simulation model evaluation of some fisheries balance indicators. Proceedings of the International Institute of Fisheries Economics & Trade.

List of Participants

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COMMENTS FROM MEMBERS OF THE GROUNDFISH MANAGEMENT TEAM TO THE SCIENTIFIC AND STATISTICAL COMMITTEE REGARDING THE STOCK ASSESSMENT AND REBUILDING ANALYSIS TERMS OF REFERENCE DOCUMENTS AND CONTINUING ISSUES WITH THE EVALUATION OF REBUILDING PLANS

Introduction

This report was written as input for the Scientific and Statistical Committee's (SSC) discussion to take place under this agenda item, scheduled for the morning of September 14. The full Groundfish Management Team (GMT) will discuss these issues at the meeting and may submit a supplemental report to the Council. However, the SSC will have likely finalized its recommendations to the Council by the time the GMT convenes to have its discussion on this agenda item.

The comments below focus on the draft Terms of Reference (ToR) documents for groundfish stock assessments and rebuilding analyses, and on the report drafted by the SSC's Economics and Groundfish subcommittees summarizing our April 2012 discussion on rebuilding plans. The summer months did not allow for full GMT discussion of these issues. What follows are comments submitted by individual GMT members based on an April 2012 discussion, a pre-September 2012 Briefing Book draft report from the SSC's Groundfish and Economics Subcommittees, and a review of the ToR documents made available in the June 2012 Briefing Book.

A. Comment on the Draft Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014

The GMT only has one comment to highlight on the ToR for stock assessment. As stated in June, there is a request that the ToR recognizes the Pacific Fishery Information Network database as the standard source of commercial landings data for California instead of CalCOM, for both full and data-moderate assessments.[1]

[1] http://www.pcouncil.org/wp-content/uploads/D3b_SUP_GMT_JUN2012BB.pdf

B. SSC Comments on the Report of the Meeting of the Groundfish and Economic Subcommittees and Groundfish Management Team

We thank the SSC's Economic and Groundfish subcommittees for the informative presentations and constructive discussion that occurred at the April 2012 joint meeting on the questions and issues the GMT has raised on the Council's rebuilding plans. The subcommittees' report from that meeting captures the core of that discussion well, and those GMT members commenting here were generally supportive of the recommendations contained in the subcommittees' report. Those commenters do have a few points of clarification and elaboration, some of which are made simply to provide additional context for those that did not attend the April 2, 2012 meeting. Comments are also offered as a means of helping the SSC decide which changes to include in the ToR document for rebuilding analyses, discussed specifically in the last section of this document, and also to further next steps in the rebuilding plan discussion.

The three topics used in the report are a helpful way of categorizing the issues and questions raised by the GMT.

1. Long-term economic effects of rebuilding

- The report's heading only mentions economic effects being of long-term concern. Economics is indeed one of the key issues the GMT has raised, yet the GMT and members of the public have noted other long-term policy concerns and tradeoffs potentially at play with rebuilding, such as ecological consequences and specific qualities/characteristics of fish populations (e.g., natural age structure, changed life history traits from selective pressure of fishing, etc.). To reflect these other considerations, we have characterized the overall question as being about the long-term conservation performance of rebuilding.

- The report's lead-in sentence on this subsection characterizes the GMT's concern as being about the proper balance between conservation goals and economic needs of fishing communities. We want to make clear that the GMT's role and motivation is analytically driven. Deciding what is "proper" is a matter of policy and law. Our motivation is to inform those policy and legal decisions better than we have done to date. Long-term tradeoffs haven't been explored and, as a result, we don't know what type of balance is being struck currently. That is the main concern of the GMT. Our engagement with the SSC is meant to determine the extent to which our best available science can speak to long-term tradeoffs now, and what can and would need to be done to improve methods and data. We do not seek to weigh in on the question of what balance is proper.

- On that note, we are encouraged by the report's mention of the multispecies models under development. We understand as well as any the complexities of this multi-species, multi-sector fishery and hope to be helpful to these efforts.

- While the multispecies methods are still in development, there is still interest in exploring the streams of annual catches from the rebuilding analysis for what they say about the tradeoffs in long-term yield and the economic value associated with that yield. The subcommittees' report contains discussion and a recommendation for pursuing such analysis. Members of the GMT see producing a formal analysis for SSC review as the best next step.

- At the same time, the report points to Dr. Punt's Schaefer model-based simulation results and the finding that the shutdown-until-rebuilt rebuilding strategy generally produces the most long-term yield from a stock. This is not what we see in the rebuilding analysis projections. More discussion on what is likely or "unlikely to be true in general" would be interesting and helpful.

- The subcommittees' suggestion for communicating the difference between rebuilding and endangered or threatened status would be valuable. As noted in earlier reports, we suspect that the perception that overfished status equates to "dire" conditions for the stock is not uncommon.

- Some GMT members would like to give strong support to the "implementation error" idea raised in the subcommittee report. This "error" would factor in the effect of actual catch deviating from predicted catch. On the whole, the Council's policies have kept actual catch below the ACL. At the same time, as we have noted before, the assumption about future catch can be quite influential to estimates of T_{TARGET} for slow rebuilding stocks like yelloweye. Until this feature is added, the effect of implementation error could be bracketed by comparing two or more rebuilding alternatives. The GMT could work with rebuilding analysis authors on a set of realistic, manageable scenarios. This issue is also connected to the discussion on alternatives to the constant spawning potential ratio (SPR) approach to rebuilding, as discussed below.

2. Criteria to evaluate adequacy of the rebuilding plans

We appreciate the subcommittee report's summary of this topic and offer the following additional comments:

- The report's discussion in this section is excellent and provides a direct response to the questions the GMT was asking. The objective criteria for defining adequate progress in rebuilding would be very valuable. There is a need to help the Council and public differentiate the signal that calls for a management response from the noise that is expected given the uncertainty in estimates of past, current, and future stock status and abundance.

- The Amendment 24 Working Group also discussed the need for better interpretation of rebuilding analysis results, and will likely recommend pursing a workshop or meeting to further discuss how management can best respond to changes in rebuilding plans.

- Changes between assessment cycles can be substantial enough that the "adequate progress" question makes little sense when evaluated by comparing two assessments. The Pacific ocean perch situation from this past cycle is a good example. In such situations, the suggestion is that the better picture of adequate progress is given from the within-assessment look, that is, from the best available information in the most recent assessment on how the stock has changed since rebuilding measures were implemented.

- In addition to the evaluation of adequate progress, some see an additional question at play when substantial changes in rebuilding estimates occur. Sometimes those changes are so substantial that the Council is posed with an entirely different problem from a policy perspective. Without performance metrics pegged to specific objectives that rebuilding is meant to achieve (i.e., the objective function we use now is largely the probability of hitting T_{TARGET}—we do not have additional yield-based metrics typically explored in management strategy evaluation and other such simulation-based studies), it is difficult to evaluate how the policy tradeoffs have changed. Additional metrics could help the Council and public better understand how the bigger, longer-term picture has changed.

- There is interest in understanding how the uncertainty in estimates of the $B_{unfished}$ level and alternative approaches to estimating that parameter, like that used in the North Pacific, might be taken into account when estimating rebuilding times.

- There is also interest in exploring how we define T_{TARGET} years and track progress against them. There was some discussion at the meeting about how T_{TARGET} estimates could better reflect and be made more robust to the expected changes in rebuilding estimates (e.g., a time period bracketed by the 40th and 60th percentiles). Short of redefining the T_{TARGET} dates, more discussion about the uncertainty would be helpful in the context of specific rebuilding plans.

- One comment expressed the view that the manner in which progress is judged adequate or not now seems overly “one-tailed” in its look at uncertainty—i.e., progress is deemed not adequate even if the T_{TARGET} looks unachievable by a few months, which is a resolution we really do not have in these projections. It may be helpful to consider the cumulative probability approach together with a two-tailed look at the projections meant to give a sense of when rebuilding is most likely to occur. There is also interest in exploring how the confidence intervals from the assessment of stock scale, status, and productivity might be brought into the evaluation of adequate progress in rebuilding and for changes that are more reflective of noise than signal in the data.

- On that note, it came to our attention at the meeting that the Puntalyzer already reports 95 percent confidence intervals for certain outputs (e.g., stock abundance by year). These confidence intervals have not typically been included in rebuilding analyses, or at least have not been used. Some on the GMT specially requested and then discussed these intervals and their interpretation in June for canary rockfish. The suggestion is that confidence intervals, either at the 95 percent level or something narrower, be included in the rebuilding analyses reports and interpreted for the Council. Confidence intervals could be helpful in communicating the signal versus noise question when comparing alternative rebuilding strategies.

- The confidence intervals may also inform the range of rebuilding alternatives that are chosen for analysis in the future. As an example, in GMT discussions this past cycle we considered whether the range of canary alternatives was appropriate or whether, based on the scientific information contained in the projections, the alternatives were based on non-differentiable differences in SPR harvest rates. We did not have objective criteria to inform that discussion.

- The issue of fixed steepness parameters and rebuilding projections was also raised at the meeting by the GMT. It was raised as one example of how rebuilding projections are not equal in terms of how they factor in uncertainty. For example, the yelloweye rebuilding analysis may take into account more uncertainty in its projections than does the darkblotched rebuilding analysis. The suggestion is that differences be taken into account and communicated to the Council and public.

3. Alternatives to constant SPR rate strategies for rebuilding

All who commented on the subcommittees' report were in favor of including various flexible rebuilding scenarios on top of the constant SPR rate alternatives considered now. The GMT and Council staff could work with stock assessment and rebuilding analysis authors on a manageable range of alternatives to explore for each stock.

There are several good reasons for making the SPR harvest rate the default rebuilding policy. From the science perspective, we understand that certain estimates and relationships are more robust to changes in stock assessments. Yet the main policy justification underlying the constant SPR rate approach has been the so-called rebuilding paradox, where catch rates are expected to increase as stocks rebuild.[2] The analogy is that "needs of fishing communities" are subject to inflation, and like wages or budgets, will go backwards if allowable catches remain constant.

While the rebuilding paradox is conceptually applicable, the constant SPR harvest rate assumes that inflation in the "needs of fishing" communities occurs in lock step with the increase in stock abundance. Based on several factors, such as the uncertainty in estimates of stock abundance and rebuilding, the broad-scale and precautionary management measures in place like the Rockfish Conservation Areas, and highly variable recruitment of some rockfish, a smooth increase in catch rates like those anticipated by the constant harvest rate strategy would seem to be the exception more than the rule. The situation seen this past cycle with the unknown size of the incoming bocaccio year class is a good example of a situation where increases in catch rates would be expected to be less than smooth. At the same time, actual catches of bocaccio in recent years have been much lower than would be allowed by the constant SPR harvest rate.

All in all, the GMT members commenting here strongly support a look at rebuilding strategies that better reflect the management reality we see. As mentioned above, the implementation error analysis discussed above—i.e., the recognition that projections of catch are uncertain and likely to differ from actual catch—should be built into the analysis of alternatives to the constant SPR approach (implementation error is applicable to constant harvest rate approaches as well).

C. Comments on the Draft Terms of Reference for the Groundfish Rebuilding Analysis for 2013-2014

We have few specific comments on the proposed changes to this ToR document at this time. In general, those commenting here are most concerned that the SSC take into account the comments made above when the SSC considers what changes are included in the ToR document. We are also unsure which changes need to go into the ToR in order to be included in the next assessment cycle versus those that can still be looked at via other means. The GMT Chair and Vice Chair will be attending the SSC discussion, as will various other GMT members, and may make specific requests and suggestions at that time.

- It was commented that some matters the ToR describes as optional should be expressed to make them more mandatory. An example can be on page 5, where the ToR reads:

[2] Since it is expected, some think we should stop calling it a "paradox."

> "… the SSC encourages analysts to explore alternative assumptions, calculations and projections that may more accurately capture uncertainties in stock rebuilding than the default standards identified in this document, and which may better represent stock-specific concerns."

The thought is that analysts should actively explore which methods best capture uncertainties.

- It was also noted that the ToR does not seem to mention the inclusion of the yield projections discussed in the subcommittees' report. Rebuilding analyses sometimes only include abbreviated summaries of the time series output to save space in the document. The GMT could work with the rebuilding analyses authors on how to best display that information.

- As requested above, it is suggested that the rebuilding analyses include confidence intervals around the rebuilding projections for each alternative. Again, the form in which they are presented could be made flexible so that documents remain manageable.

PFMC
08/24/12

NMFS REPORT ON GROUNDFISH STOCK ASSESSMENT PLANNING FOR 2013

This report includes supplemental information pertaining to three issues under Council consideration in September: the need for a sablefish assessment in 2013, selection of the 8th species for final slot in next year's four "full-assessment" STAR panels, and identification of candidate species for inclusion in the "data-moderate" STAR panel.

Sablefish

At the June 2012 Council meeting, the Northwest Fisheries Science Center (NWFSC) committed to providing the Council with additional information bearing on the value of conducting a sablefish assessment in 2013. Subsequently, the 2011 assessment model was updated with 2011 catch data, along with biomass and length-composition information from the 2011 trawl survey. No age compositions were added to the model, nor were length compositions from the fishery. Figure 1 illustrates the updated survey biomass index, with model fits. The point estimate of survey abundance in 2012 is slightly higher than those of the prior three years; however, it lies within the confidence interval of the 2008-10 estimates.

The principal difference between the 2011 and 2012 models is a slight increase in scale throughout the spawning biomass time series. The updated model's estimate of unfished spawning biomass is 4.1% higher than in the 2011 model, while the estimate of spawning biomass in 2012 is 6.1% higher. As a result, the depletion ratio in the updated model is slightly higher (32.4%) than in the 2011 model (31.8%). Although this increase provides a slightly higher buffer, relative to the Minimum Stock Size Threshold (25%), the spawning biomass remains on a downward trajectory, awaiting the maturation of somewhat larger recent cohorts.

These new results are generally very consistent with the 2011 assessment and suggest that, barring radical differences in the 2012 survey and fishery, a new assessment of sablefish in 2013 would result in little change in the stock's outlook or harvest specifications. Because of fishery changes associated with the implementation of catch shares in 2011, and the structure of the 2011 assessment model, conducting an update of that assessment is not recommended. Since conducting a new full assessment in 2013 appears unlikely to produce findings that differ greatly from the 2011 assessment's projections, we recommend that a full assessment of sablefish be conducted next in 2015.

Alternatives for the Final Full-Assessment Slot

Aside from sablefish, the Council narrowed its focus for the 8th full-assessment species to rougheye and yellowtail rockfishes at its June 2012 meeting. To assist Council consideration of this decision, data from the AFSC Triennial trawl survey and the NWFSC trawl survey are summarized in Table 1 and Figure 3. Rougheye rockfish has been assigned the highest vulnerability score of all species included in the Groundfish FMP, and has never been assessed. Additionally, as noted by the GMT in 2011, the fishing mortality of rougheye has exceeded its estimated OFL contribution (*ex post*) to the Northern Slope Rockfish assemblage in several recent years. Rougheye has not been well selected by Pacific coast trawl surveys; however, the substantially larger commercial catch of rougheye has been subject to routine biological sampling, which could provide important information regarding stock structure that would not be included in a data-moderate assessment. Rougheye rockfish otoliths have not previously been aged by the NWFSC-PSMFC Cooperative Ageing Project (CAP), which carries some uncertainty regarding the ability to conduct an age-structured assessment for the stock. Although commercial landings reconstructions have been completed for California and Oregon, the lack of a reconstructed landings history for Washington, which is nearer the species' abundance center, will represent a challenge for an assessment of any kind for rougheye rockfish. Despite its limited survey data, if rougheye is not selected for a full assessment in 2013, it should be strongly considered for a data-moderate assessment.

Yellowtail rockfish was an important target species throughout the 1980s and 1990s, and numerous assessments of the species were conducted from the mid-1980s through the early 2000s. The most recent assessment update was conducted in 2005. The value of the bottom trawl survey has been debated extensively throughout the review history of yellowtail assessments, due to the propensity for yellowtail to occupy mid-water depths, and the inability of early trawl surveys to sample at designated stations in the northern coast, because of rocky habitat. As a result, yellowtail assessments have included, over the years, additional fishery-dependent indices of abundance based on bycatch in the hake and pink shrimp fisheries. Re-examination of these various indices of abundance will require substantial work. Due to restrictions in harvest relating to the co-occurrence of yellowtail and canary rockfishes, yellowtail has been harvested at a modest percentage of its ABC over the past decade. However, with the completion of widow rockfish rebuilding in 2011, the prospect of increased mid-water targeting of widow may signal greater harvest of yellowtail rockfish, as well. Previous ageing of yellowtail rockfish otoliths has been conducted by the Washington Department of Fish and Wildlife, and it is uncertain whether that agency would have sufficient resources to age needed structures (or assist in training CAP agers) to accommodate a new full assessment. Because of the amount of work that would be required to re-evaluate fishery-dependent indices of abundance used in prior yellowtail assessments, yellowtail is not recommended for a data-moderate assessment in 2013, if it is not designated for a full assessment.

Species for the Data-Moderate STAR Panel

A second review of methods for assessing species using data-limited methods was held in Seattle during June 26-29 of this year. That meeting was chaired by Dr. Martin Dorn on behalf of the SSC, and included two members from the Center for Independent Experts. The Panel endorsed two methods for conducting "data-moderate" assessments as part of the 2013 review process. These assessments would supplement catch information with one or more indices of stock abundance, but would not explicitly include any length or age data. Accordingly, added value from applying these new methods, relative to previously used data-limited approaches, will rest largely upon the precision of the indices that can be developed for a species. The trawl surveys that have been conducted by the NWFSC and the Alaska Fisheries Science Center (AFSC) represent the principal sources of data with which fishery-*independent* indices of abundance can be created. The hook-and-line survey conducted by the NWFSC in the Southern California Bight is an additional source of fishery-independent data, although it is far more limited in its spatial and seasonal coverage. Fishery-*dependent* indices of abundance have been included in some full assessments of Pacific coast groundfish species, particularly nearshore ones that are not sampled by fishery-independent surveys, and have more commonly been based on data from recreational fleets. Management changes that have accompanied efforts to rebuild depleted Pacific coast stocks present some challenges to the development of fishery indices that encompass the past 10-12 years. However, fishery data provide the only potential source of trend information for many target species that are not sampled well, or at all, by existing trawl surveys.

Median index estimates (along with 95% confidence intervals and the numbers of hauls in which each species was caught) are presented in Table 2 and Figure 3 for the species which show the greatest promise for creating fishery-independent indices by 2013. This list includes three flatfish species [Vulnerability score in ()]—arrowtooth flounder (1.21), English sole (1.19), and rex sole (1.28)—two of which have been assessed previously, but long enough ago that those assessments are no longer considered "adequate" by NMFS. Although these two species have low vulnerability scores, their previous assessments would reduce the workload for assembling needed data and provide additional bases for evaluating the performance of new data-moderate models for these species. The list includes four rockfish—redbanded (2.02), rosethorn (2.09), sharpchin (2.05), and stripetail (1.8)—along with Pacific cod (1.34) and spotted ratfish (1.57). The three flatfish species and Pacific Cod are included in the NMFS Fishery Stock Sustainability Index (FSSI). The existence of current, adequate assessments for those species would increase the FSSI score for Pacific coast groundfish, which is included in reporting to Congress on assessment progress and stock status. Pacific grenadier is also an FSSI stock and was initially included in this list, but was removed after the discovery of an unusual pattern in AFSC slope survey data for the species, which has not yet been resolved. Although the status of and appropriate harvest levels for shortraker rockfish were the focus of new Council attention last year, fewer than 170 shortraker rockfish have been caught in 24 years of trawl surveys conducted by the AFSC (Triennial) and NWFSC.

In addition to these species, assessment scientists at the Southwest Fisheries Science Center have reviewed the recreational catch and effort information available for numerous species and believe that China (2.23), copper (2.27), quillback (2.22), brown (1.99), and vermilion (2.05) rockfishes offer the best short-term prospects for the development of informative abundance indices using recreational data (see Appendix 4 to the Report from the review of Assessment Methods for Data-Moderate Stocks.) Brown and vermilion rockfishes are also on the FSSI list, and it may be possible to construct a useful fishery-independent index, over the past decade, for vermilion, using data from the NWFSC hook-and-line survey.

In its recommendations for developing and reviewing data-moderate assessment in 2013, the Methods Review Panel suggests that a list of 6-12 promising candidate species be identified, with the possibility of culling poorly performing assessments from the group prior to the STAR review. This strategy would seem to provide the best opportunity to take full advantage of the STAR opportunity. Not knowing how quickly the STAR Panel will be able to review each data-moderate assessment, the Panel could be instructed to review as many of the available assessments as it can, given the meeting's time constraints. The choice of how many species will be included in the first year of this process is, however, a matter of workload and, in particular, the extent to which species are expected or desired to have assessments conducted using both XDB-SRA and exSSS methods. SSC discussion of the tradeoffs between the number of species for which assessments can be developed and reviewed and the benefits of having multiple model results for each species would be appreciated.

The STAR Panel's ability to focus on the performance and results of the assessment models would likely be enhanced by having the SSC's Groundfish Subcommittee review any new approaches that are being used to develop indices of abundance, along with any particularly troublesome catch data issues, prior to the STAR. Given the late April timing of the STAR panel, such a review would need to occur no later than the March Council meeting, and could perhaps be conducted immediately prior to or following that meeting's normal SSC gathering.

The report of the Data-Moderate Assessment Methods Review also suggests that the results of these intermediate-level assessments not be used for determining stock status, in an official sense, but for identifying stocks that are high priorities for upcoming full assessments, based on the depletion level estimated. Although results from data-moderate assessments, in general, may be subject to greater uncertainty than those from most full assessments, it is not clear that the differences will be of such a magnitude as to warrant this limitation on the interpretation and use of results. Within the NMFS Stock Assessment Improvement Plan (SAIP), the lowest level of "adequate" assessment is defined as Level 3, in which an assessment is "based on time series of catch and an abundance index to support application of a dynamic model." Models meeting this minimum standard are used elsewhere in the nation for status determination, and it is not clear what factors would disqualify the proposed data-moderate assessments from also being used for this purpose. The implications of restricting the determination of stock status from data-moderate assessments may have greater consequences than may have been considered by the Methods Review Panel, and should be considered carefully by the Council, in consultation with NMFS, its advisory bodies, and the public.

Figure 1. Model fit to the updated trawl-survey GLMM index (2003-2011) in a mini-update of the 2011 sablefish assessment model.

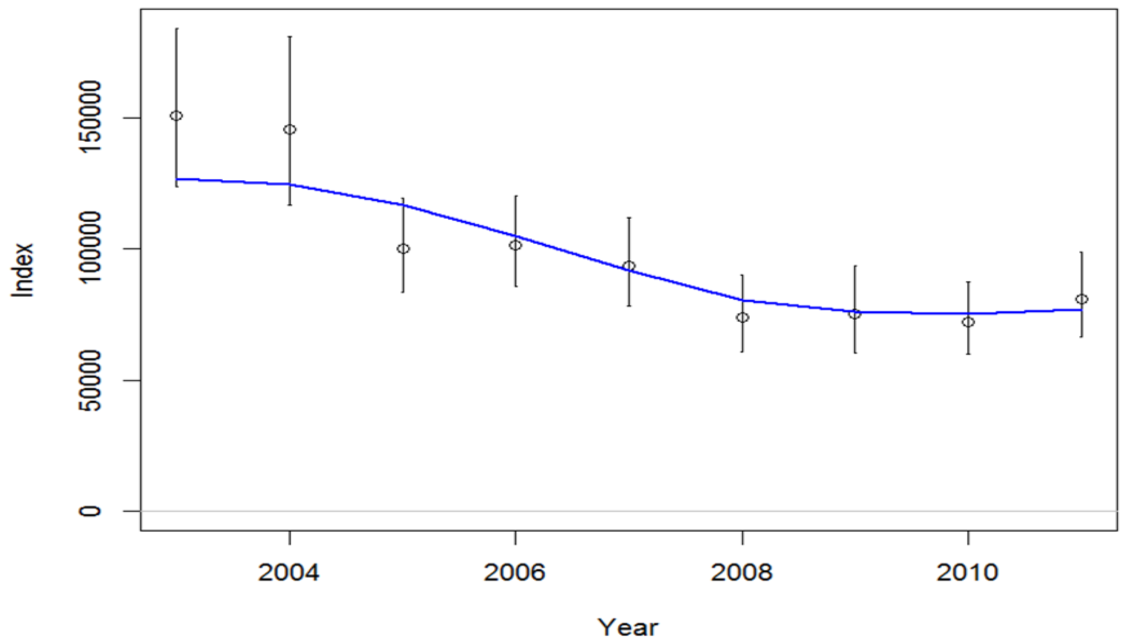


Figure 2. Sablefish spawning biomass and depletion, as estimated in 2011, and in a 2012 mini-update of that model, with 2011fishery catch, and survey biomass and length-composition data.

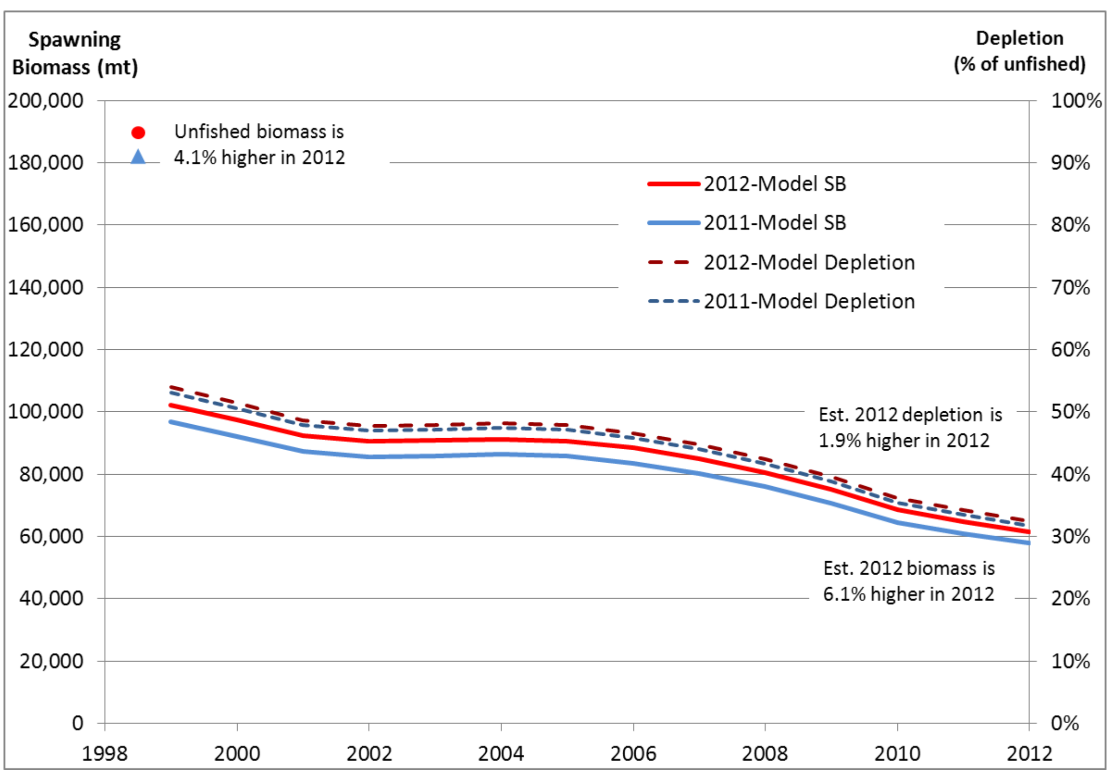
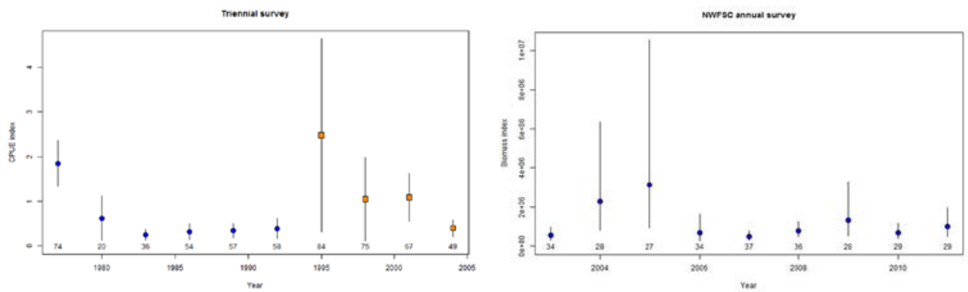


Table 1. Survey encounter frequencies and abundance index estimates for rougheye and yellowtail rockfishes.

		AFSC Triennial Survey Index										NWFSC Trawl Survey Index (in millions)								
Species	Metric	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004	2003	2004	2005	2006	2007	2008	2009	2010	2011
Rougheye rockfish	Upper	2.36	1.12	0.37	0.49	0.50	0.61	4.64	1.98	1.63	0.58	0.97	6.35	10.53	1.67	0.79	1.29	3.30	1.20	1.96
Vulnerability= 2.27	**Median**	**1.85**	**0.62**	**0.25**	**0.32**	**0.34**	**0.39**	**2.48**	**1.05**	**1.09**	**0.40**	**0.56**	**2.30**	**3.15**	**0.71**	**0.51**	**0.80**	**1.33**	**0.70**	**1.01**
FSSI species	Lower	1.34	0.13	0.12	0.15	0.18	0.17	0.32	0.12	0.55	0.22	0.32	0.83	0.94	0.30	0.33	0.50	0.54	0.41	0.52
	N	**74**	**20**	**36**	**54**	**57**	**58**	**84**	**75**	**67**	**49**	**34**	**28**	**27**	**34**	**37**	**36**	**28**	**29**	**29**
Yellowtail rockfish	Upper	20.66	8.81	13.78	10.99	30.22	14.72	2.98	20.52	17.27	21.18	99.32	34.55	49.62	31.84	91.62	56.12	41.85	72.72	93.76
Vulnerability= 1.88	**Median**	**12.01**	**5.34**	**8.58**	**7.66**	**15.94**	**9.87**	**1.89**	**14.02**	**9.43**	**13.39**	**30.84**	**14.76**	**23.55**	**10.83**	**33.90**	**17.06**	**13.48**	**31.50**	**35.25**
FSSI species	Lower	3.36	1.88	3.39	4.33	1.66	5.01	0.80	7.52	1.59	5.60	9.58	6.31	11.17	3.68	12.54	5.18	4.34	13.64	13.25
	N	**96**	**100**	**190**	**140**	**75**	**93**	**72**	**130**	**58**	**54**	**35**	**27**	**47**	**36**	**45**	**37**	**41**	**47**	**48**

Figure 3. Survey encounter frequencies (# of hauls above years) and abundance index estimates: rougheye and yellowtail rockfishes.

Rougheye rockfish



Yellowtail rockfish

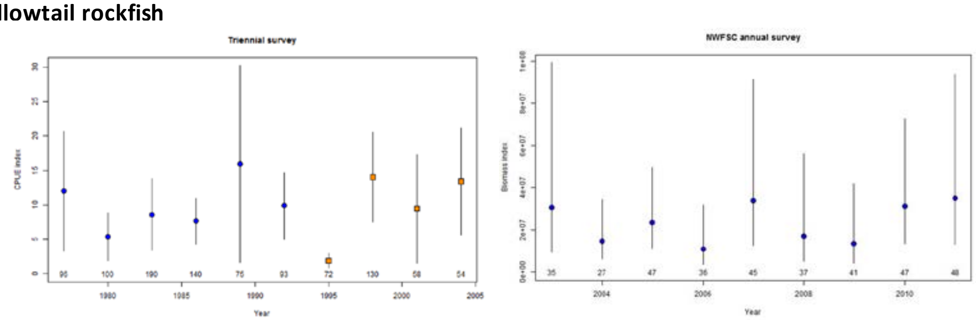
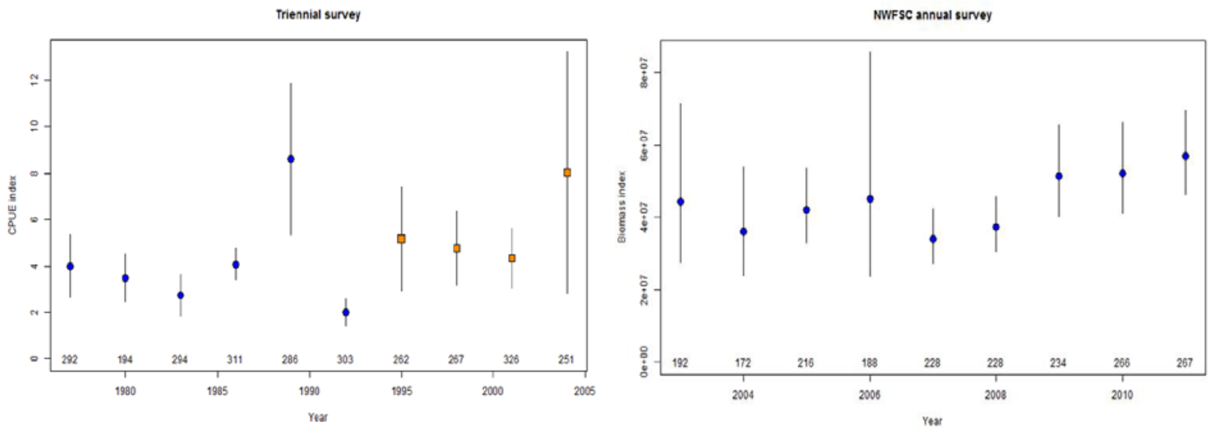


Table 2. Survey encounter frequencies and abundance index estimates for data-moderate candidate species.

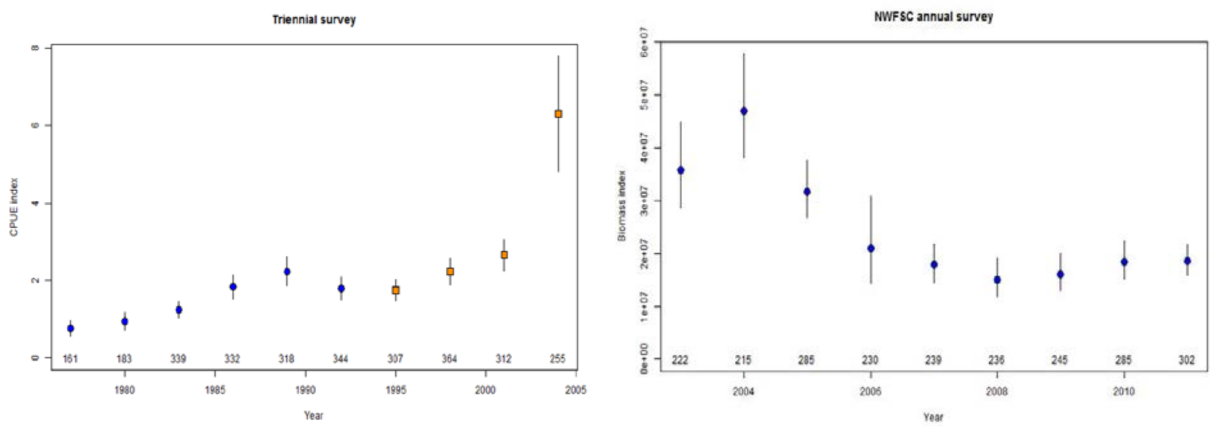
		AFSC Triennial Survey Index										NWFSC Trawl Survey Index (in millions)								
Species	Metric	1977	1980	1983	1986	1989	1992	1995	1998	2001	2004	2003	2004	2005	2006	2007	2008	2009	2010	2011
Arrowtooth flounder	Upper	5.33	4.53	3.62	4.75	11.88	2.58	7.40	6.37	5.60	13.24	71.37	54.01	53.71	85.53	42.30	45.60	65.57	66.32	69.55
Vulnerability= 1.21	**Median**	**3.99**	**3.49**	**2.74**	**4.07**	**8.60**	**2.00**	**5.18**	**4.76**	**4.33**	**8.04**	**44.31**	**35.94**	**42.17**	**45.05**	**34.01**	**37.35**	**51.44**	**52.16**	**56.86**
FSSI species	Lower	2.66	2.46	1.86	3.39	5.33	1.43	2.95	3.15	3.07	2.84	27.51	23.92	33.11	23.73	27.34	30.60	40.35	41.03	46.48
	N	**292**	**194**	**294**	**311**	**286**	**303**	**262**	**267**	**326**	**251**	**192**	**172**	**216**	**188**	**228**	**228**	**234**	**266**	**267**
English sole	Upper	0.98	1.18	1.44	2.14	2.61	2.10	2.04	2.57	3.05	7.79	44.93	57.82	37.57	30.85	21.85	19.10	19.92	22.26	21.65
Vulnerability= 1.19	**Median**	**0.77**	**0.95**	**1.24**	**1.84**	**2.24**	**1.80**	**1.75**	**2.23**	**2.66**	**6.30**	**35.81**	**46.97**	**31.68**	**21.06**	**17.85**	**14.99**	**16.04**	**18.42**	**18.59**
FSSI species	Lower	0.56	0.72	1.04	1.53	1.87	1.50	1.47	1.89	2.26	4.82	28.54	38.16	26.72	14.37	14.59	11.77	12.91	15.24	15.96
	N	**161**	**183**	**339**	**332**	**318**	**344**	**307**	**364**	**312**	**255**	**222**	**215**	**285**	**230**	**239**	**236**	**245**	**285**	**302**
Rex sole	Upper	1.21	1.01	1.87	1.67	2.20	2.05	2.66	3.71	4.39	8.05	62.77	67.51	57.91	56.64	51.95	38.74	41.08	44.86	48.91
Vulnerability= 1.28	**Median**	**1.07**	**0.86**	**1.61**	**1.50**	**1.97**	**1.80**	**2.38**	**3.34**	**3.91**	**7.13**	**55.54**	**58.87**	**51.50**	**49.43**	**46.77**	**34.29**	**35.81**	**39.99**	**43.62**
FSSI species	Lower	0.93	0.71	1.34	1.33	1.73	1.56	2.09	2.98	3.44	6.21	49.14	51.34	45.80	43.15	42.10	30.36	31.22	35.66	38.89
	N	**514**	**308**	**482**	**447**	**469**	**454**	**492**	**508**	**492**	**371**	**350**	**312**	**424**	**397**	**425**	**398**	**398**	**443**	**431**
Redbanded rockfish	Upper	1.02	1.62	2.15	0.80	0.40	0.52	0.35	0.23	0.35	0.32	1.47	6.29	0.95	0.81	2.51	0.86	0.64	0.50	0.91
Vulnerability= 2.02	**Median**	**0.79**	**1.07**	**1.36**	**0.48**	**0.28**	**0.36**	**0.26**	**0.17**	**0.20**	**0.21**	**1.05**	**1.72**	**0.57**	**0.48**	**0.81**	**0.49**	**0.38**	**0.32**	**0.57**
Non-FSSI species	Lower	0.56	0.52	0.58	0.16	0.16	0.21	0.18	0.12	0.05	0.11	0.75	0.47	0.35	0.28	0.26	0.28	0.23	0.20	0.35
	N	**137**	**57**	**89**	**48**	**78**	**62**	**97**	**82**	**85**	**62**	**63**	**37**	**54**	**48**	**52**	**54**	**53**	**37**	**52**
Rosethorn rockfish	Upper	0.53	0.50	0.91	0.62	1.18	1.13	1.06	0.39	0.64	1.03	8.63	4.90	9.60	4.25	5.84	4.83	11.51	6.36	6.08
Vulnerability= 2.09	**Median**	**0.32**	**0.34**	**0.64**	**0.40**	**0.83**	**0.78**	**0.70**	**0.27**	**0.42**	**0.54**	**5.31**	**2.89**	**4.37**	**2.73**	**3.19**	**2.58**	**4.85**	**3.50**	**3.59**
Non-FSSI species	Lower	0.11	0.17	0.38	0.18	0.48	0.43	0.35	0.14	0.19	0.06	3.27	1.71	1.99	1.75	1.74	1.38	2.04	1.92	2.12
	N	**56**	**48**	**80**	**60**	**75**	**67**	**54**	**61**	**43**	**31**	**63**	**41**	**47**	**58**	**53**	**44**	**58**	**56**	**63**
Sharpchin rockfish	Upper	6.18	6.41	20.30	5.40	7.68	15.40	7.41	8.59	15.01	3.52	278.60	54.20	47.62	14.50	5.55	9.17	20.87	1.79	80.80
Vulnerability= 2.05	**Median**	**3.78**	**4.35**	**12.09**	**3.00**	**4.35**	**8.31**	**4.52**	**3.98**	**5.68**	**2.04**	**117.59**	**22.61**	**19.31**	**7.24**	**2.53**	**3.99**	**7.03**	**0.86**	**34.50**
Non-FSSI species	Lower	1.38	2.30	3.88	0.60	1.02	1.22	1.62	0.00	0.00	0.56	49.63	9.43	7.83	3.61	1.15	1.73	2.37	0.41	14.73
	N	**77**	**67**	**106**	**87**	**101**	**95**	**64**	**62**	**47**	**54**	**53**	**33**	**35**	**43**	**35**	**26**	**39**	**43**	**49**
Stripetail rockfish	Upper	8.14	16.31	11.64	4.95	7.96	8.24	8.77	5.58	6.73	9.85	25.62	50.53	45.92	24.54	24.55	38.77	32.92	15.16	25.39
Vulnerability= 1.8	**Median**	**6.02**	**9.41**	**6.34**	**3.24**	**5.12**	**4.92**	**6.11**	**4.10**	**4.78**	**6.78**	**17.42**	**30.21**	**27.47**	**16.03**	**14.42**	**21.85**	**19.51**	**9.62**	**16.13**
Non-FSSI species	Lower	3.90	2.50	1.03	1.53	2.27	1.60	3.45	2.63	2.83	3.71	11.84	18.06	16.43	10.46	8.47	12.31	11.56	6.11	10.24
	N	**168**	**64**	**98**	**82**	**138**	**93**	**167**	**126**	**113**	**118**	**117**	**115**	**135**	**136**	**138**	**121**	**148**	**166**	**160**
Pacific cod	Upper	2.45	3.70	2.97	1.99	4.40	2.07	2.77	1.03	1.96	3.26	8.50	8.74	2.88	4.97	1.17	1.05	1.88	36.48	53.29
Vulnerability= 1.34	**Median**	**1.96**	**2.34**	**1.96**	**1.59**	**3.00**	**1.57**	**1.53**	**0.79**	**1.44**	**2.63**	**6.31**	**5.66**	**1.67**	**1.77**	**0.61**	**0.62**	**1.09**	**11.45**	**14.69**
FSSI species	Lower	1.48	0.98	0.95	1.19	1.61	1.07	0.29	0.55	0.91	2.01	4.68	3.67	0.97	0.63	0.32	0.36	0.63	3.59	4.05
	N	**83**	**42**	**83**	**148**	**108**	**90**	**52**	**65**	**35**	**68**	**69**	**48**	**28**	**14**	**25**	**19**	**21**	**49**	**34**
Spotted ratfish	Upper	1.19	1.82	0.71	0.54	1.18	0.81	2.16	1.30	0.76	2.42	47.78	32.50	82.33	31.57	37.53	31.55	23.26	21.80	35.79
Vulnerability= 1.57	**Median**	**0.69**	**0.92**	**0.57**	**0.40**	**0.83**	**0.61**	**1.24**	**0.80**	**0.62**	**1.62**	**30.10**	**22.09**	**39.44**	**21.13**	**26.18**	**24.09**	**18.15**	**17.04**	**24.46**
Non-FSSI species	Lower	0.19	0.02	0.43	0.26	0.49	0.40	0.33	0.30	0.47	0.82	18.96	15.01	18.89	14.14	18.26	18.39	14.15	13.31	16.72
	N	**245**	**143**	**254**	**229**	**238**	**208**	**272**	**322**	**301**	**257**	**255**	**247**	**331**	**328**	**351**	**349**	**310**	**350**	**327**

Figure 3. Survey encounter frequencies (# of hauls above years) and abundance index estimates for data-moderate candidate species (bars indicate 95% confidence intervals).

Arrowtooth flounder



English sole



Rex sole

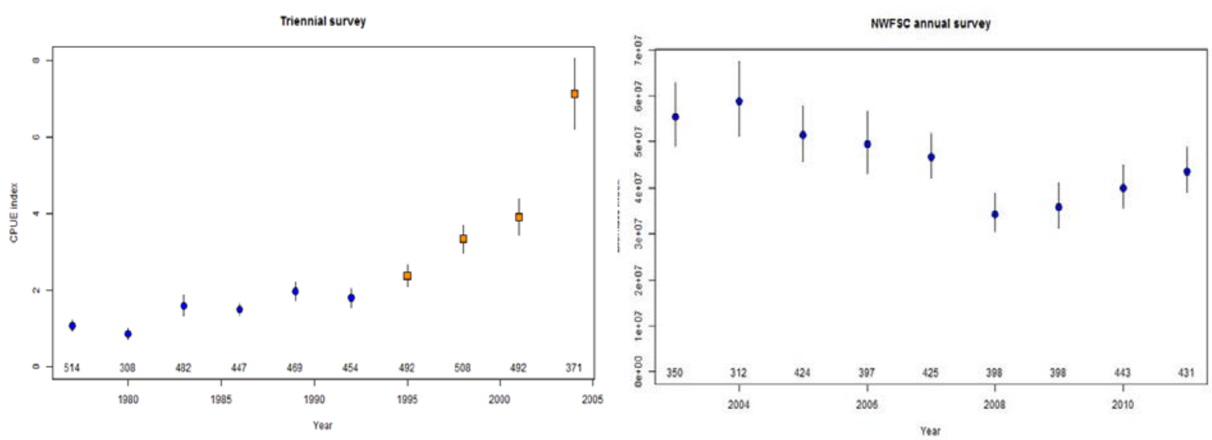
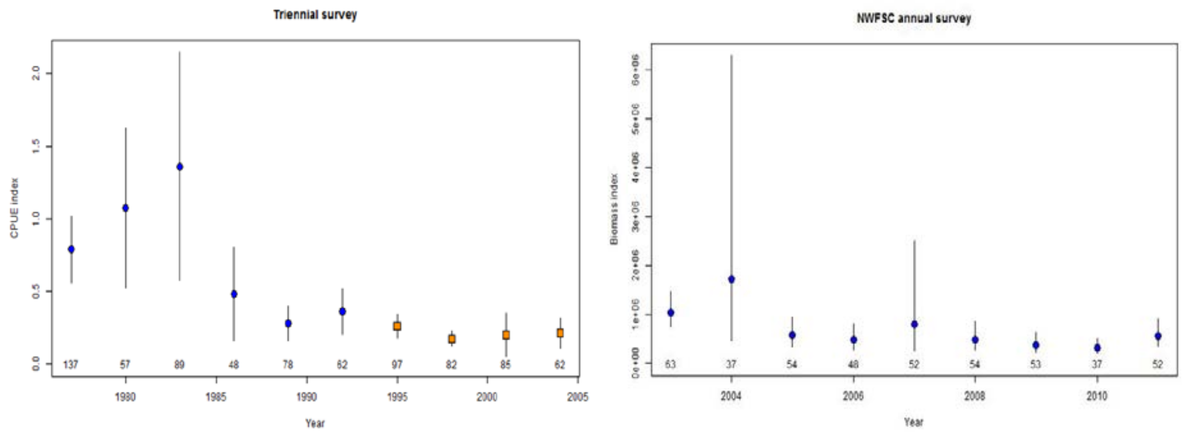
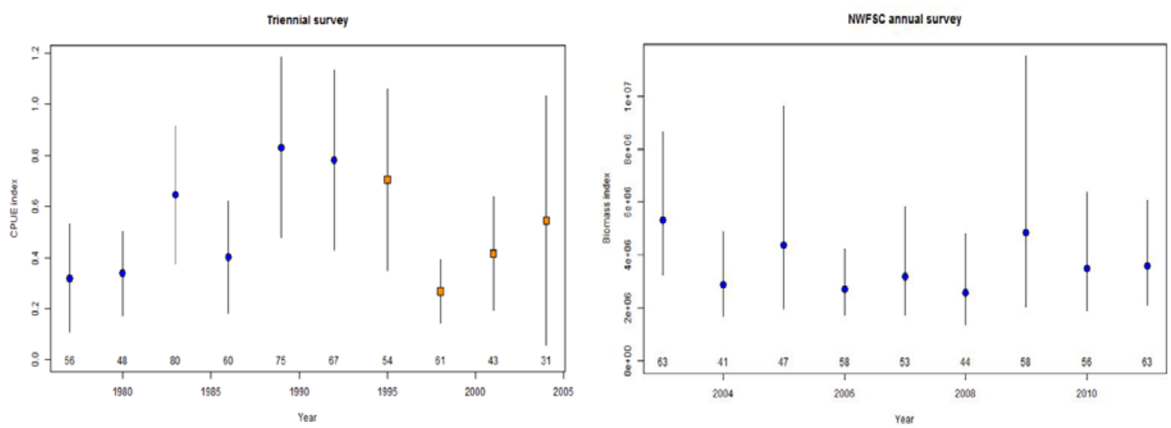


Figure 3 (cont.). Survey encounter frequencies (# of hauls above years) and abundance index estimates for data-moderate candidate species (bars indicate 95% confidence intervals).

Redbanded rockfish



Rosethorn rockfish



Sharpchin rockfish

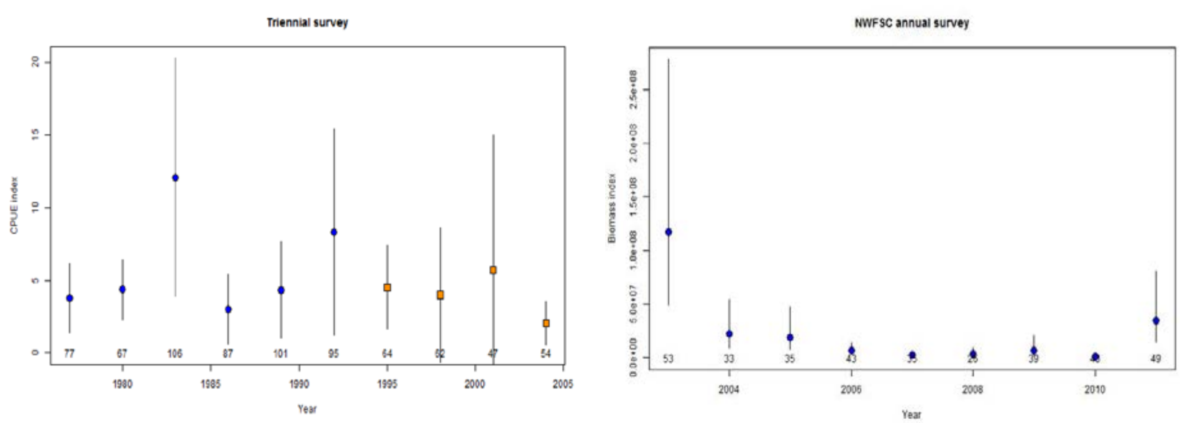
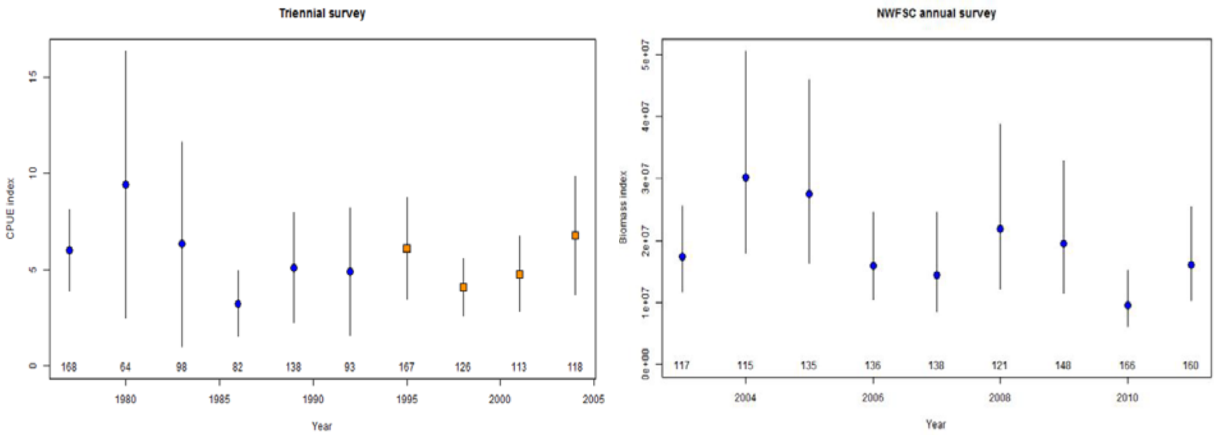
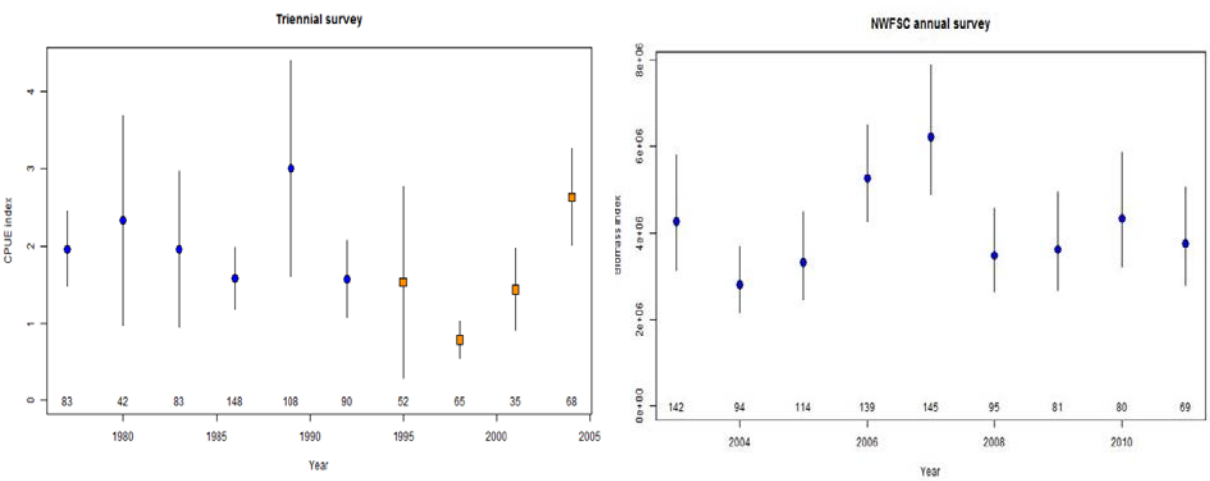


Figure 3 (cont.). Survey encounter frequencies (# of hauls above years) and abundance index estimates for data-moderate candidate species (bars indicate 95% confidence intervals).

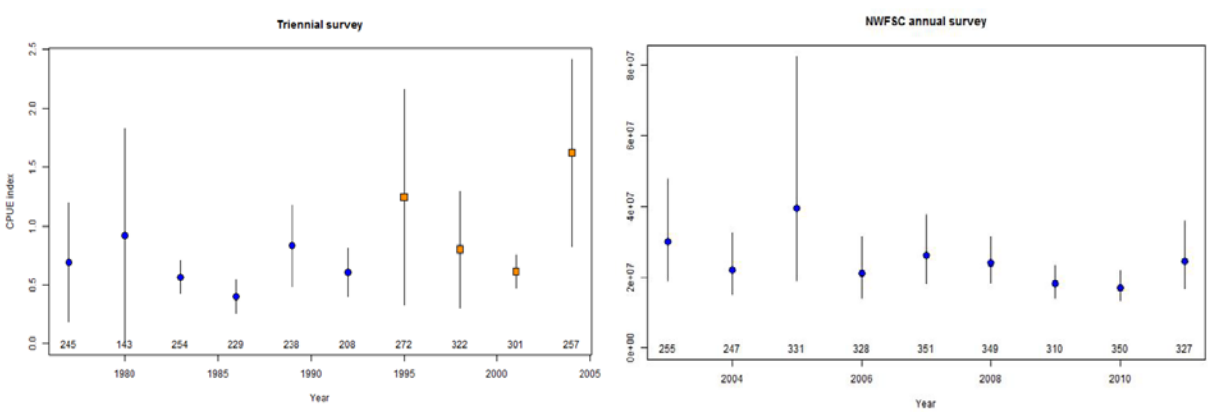
Stripetail rockfish



Pacific cod



Spotted ratfish



GROUNDFISH ADVISORY SUBPANEL REPORT ON STOCK ASSESSMENT PLANNING FOR 2013

The Groundfish Advisory Subpanel (GAP) was briefed by Dr. Jim Hastie and Mr. John DeVore regarding stock assessment planning for 2013 and offers the following recommendations for Council consideration.

The GAP continues to support doing full assessments for the following stocks in 2013: aurora rockfish, cowcod, darkblotched rockfish, longspine thornyhead, shortspine thornyhead, Pacific sanddabs, petrale sole, and yellowtail rockfish.

The GAP continues to recommend doing a full yellowtail rockfish assessment. Yellowtail rockfish are a species of growing importance economically to both the recreational and commercial sectors. Yellowtail was the eighth most important stock in the 2011 individual fishing quota (IFQ) fishery in terms of volume of total catch and a higher rate of trawl targeting of yellowtail rockfish is anticipated in the near future. In fact, 2012 catch data indicates that we are ahead of the pace in the 2011 IFQ fishery. The GAP also hopes that implementation of techniques such as floated longline leaders will allow greater recreational and commercial line gear access to yellowtail rockfish. The GAP suggests it would be wise to do a full assessment of this stock since the last full assessment was done over 10 years ago.

The GAP discussed when to conduct the next sablefish assessment. While industry continues to report seeing large numbers of the 2008 and 2010 year classes in the fishery which the recent 2011 assessment suggested may be quite substantial, the “mini-update” assessment done by the Northwest Fisheries Science Center this summer suggests that a new assessment in 2013 will not significantly change our understanding of stock status. The GAP therefore believes that waiting one more cycle to assess the stock will provide more information for management decision-making.

The GAP is also comfortable with doing an update assessment for bocaccio and data reports for canary, Pacific ocean perch (POP), and yelloweye.

The GAP had considerable discussion regarding data-moderate assessments in 2013. The GAP is deeply concerned with the prospect of determining stock status using assessment methods that do not incorporate all the available data that may inform status. A case in point was presented at the Data-Moderate Assessment Methods Review Workshop where a data-moderate sablefish assessment result was compared to that of the 2011 full assessment. The data-moderate assessment did not incorporate composition data (i.e., length and age data) as per the rule for a data-moderate assessment. The data-moderate assessment result indicated the stock would be overfished without incorporating composition data. The GAP notes that the Review Workshop participants recommended that if a data-moderate assessment result indicates a stock might be overfished, the stock should be prioritized for a full assessment in the next cycle.

However, the GAP also heard that such a process may not be defensible and that a status determination from a data-moderate assessment may stand according to NMFS national standards. This is a serious concern since an overfished declaration would necessitate management under a rebuilding plan even if a new assessment in the next cycle indicated the stock was never overfished. The GAP strongly recommends a formal process be developed that only considers the results of a full assessment for determining stock status before implementing new assessment methods that intentionally limit the input data.

In the event that such a process is developed or the Council is compelled to recommend doing data-moderate assessments in 2013 despite these concerns, the GAP recommends prioritizing the following stocks for data-moderate assessment: copper rockfish, China rockfish, vermilion rockfish, brown rockfish, rougheye rockfish, English sole, rex sole, stripetail rockfish, and sharpchin rockfish. These stocks have a relatively greater amount of data informing an assessment, represent a variety of taxa for testing these new methods, and includes some of the most vulnerable stocks to overfishing based on the GMT's PSA analysis (i.e., copper, China, and rougheye rockfish). English sole is recommended for a data-moderate assessment since there are recent, yet outdated assessments (a full assessment in 2005 and an update in 2007) to compare results.

The GAP has no recommended changes to the three Terms of Reference.

Summary of GAP Recommendations

2013 Full assessments

1) **Aurora Rockfish**
2) **Cowcod**
3) **Darkblotched Rockfish**
4) **Longspine Thornyhead**
5) **Shortspine Thornyhead**
6) **Pacific Sanddabs**
7) **Petrale Sole**
8) **Yellowtail Rockfish**

2013 Update Assessments

1) **Bocaccio**

2013 Data Reports

1) **Canary Rockfish**
2) **Yelloweye Rockfish**
3) **POP**

2013 Data-Moderate Assessments

1) **Copper Rockfish**
2) **China Rockfish**
3) **Vermilion Rockfish**
4) **Brown Rockfish**
5) **Rougheye Rockfish**
6) **English Sole**
7) **Rex Sole**
8) **Stripetail Rockfish**
9) **Sharpchin Rockfish**

PFMC
09/16/12

Agenda Item H.3.b
Supplemental GMT Report 2
September 2012

GROUNDFISH MANAGEMENT TEAM REPORT ON STOCK ASSESSMENT PLANNING

The Groundfish Management Team (GMT) discussed three major topics under this agenda item: (i) Category 2, data-moderate assessments; (ii) Category 1, full assessments; and, (iii) the rebuilding terms of reference (TOR).

(i) Category 2 (data moderate) assessments

The GMT supports the data-moderate Assessment Review Panel's approval of two abundance index-only methods for conducting Category 2 stock assessments. The Northwest Fisheries Science Center (NWFSC) and Southwest Fisheries Science Center (SWFSC) provided information on and proposed several candidate species for consideration as Category 2 assessments to be conducted during the next assessment cycle (Agenda Item H.3.b, NMFS Report, September 2012). The GMT reviewed those species and recommendations and offers the following considerations.

The GMT recognizes that there are several reasons one may conduct a Category 2 stock assessment:

- **a)** to elevate the assessment degree of a Category 3 stocks to Category 2 (e.g., the majority of candidate stocks in the Science Centers' list);
- **b)** to maintain Category 2 stock assessment as current (e.g., arrowtooth flounder);
- **c)** to address resources limitations in performing full or update assessments for Category 1 stocks that have expired (e.g., English sole), and
- **d)** the availability of at least one index of abundance, which is the basic requirement to qualify as a Category 2 assessment and often the most informative data source.

There are not enough resources to do Category 2 assessments for every stock listed by the Science Center. Developing abundance indices, defining catch histories, and detailing the life histories all take time. It is also unclear how many stocks a review panel can reasonably review. Arguments can thus be made for and against including more or less stocks.

One important consideration is that the quality and availability of abundance index information will affect the success of applying any Category 2 assessment. To that end, it is unknown at this time which of these candidate species will ultimately produce informative Category 2 assessments. Any recommendation of Category 2 candidate stocks needs to consider that attempts may fail to produce viable stock assessments for those stocks.

Balancing the desire to inform management for as many species as possible, while also respecting resource limitations, the team suggests that 8-10 stocks be initially targeted for Category 2 assessments. **The GMT recommends that the stock assessment teams (STATs) be allowed the leeway to prioritize selection of candidate stocks for data-moderate assessment using metrics such as vulnerability score, available data, etc**. **Furthermore, we recommend that the Council allow prioritization of stocks once they are assessed that are presented to the review panel, in case the panel is unable to review them all.** One option of post-assessment prioritization would be to have species presented in order of their stock status, with lower status first.

To expedite the review process of these stocks, the GMT recommends any new data sources (catch reconstructions or abundance index) or methods to create indices of abundance be vetted by the Scientific and Statistical Committee (SSC) groundfish subcommittee well before the review panel. This will allow the review panel to focus on model diagnostics and output rather than data and methods issues, allowing for throughput of more species. The GMT notes the potential that recommendations that come from such a meeting may also have implications for Category 1 stock assessments that apply similar data sources and methods.

Lastly, the data-moderate review panel questioned the use in management of stock status estimates coming from data-moderate methods. There is a precedent from other abundance index only Category 2 stock assessments that use the estimated stock status for management (e.g., cowcod). The worry is that highly uncertain assessments could have major management implications. Further, analysis has shown that Category 2 assessments can also produce substantially different results than full assessments.

The team recommends that the Council and SSC, with input from advisory bodies, define consistent protocols and decision rules on when and how to apply and interpret stock status from Category 2 stock assessments. However, this suggestion that Category 2 stock status be used to flag species for full assessment may only be fruitful if additional data (e.g. age or length compositions) is sufficient or collectible to support that full assessment. If not, the Category 2 estimate of status will remain the best estimate available like with cowcod. The decision rules and protocols could at least provide for that evaluation of which additional data is available and what it would take to collect additional data.

(ii) Full assessments

On the question of which species to select for the last full assessment slot, **the GMT recommends that rougheye take the last available assessment slot.** Yellowtail is of low management concern since it has been so lightly exploited in recent decades. We think that will hold true even if additional targeting takes place in the individual fishing quota (IFQ) fishery.

Rougheye is of greater concern because it is highly vulnerable and recent exploitation is above the estimate of its overfishing limit contribution to the minor slope rockfish north complex. In addition, there is some concern that there is relatively little survey data available for rougheye; a critical limitation for conducting a Category 2 data-moderate assessment. Moreover, it is our understanding that there is more data (e.g., age data from trawl survey and biological data from catch sampling over the last ten years) to contribute to a full rougheye rockfish assessment, data that cannot be used in the data-moderate approaches.

Lastly, a data moderate assessment would be an incomplete and inefficient way to address concern over the potential status of rougheye now. If the Council has that concern, as some of us do, a full assessment for rougheye would provide a more robust picture of the status and sustainable harvest level than a data moderate assessment could provide. In addition, as we understand it, the data situation will not change significantly between this and the next cycle.

(iii) Draft Terms of Reference for the Groundfish Rebuilding Analysis for 2013-2014 (Agenda Item H.3.a, Attachment 4)

Members of the GMT attended the SSC's discussion on this agenda item to continue the discussion on the questions and issues we have raised about the rebuilding analyses and our interpretation of them. The SSC has suggested some changes to the Terms of Reference based on our requests. We think these are important improvements that will allow exploration of various scenarios with the rebuilding projections.

As to the Agenda Item H.3.b, GMT Report, the comments there are directed at Agenda Item H.3.a, Supplemental Attachment 6. The Supplemental Attachment 6 report captures the discussion we had in April with SSC's Economics and Groundfish Subcommittees. We think that report and discussion were very helpful. We would like to schedule follow-up discussions with the SSC and will be making specific requests on those under Agenda Item G.6, Future Council Meeting Agenda and Workload Planning.

PFMC
09/16/12

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENT PLANNING

Methodology Review Recommendations

Collaborative Optical-Acoustic Survey Technique

The review of this technique concluded that the resulting estimates of abundance should not be used in Council stock assessments at this time, and provided several recommendations which should help to address the current concerns with the technique. The Scientific and Statistical Committee (SSC) endorsed the recommendations and conclusions of the Review Panel.

Data-Moderate Species Assessment Methods

Dr. Martin Dorn summarized the report of the Data-Moderate Panel. The Panel provided recommendations related to application of the catch data-only methods, Depletion-Corrected Annual Catch (DCAC), Depletion-Based Stock Reduction Analysis (DB-SRA) and Simple Stock Synthesis (SSS). In particular, the Panel recommended that the input probability distribution for depletion should take account of the score from the Productivity-Susceptibility Analyses, as this improved the ability of catch-only methods to replicate the results of Tier 1 assessments. The Panel also evaluated two data-moderate methods, Extended DB-SRA and Extended SSS, which use index data, and recommended that they be accepted for use in Council stock assessments. The Panel also outlined a process for reviewing the results of assessments conducted using data-moderate methods.

The SSC endorsed the conclusions and recommendations of the Panel regarding the modifications to the catch-only methods and the acceptability of the two data-moderate methods for use in Council stock assessments. It also agreed with the Panel that the first review of assessments based on data-moderate methods should be conducted by a full Stock Assessment Review (STAR) Panel, but that subsequently such reviews could be conducted by the SSC or its groundfish subcommittee.

The SSC noted that the data-moderate methods fill an important gap in the set of methods available to the Council, but their utility still needs to be fully understood. Specifically, both catch-only and data-moderate methods provide sustainable catch estimates which could be used to recommend over fishing limits (OFLs). However, data-moderate methods also provide estimates of spawning biomass relative to B_0, B_{MSY} and the overfished threshold. The Panel recommended that data-moderate assessments should not be used for status determination, but rather to identify whether there is potential concern with stock status, and to prioritize stocks for a full assessment at the earliest opportunity, at which time all available information should be considered. The SSC agreed that stock status estimates from data-moderate assessments should not automatically be accepted for use in status determinations. The SSC recommended that the Council develop a formal process for how to use the estimates of stock status from data-moderate assessments in management. As part of this process, assessment authors should be asked to summarize what other information is available, including the amount of age and length composition data (and number of unaged structures) from survey and fishery catches, when the results of data-moderate assessments are of concern. The SSC will use this information to comment on the value of conducting a full assessment.

Stock Assessment Planning

The SSC discussed the list of species to be assessed in 2013. Dr James Hastie presented the NMFS report on groundfish stock assessment planning for 2013 (Agenda Item H.3.b, NMFS Report).

The list of species for full assessments to be conducted in 2013 was previously discussed at the June Council meeting, where seven species were identified. NMFS developed the STAR Panel schedule to accommodate review of these seven species (Fig. 1). The STAR Panel schedule has space for one additional species to be fully assessed and reviewed. The SSC discussion focused on yellowtail and rougheye rockfish as candidates for the eighth species for full assessment. Rougheye rockfish has never been assessed, and it has the highest vulnerability score of all Groundfish Fishery Management Plan species. Yellowtail rockfish was most recently assessed in 2005 (as an update assessment). It has been harvested at a modest percentage of its annual catch limit (ACL) over the past decade. However, the prospect of increased targeting of widow rockfish may result in greater harvest of yellowtail.

The SSC agreed that it would be beneficial to assess both of these species. Regardless of which species the Council selects for full assessment, the other one should be assessed using data-moderate assessment methods. The SSC emphasizes that the full STAR process is better structured to deal with a stock for which status is of concern.

At the June meeting, the SSC and the Council also discussed whether an update assessment should be conducted for sablefish. NMFS conducted an additional analysis of sablefish to provide more information with which to evaluate the need for a sablefish update assessment in 2013. The 2011 assessment model was updated with 2011 catch data, along with biomass and length composition data from the 2011 trawl survey. The new results are consistent with the 2011 assessment, with depletion ratio being slightly higher than that from the 2011 model (32.4 percent versus 31.8 percent, respectively), suggesting that an update assessment of sablefish in 2013 would result in little change in model output. The SSC supports the NMFS recommendation not to conduct an update assessment for sablefish in 2013. The SSC requested that NMFS provide OFL and ACL estimates for 2015 and 2016 generated by the sablefish analysis. Those estimates were found to be very close to those produced by the 2011 assessment, which further supports NMFS recommendation to not conduct a sablefish update assessment in 2013.

The SSC also discussed the list of potential species for data-moderate assessments. NMFS presented a list of 15 species, including some that have previously been assessed (such as English sole and Arrowtooth flounder). At this point, there is significant uncertainty associated with how many data-moderate assessments can be conducted by NMFS, and how many can be thoroughly reviewed during a week-long STAR Panel. The SSC suggests capping the number of data-moderate assessments at 10, with some assessments being based on survey abundance indexes and some utilizing recreation fishery CPUEs. It may not be possible to conduct 10 data-moderate assessments because of data- and workload-related issues.

The SSC supports the NMFS recommendation to have methods used to develop indices of abundance (to be utilized in the data-moderate assessments) reviewed by the SSC Groundfish subcommittee prior to the data-moderate assessments STAR Panel; this would make STAR Panel review more efficient.

Review Meeting	Timing	Tentative Location	Species	
Hake Review (Treaty)	Late Feb.	Canada	Pacific Hake	
Data-Moderate Panel	4/29-5-3	Santa Cruz or Seattle	Number and Names To Be Determined	
Full Panel 1	5/13-5/17	Seattle	Petrale sole	Darkblotched or Yellowtail
June Council Meeting	6/18-6/25	Orange County	Petrale sole & Darkblotched/or/ Yellowtail STAR reports; Bocaccio update POP, Canary, & yelloweye data reports	
Full Panel 2	7/8-7/12	Seattle	Rougheye rockfish or Darkblotched	Aurora rockfish
Full Panel 3	7/22-7/26	Seattle	Shortspine thornyhead	Longspine thornyhead
Full Panel 4	8/5-8/9	Santa Cruz	Cowcod	Pacific sanddabs
Sept. Council Meeting	9/10-9/17	Boise	STAR reports for: shortspine and longspine, rougheye/or/darkblotched, and aurora rockfishes, cowcod, and Pacific sanddab	
Mop-up / Rebuilding	9/23-9/27	Seattle	Rebuilding analyses and continuing issues, as determined to be necessary	

Table 1. STAR Panel schedule for 2013 full and data-moderate stock assessments proposed by NMFS.

Approve Terms of Reference (TOR)

TOR for Stock Assessments

The SSC recommends the adoption of the STAR TOR (Agenda Item H.3.a) with an inclusion of a note that PacFIN should be treated in stock assessments as a standard source of commercial landings. This edit was suggested by the Groundfish Management Team (GMT).

TOR for Methodology Reviews

The SSC noted that the TOR require that revised versions of the documents reviewed by Methodology Panels be provided to the Council Advisory Bodies. However, this does not always occur. For example, no revised COAST documents were available at this meeting. The SSC requests that the TOR be updated to request that Panel chairs (1) identify which documents should be provided to the Council meeting at which the Panel report is to be reviewed by the SSC, and (2) ensure that this takes place.

TOR for Rebuilding Analysis

The SSC reviewed the GMT comments on the rebuilding TOR and on issues related to the evaluation of rebuilding plans. The SSC welcomed the GMT comments, which continue the discussion regarding the evaluation of rebuilding plans which was initiated during a meeting following the April 2012 SSC meeting. The SSC recommended that these discussions continue during further joint meetings. A key aspect for discussion is the development of an operational definition of “adequate progress of rebuilding”. The SSC has a process for evaluating such progress, but it is not currently based on documented quantitative measures. Developing such measures may require additional analyses.

The SSC recommended the following additions to the TOR:

- the time series of cumulative catches should be reported (Item 7f in Section 5).
- scenarios should include cases in which the realised catch is not equal to the annual catch limit (implementation error) (Section 2.5). Analysts should develop scenarios regarding implementation error with the GMT.

The ability of the GMT to interpret the results from rebuilding analyses will be greater if the output files from the rebuilding program (Puntalyzer) are available. The SSC therefore recommends that all input and output files be housed both at the Science Centers and at the Council office.

PFMC
09/15/12

Science, Service, Stewardship

Stock Assessment Planning

Michelle McClure and Jim Hastie
Northwest Fisheries Science Center

September 16, 2012

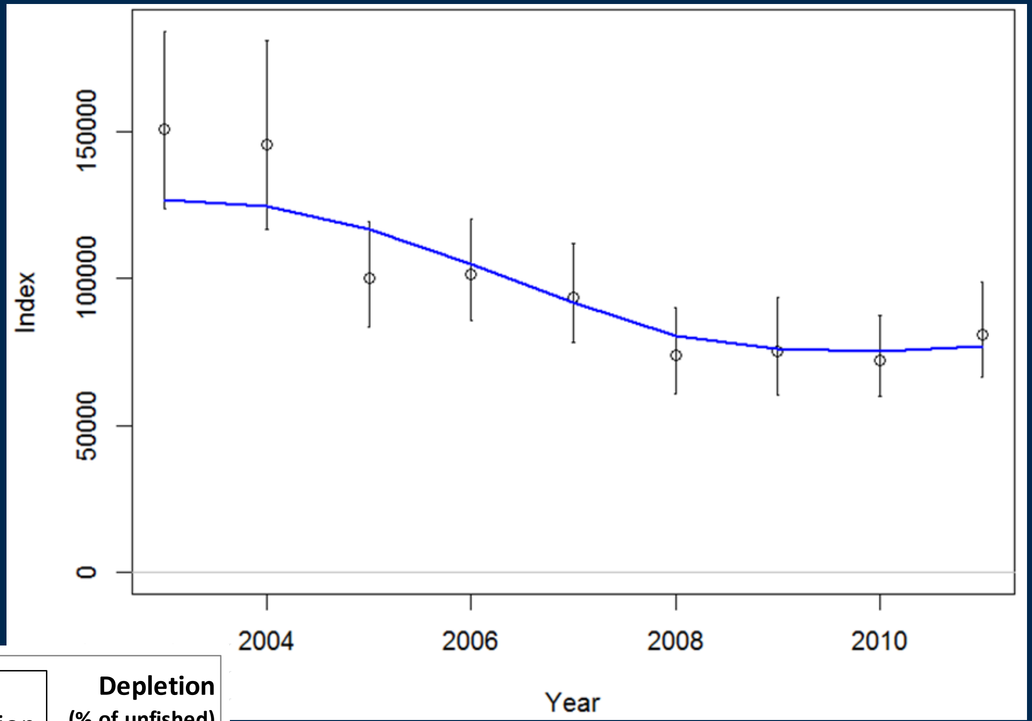
NOAA FISHERIES SERVICE

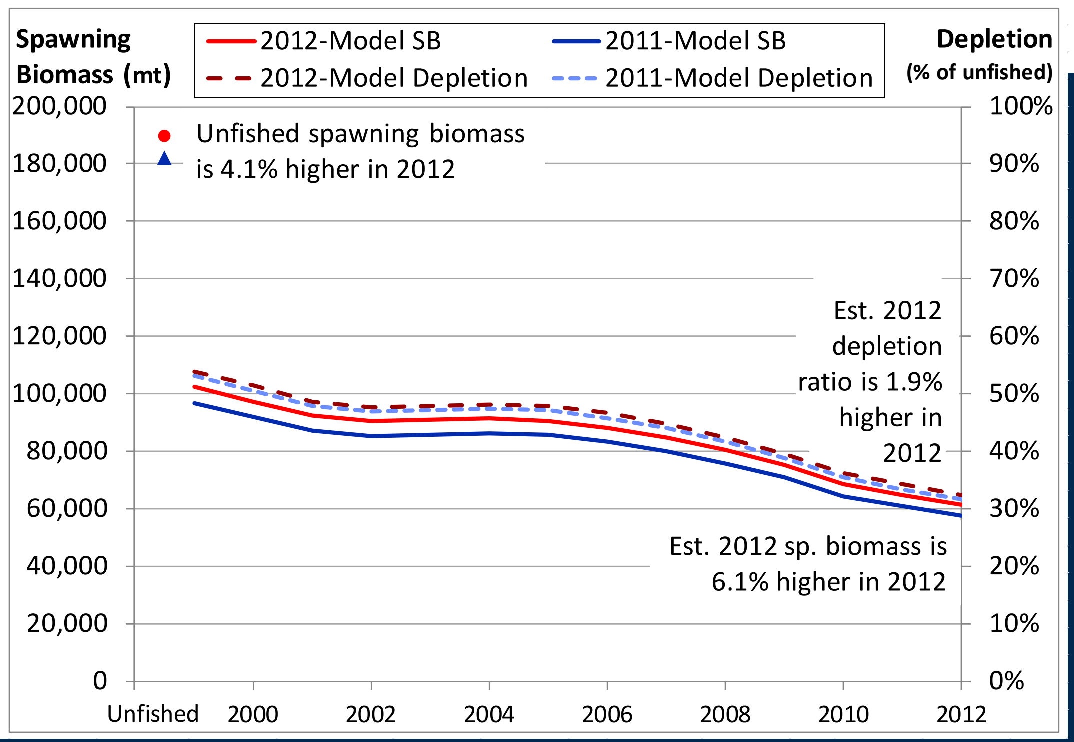
Issues

- Need for a sablefish assessment
  - Results from a mini-update of 2011 assessment
- Filling the last full-assessment slot
  - Rougheye – yellowtail – sablefish
- Consideration of how many and which species will be considered by a Data-Moderate STAR Panel
  - Interpretation of stock-status results from data-moderate assessments

Mini-update of the 2011 sablefish assessment model run with 2012 catch, survey index and survey length-composition data.

The GLMM survey index and the model fit to the index have no trend in recent years. →





← The 2012 mini-update assessment is consistent with the 2011 assessment. Differences are well within the uncertainty of the 2011 assessment and do not indicate substantial new information in the data.

Filling the Last Full-Assessment Slot

- In June, Council requested more information on rougheye and yellowtail rockfish

	Rougheye	Yellowtail
Vulnerability	2.27	1.88
FSSI stock	Yes	Yes
Catch-related issues -Recent possible over-harvest	Yes	No
-Future increase in targeting	No	Yes (w/ widow)
Survey CPUE Data	Limited	Limited
Survey age data: NWFSC	Yes	Yes
Survey age data: AFSC	Few	Yes
Survey length data	Yes	Yes
Fishery length/age data	> 1996/2002	Yes (aged)
WA pre-1981 landings series exists	No	Yes

Data-Moderate Issues

- We support moving forward with a review of data-moderate assessments in 2013
- The added value of the D-M vs Data-Poor approaches hinges on the information contained in the index
  - Index can be created using catch-effort data from a survey or from a fishery
- In this first round, it makes sense to cast a broad net in the number and type of species examined
  - Don’t know up front which species the method will work for
  - Don’t know how much time will be needed to review each one
- A number of species are proposed for consideration
  - Mix of index types and vulnerability scores

Data-moderate Candidate Species

Increasing Depth →

↑ Increasing Vulnerability

Vulnerability	Nearshore	Shelf-shallow	Shelf-deep	Slope
Major (V≥2.2)	*Copper (2.27)* *China (2.23)* *Quillback (2.22)*			Rougheye (2.27)
High (2.0≤V<2.2)		*Vermilion (2.05)*	Rosethorn (2.09) Sharpchin (2.05)	Redbanded (2.02)
Medium (1.7≤V<2.0)	*Brown (1.99)*	Ratfish (1.72)	Yellowtail (1.88)* Stripetail (1.80)	
Low (V<1.7)		English sole (1.19)*	P. cod (1.34) Rex sole (1.28) Arrowtooth (1.21)*	

Rockfishes
Flatfishes
Other fishes

*Out-of-date Tier-1/2 assessment

FSSI stock

Primary source for index data:

Trawl Survey

Recreational Fishery

Data Availability for Data-Mod. Indices

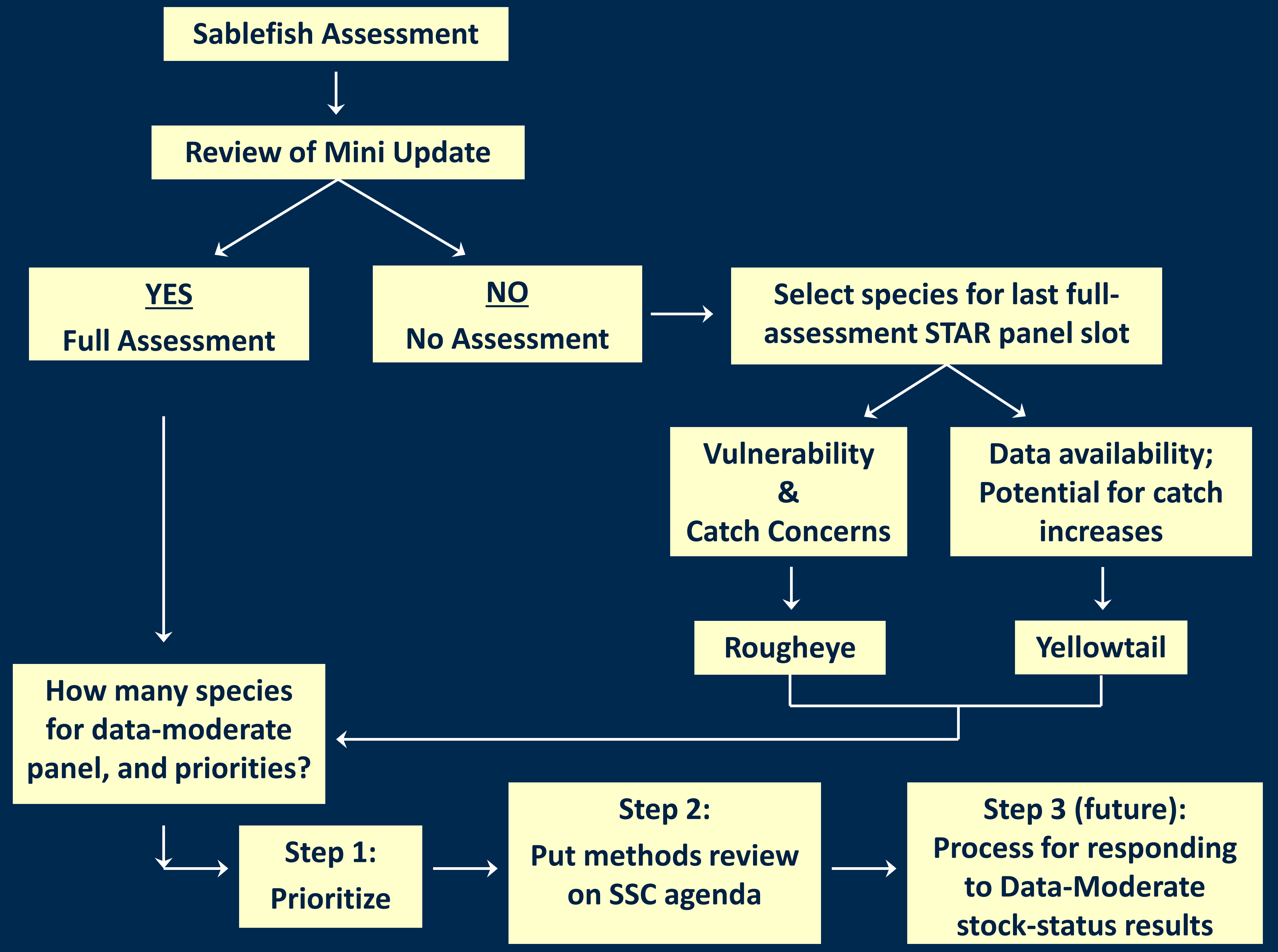
Species	Depth	Prior Assessment	FSSI	PSA	Index Data Availability	
					Surveys	Rec. Fisheries
Copper	Nearshore	N	N	2.27	Low (H&L)	High
Rougheye	Slope	N	Y	2.27	Low-Mod.	None
China	Nearshore	N	N	2.23	None	Moderate
Quillback	Nearshore	N	N	2.22	None	Moderate
Rosethorn	Shelf-deep	N	N	2.09	Low-Mod.	None
Sharpchin	Shelf-deep	N	N	2.05	Moderate	None
Vermilion	Shelf-shallow	N	Y	2.05	Low (H&L)	High
Redbanded	Slope	N	N	2.02	Moderate	None
Brown	Nearshore	N	Y	1.99	None	High
Yellowtail	Shelf-deep	2005 (Update)	Y	1.88	Moderate	None
Stripetail	Shelf-deep	N	N	1.80	High	None
Ratfish	Shelf-shallow	N	N	1.72	Moderate	None
P. cod	Shelf-deep	N	Y	1.34	Moderate	None
Rex sole	Shelf-deep	N	Y	1.28	High	None
Arrowtooth	Shelf-deep	2005	Y	1.21	High	None
English sole	Shelf-shallow	2007 (Update)	Y	1.19	High	None

Data-Moderate Wrap-up

- Given uncertainties, Council may want to guide the work by *prioritizing* species and allowing flexibility on the specific species that end up being reviewed
  - Likely 3-4 species using Rec CPUE and 6-7 using survey data
  - Although English sole and arrowtooth have low vulnerability scores, they will require little new work
- Analysts will attempt to complete assessments of the highest priority species using both D-M methods, subject to available time and model performance
- Best if Panel can focus on assessments, not methods
  - Helpful if SSC Groundfish Sub-Committee could review methods used to create indices and reconstruct WA catch data in March

Data-Moderate Status Determination

- The Methods Review Panel recommended that "results not be used for status determination"
- Simple assessments with catch series and an index are viewed as adequate under NMFS' SAIP, and are used for status determination elsewhere (although commonly where no other data are available)
- The PFMC's expedited D-M process will exclude information & restrict modeling options for most species
- We urge the Council to elicit input from the SSC and NMFS regarding the specification of a process for responding to adverse stock status results from D-M assessments in a proactive manner.


Sablefish Assessment
Review of Mini Update
YES
Full Assessment
NO
No Assessment
Select species for last full-assessment STAR panel slot
Vulnerability & Catch Concerns
Data availability; Potential for catch increases
Rougheye
Yellowtail
How many species for data-moderate panel, and priorities?
Step 1: Prioritize
Step 2: Put methods review on SSC agenda
Step 3 (future): Process for responding to Data-Moderate stock-status results

Proposed 2013 Assessment Schedule

Review Meeting	Timing	Tentative Location	Species	
Hake Review (Treaty)	Late Feb.	Canada	Pacific Hake	
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September 16, 2012

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

RE: Agenda Item H.3, Stock Assessment Planning

Dear Chairman Wolford and Council Members:

Please accept the following comments on behalf of the Natural Resources Defense Council (NRDC), in regard to groundfish stock assessment planning for the 2013-14 harvest specifications cycle.

1. Give Rougheye Rockfish a Full Stock Assessment

NRDC strongly supports a full stock assessment for Rougheye Rockfish. This is a stock with significant conservation concerns, and the Council cannot afford to ignore it. In particular, Cope et al., 2011, found that Rougheye has a very high Productivity-Susceptibility Analysis (PSA) vulnerability score of 2.27, placing it in the category of "Major" concern. This is the highest vulnerability score assigned to any species in the Groundfish FMP. Additionally, the original Dick & MacCall 2010 technical memorandum found there was a greater than 50% chance (specifically, a 64% chance) that average catch in 2008-2009 exceeded the OFL contribution for 2010 for this stock. Subsequent analysis by the GMT confirmed this, showing that average mortality on Rougheye for 2004-2010 exceeded Rougheye's most-recent OFL contribution (2013-2014). *See* November 2011 Briefing Book, Agenda Item E.5.b Supplemental GMT Report 3.

As the National Marine Fisheries (NMFS) Report under this agenda item notes, there will be some difficulties in assessing Rougheye, but a full assessment would provide significantly more information that merely including Rougheye in the data-moderate category. Accordingly, NRDC urges the Council to go ahead with a full assessment of Rougheye for the 2015-16 specs cycle. This Council's mandate under the Magnuson-Stevens Act is for "conservation and management," and there is ample evidence that Rougheye Rockfish needs conservation and management.

2. Give Yellowtail Rockfish a Full Stock Assessment

NRDC also supports a full assessment for Yellowtail Rockfish. Yellowtail is a commercially important species, and catches have increased significantly in recent years. While catch levels remain below the Overfishing Limit (OFL), the overall tonnage and increasing trend provide strong reasons to look more closely at this stock. Yellowtail Rockfish is also the subject of EFP proposals, indicating interest in further exploitation of this stock, and the rebuilt status of Widow will likely lead to increased Yellowtail exploitation in the future. The last Yellowtail assessment of any kind was in 2005, which is now seven years ago. This is another situation where "conservation and management" implies providing a full assessment to examine the current status of the stock.

3. Remove Cowcod from the Set of Species Receiving Full Stock Assessments

In order to accommodate both Rougheye and Yellowtail assessments, NRDC would recommend dropping Cowcod from the list of full assessments. Cowcod is relatively data-poor, and it is not clear what new information is available for a Cowcod assessment, or what would be gained from attempting one. Instead of using resources for a full Cowcod assessment, the Council should simply request a data report for Cowcod (or whatever staff believes is the minimum required treatment). Then, at the end of this upcoming assessment cycle, when the rest of the work is finished, the Council could request that staff and NMFS scientists survey the available data on Cowcod and assemble any new indices or information that would be useful for a more robust assessment of Cowcod. By doing so, the Council would use its resources more effectively during this assessment cycle—covering both Rougheye and Yellowtail—and position itself to re-evaluate whether Cowcod should receive a full assessment for the following cycle.

4. Apply Data-Moderate Methods to China, Copper, and Quillback Rockfish

NRDC strongly urges the Council to prioritize China, Copper, and Quillback Rockfish for data-moderate analysis, using recreational data for indices of abundance. All three of these species have PSA vulnerability scores in the "Major" category, and China and Quillback have similar overfishing concerns to those outlined for Rougheye Rockfish above. They also provide an important chance to test whether recreational data is usable to form indices, which could have implications for other stocks.

Proceeding with a full Rougheye assessment, and data-moderate analyses of China, Copper, and Quillback, would also tie in with reorganizing the current groundfish complexes in the 2015-16 specs cycle. For some time now, the Council has had before it GMT analysis showing that the current complexes group together species of different vulnerabilities and vastly differing OFLs, and that several species are likely subject to overfishing under status quo management. It is well-understood that these issues need to be addressed, in order to bring the Groundfish Fishery Management Plan (FMP) into compliance with the Magnuson-Stevens Act and the National Standard 1 Guidelines. The Council and NMFS initially recognized the need to reorganize the groundfish complexes during the 2011-12 specs cycle, but delayed action until the following cycle. During the 2013-14 specs cycle, however, the Council and NMFS once again delayed, stating an intention to address the issue in the 2015-16 cycle. Because of this pattern of delay, NRDC is concerned that the if the Council does not build momentum here in the stock assessment planning process, the reorganization of complexes will once again get ignored in 2015-16. That would be a real mistake, which we advise the Council to avoid. Instead, the Council should get out in front of the issue by planning a full stock assessment for Rougheye, and data-moderate methods for China, Copper, and Quillback. That way, the GMT and staff can move forward with reorganization efforts in parallel with—and being informed by—the results of the assessments.

5. Maintain the Focus on Rebuilding and Avoid Irrelevant Analyses

Finally, NRDC would like to address the ad-hoc report under this agenda item of the meeting between the SSC and GMT subcommittees last April. *See* September 2012 Briefing Book, Agenda Item H.3.a Supplemental Attachment 6. In its summary of recommendations, this report suggests modifying the Terms of Reference for rebuilding analyses in four ways, all of which NRDC strongly opposes.

The first recommendation in that report is for rebuilding analyses to report on the probability of dropping below the spawning output level from when the stock was first declared overfished, as a way of indicating relative risk of extinction. This is irrelevant to the question of rebuilding under the Magnuson-Stevens Act. Section 304(e) of the Act requires rebuilding to B_{msy} as quickly as possible, with the limited carve-out that harvest is allowed up to the level needed to avoid disaster in fishing communities. *See NRDC v. NMFS*, 421 F.3d 872, 880 (9th Cir. 2005). Nowhere do the rebuilding requirements reference extinction. Nor do any court cases rely on the concept of extinction in their holding. Basic legal analysis involves separating dicta from the holding in a case, and if one reviews the existing court opinions on rebuilding, one will find no holding that depends on the notion of extinction. Rather, any mention of the dire condition of stocks, or language suggesting extirpation, is merely dicta. Because extinction risk is simply irrelevant, NRDC recommends against changing the rebuilding analysis Terms of Reference to include it.

The second recommendation in the report is for rebuilding analyses to include projected catch streams under different harvest scenarios, to allow comparison of which harvest strategy has the highest cumulative revenue or yield. When read in conjunction with the first few pages of the report, it is clear that this recommendation is intended to provide numbers that would justify higher short-term catches of rebuilding species. NRDC believes this would be a bad idea, as well as legally indefensible. Under *NRDC v. NMFS*, it is clear that the allowable catch in a rebuilding plan is determined with respect to the needs of the community, not with respect to which harvest strategy squeezes the most cumulative yield out of the stock. These are very different concepts, and NRDC believes it would be irrelevant and dangerous to start analyzing catch streams and using that information to choose rebuilding strategies. The suggestion is also problematic on a broader level. There are always trade-offs to catching more in the short term. Even if it looks like higher short-term catch also corresponds to higher cumulative catch, such a harvest strategy represents a shift in risk away from industry and onto the ecosystem, as well as a shift—not necessarily a gain—in value, away from non-consumptive and non-monetary value, and toward monetized value of exploitation. Without analyzing the non-consumptive and non-monetary value streams, it is essentially meaningless to analyze the value of catch streams.

The third recommendation is to have rebuilding analyses include a yield stream generated from maintaining the stock in its current depleted state—in other words, not rebuilding—and then using that as a benchmark from which to compare "lost yield" due to rebuilding. This is perhaps the most problematic of the recommendations in the report. First of all, it illustrates a severe misunderstanding of valuation. As noted above, comparing yield (or revenue) in a vacuum is meaningless. Fisheries are valuable and important to us as a society for myriad reasons, only a small subset of which are monetizable, and only an even smaller subset of which involve exploitation. Simply looking at the value of exploitation, without also looking at the values of wildlife viewing, diving, tourism, ecosystem support services, existence value, and all the other ways that fisheries matter to us, shows a deep misunderstanding of economics and the concept of value. It is also irrelevant, under the law. The Magnuson-Stevens Act requires rebuilding. It is not optional. Therefore it is meaningless to call something "lost yield," due to rebuilding. That would be like setting the benchmark for air quality at the level of Beijing on a smoggy day, and then saying any actions taken to improve air quality represent "lost revenues" for the coal power plants that have to clean up their acts. We don't do that, as a society. We value the resource in a clean state (for our air), and in a rebuilt state (for our fisheries), and we set our benchmarks accordingly. NRDC is deeply frustrated with the myopic view that seems to permeate this decision-making body, with respect to why our natural resources are important and how the law works. Merely because many people at Council meetings are involved in exploiting our fish resources (or facilitating those that do), does not mean that federal law grants them free rein to maximize profits. Our marine fisheries are public trust resources, and the laws set by Congress reflect *all* of the types of value that those resources represent. NRDC urges the Council to respect that concept, and to respect the law, which unambiguously requires rebuilding.

The final recommendation in this report is that rebuilding analyses should run projections wherein actual catch is lower than the ACL. Once again, this is an effort to squeeze more yield out of rebuilding stocks. NRDC recognizes that actual catch often is lower than the ACL, but changing the rebuilding projections is the wrong way to deal with this issue. The assumption behind the GMT's recommendation is that by catching fewer fish, more biomass is left in the ocean, recruitment is correspondingly higher, and the following year we will be able to take more fish. This is a fine theory, with which NRDC has no problem, but we would urge the Council not to rely on it too heavily in practice when setting ACLs for rebuilding species. A natural "truing-up" will end up happening periodically anyway, when new recruitment data come in and new biomass estimates are produced. At that point, if faster-than-expected rebuilding actually did occur due to catches being lower than ACLs, then the new ACLs will be higher as a result of the new biomass estimates being higher. NRDC would recommend the Council stick with this "ex post" method of truing up, and let any extra rebuilding be reflected after it has already happened, rather than banking on it ahead of time. We believe it would be risky to use an "ex ante" approach that essentially runs a deficit in the current year on the assumption of a future surplus, all the while hoping for optimal environmental conditions and recruitment. Because this would be risky and unwise, we urge the Council to not move forward with the fourth recommendation in this report.

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We hope these comments are helpful, and thank you for your consideration.

Sincerely,

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Agenda Item H.4
Situation Summary
September 2012

UPDATE ON BIOLOGICAL OPINION FOR THE GROUNDFISH FISHERY, INCLUDING CONSIDERATION OF SEABIRD PROTECTION REGULATIONS

The National Marine Fisheries Service (NMFS) Protected Resources Division and the US Fish and Wildlife Service (USFWS) have prepared draft biological opinions that consider the effects of west coast groundfish fisheries to threatened and endangered marine species, including marine mammals, sea turtles, fish, and seabirds. Both agencies have submitted draft reasonable and prudent measures, terms and conditions, and conservation recommendations[1] for Council consideration at this meeting (Agenda Items H.4.b, NMFS Draft Biological Opinion and USFWS Draft Biological Opinion). These include measures to reduce interactions, establish a workgroup to develop future recommendations, generate standards for data collection, and create a cycle for reporting. The Council should review the excerpts of the draft biological opinions and provide feedback to the agencies.

Relative to seabird protection regulations, the USFWS proposes mandatory streamer lines for longline vessels 55 feet or greater in length to reduce the incidental take of seabirds, while maintaining the voluntary program for smaller vessels (Agenda Item H.4.b, USFWS Draft Biological Opinion). The proposed regulations are intended to be similar to the Alaska streamer line regulations for Federal waters (Agenda Item H.4.b, NMFS Report). The USFWS recommends regulations be implemented as soon as practical, but not to exceed a two-year transition period. The Council should review the measures proposed by USFWS, provide feedback, and establish a timeline for implementation.

Council Action:

1. Review and provide feedback on the draft reasonable and prudent measures, terms and conditions, and conservation recommendations.
2. Establish a timeline for implementing seabird protection regulations.

Reference Materials:

1. Agenda Item H.4.b, NMFS Draft Biological Opinion: Draft Reasonable and Prudent Measures, Terms and Conditions, and Conservation Recommendations.
2. Agenda Item H.4.b, USFWS Draft Biological Opinion: Draft Reasonable and Prudent Measures, Terms and Conditions, and Conservation Recommendations.
3. Agenda Item H.4.b, NMFS Report: Excerpt of the Alaska Streamer Line Regulations.

[1] Reasonable and prudent measures are non-discretionary measures to minimize the amount or extent of incidental take. Terms and conditions are non-discretionary terms to implement the reasonable and prudent measures. Conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects on listed species or critical habitat or regarding the development of information.

Agenda Order:

a. Agenda Item Overview — Kelly Ames
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action**: Consider Issues in the Biological Opinion Including Implementation of Seabird Protection Regulations

PFMC
08/23/12

§ 679.24 *Gear limitations.*

Regulations pertaining to vessel and gear markings are set forth in this section and as prescribed in the annual management measures published in the ***Federal Register*** pursuant to § 300.62 of chapter III of this title.

(a) Marking of hook-and-line, longline pot, and pot-and-line gear.

(1) All hook-and-line, longline pot, and pot-and-line marker buoys carried on board or used by any vessel regulated under this part shall be marked with the following:

(i) The vessel's name; and

(ii) The vessel's Federal fisheries permit number; or

(iii) The vessel's ADF&G vessel registration number.

(2) Markings shall be in characters at least 4 inches (10.16 cm) in height and 0.5 inch (1.27 cm) in width in a contrasting color visible above the water line and shall be maintained so the markings are clearly visible.

(b) Gear restrictions

(1) Longline pot gear.
Any person using longline pot gear must treat any catch of groundfish as a prohibited species, except:

(i) In the Aleutian Islands subarea.

(ii) While directed fishing for sablefish in the Bering Sea **subarea.**

(2) ***[Reserved]***

(3) Trawl footrope.
No person trawling in any GOA area limited to pelagic trawling under § 679.22 may allow the footrope of that trawl to be in contact with the seabed for more than 10 percent of the period of any tow.

(4) BSAI pollock nonpelagic trawl prohibition.
No person may use nonpelagic trawl gear to engage in directed fishing for pollock in the BSAI.

(c) Gear restrictions for sablefish

(1) Gear allocations.
Gear allocations of sablefish TAC are set out under § 679.20.

(2) Eastern GOA regulatory area

(i) General.

(A) No person may use any gear other than hook-and-line and trawl gear when fishing for sablefish in the Eastern GOA regulatory area.

(B) No person may use any gear other than hook-and-line gear to engage in directed fishing for sablefish.

(ii) Sablefish as prohibited species

(A) Trawl gear. When operators of vessels using trawl gear have harvested 5 percent of the TAC for sablefish in the Eastern GOA regulatory area during any year, further trawl catches of sablefish must be treated as prohibited species as provided by § 679.21(b).

(B) Other gear. Operators of vessels using gear types other than those specified in paragraph (c)(2)(i) of this section in the Eastern GOA regulatory area must treat any catch of sablefish as a prohibited species as provided by § 679.21(b).

(3) Central and Western GOA regulatory areas; sablefish as prohibited species.
Operators of vessels using gear types other than hook-and-line and trawl gear in the Central and Western GOA regulatory areas must treat any catch of sablefish in these areas as a prohibited species as provided by § 679.21(b).

(4) BSAI.
Operators of vessels using gear types other than hook-and-line, longline pot, pot-and-line, or trawl gear in the BSAI must treat sablefish as a prohibited species as provided by § 679.21(b).

(d) Trawl gear test areas

(1) General.
For purposes of allowing pelagic and nonpelagic trawl fishermen to test trawl fishing gear, NMFS may establish, after consulting with the Council, locations for the testing of trawl fishing gear in areas that would otherwise be closed to trawling.

(2) Trawl gear testing.
For the purposes of this section, "trawl gear testing" means deploying trawl gear in areas designated in this paragraph (d) and in Figure 7 to this part under the following conditions.

(i) The codend shall be unzipped while trawl gear testing.

(ii) Groundfish shall not be possessed on board when trawl gear testing.

(iii) Observers aboard vessels during the time spent trawl gear testing shall not fulfill observer requirements at subpart E of this part.

(3) Criteria.
The establishment of test areas must comply with the following criteria:

(i) Depth and bottom type must be suitable for testing the particular gear type.

(ii) The areas must be outside State waters.

(iii) The areas must be in locations not normally closed to fishing with that gear type.

(iv) The areas must be in locations that are not usually fished heavily by that gear type.

(v) The areas must not be within a designated Steller sea lion protection area at any time of the year.

(4) Test areas.
Trawl gear testing is allowed in the following areas (Figure 7 to this part) bounded by straight lines connecting the coordinates in the order listed, at all times:

(i) Kodiak Test Area.

57° 37' N. lat., 152° 02' W. long.
57°37' N. lat., 151° 25' W. long.
57°23' N. lat., 151° 25' W. long.
57°23' N. lat., 152° 02' W. long.
57°37' N. lat., 152° 02' W. long.

(ii) Sand Point Test Area.

54° 50' N. lat., 161° 00' W. long.
54° 50' N. lat., 160° 30' W. long.
54° 35' N. lat., 160° 30' W. long.
54° 35' N. lat., 161° 00' W. long.
54° 50' N. lat., 161° 00' W. long.

(iii) Bering Sea Test Area.

55° 00' N. lat., 167° 00' W. long.
55° 00' N. lat., 166° 00' W. long.
54° 40' N. lat., 166° 00' W. long.
54°40' N. lat., 167° 00' W. long.
55° 00' N. lat., 167° 00' W. long.

(e) Seabird avoidance program for vessels fishing with hook-and-line gear.

(1) Applicability.
The operator of a vessel that is longer than 26 ft (7.9 m) LOA fishing with hook-and-line gear must comply with the seabird avoidance requirements as specified in paragraphs (e)(2) and (e)(3) of this section while fishing for any of the following species:

(i) IFQ halibut or CDQ halibut,

(ii) IFQ sablefish.

(iii) Groundfish in the EEZ off Alaska.

(2) Seabird Avoidance Requirements.
The operator of a vessel described in paragraph (e)(1) of this section must:

(i) Gear onboard. Have onboard the vessel the seabird avoidance gear as specified in paragraph (e)(3) of this section;

(ii) Gear inspection. Upon request by an authorized officer or observer, make the seabird avoidance gear available for inspection;

(iii) Gear use. Use seabird avoidance gear as specified in paragraph (e)(3) of this section that meets standards as specified in paragraph (e)(4) of this section, while hook-and-line gear is being deployed.

(iv) Sink baited hooks**.** Use hooks that when baited, sink as soon as they are put in the water.

(v) Offal discharge.

(A) If offal is discharged while gear is being set or hauled, discharge offal in a manner that distracts seabirds from baited hooks, to the extent practicable. The discharge site on board a vessel must be either aft of the hauling station or on the opposite side of the vessel from the hauling station.

(B) Remove hooks from any offal that is discharged.

(C) Eliminate directed discharge through chutes or pipes of residual bait or offal from the stern of the vessel while setting gear. This does not include baits falling off the hook or offal discharges from other locations that parallel the gear and subsequently drift into the wake zone well aft of the vessel.

(D) For vessels not deploying gear from the stern, eliminate directed discharge of residual bait or offal over sinking hook-and-line gear while gear is being deployed.

(vi) Safe release of seabirds. Make every reasonable effort to ensure birds brought on board alive are released alive and that, wherever possible, hooks are removed without jeopardizing the life of the birds.

(3) Seabird avoidance gear requirements. (See also Table 20 to this part.)

(i) The operator of a vessel identified in paragraph (e)(1) of this section must comply with paragraph (e)(3)(ii) or (e)(3)(iii) of this section while fishing with hook-and-line gear for groundfish, IFQ halibut, CDQ halibut, or IFQ sablefish in Federal waters (EEZ) and for IFQ halibut, CDQ halibut, or IFQ sablefish in the State of Alaska waters, excluding fishing in:

(A) NMFS Reporting Area 649 (Prince William Sound);

(B) State waters of Cook Inlet;

(C) NMFS Reporting Area 659 (Eastern GOA Regulatory Area, Southeast Inside District), but including waters in the areas south of a straight line at 56º17.25 N. lat. between Point Harris and Port Armstrong in Chatham Strait, State statistical areas 325431 and 325401, and west of a straight line at 136º21.17 E. long. from Point Wimbledon extending south through the Inian Islands to Point Lavinia; and

(D) Area 4E with a vessel less than or equal to 55 ft (16.8 m) LOA, but including fishing in waters south of 60º00.00 N. lat. And west of 160º00.00 W. long.

(ii) Using other than snap gear.

(A) A minimum of 1 buoy bag line as specified in paragraph (e)(4)(i) of this section must be used by vessels greater than 26 ft (7.9 m) LOA and less than or equal to 55 ft (16.8 m) LOA without masts, poles, or rigging.

(B) A minimum of a single streamer line as specified in paragraph (e)(4)(ii) of this section must be used by vessels greater than 26 ft (7.9 m) LOA and less than or equal to 55 ft (16.8 m) LOA with masts, poles, or rigging.

(C) A minimum of a paired streamer line of a standard as specified in paragraph (e)(4)(iii) of this section must be used by vessels greater than 55 ft (16.8 m).

(iii) Using snap gear.

(A) A minimum of 1 buoy bag line as specified in paragraph (e)(4)(i) of this section must be used by vessels greater than 26 ft (7.9 m) LOA and less than or equal to 55 ft (16.8 m) LOA without masts, poles, or rigging.

(B) A minimum of a single streamer line as specified in paragraph (e)(4)(iv) of this section must be used by vessels greater than 26 ft (7.9 m) LOA and less than or equal to 55 ft (16.8 m) LOA with masts, poles, or rigging.

(C) A minimum of a single streamer line as specified in paragraph (e)(4)(iv) of this section must be used by vessels greater than 55 ft (16.8 m) LOA.

(4) Seabird avoidance gear performance and material standards:

(i) Buoy bag line weather exception. In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of a buoy bag line is discretionary.

(ii) Single streamer standard.

(A) A single streamer line must:

(1) Be a minimum of 300 feet (91.4 m) in length;

(2) Have streamers spaced every 16.4 ft (5 m);

(3) Be deployed before the first hook is set in such a way that streamers are in the air for a minimum of 131.2 ft (40 m) aft of the stern and within 6.6 ft (2 m) horizontally of the point where the main groundline enters the water.

(4) Have individual streamers that hang attached to the mainline to 9.8 in (0.25 m) above the waterline in the absence of wind.

(5) Have streamers constructed of material that is brightly colored, UV-protected plastic tubing or 3/8 inch polyester line or material of an equivalent density.

(B) Weather exception: In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of a single streamer line is discretionary.

(iii) Paired streamer standard:

(A) At least one streamer line must be deployed before the first hook is set and two streamer lines must be fully deployed within 90 seconds.

(B) Weather exceptions: In conditions of wind speeds exceeding 30 knots (near gale or Beaufort 7 conditions), but less than or equal to 45 knots, a single streamer must be deployed from the windward side of the vessel. In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of streamer lines is discretionary.

(C) Streamer lines must:

(1) Be deployed in such a way that streamers are in the air for a minimum of 131.2 ft (40 m) aft of the stern for vessels under 100 ft (30.5 m) and 196.9 ft (60 m) aft of the stern for vessels 100 ft (30.5 m) or over;

(2) Be a minimum of 300 feet (91.4 m) in length;

(3) Have streamers spaced every 16.4 ft (5 m);

(4) For vessels deploying hook-and-line gear from the stern, the streamer lines must be deployed from the stern, one on each side of the main groundline.

(5) For vessels deploying gear from the side, the streamer lines must be deployed from the stern, one over the main groundline and the other on one side of the main groundline.

(6) Have individual streamers that hang attached to the mainline to 9.8 in (0.25 m) above the waterline in the absence of wind.

(7) Have streamers constructed of material that is brightly colored, UV protected plastic tubing or 3/8 inch polyester line or material of an equivalent density.

(iv) Snap gear streamer standard

(A) For vessels using snap gear, a single streamer line must:

(1) Be deployed before the first hook is set in such a way that streamers are in the air for 65.6 ft (20 m) aft of the stern and within 6.6 ft (2 m) horizontally of the point where the main groundline enters the water.

(2) Have a minimum length of 147.6 ft (45 m).

(B) Weather exception: In winds exceeding 45 knots (storm or Beaufort 9 conditions), the use of a single streamer line is discretionary.

(v) Weather safety standard. The use of seabird avoidance devices required by paragraph (e)(3) of this section is discretionary for vessels greater than 26 ft (7.9 m) LOA and less than or equal to 55 ft (16.8 m) LOA in conditions of wind speeds exceeding 30 knots (near gale or Beaufort 7 conditions).

(5) Other methods.
Any of the following measures or methods must be accompanied by the applicable seabird avoidance gear requirements as specified in paragraph (e)(3) of this section:

(i) Night-setting,

(ii) Line shooter.

(iii) Lining tube.

(6) Seabird avoidance exemption.
Notwithstanding any other paragraph in this part, operators of vessels 32 ft (9.8 m) LOA or less using hook-and-line gear in IPHC Area 4E in waters shoreward of the EEZ are exempt from seabird avoidance regulations.

(f) Modified nonpelagic trawl gear.

Nonpelagic trawl gear modified as shown in Figure 26 to this part must be used by any vessel required to be federally permitted and that is used to directed fish for flatfish, as defined in § 679.2, in any reporting areas of the BS or directed fish for groundfish with nonpelagic trawl gear in the Modified Gear Trawl Zone specified in Table 51 to this part. Nonpelagic trawl gear used by these vessels must meet the following standards.

(1) Elevated section minimum clearance.
Except as provided for in paragraph (f)(3)(iii) of this section, elevating devices must be installed on the elevated section shown in Figure 26 to this part to raise the elevated section at least 2.5 inches (6.4 cm), as measured adjacent to the elevating device contacting a hard, flat surface that is parallel to the elevated section, regardless of the elevating device orientation, and measured between the surface and the widest part of the line material. Elevating devices must be installed on each end of the elevated section, as shown in Figure 26 to this part. Measuring locations to

determine compliance with this standard are shown in Figure 25 to this part.

(2) Elevating device spacing.

Elevating devices must be secured along the entire length of the elevated section shown in Figure 26 to this part and spaced no less than 30 feet (9.1 m) apart; and either

(i) If the elevating devices raise the elevated section shown in Figure 26 to this part 3.5 inches (8.9 cm) or less, the space between elevating devices must be no more than 65 feet (19.8 m); or

(ii) If the elevating devices raise the elevated section shown Figure 26 to this part more than 3.5 inches (8.9 cm), the space between elevating devices must be no more than 95 feet (29 m).

(3) Clearance measurements and line cross sections.

(i) The largest cross section of the line of the elevated section shown in Figure 26 to this part between elevating devices shall not be greater than the cross section of the material at the nearest measurement location, as selected based on the examples shown in Figure 25 to this part. The material at the measurement location must be —

(A) The same material as the line between elevating devices, as shown in Figures 25a and 25d to this part;

(B) Different material than the line between elevating devices and used to support the elevating device at a connection between line sections (e.g., on a metal spindle, on a chain), as shown in Figure 25b to this part; or

(C) Disks of a smaller cross section than the elevating device, which are strung continuously on a line between elevating devices, as shown in Figure 25c to this part.

(ii) Portions of the line between elevating devices that are braided or doubled for section terminations or used for line joining devices are not required to be a smaller cross section than the measuring location.

(iii) Required minimum clearance for supporting material of a larger cross section than the cross section of the line material. When the material supporting the elevating device has a larger cross section than the largest cross section of the line between elevating devices, except as provided for in paragraph (f)(3)(ii) of this section, based on measurements taken in locations shown in Figure 27 to this part, the required minimum clearance shall be as follows:

(A) For elevating devices spaced 30 feet (9.1 m) to 65 feet (19.8 m), the required minimum clearance is ≥ [2.5 inches - ((support material cross section - line material cross section)/2)], or

(B) For elevating devices spaced greater than 65 feet (19.8 m) to 95 feet (29 m), the required minimum clearance is ≥ [3.5 inches - ((support material cross section - line material cross section)/2)].

DRAFT Reasonable and Prudent Measures, Terms and Conditions, and Conservation Recommendations

Excerpt from the DRAFT Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Section 7(a)(2) "Not Likely to Adversely Affect" Determination for the Continuing Operation of the Pacific Coast Groundfish Fishery

Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

Management Planning and Take Reporting Measures

We include reasonable and prudent measures in this incidental take statement for management planning and take reporting that is applicable to all species considered in this opinion (green sturgeon, eulachon, humpback whales, Steller sea lions, and leatherback sea turtles). These measures will require NMFS to periodically analyze, report, and review new information, and evaluate whether reinitiation is warranted.

(1) NMFS shall develop a Pacific Coast Groundfish and Endangered Species Workgroup.
(2) NMFS shall characterize changes in fishing effort.
(3) NMFS shall update reporting of take considered in this opinion.
(4) NMFS shall update the NWFSC risk assessment, as needed.

Take Monitoring Measure

We include a reasonable and prudent measure in this incidental take statement to monitor the extent of incidental take of species considered in this opinion associated with the operation of the Pacific Coast groundfish fishery. The extent of take monitored will be compared with take limits specified for the fishery (2.8.2 Amount or Extent of Take). To this end, monitoring is specific to observer coverage for all species considered in the opinion, with the exception of humpback whales. NMFS does not anticipate that observer programs will be able to provide accurate bycatch estimates for humpback whales entangled in sablefish pot/trap gear, because the gear is left untended (and therefore unobserved) and humpback whales are mobile once entangled in the gear.

(1) NMFS shall identify goals for minimum coverage levels to achieve fleet-wide take estimates and a plan for implementation.

Species-Specific Measures

We also include reasonable and prudent measures in this incidental take statement specific to individual species considered in this opinion. Included are measures to minimize the amount or extent of incidental take associated with NMFS observer program sampling and handling of protected species, where these effects are not otherwise authorized or exempted.[1] For this action and species contemplated in the opinion, green sturgeon are the only species not otherwise authorized or exempted.

Eulachon

We include the following reasonable and prudent measures in this incidental take statement to monitor the incidental take of eulachon associated with operation of the Pacific Coast groundfish fishery.

(1) NMFS shall regularly develop and modify protocols and implement biological sampling to assess the impacts of the Groundfish FMP actions upon eulachon.
(2) Any changes in groundfish trawling regulations that are anticipated to increase eulachon bycatch [i.e. trawl net requirements (chafing gear, mesh size, codend specifications)] will result in a reinitiation of this biological opinion.
(3) Promulgation of 4(d) take prohibitions for eulachon shall result in a reinitiation of this biological opinion if the Groundfish FMP falls outside of the realm of the 4(d) eulachon take prohibition rules.

Green Sturgeon

We include the following reasonable and prudent measures in this incidental take statement to monitor the incidental take of Southern DPS green sturgeon associated with operation of the Pacific Coast groundfish fishery.

Although the expected incidental capture and associated mortality of Southern DPS green sturgeon per year in the fishery is relatively low, the bycatch data from 2002 through 2010 indicate that incidental capture and mortality can be greater in some years. Given the uncertainties in this analysis, measures should be taken to identify factors contributing to greater incidental take of green sturgeon, to improve our ability to predict when greater levels of incidental take may occur and to address those factors in the future. The measures and the associated terms and conditions also specify monitoring needed to track the fleet-wide incidental take and to estimate the lethal take of Southern DPS green sturgeon in the fishery, to demonstrate that the impacts of the fishery are consistent with this opinion. To do that, the measures and

[1] Samples collected for turtles are authorized under 50 CFR 222.310 and 223.206 of the ESA. For Category I and II fisheries, observers are authorized to take samples of marine mammals under MMPA, Section 118, 50 CFR 229.7(b) and (c), and for Category III fisheries, observers are authorized via 229.7(d). Disentanglement, dehooking and other handling considered aiding a stranded marine mammal are authorized under MMPA Section 109(h). Samples collected for eulachon do not cause additional effects, because mortality is assumed from trawl bycatch.

associated terms and conditions address the uncertainties regarding the effects on Southern DPS green sturgeon from capture in the fishery.

The primary uncertainties include those regarding the expanded estimate of encounters, the recapture rate of fish that are captured and released alive, and the sublethal and lethal impacts on green sturgeon of capture with trawl gear[2]. These uncertainties need to be addressed to more accurately assess the effects of the fishery on Southern DPS green sturgeon. The information generated from implementation of these measures is relevant to and necessary for implementation of the measures described in this take statement under "Management Planning and Take Reporting."

(1) NMFS shall identify factors associated with greater incidental take of green sturgeon in the Pacific Coast groundfish fishery.
(2) NMFS shall collect biological samples and data on incidental take of Southern DPS green sturgeon associated with the operation of the Pacific Coast groundfish fishery.

Humpback Whales

We include the following reasonable and prudent measure to improve our knowledge of incidental take of humpback whales in the Pacific Coast Groundfish Fishery.

(1) NMFS shall provide all west coast observers with the Fixed Gear Guide (http://swr.nmfs.noaa.gov/psd/Fixed%20Gear%20Guide-FINAL_12.14.11.pdf) and the entangled whale hotline (877-SOS-WHALE) during observer training. The guide will help observers that may opportunistically sight an entangled whale identify the entangling gear to a specific fishery. The hotline provides a resource for reporting and response.

Leatherback Sea Turtles

(1) NMFS shall educate observers on methods that will reduce sea turtle injury or mortality during fishing operations.

[2] Our conclusions regarding the effects of the fishery on the viability of Southern DPS green sturgeon were based on the best available information from the observer programs and assumptions that green sturgeon encountered in the fishery are not recaptured within the same year and green sturgeon caught in the fishery and released alive have high survival rates and do not experience significantly adverse sublethal effects. The impacts of the fishery on the species may become of more concern if information indicates that the fishery recaptures the same green sturgeon more than once and/or that green sturgeon encountered and released alive experience higher post-release mortality rates and more severe sublethal impacts than estimated here.

Terms and Conditions

The terms and conditions described below are non-discretionary, and NMFS must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). NMFS has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

Management Planning and Take Reporting Terms and Conditions

Terms and conditions (a,b,c…) specific to each of the above identified reasonable and prudent measures (1,2,3…) for management planning and take reporting are identified below (1.a, etc.).

1.a. NMFS shall identify membership for a Pacific Coast Groundfish and Endangered Species Workgroup (PCGW) within six months of opinion issuance.

1.b. Within three months of opinion issuance, NMFS shall invite PFMC and USFWS to provide points of contact, participate in the PCGW, and help develop terms of reference for the workgroup (see e. below). NMFS shall request response within six months of opinion issuance.

1.c. The PCGW shall convene on a biennial basis to consider all new information, described in the below measures.

1.d. Based on review of new information, the PCGW will make recommendations, for example, to develop new analyses or reports, changes to sampling protocols, implement conservation measures, and identify whether reinitiation is warranted.

1.e. The PCGW members shall develop terms of reference for the PCGW within 12 months of opinion issuance. These terms shall document the purpose and structure of the group, the basis for key recommendations, staff points of contact and their roles and responsibilities, resources needed to accomplish the workgroup purpose, and a breakdown of anticipated work schedules (e.g., for biennial reporting and completing a future consultation following a PCGW recommendation to reinitiate).

2.a. NMFS shall analyze the available data on fishing effort to evaluate changes in fishing effort by gear type that may result from implementing the IFQ management program, and develop a report to characterize changes on a biennial basis. Roles for this analysis will be defined as part of 1(e), above.

   i. For example, NMFS shall monitor any significant increases or changes in the spatial and temporal characteristics fisheries, where possible.

3.a. Fleet-wide take reporting: NMFS shall analyze the available data on observed take of protected species to provide fleet-wide take estimates on a biennial basis. Roles for this reporting will be defined as part of 1(e), above.

3.b. Annual tracking of observed take: NMFS Groundfish observer programs shall provide annual summaries of observed takes based on final data each year. NMFS NWR and

SWR stranding networks shall provide annual summaries of observed marine mammal and sea turtle human-interactions each year.

3.c. Immediate notification: NMFS Groundfish observer programs shall provide immediate notification[3] of observed sea turtle takes as well as any opportunistically observed whale or sea turtle entanglements, regardless of whether the entangled species or gear is known.

4.a. The need for an updated risk assessment shall be determined by recommendation of the PCGW. Roles for this assessment will be defined as part of 1.e, above.

Take Monitoring Terms and Conditions

Terms and conditions specific to the above identified reasonable and prudent measures for take monitoring are identified below.

1.a. Roles to identify minimum coverage levels and an implementation plan will be defined as part of the Management Planning and Take Reporting Term and Condition 1.e, above.

1.b. The minimum goals will be defined for fisheries with anticipated observable take of ESA-listed species identified in Table 26, below.

Table 26. Anticipated observable take in the WCGF fishery by species and fisheries.

Species*	Fisheries	Source
Green Sturgeon	LE groundfish bottom trawl and at-sea hake fisheries	Al-Humaidhi et al. 2012
Eulachon	LE groundfish bottom trawl and at-sea hake fisheries	Al-Humaidhi et al. 2012
Steller sea lions	LE groundfish bottom trawl and at-sea hake fisheries	Jannot et al. 2011
Leatherback sea turtles**	Sablefish pot/trap fisheries	Jannot et al. 2011 and stranding records

*Although humpback whale take is anticipated in sablefish pot/trap fisheries, observer programs as described in the analysis above do not observe this take because humpback whales are mobile once entangled.

**Leatherback sea turtles are not mobile once entangled, and therefore, entanglements are readily observable upon gear retrieval.

1.c. The implementation plan will identify a near-term timeframe to implement goals for minimum coverage.

1.d. Once implemented, NMFS shall meet or exceed the minimum observer coverage levels each year, unless take is no longer observed for a minimum number of years.

[3] By immediate, NMFS means as soon as practicably feasible. For sea turtles, contact the Southwest Fisheries Science Center, attention Scott Benson. For marine mammals, use the 1-800-SOS-WHALE hotline for reporting. [Need to work with S. Benson and stranding network to develop data forms for this reporting]

Species-Specific Terms and Conditions

Eulachon

Terms and conditions specific to each of the above identified reasonable and prudent measures for fishery modification are identified below.

1.a. By late summer/early fall, the Groundfish observer program will analyze the current year's eulachon bycatch data and will discuss and modify, if necessary, protocols and sampling procedures with NMFS PRD and NWFSC for the following year.

Green Sturgeon

Terms and conditions specific to each of the above identified reasonable and prudent measures for fishery modification are identified below.

1.a. In coordination with the PCGW, NMFS shall evaluate years of high green sturgeon encounters (i.e., years with greater than 28 estimated green sturgeon encounters, representing the number of encounters expected on average based on the WCGOP and A-SHOP data and estimates from 2002 through 2010) to investigate factors that may have contributed to the higher number of encounters compared to other years. Factors to investigate include characteristics of the fishery (e.g., the level and distribution of fishing effort in the LE groundfish bottom trawl sector, by area, season, depth, haul duration, etc.), characteristics of the observer program (e.g., overall observer coverage rates, the distribution of observer coverage by sector, area, and season), characteristics of green sturgeon populations and movements (e.g., distribution of green sturgeon along the coast, transition of a strong year class of juveniles to subadults), and oceanographic conditions (e.g., water temperature, productivity).

2.a. NMFS shall continue to collect biological data on observed green sturgeon throughout the groundfish observer programs, according to the green sturgeon sampling protocol in the observer manuals. These data will be provided to NMFS PRD in the take reports as described in this section of the opinion under "Management Planning and Take Reporting."

2.b. NMFS shall ensure that green sturgeon tissue samples collected are appropriately stored and transported for genetic analysis.

2.c. In coordination with the PCGW, NMFS shall develop and implement methods to monitor the extent to which individual green sturgeon incidentally captured in the Pacific Coast groundfish fishery are recaptured each year. These methods may involve applying external tags (e.g., spaghetti tags) or internal tags (e.g., passive integrated transponder, or PIT, tags) to green sturgeon encountered and observed in the fishery. [May want to include a time frame for developing and implementing this as a term/condition].

2.d. In coordination with the PCGW, NMFS shall develop and implement methods to monitor the impacts on green sturgeon of capture and release in the fishery. The methods should address the lethal and sublethal impacts on green sturgeon post-release. Methods may include the application of external or internal tags to green sturgeon encountered and observed in the fishery and/or development and implementation of a fish condition key to more consistently assess the condition of fish caught and released in the fishery. ESA coverage must be obtained for any additional take of Southern DPS green sturgeon as a result of implementing this term and condition, if not already considered in this opinion. [To include a time frame for developing and implementing this].

Humpback Whales

1.a. Reporting shall be directed from observers through the observer program.
1.b. Reporting shall follow the format of the attached form [to append, need to work with the stranding network to develop a reporting form]

Leatherback Sea Turtles

1.a. NMFS shall provide information to observers regarding regulations requiring fishermen to properly handle, release and resuscitate sea turtles, per 50 CFR 223.206(d)(1).
1.b. NMFS shall provide information on sea turtle biology during groundfish observer training.

<u>Conservation Recommendations</u>

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

Eulachon

The following conservation recommendations for eulachon would provide information for future consultations involving the operation of the Pacific Coast groundfish fishery:

(1) NMFS should continuing adequate level of operations for the NMFS Observer Program – To further understand the impacts of the groundfish fishery upon eulachon, it is important for the WA/OR/CA pink shrimp fishery to be adequately observed.

(2) NMFS should retain eulachon bycatch for archiving – Whole body eulachon specimens should be retained to further understanding of the species. Eulachon marine life history is poorly understood; therefore, the impact of the Groundfish FMP upon eulachon is not well understood. Whole body specimens can allow for stock identification (genetic samples), diet (stomach analysis), sex ratios (examination of gonads), age (Ba:Ca ratios

in otoliths), presence (locations of captures), and general morphology measurements. Eulachon sampling procedures for sample size, collection location and frequency, and archiving details should be determined by NMFS PRD, NWFSC, and Groundfish observer programs.

Green Sturgeon

The following conservation recommendations for green sturgeon and green sturgeon critical habitat would provide information for future consultations involving the operation of the Pacific Coast groundfish fishery:

(1) NMFS should develop a rangewide abundance estimate for the Southern DPS green sturgeon. The lack of data to generate reliable rangewide abundance estimates of adult and subadult Southern DPS green sturgeon was a source of uncertainty in the analysis in this opinion of the impacts of the fishery to the species. This source of uncertainty can be reduced or eliminated by developing an abundance estimate. One of the main concerns with existing abundance estimates is that the data used were generally from studies not specifically designed to sample green sturgeon. Reliable methods need to be developed for estimating the abundance of adults, subadults, and juveniles. In particular, methods for monitoring the annual spawning run size and for monitoring the abundance of juveniles are needed. These methods would need to be applied over a sufficiently long period of time (e.g., at least 10 years) to collect the data required to generate reliable rangewide abundance estimates.

(2) NMFS should assess the effects of bottom trawl gear on bottom habitat within designated green sturgeon critical habitat. Repeated disturbance of bottom habitats could be a concern for green sturgeon critical habitat because of effects on prey resources. Information needed to evaluate the effects of this fishery on green sturgeon critical habitat include characterization of the bottom types where bottom trawl fishing occurs, quantification of the area affected by bottom trawl gear, and quantification of the distribution, frequency, and level of bottom trawling effort throughout green sturgeon critical habitat, to assess the level of repeated impacts.

(3) NMFS should continue to monitor state-managed fishery sectors that encounter green sturgeon (i.e., the California halibut bottom trawl sector) and, if funding is available, increase coverage rates. Develop minimum coverage levels necessary to extrapolate fleet-wide take estimates from monitoring data. Rationale: The observer program provides valuable data to estimate the effects of these fisheries on Southern DPS green sturgeon and inform the assessment of the environmental baseline, which is an integral part of the opinion analysis. Determining the minimum coverage levels necessary to extrapolate fleet-wide take estimates from monitoring data would help to set target coverage levels.

Humpback Whales and Leatherback Sea Turtles

The following conservation recommendations for humpback whales and leatherback sea turtles provide general guidance for unique, visual marking of sablefish pot/trap gear as identifiable to a specific fishery, as well as guidance to report, track, and retrieve pot/trap gear that becomes lost, and guidance to minimize the loss of pot/trap gear. Implementing these recommendations would improve our knowledge of incidental take of humpback whales and leatherback sea turtles in the Pacific Coast groundfish fishery and minimize that take. Washington and Oregon commercial Dungeness crab fisheries are example models where regulations for unique, visual marking of gear and programs to report, track and retrieve lost gear are established. Citations regarding these regulations and programs are provided below. Dan Ayres, WDFW's Coastal Shellfish Lead Biologist, is a point of contact for questions about the Washington fishery: Daniel.Ayres@dfw.wa.gov or 360-249-4628 ext. 209. Kelly Corbett, ODFW's Commercial Crab Project Leader, is a point of contact for questions about the Oregon fishery: Kelly.C.Corbett@state.or.us or 541-867-0300 ext. 244. These measures shall be further discussed and developed by the PCGW, who may recommend adoption as conservation measures.

(1) NMFS and the PCGW should work with the PFMC to require visual marking that can be used to uniquely identify sablefish pot/trap gear (e.g., OAR 635-005-0480 and WAC 220-52-040 for Dungeness Crab Buoy Tag and Gear Marking Requirements). Visual marking can help identify gear entangled on a whale or turtle to a specific fishery, while absence of visual markings can also help rule out a fishery that uses unique, visual markers (e.g., Figure 9).

Figure 9. In the below photograph, unique, visual markers (blue tag and buoy identification number) confirm that the entangled gear is from the Washington commercial crab fishery.

(2) NMFS and the PCGW should work with the PFMC to create electronic monitoring and logbook reporting requirements for the sablefish pot/trap fishery that require fishers to document effort and lost gear (see Appendix B for example logbook regulations, instructions and entry forms that include lost gear reporting).
(3) NMFS and the PCGW should work with the PFMC to develop a database to track sablefish pot/trap fishing effort, locations and lost fixed-gear (see Appendix C for an example database).
(4) NMFS and the PCGW should work with the PFMC to summarize data on lost gear from the sablefish pot/trap fishery to evaluate the magnitude of gear loss and factors that may influence loss (specific areas, times of year, etc.). Also, summarize fixed-gear fishing effort and locations to support overlap analysis with humpback whale (or other large whale) migrations or aggregation. Data summary should follow the reporting cycle developed for the PCGW above.
(5) NMFS and the PCGW should work with the PFMC to promote retrieval of lost gear (see Appendix D and E for information about example programs for gear recovery).
(6) NMFS and the PCGW should work with the PFMC to assess available technology to minimize loss of sablefish pot/trap gear (i.e., Gearfinder technology) and promote use of appropriate technology.
(7) NMFS and the PCGW should work with the PFMC to investigate the practice of storing sablefish pot/trap gear in the ocean to evaluate the potential for conservation issues and any need for additional regulation.

Leatherback Sea Turtles

(1) NMFS and the PCGW should assess the feasibility of collecting data to assess bycatch of jellyfish in the groundfish trawl fisheries.

(a) NMFS and the PCGW should consider the practicality of identifying jellyfish to species that could be encountered in the groundfish trawl fisheries.
(b) NMFS and the PCGW should evaluate methods that observers could use to estimate the proportion of jellyfish in a trawl set and, if applicable, the proportion of brown sea nettles in that estimate.

<u>Reinitiation of Consultation</u>

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action.

Appendix B. Example logbook regulations, instructions and entry forms for the Washington commercial Dungeness crab fishery.

Logbook regulations:

WAC 220-52-041

Coastal Dungeness crab logbook requirements.

(1) It is unlawful for any vessel operator engaged in fishing for Dungeness crab in the coastal commercial fishery to fail to complete a department-issued logbook for all fishing activity occurring in Grays Harbor, Willapa Bay, the Columbia River, or the Pacific Ocean waters adjacent to the state of Washington.

(2) It is unlawful for any vessel operator engaged in fishing to fail to comply with the following method and time frame related to harvest logbook submittal and record keeping:

(a) The department must receive a copy of the completed logbook sheets within ten days following any calendar month in which fishing occurred. Completed Dungeness crab harvest logs must be sent to the following address: Washington Department of Fish and Wildlife, Attention: Coastal Dungeness Crab Manager, 48 Devonshire Rd., Montesano, WA 98563.

(b) Vessel operators engaged in fishing for Dungeness crab in the coastal commercial fishery must complete a logbook entry for each day fished prior to offloading. Vessel operators responsible for submitting logs to the department must maintain a copy of all submitted logs for no less than three years after the fishing activity ended.

(c) Vessel operators can obtain logbooks by contacting the department's coastal Dungeness crab manager at 360-249-4628.

(3) Violation of this section is a misdemeanor, punishable under RCW 77.15.280.

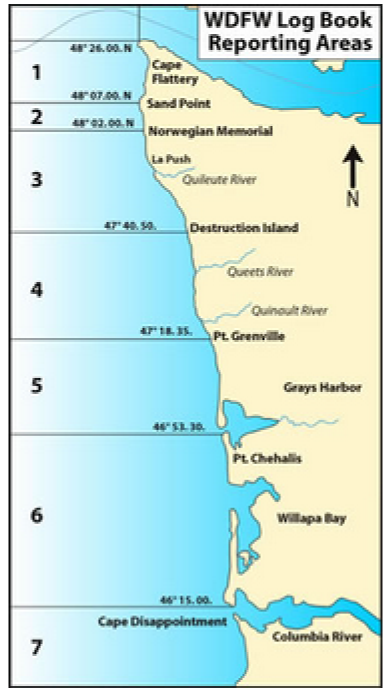
[Statutory Authority: RCW 77.12.047. 07-23-090 (Order 07-285), § 220-52-041, filed 11/20/07, effective 12/21/07.]

Logbook Instructions (http://wdfw.wa.gov/fishing/commercial/crab/coastal/logbook.html)**:**

Washington Coastal Commercial Dungeness Crab Logbook Instructions

Notice: *The skipper of each vessel landing Dungeness crab in Washington is responsible for maintaining a logbook provided by the Washington Department of Fish and Wildlife in accordance with these instructions* (WAC 220-52-040).

> Logbooks are due by the 10th of each month for the previous month
> Send completed logbooks to:
>
> WDFW Attn: Coastal Crab Manager
> 48 Devonshire Rd.
> Montesano, WA 98563



Logbook Catch Areas	Location
1	U.S. Border - 48°07.00 (Sand Point)
2	48°07.00 - 48°02.00 (Norwegian Memorial)
3	48°02.00 - 47°40.50 (Destruction Island)
4	47°40.50 - 47°18.35 (Point Grenville)
5	47°18.35 - 46°53.30 (Point Chehalis)
6	46°53.30 - 46°15.00 (WA/OR border)
7	South of 46°15.00 (Oregon)

Vessel: Registered name of vessel

Crab License #: Coastal Dungeness crab license number

Port: Port of landing

Federal #: Vessel's Federal document number

Landing date: Date of landing (on fish ticket)

Fish Ticket #: Fish ticket number

LOGBOOK INFORMATION INSTRUCTIONS

Date: Date the pot or string is picked

String #: A random numeric identifier for strings (example: 1, 2, 3, etc...)

Depth (fm): Average depth of the string

Pots Fished: Number of pots currently being fished in string

Pots Lost: Number of pots that are unlikely to be retrieved due to weather or disappearance of pot

Soak Time (days): Number of days a pot has been fishing (example: 2.5 days)

Latitude Begin/End: Latitude of the beginning and end of the string

Longitude Begin/End: Longitude of the beginning and end of the string

Number of Crab Retained: Number of individual crab retained in each string of pots

Logbook Catch Area: Catch area of string using catch areas on front cover of Coastal Dungeness Crab Fishery Logbook

Bait: List bait used to lure crab into pots of current string

Lost Gear Recovered: Number of pots recovered that were previously considered lost and recorded in Pots Lost column of logbook

Logbook Entry Form:

Washington Coastal Dungeness Crab Fishery Logbook

Washington Department of FISH and WILDLIFE

Vessel_____________________________ Crab License #_____________ Port__________________

Federal #__________________________ Landing Date______________________

Fish Ticket #_______________________ Fish Ticket #_______________________

Date	String #	Depth (fm)	Pots Fished	Pots Lost	Soak Time (days)		Latitude	Longitude	Number of Crab Retained	Logbook Catch Area	Bait
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					
						Begin					
						End					

NOTES:

SIGNED:________________________________ Date____________

Under penalty of perjury, I certify that the information contained herein is true and complete.

Lost Gear Recovered:_______________________

Appendix C. A spreadsheet from WDFW's logbook database with example data, including information about lost gear. The example data does not reflect actual fishing activities.

Logbook Header.ID	Vessel	License	Port	Federal ID	Landing Date	Fish Ticket 1	Fish Ticket 2	Logbook Header.Primary Logbook Page	Secondary Pages	Logbook Sets.ID	Set Date	String	Depth (ftm)	Pots Fished	Pots Lost	Soak Time (days)	Latitude Begin Degrees	Latitude Begin Minutes	Longitude Begin Degrees	Longitude Begin Minutes	Latitude End Degrees	Latitude End Minutes	Longitude End Degrees	Longitude End Minutes	Crab Retained (count)	Crab Retained (lbs)	Logbook Catch Area	Lost Gear Recovered
2712	VESSEL NAM	99999	WESTPORT	123456	12/18/10	Z123456		15301	15302, 153(	13926	12/15/10	15	19	25	1	2	47	21.58	124	11.86	47	18.24	124	11.78	190		6	
2712	VESSEL NAM	99999	WESTPORT	123456	12/18/10	Z123456		15301	15302, 153(	13930	12/16/10	19	6	42	3	1	47	24.92	124	5.38	47	22.12	124	5.24	440		6	
2712	VESSEL NAM	99999	WESTPORT	123456	12/18/10	Z123456		15301	15302, 153(	13932	12/16/10	21	21	41	1	3	47	19.12	124	12.10	47	15.99	124	11.84	121		6	
2712	VESSEL NAM	99999	WESTPORT	123456	12/18/10	Z123456		15301	15302, 153(	13933	12/16/10	22	25	39	2	1	47	19.99	124	13.49	47	24.09	124	13.79	397		6	
2712	VESSEL NAM	99999	WESTPORT	123456	12/18/10	Z123456		15301	15302, 153(	13938	12/17/10	27	20	47	1	1	47	21.58	124	11.86	47	18.24	124	11.78	180		6	
2713	VESSEL NAM	99999	WESTPORT	123456	12/21/10	Z123456		15306		13940	12/19/10	1	6	42	2	2	47	24.92	124	5.24	47	22.12	124	5.38	550		6	
2714	VESSEL NAM	99999	WESTPORT	123456	12/29/10	Z123456		15308		13946	12/28/10	2	7	62	1	8	47	25.94	124	6.01	47	22.27	124	6.21	550		6	
2714	VESSEL NAM	99999	WESTPORT	123456	12/29/10	Z123456		15308		13949	12/28/10	5	22	31	1	18	47	19.96	124	14.60	47	15.76	124	12.07	300		6	
2602	VESSEL NAM	99999	WESTPORT	123456	1/10/11	Z123456		42822		13541	1/9/11	7	17	100	8	1	47	28.00	124	10.00	47	18.00	124	9.00	550		6	
2602	VESSEL NAM	99999	WESTPORT	123456	1/10/11	Z123456		42822		13542	1/9/11	8	19	100	7	1	47	28.00	124	11.50	47	18.00	124	10.50	350		6	
2603	VESSEL NAM	99999	CHINOOK	123456	12/13/10	Z123456		37164-1		13543	12/13/10	1	18	100	2	3	47	16.46	124	11.06	47	22.40	124	11.13	1000		6	
2603	VESSEL NAM	99999	CHINOOK	123456	12/13/10	Z123456		37164-1		13544	12/13/10	2	23	55	1	3	47	18.31	124	12.39	47	16.25	124	11.83	800		6	
2604	VESSEL NAM	99999	CHINOOK	123456	12/16/10	Z123456		37164-2		13547	12/16/10	1	18	100	2	3	47	16.46	124	11.06	47	22.40	124	11.13	900		6	
2604	VESSEL NAM	99999	CHINOOK	123456	12/16/10	Z123456		37164-2		13548	12/16/10	2	23	55	1	3	47	18.31	124	12.39	47	16.25	124	11.83	600		6	
2604	VESSEL NAM	99999	CHINOOK	123456	12/16/10	Z123456		37164-2		13549	12/16/10	3	26	50	2	3	47	16.46	124	11.06	47	22.40	124	11.13	700		6	
2604	VESSEL NAM	99999	CHINOOK	123456	12/16/10	Z123456		37164-2		13550	12/16/10	4	35	65	1	3	47	18.31	124	12.39	47	16.25	124	11.83	1000		7	
2605	VESSEL NAM	99999	CHINOOK	123456	12/17/10	Z123456		37165-1		13552	12/17/10	2	18	100	3	1	47	16.42	124	11.13	47	22.58	124	11.06	300		6	
2606	VESSEL NAM	99999	CHINOOK	123456	12/21/10	Z123456		37165-2		13553	12/21/10	1	16	45	4	2	47	19.15	124	10.11	47	21.32	124	10.06	350		7	
2608	VESSEL NAM	99999	CHINOOK	123456	12/28/10	Z123456		37165-3		13554	12/28/10	1	16	44	1	6	47	19.15	124	10.11	47	21.32	124	10.11	403		6	
2608	VESSEL NAM	99999	CHINOOK	123456	12/28/10	Z123456		37165-3		13555	12/28/10	2	18	60	4	6	47	16.42	124	11.06	47	22.58	124	11.13	1000		6	
2609	VESSEL NAM	99999	CHINOOK	123456	12/30/10	Z123456		37165-4		13556	12/30/10	1	16	40	5	6	47	19.15	124	10.11	47	21.32	124	10.06	150		6	
2609	VESSEL NAM	99999	CHINOOK	123456	12/30/10	Z123456		37165-4		13557	12/30/10	2	18	60	5	6	47	16.42	124	11.06	47	22.58	124	11.13	300		6	
2610	VESSEL NAM	99999	CHINOOK	123456	12/31/10	Z123456		37166-1		13558	12/31/10	1	16	44	1	2	47	12.06	124	9.10	47	14.75	124	10.17	100		6	
2610	VESSEL NAM	99999	CHINOOK	123456	12/31/10	Z123456		37166-1		13559	12/31/10	2	18	100	4	2	47	16.46	124	11.06	47	22.40	124	11.13	50		6	
2610	VESSEL NAM	99999	CHINOOK	123456	12/31/10	Z123456		37166-1		13560	12/31/10	3	26	50	2	2	47	15.00	124	12.01	47	18.18	124	12.72	100		6	
2612	VESSEL NAM	99999	CHINOOK	123456	1/3/11	Z123456		37166-2		13562	1/3/11	2	26	50	3	1	47	16.46	124	11.06	47	22.40	124	11.13	130		6	
2614	VESSEL NAM	99999	CHINOOK	123456	1/9/11	Z123456		37167-2		13567	1/9/11	2	35	65	1	3	47	12.00	124	11.30	47	10.00	124	11.89	140		7	
2615	VESSEL NAM	99999	CHINOOK	123456	1/10/11	Z123456		37167-3		13568	1/10/11	1	16	45	1	2	47	19.15	124	10.11	47	21.32	124	10.06	40		6	
2615	VESSEL NAM	99999	CHINOOK	123456	1/10/11	Z123456		37167-3		13569	1/10/11	2	18	99	1	2	47	16.46	124	11.06	47	22.40	124	11.13	75		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13570	12/12/10	1	10	55	1	2	47	22.70	124	6.40	47	25.40	124	6.20	1130		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13571	12/12/10	2	10	54		2	47	27.90	124	6.20	47	25.40	124	6.70	932		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13572	12/12/10	3	11	98		2	47	27.70	124	7.00	47	22.40	124	7.40	2067		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13573	12/12/10	4	19	43		2	47	27.30	124	10.50	47	23.80	124	10.80	575		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13574	12/13/10	5	10	55		1	47	22.70	124	6.40	47	25.10	124	5.20	720		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13575	12/13/10	6	10	54		1	47	27.90	124	6.20	47	25.40	124	6.70	452		6	
2616	VESSEL NAM	99999	ILWACO	123456	12/13/10	Z123456		5821		13576	12/13/10	7	11	98		1	47	27.70	124	6.70	47	22.40	124	7.00	1125		6	
2617	VESSEL NAM	99999	ILWACO	123456	12/16/10	Z123456		5823		13577	12/16/10	1	10	55		2	47	22.70	124	6.40	47	25.40	124	6.20	560		6	
2617	VESSEL NAM	99999	ILWACO	123456	12/16/10	Z123456		5823		13578	12/16/10	2	10	54	1	2	47	27.90	124	6.70	47	25.40	124	6.70	586		6	
2617	VESSEL NAM	99999	ILWACO	123456	12/16/10	Z123456		5823		13579	12/16/10	3	11	98		2	47	27.70	124	7.00	47	22.40	124	7.40	565		6	
2617	VESSEL NAM	99999	ILWACO	123456	12/16/10	Z123456		5823		13580	12/16/10	4	19	43		2	47	27.30	124	10.50	47	23.80	124	10.80	286		6	
2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13585	12/28/10	1	11	96	2	6	47	27.70	124	7.00	47	22.40	124	7.40	667		6	
2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13586	12/28/10	2	10	53	1	6	47	22.70	124	6.40	47	25.40	124	6.20	364		6	
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2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13588	12/30/10	4	19	43		7	47	27.30	124	10.50	47	23.80	124	10.80	373		6	
2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13589	12/30/10	5	11	96		7	47	27.70	124	7.00	47	22.40	124	7.40	598		6	
2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13590	12/30/10	6	10	52		7	47	27.70	124	6.70	47	25.40	124	6.70	299		6	
2619	VESSEL NAM	99999	ILWACO	123456	12/30/10	Z123456		5825		13591	12/30/10	7	19	43		7	47	22.70	124	7.40	47	25.40	124	6.40	265		6	
2627	VESSEL NAM	99999	ILWACO	123456	12/14/10	Z123456		7851-2		13606	12/14/10	1	15	140	1	2	47	24.35	124	9.81	47	16.06	124	9.99		2500	6	
2629	VESSEL NAM	99999	ILWACO	123456	12/18/10	Z123456		7852-1		13612	12/17/10	1	30	190	1	2	47	26.05	124	14.78	47	16.03	124	13.32		4000	6	
2653	VESSEL NAM	99999	WESTPORT	123456	12/17/10	Z123456		34822		13658	12/12/10	1	15	160	2	2	47	28.00	124	8.98	47	16.77	124	10.21	2833		6	
2653	VESSEL NAM	99999	WESTPORT	123456	12/17/10	Z123456		34822		13662	12/13/10	5	32	65	3	3	47	23.51	124	15.52	47	20.02	124	16.74	855		6	
2653	VESSEL NAM	99999	WESTPORT	123456	12/17/10	Z123456		34822		13665	12/15/10	8	15	160	4	1	47	27.99	124	8.90	47	15.67	124	10.20	2552		6	
2654	VESSEL NAM	99999	WESTPORT	123456	12/23/10	Z123456		34823		13666	12/19/10	1	21	60	1	5	47	28.01	124	10.73	47	24.14	124	10.90	299		6	
2654	VESSEL NAM	99999	WESTPORT	123456	12/23/10	Z123456		34823		13668	12/20/10	3	15	120	1	5	47	24.14	124	9.94	47	16.71	124	10.22	1301		6	
2654	VESSEL NAM	99999	WESTPORT	123456	12/23/10	Z123456		34823		13669	12/20/10	4	17	35	3	5	47	27.02	124	9.29	47	24.25	124	11.97	196		6	
2655	VESSEL NAM	99999	WESTPORT	123456	1/3/11	Z123456		15309	15310, 153:	13676	12/31/10	7	30	48	2	14	47	27.83	124	15.94	47	22.60	124	14.70	376		6	
2655	VESSEL NAM	99999	WESTPORT	123456	1/3/11	Z123456		15309	15310, 153:	13683	1/1/11	14	21	40	1	4	47	18.96	124	12.28	47	15.46	124	11.70	129		6	
2663	VESSEL NAM	99999	ILWACO	123456	12/22/10	Z123456		1054		13749	12/22/10	1	12	59	1	6	47	12.66	124	5.62	47	9.74	124	3.04	457		7	
2700	VESSEL NAM	99999	ASTORIA	123456	12/31/10	Q999999		31724		13838	12/30/10	1	8	130	4	2	47	22.80	124	6.00	47	28.00	124	5.90			6	
2700	VESSEL NAM	99999	ASTORIA	123456	12/31/10	Q999999		31724		13839	12/30/10	2	11	80	2	2	47	22.53	124	7.61	47	18.56	124	8.28			6	
2700	VESSEL NAM	99999	ASTORIA	123456	12/31/10	Q999999		31724		13840	12/30/10	3	11	40	1	2	47	15.14	124	9.77	47	16.47	124	9.95			6	
2700	VESSEL NAM	99999	ASTORIA	123456	12/31/10	Q999999		31724		13841	12/30/10	4	12	50	3	2	47	16.57	124	9.63	47	18.64	124	8.78			6	

Appendix D. Information about Washington programs for recovery of lost Dungeness crab gear and public hotline for reporting lost gear sightings.

Permit Program for Gear Recovery:

<u>Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program, Final Report:</u>

NOAA Restoration Center

Community-based Restoration Program (CRP)

Progress Report Narrative Format

OMB Approval No. 0648-0472

Expires 12/31/2011

I. Project Title: **Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program**

II. Reporting Period (01/01/09 - 12/31/11)

III. Project Narrative (this section is required for the final comprehensive report only)

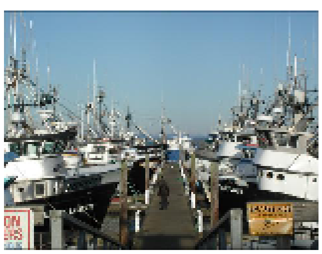
Background

The states of Washington, Oregon and California are authorized to manage the coastal Dungeness crab fisheries adjacent to each state in state (0-3 miles) and federal waters (3-200 miles) through the Magnuson Stevens Fishery Conservation and Management Act. The Washington Department of Fish and Wildlife (WDFW) manages the fishery off the coast of Washington.

The coastal commercial Dungeness crab fishery has occurred in Washington's coastal waters for many years and is one of the most important commercial fisheries in Washington State. Since 1950, the Washington coastal crab fishery has produced between 2.6 and 25 million pounds per season. Coastal crab landings over the last 20 years average about 14.7 million pounds per season; the 2004-2005 season produced record high landings of 25 million pounds.

Dungeness crab fishing

The commercial fishery in Washington occurs in coastal waters extending approximately 140 miles from the U.S. Canadian Border to the Washington Oregon border and west from the shore to approximately 80 fathoms and at times deeper.



A small portion of the Washington Dungeness crab fleet

There are 223 coastal Dungeness crab licenses under a limited license program; approximately 190-200 of those have been actively fished during the most recent seasons. Under a two tiered pot limit of 300 or 500 pots per vessel, approximately 90,000 crab pots are deployed at the start of each commercial season, which typically starts in December or January. The majority of the crabs are harvested in the first four to five months of the nine-month season.

A healthy Dungeness crab resource sustains a commercial fishery that has a strong socioeconomic impact on the small remote coastal communities of Westport, Ilwaco, Chinook, Neah Bay and LaPush. The majority of the crabs harvested in the coastal fishery are delivered to buying facilities and processing plants located in these ports, which provides additional jobs and resources to these communities. Most of the fishers that participate in this fishery also make their homes and raise their families in these communities. A healthy Dungeness crab resource has provided these communities long term stability during years when salmon and groundfish resources could not support large commercial fisheries.

One long term issue for most fisheries is that fishing gear is occasionally lost. Consistent gear loss is a problem for the Dungeness crab fishery. Weather is a major mechanism for crab gear loss, poor weather during the season can create rough seas where pots can drift off with strong currents and become lost. Crab pots can also get buried by sand because of strong currents and become what is known as a "stuck pot". Marine vessel propellers may cut off buoys as they pass through heavily fished areas creating what are called "cut-offs". Dungeness crab pots can also become lost if they are moved from their organized strings by becoming snagged on the tow bridles of barges that frequently transit crab-fishing grounds. If fishers cannot find lost pots or do not have the means to recover stuck pots or pots with cut off buoys they become abandoned or derelict gear.

The coastal crab fishery is underway during some of the most severe weather of the year. In the past, post-season surveys have estimated gear loss to be approximately 10% of the pots fished during the season. Gear loss may be higher in some areas.

For the Dungeness crab fishery these stray and abandoned crab pots present a problem to those that are dependent on a healthy Dungeness crab resource to make a living, they also have a detrimental effect on NOAA trust resources. State-enforced regulations governing crab pot design and construction serve to minimize the potential for long term 'ghost fishing' by pots that remain on the sea floor. 'Escape rings' and panels held together with biodegradable cotton help to insure that crabs trapped in lost pots can escape in a reasonable amount of time. These measures will protect the Dungeness crab resource to some extent but even with these provisions, it is certain that lost crab pots are responsible for unnecessary crab mortality and degradation of the marine environment.

Project Overview

WDFW is taking a stepwise approach to the development and implementation of a stray and abandoned crab pot removal program in coastal waters. The portion of this WDFW project that comprises the majority of the funding focuses on stray and abandoned crab pot removal efforts on the southern Washington coast. The rationale behind this smaller scale focus is twofold: 1) to provide the WDFW team an opportunity to develop the skills and methods required for effective gear removal on the open ocean; 2) to target the gear removal to specific high priority areas (one on the northern Washington coast, one near Grays

Harbor and one near the mouth of the Columbia River). The northern high priority area is located in an area that is co-managed by the WDFW and the Quinault Indian Nation (QIN). WDFW and QIN will work together to coordinate gear removal effort in this area.

In addition to this project, with the support of the coastal commercial crab industry and the Washington State Legislature, WDFW implemented the state supported Permitted Stray and Abandoned Gear Recovery Program. Separate from this NOAA funded project, this program provides fishers who hold a Washington State commercial crab fishing license the opportunity to request a permit from WDFW that allows them to recover and retain any pots remaining in the ocean following the close of the commercial fishing season. This permitted program required action by the state legislature to modify long-standing lost property statutes in Washington State law and provides some incentive for fishers to recover abandoned pots by allowing them to keep the gear recovered.

IV. Methodology

Active crab fishing by both tribal and state fishers is in progress during the majority of the year (December 1 through September 15). No gear recovery work on this project occurred during the period when the fishery was open. This was due to the fact that it is difficult to identify lost and abandoned pots during periods of active fishing and not mistakenly recover pots that are still in use. In addition, the project's recovery work waited one-week after the close of the season to provide WDFW Enforcement Officers an opportunity to seize any gear that was not lost, but had simply (and illegally) not been removed by September 15. In short, the project's recovery work did not begin until late September all three years.

The gear recovery portion of the project was divided into two parts: the Stray and Abandoned Pot Recovery work and the Cut-Off Pot Recovery work. In addition, WDFW also implemented a monitoring component that was designed to use the data collected during gear recovery to provide a measure of the numbers of lost pots per square mile and an estimate of ghost fishing mortality per pot for each area monitored. Finally, an education component was also implemented.

Stray and Abandoned Pot Recovery

This portion of the project focused on the removal of stray and abandoned crab pots that are visible from the surface using contracted commercial crab vessels. A total of seventeen vessel days (included two donated days) were dedicated to removing stray and abandoned pots visible from the surface (exceeding the goal of twelve days). During the course of this work a total of 20.20 MT of gear was recovered.

Hydraulic crab block

During the course of this portion of the project, WDFW signed contracts with the owners of a total of five commercial crab fishing vessels. The captains of each of these vessels and their crews were all experienced crab fisherman and all had extensive

Gas powered pot pump

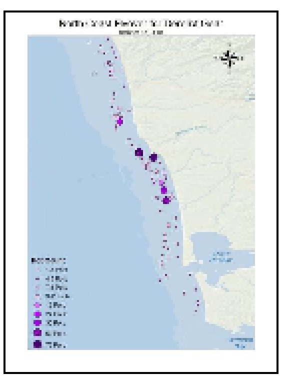
experience in the recovery of stray and abandoned pots with buoys still visible from the surface. Pots were recovered using the vessel's hydraulic crab block, attaching the crab pot line to the block and pulling the pot to the surface. However, many of the pots were stuck or "sanded-in" on the ocean floor. In these cases, a water hose was attached to the crab line and run down the line to the ocean floor. A high pressure pump attached to the opposite end of the hose was used to "jet" the sand and mud from around the stuck pot – eventually freeing it. We found this to be a time consuming process requiring as much as one hour of pumping per pot.

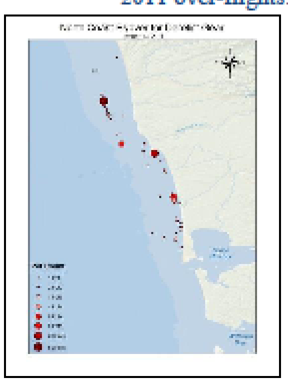
In every case when the pot came to the boat deck, WDFW staff was always onboard to inspect the pot, record the general condition of the pot, the status of the biodegradable cotton, the number of crab (dead or alive) in each pot, determine (when possible) the pot owner and record anything else that was notable.

Late fall weather and ocean conditions played a role in restricting recovery operations to a certain degree. Our contract vessels were less likely to want to operate too far from their home port when conditions were predicted to deteriorate. Final decisions on what conditions were suitable for safe work were always left to the judgment of the experienced vessel captains. Despite these issues, WDFW was able to successfully execute a total of seventeen vessel days of recovery work on this portion of the project.

WDFW Partenavia P68 used for flyovers

WDFW also conducted two low level ocean over-flights using an agency owned aircraft with project personnel onboard to locate and document the GPS locations of as many pots as possible, paying close attention to areas of pot accumulations. The over flights were conducted in 2010 and 2011 just prior to commencing pot recovery work funded by this project (following the Sept. 15 end of the commercial crab season). There is a noticeable difference in the density of pots between the 2010 and 2011 over-flights. WDFW staff observed 486 pots during the 2010 flight and 209 pots during the 2011 flight. This data appears in the two graphics presented here.





During the course of the project, WDFW observed that fishers were doing a better job of cleaning up their own gear. The reasons for this are not certain; however among those reasons is certainly an increased awareness within the crab industry of the

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problems lost crab gear creates, the additional attention WDFW was placing on the issue and the potential negative image lost gear can give their fishery among groups outside the industry. In addition, more fishers are using the separate WDFW Permitted Pot Recovery Program (described earlier) to actively clean up remaining gear.

Cut-off Crab Pot Recovery

This portion of WDFW's project focused on the removal of up to 100% of the crab pots that have had buoys separated and become un-retrievable in two one square mile areas. The removal was focused in the high priority areas near the mouth of the Columbia River and the entrance to Grays Harbor. The goal was to quantify the amount of gear on the ocean floor in each of these areas and to attempt to restore marine habitat and protect living marine resources by removing derelict gear from these two specific areas.

A total of three vessel days were dedicated to using a large commercial trawl vessel sweeping an area near the mouth of Grays Harbor for cut off pots. During the course of this work a total of 1.5 MT of gear was recovered.

A total of five vessel days were dedicated to using a smaller commercial crab vessel to sweep an area near the mouth of the Columbia River for cut-off pots. During these five days a total of 0.6 MT of gear was recovered.

WDFW began this portion of the project by convening a group of experienced coastal crab fishers in September 2009 to study the nautical charts of the Washington coast and agree on two areas, one near the mouth of the Columbia River and one near the mouth of Grays Harbor where likely accumulations of cut off gear would be found. After some discussion, these fishers were successful in identifying two areas where this portion of the project could be executed.

Initially, to conduct this portion of the project, WDFW choose to seek a contract with a large trawl vessel that met the bid specifications to: have a crab block; have a forward net reel; and have a vessel length at a minimum of seventy-five feet. The successful bidder provided a vessel that not only met the specifications, but was also operated by a captain with extensive experience using trawl gear.

Because pots in this area had their buoys cut-off and were not visible from the surface, it was planned to use grappling gear to sweep the area. It is important to note that the bottom depths in this area are 45 to 80 fathoms, depths not easily accessed by divers. Bathometry charts indicate that while these areas have a soft (sandy) substrate, these depths would not support eelgrass. There were no hard rocky sensitive habitats in either of these areas.

WDFW staff worked with the skipper of the contracted trawl vessel to design grappling equipment intended to decrease the bottom impacts resulting from towing grapples on the sea floor. The new grappling set up included buoys that were designed to "roll" the tow line and grapples off the bottom but still allow the grapples to catch the pots and/or the line attached to the pots. WDFW also consulted with Oregon Department of Fish and Wildlife staff and a captain of a vessel they used for similar gear recovery work in Oregon, to closely model the design of the grapples used there.

Difficult weather and ocean conditions combined with conflicts with fishing schedules of the contract vessel resulted in the delay of the execution of the first phase of this work.

However, in late October 2010 everything came together and WDFW staff and the contract vessel spent three days in an area near the mouth of Grays Harbor.

Grappling array ready for deployment

Badly deteriorated pot recovered with grappling array.

The initial plan was to pull the grappling array to cover the bottom in the previously identified one square mile areas. During the grappling recovery near Grays Harbor it was discovered when using a trawl vessel to deploy the array the original plan to cover the one-square mile area became impractical, primarily because the time to "turn-around" the gear set up was much longer than expected. Instead an at-sea decision was made to run longer tracks with the grappling gear with the intent to cover an area equivalent to one-square mile. In the end, over the course of three full days of work the contract vessel, crew and WDFW staff executed numerous tracks that covered a total of 0.87 square miles of area near the mouth Grays Harbor (calculated using the width of the area covered by the gear and the length of each track). These tracks occurred within the same general area of the original "box" – an area expected to have a high volume of lost or abandoned gear. This operation recovered a total of twenty-one pots and seventeen sections of line (that had connected the buoys to the pots) for a total of 3,330 pounds (1.5 MT) of stray or abandoned fishing gear removed from this 0.87-mile square area. The vast majority of the pots recovered were in a badly deteriorated and unfishable condition, similar to the pot pictured above.

On two occasions WDFW also used the contracted trawl vessel to attempt to recover large concentrations of crab pots commonly referred to by crab fishers as "flower pots". These are best described as pots and line that have been moved together by heavy ocean swell and currents resulting from storm conditions. This gear is "twisted" in to large concentrations and can act to easily "trap" even more gear as they are "swept" into the area by ocean conditions. Even though the trawl vessel was a large, powerful vessel – in both cases it was unable to bring these large accumulations of gear on-board, or even break them free from the ocean floor.

The plan was to move directly from the Grays Harbor area to work the area near the Columbia River with the same contract vessel. However, the on-set of a major winter storm with resulting difficult ocean conditions that persisted for an extended period of time side-tracked those plans essentially ending the 2010 work window.

In our initial overall project planning, we had set aside a total of four-days in our schedule and budget to sweep two one-square mile areas with this vessel using a "grappling array". This plan proved to be more ambitious than we expected. In practice, we found that sweeping just one area required three days (rather than the anticipated two days) and one third more staff time and funds than were initially expected.

While we were confident that the grappling array as towed by the contract trawl vessel was making bottom contact (based on observed "scouring" of the iron grapples) we remain puzzled by the lack of gear recovered. One possibility was that we may not have been operating in an area of concentration of lost pots.

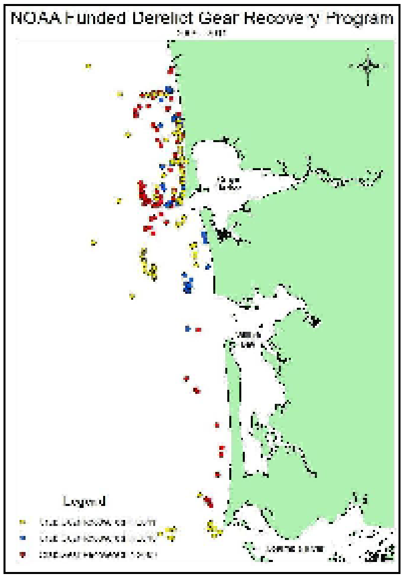
Before beginning phase two of this portion of the project, we discussed a plan of action with some of our industry advisors. After much consideration, we made the decision to conduct the sweep of the one-square mile area near the mouth of the Columbia River with a smaller more maneuverable and less expensive crab vessel.

Grapple coming to surface with crab line it "caught".

Our crew worked aboard a contract commercial crab fishing vessel, for five days at the end of September and into the first of October 2011 sweeping through the previously determined designated area. Rough weather made it impossible to conduct this work in five consecutive days. However the entire area was successfully swept with grappling gear and we were able to stay true to the one-square mile box we had initially designated.

Because this area was indentified to be a location with a high concentration of lost pots, we were surprised to recover only a total of eight crab pots. These eight pots, when combined with the nylon crab line also recovered resulted in a total of 0.57 MT of cut-off gear recovered. Each of these pots were very deteriorated and broken up. No crabs (either dead or alive) were found and the biodegradable cotton in each was "long-gone" and the escape panels open. While it is difficult to determine with certainty if our grappling gear was working correctly, we are confident that bottom contact was being made as evidenced again by scouring of the iron grapples. During each of the days we worked, we made minor adjustments to assure to gear was working correctly. One assumption is that the one-square mile pre-selected for this work did not have the accumulation of gear that was expected.

V. Results/Progress to Date



At the onset of this project, WDFW proposed to conduct a total of sixteen vessel days with the goal of collecting a total of 27 MT of stray and abandoned crab gear.

During the three years in which WDFW conducted field work associated with this project, a total of 25 vessel days were dedicated to the recovery of stray and abandoned crab gear. That work was conducted aboard a total of nine commercial crab vessels and one contracted trawl vessel.

During all of these trips a total of 330 crab pots and a large volume of heavy nylon line associated with these pots were recovered. In addition, more heavy nylon line was recovered when in some occasions, pot recovery efforts resulted in the line breaking off.

The total amount of gear (pots and line) recovered was 23.4 MT. This value is primarily based on the actual weight of the gear recovered. However, in some cases fishable gear was returned to the legal owners just after the recovery boat returned to the dock and before that gear could be weighed. In these cases an estimate of the weight was used, based on the actual weights of other gear that had been recovered.

Stray and Abandoned Pot Recovery

Goal: This portion of the proposal focused on the removal of stray and abandoned crab gear that are visible from the surface using contracted commercial vessels.

Results: As we stated earlier, a total of seventeen vessel days (included two donated days) were dedicated to this portion of the project (exceeding the goal of twelve vessel days). A total of 21.3 MT of gear was recovered. In 2010 and 2011 we preceded this work with an ocean over-flight aboard a WDFW aircraft to locate concentrations of gear visible from the surface.

	2009	2010	2011	*TOTAL*
VESSEL DAYS	4	5	8	*17*
NO. POTS	103	77	121	*301*
POTS LBS	15,900	11,550	18,150	*45,600*
NO. CUT LINES	30	39	14	*83*
CUT LINE LBS	350	600	280	*1,230*
TOTAL LBS	16,250	12,150	18,430	*46,830*
TOTAL MT	7.4	5.5	8.4	*21.3*

Table 1. Results from the stray and abandoned pot recovery portion of the project.

Discussion: During the course of this project we learned much about recovering crab gear visible from the surface. Among those lessons was the realization of the role good weather conditions plays in successful gear recovery. We also learned the importance of aerial surveys. In 2009 we did not do an ocean over flight and found we spent more time looking for

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gear than we had expected. In 2010 and 2011 we tried to time our aerial survey to the beginning of a period of good weather so that at-sea work could begin immediately following. This of course was complicated by aircraft and contract vessel availability – and the reliability of weather and ocean forecasts in the late fall. In 2010 the at-sea work started ten days after the over-flight (due to the above reasons and a big storm that moved into the area) and much of the gear we saw from the air had been moved by the heavy swell that accompanied the storm. We also learned that having to pump stuck pots is very time consuming and can greatly slow down the overall gear recovery work. Gear that was not stuck or "sanded in" was recovered at a rate of fifteen or more pots/hour – the only limiting factor was finding the buoys. While stuck gear (that required pumping) had a recovery rate closer to four pots per hour. We also found that the later in the season the recovery work occurred, the more time for storms to move and cause pots to become stuck – resulting in less successful the recovery work.

Cut-off Crab Pot Recovery

Goal: This portion of the program focused on the removal of up to 100% of the crab pots that have had buoys separated and become un-retrievable in two one square mile areas.

	2009	2010	2011	*TOTAL*
VESSEL DAYS	0	3	5	*8*
NO. POTS	0	21	8	*29*
POTS LBS	0	3,150	1,200	*4,350*
NO. CUT LINES	0	17	3	*20*
CUT LINE LBS	0	180	50	*230*
TOTAL LBS	0	3,330	1,250	*4,580*
TOTAL MT	0.0	1.5	0.6	*2.1*

Table 2. Results from the cut-off pot recovery portion of the project.

Results: A total of three vessel days were dedicated to using a large commercial trawl vessel sweeping an area near the mouth of Grays Harbor for cut off pots and a total of 1.5 MT of gear was recovered. A total of five vessel days were dedicated to using a smaller commercial crab vessel to sweep an area near the mouth of the Columbia River for cut-off pots and here a total of 0.6 MT of gear was recovered.

Results: It is possible to use the data collected by this portion of the project to make an estimate of the number of crab pots are within a one-square mile area. As we stated in the methods section where we described this work, we were able to sweep a total of 1.87 square miles of ocean floor using two different sized vessels to pull grapple gear. That resulted in the recovery of 29 crab pots. Using those results we calculate a total of 15.5 pots per square mile.

Discussion: With the help of our industry advisors we purposely tried to choose two areas where there would be a high density of crab pots. We do not know if the resulting estimate of 15.5 crab pots per square mile is an accurate representation of the lost pots on the ocean floor in these areas. Future projects would benefit from securing additional funding to use sonar and/or remotely operated vehicles (ROV) with lights and cameras to confirm areas of high density of lost gear and the effectiveness of grapples to remove that gear. An approach of this type could also be designed to gather data on the impacts of grappling equipment to recover lost crab gear.

Monitoring

Goal: to provide a specific measure of the numbers of derelict pots per square mile and an estimate of ghost fishing mortality per pot and per square mile for each area monitored.

Total	2009	2010	2011	*TOTAL*
VESSEL DAYS	4	8	13	*25*
POTS RECOVERED	103	98	129	*330*
% BIO.LINE BROKEN	73.8%	83.7%	93.0%	*76.7%*
AVER. LIVE CRAB/POT	6.47	0.29	2.81	*3.22*
AVER. DEAD CRAB/POT	0.03	0.13	0.08	*0.08*

Table 3. Results from the monitoring portion of the project.

Results: As described in the previous section, we were able to calculate an estimate of 15.5 lost or abandoned crab pots per square mile; however for the reasons in the previous section, we are not sure if this represents an area of high concentration of lost gear.

Biodegradable line holding closed an escape panel

WDFW staff did collect data on the number of pots with "broken" biodegradable line – required to be used to tie closed the also required escape panels in each pot. Table 3 shows that a total of 76.7% of the pots recovered had the biodegradable cotton broken. On average, a total of 3.2 live crab and .08 dead crab were found per pot.

Discussion: The results of our observations of the usefulness of biodegradable line to open escape panels is conclusive. Very few dead crabs were found with an average of less than 1/10 dead crab per pot. The vast majority of the live crabs found were found in pots where the escape panel had opened and the crab were free to come and go. In fact, our crews observed that the majority of these were smaller females or sub-legal sized males who may have been using these pots for shelter – moving in and out as needed.

VI. Monitoring and Maintenance Activities

Through-out the project WDFW monitored the stray and abandoned gear reporting hot line. However, by far most of the information on locations of lost gear came directly from some coastal crab fishers. This came both in direct contacts in phone calls or in-person meetings and from notations in their required log books. We also found the locations of gear recovered during our ocean over flights were very helpful.

VII. Community Involvement

WDFW worked closely with members of the coastal crab industry. An estimated total of forty-five crab fishers volunteered time and energy to provide WDFW advice and guidance on the recovery of stray and abandoned crab gear. These fishers also were a great assistance to us in returning fishable crab gear to the legal owners. Because of their efforts, we were not required to rent any storage space allowing us to re-direct $3,000 set-aside for that purpose to additional vessel time. In addition, a local owner of a refuse business agreed to take all of the recovered gear that was broken and un-repairable, free of charge. This allowed WDFW to re-direct $3,500 of our project funds originally designated for disposal to more gear recovery vessel time and to cover the costs aircraft time associated with two aerial surveys.

During the course of this project WDFW also began a buoy tag recycling program in cooperation with a local recycling firm. Many thousands of buoy tags must be replaced annually and we are told that many are dumped at sea or thrown in the garbage. By placing labeled recycling containers in coastal ports (Westport, Ilwaco and Chinook) we successfully delivered over 250 pounds (0.11 MT) of tags for recycling. This total is not included in our total of recovered gear.

Buoy tags recovered for recycling.

VIII. Outreach Activities

An educational brochure was produced describing the problems associated with lost crab pots; how to avoid pot loss; and pot recovery efforts. The brochures have been distributed to all licensed commercial crab fishers have been made available to the general public through local visitor centers, museums and chambers of commerce. This brochure has also been posted on the WDFW web site. A full copy of the brochure is included with this report.

WDFW brochure

IX. Supporting Materials

Please include any supporting materials relating to the project, such as articles/news clippings, project photographs (before, during, and after--high resolution images on CD ROM are appreciated), project maps, related web sites, and evidence of NOAA Community-based Restoration Program support (e.g. photographs of signs at project sites, funding credit on outreach materials, press releases with complete program name, etc.)

X. Funding Information (Cash and In-kind)

Itemized Budget table (similar to example below) showing expenses incurred during the reporting period, for both NOAA funds and matching contributions, as follows. Budget categories should correspond to those described in the approved proposal.

Budget Category (e.g. personnel, supplies, contractual, etc.)	NOAA Funds	Matching Contributions	Total Expense	Nature (cash or in-kind) and Source of Match
Salaries		$66,390	$66,390	In-kind / WDFW and Quinault Indian Nation
Contractual (vessel charters)	$48,700	$5,000	$53,750	In-kind / Vessel Owners
Aircraft	$944			
Travel	$1,546			
Supplies (grapples, line, buoys)	$4,751			
Educational Material	$1,172			
Agency Approved Indirect	$13,179			

1. Budget Narrative: Briefly describe expenditures by category and explain any differences between actual and scheduled expenditures. Include documentation of volunteer hours and in-kind donations.

   Contractual: vessel charters. In October, 2010 with approval from our NOAA project Officer we moved $13,960 to this category from previously budgeted categories (salary, benefits, travel) to increase the funds available for vessel charter.

   Aircraft: use of WDFW aircraft for two ocean over-flights.

   Travel: lodging and per diem costs for WDFW staff working on the project, per Washington State Travel Regulations.

   Supplies: grappling gear, nylon crab line and weights to support grappling gear used to recover crab pots.

   Educational Material: brochure developed by WDFW and printed by state printer (3,600 total copies).

   Volunteer hours: commercial crab fishers provided volunteer assistance to this project by: attending planning meetings; locating stray and abandoned crab gear and providing that location information to WDFW; returning recovered crab pots to the legal owners.

   In-kind donations were made in the form of two vessel days provided by the Westport Crab Fisherman's Association and the Columbia River Crab Fisherman's Association (one each). In addition, one month of biologist time was provided as an in-kind donation by the Quinault Indian Nation in consulting, analyzing and direct participation in the project.

NOAA Restoration Center

Community-based Restoration Program (CRP)

OMB Approval No. 0648-0472

Expires 12/31/2011

Project Data Form

CONTACT INFORMATION

Contact Name: **Dan L. Ayres**

Contact Title: Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program

Organization (Grantee): **Washington Department of Fish and Wildlife**

Street Address: **48 Devonshire Road**

City: **Montesano** State: **WA** Zip: **98563**

Phone: **360-249-4628 (ext. 209)** Fax: **360-664-0689**

E-mail: **Daniel.Ayres@dfw.wa.gov**

Organization website (if applicable): **www.wdfw.wa.gov**

PROJECT INFORMATION

Project Title: Washington Coastal Stray and Abandoned Crab Pot Reporting and Recovery Program

Project Award Number: **NA09NMF4630063** Project Reporting Period: 1/1/09 – 12/31/11

Project Location: Washington Coast

City:

County: **Grays Harbor and Pacific** State: **WA** Zip Code:

Congressional District(s): **WA-006**

Landmark (e.g. road intersection, beach):

Land Ownership (check one): Public: X Private: Both:

Geographic Coordinates (in decimal degrees, if readily available)

Longitude (X-coord):

Latitude (Y-coord):

Are there multiple project sites for this award?* Yes No

River Basin:

Geographic Identifier (e.g. Chesapeake Bay):
Pacific Ocean Coast of Washington

Project Start Date: **7/1/09** Project End Date: **12/31/11**

Project Volunteers

Number of Volunteers: **45** Volunteer Hours: **200**

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Brief Project Description (1-2 sentences) describing project and what it hopes to accomplish:

- Implement a program utilizing chartered vessels operating both during and after the commercial crab season to remove crab pots that have been lost or abandoned.
- Implement data collection protocols that will quantify the amount of gear removed and the species affected by derelict gear in the chartered vessel removal and the high priority area gear removal effort.
- Develop educational materials on the effect of derelict gear, ways to reduce gear loss, and report on the extent of derelict gear on the Washington coast.

List of Project Partners and their contributions (e.g. cash, in-kind, goods and services, etc.)

Westport Crab Fisherman's Association : in-kind services / vessel days
Columbia River Crab Fisherman's Association: in-kind service / vessel days
Quinault Indian Nation: in-kind services / staff time.

If permits are required, please list the permits pending and those acquired to date:

NEPA Permit (acquired on Sept. 15, 2009)
WDFW Gear Recovery Permit (acquired Sept. 16, 2009)

RESTORATION INFORMATION- Please complete this section to the best of your ability. Information below will be confirmed via site visit or phone call by NOAA staff before the close-out of an award.

List the habitat type(s) and acres restored/enhanced/protected or created to date (cumulative) and remainder to be restored/enhanced/protected or created (projected) with CRP funds by the end date of the award. If the project restores fish passage, list the stream miles opened upstream and downstream for fish access. Actual and Projected columns should add up to the total(s) for acreage to be restored with CRP funds indicated in the approved proposal.

Habitat Type (e.g. tidal wetland, oyster reef, mangrove)	**Actual Acres Restored** (To date-cumulative)	**Projected Acres** (i.e. Remainder to be restored with CRP funds by award end date)	**Actual Stream Miles Opened for Fish Access**	**Projected Stream Miles Opened for Fish Access** (i.e. Remainder to be restored with CRP funds by award end date)

What indirect benefits resulted from this project? (e.g. improved water quality, increased awareness/stewardship):
The removal of these abandoned pots will eliminate the chance that they will become entangled with pots fished at the beginning of the upcoming crab season. The removal of these abandoned

pots creates more open space for vessels to transit coastal waters and reduces potential entanglements with marine mammals. The removal of derelict gear protects marine resources and restores habitat. WDFW and industry members that are involved in the removal of derelict gear benefit from a cooperative effort to recover stray and abandoned crab gear.

List of species (fish, shellfish, invertebrates) benefiting from project (common name and/or genus and species):

1. Dungeness crab	**6.**
2.	**7.**
3.	**8.**
4.	**9.**
5.	**10.**

MONITORING ACTIVITIES

List of monitoring techniques used (e.g. salinity, fish counts, vegetation presence/absence):

1. Sampling of crab caught in recovered pots.	**6.**
2. Specific locations of recovered pots.	**7.**
3. Depth of recovered pots.	**8.**
4. Presence of biodegradable cotton.	**9.**
5. Biodegradable cotton broken/unbroken.	**10.**

Report Prepared By: ______________________ **March 27, 2012**
Signature Dan L. Ayres Date

Please send semi-annual and final progress reports and supporting materials to:

NOAA Restoration Center F/HC3
1315 East-West Highway
Silver Spring, MD 20910
ATTN: NOAA Community-based Restoration Program Progress Reports

The Progress Report Narrative Format and Project Data Form are available on the NOAA Restoration Center website at: http://www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/index.html. Electronic submissions are encouraged. Please submit electronic progress reports on PC compatible floppy disk or CD ROM in Microsoft Word, WordPerfect or PDF formats.

Be sure to save a copy of each report for your records; subsequent submissions of the Project Data Form need only add outstanding information, so that the form is completed in its entirety as part of the final comprehensive progress report.

Questions? Please call 301-713-0174 and ask to speak with NOAA Community-based Restoration Program staff

NOTICE

Responses to this collection are required of grant recipients to support the NOAA Community-based Restoration Program. The information provided will be used to evaluate the progress of the work proposed under the grant/cooperative agreement and determine whether the project conducted under the grant/cooperative agreement was successfully completed. Public reporting burden for completing the progress report narrative and project data form is estimated to average fifteen hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the information needed and completing and reviewing the collection of information. Responses to this information collection are required to retain funding provided by the NOAA Community-based Restoration Program. Confidentiality will not be maintained – the information will be available to the public. Send comments regarding this burden estimate or any other aspects of this collection of information, including suggestions for reducing this burden, to the NOAA Fisheries Office of Habitat Conservation, Restoration Division, F/HC3, 1315 East West Highway, Silver Spring, MD 20910.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

The information collected will be reviewed for compliance with the NOAA Section 515 Guidelines established in response to the Treasury and General Government Appropriations Act, and certified before dissemination.

Example Permit:

COASTAL DUNGENESS CRAB GEAR REMOVAL PERMIT

This permit, when issued by the WDFW to a coastal commercial Dungeness crab license owner, allows for the recovery and retention of commercial Dungeness crab gear owned by Washington state licensed fishermen in the specified areas and at times outlined below. Failure of the license owner or alternate operator to abide by the terms of this permit will result in termination of the provisions authorized.

- Recovery operations are restricted to the waters between 46° 15 North Latitude and the Washington-Canada border.
- This permit must be on board the vessel at any time crab pot recovery work is being conducted or anytime crab pots that do not belong to the license owner are on board.
- WDFW staff must be notified 24-hours prior to the vessel leaving the dock and at least 2-hours prior to returning to the dock following a gear recovery operation even if no gear was recovered during the trip. Notification can be made by calling 360-581-3337.
- All pots recovered during permitted gear recovery must remain on the vessel and remain in the condition it was recovered until the gear is registered and tagged by WDFW. Tampering with recovered gear, including removing pot tags, buoys or other markings prior to registering the gear will result in termination of this permit.
- No fishing gear belonging to tribal fishers can be recovered.
- Accurate and complete data records must be collected and provided to the Department upon returning with recovered gear.
- It is unlawful to retain crab during the closed season, WAC 220-52-040, all crab caught must be immediately returned to the ocean.
- A one square mile area off the Columbia River is off limits to WDFW permitted gear recovery to allow WDFW to conduct cut-off gear recovery work as part of our project which is funded through NOAA's Community-based Marine Debris Prevention and Removal Program. Coordinates for the closed area is as follows:

Columbia Closure (1 nm^2)

46° 15.0' N 124° 13.5' W
46° 15.0' N 124° 14.9' W
46° 16.0' N 124° 14.9' W
46° 16.0' N 124° 13.5' W

Washington Department of
FISH and WILDLIFE

COASTAL DUNGENESS CRAB GEAR REMOVAL PERMIT

Permit Valid Dates	
License Owner	
Vessel Operator	
Alternate Operator	
Vessel Name	
Geographic Restrictions	
Permit Authorized by	Sgt. Dan Chadwick

I understand and agree to abide by the terms of this permit and acknowledge that failure to do so will result in immediate termination of the provisions of this permit.

Signature (license owner) ____

Date____

Signature (alternate operator) ____

Date____

Example Gear Recovery Log:

WASHINGTON STRAY & ABANDONED GEAR RECOVERY LOGBOOK

Washington Department of FISH and WILDLIFE

Vessel________________________ Crab License #________________ Port________________

Federal #______________________ Leave Date__________________ Return Date______________

			Rotten Cotton				SPECIES RELEASED (COUNT)			
									Others (List Live/Dead)	
Date	Gear Description/Buoy #	Depth (fm)	Present yes/no	Broken yes/no	Latitude	Longitude	Live Crab	Dead Crab	Species:	Species:

NOTES:

SIGNED:____________________________

Public Reporting for Lost Gear Sightings (http://wdfw.wa.gov/fishing/derelict/**):**

Derelict Fishing Gear Removal Project

Buy Your License Online!

What's the Problem?

Derelict fishing gear includes nets, lines, crab and shrimp traps/pots, and other recreational or commercial harvest equipment that has been lost or abandoned in the marine environment. Modern nets and fishing line made of synthetic materials have been in use since the 1940s and take decades, even hundreds of years, to decompose in water. Derelict fishing gear is long-lasting marine debris that poses many problems to people and to marine animals, including:

- Entangling divers and swimmers;
- Trapping and wounding or killing fish, shellfish, birds and marine mammals;
- Degrading marine ecosystems and sensitive habitats;
- Damaging propellers and rudders of recreational boats, commercial and military vessels;
- Endangering boat crews and passengers with vessel capsizing.

Unfortunately, Puget Sound is littered with derelict fishing gear. It is estimated that hundreds of tons of derelict gear have collected over time in Puget Sound and the Northwest Straits region, especially the Strait of Juan de Fuca and northern Puget Sound from Everett to the Canadian border.

What's Being Done?

In 2002, the Northwest Straits Initiative, a program authorized by Congress to protect and restore marine resources in the Northwest Straits, began a comprehensive program to locate and remove harmful derelict fishing gear from Puget Sound. In cooperation with the Department of Fish and Wildlife and other federal and state agencies, it developed removal guidelines, created a database of known derelict gear, established a phone and web-based reporting system and began removing derelict fishing gear, primarily gillnets and crab pots. By mid 2009 the Initiative had removed over 1,200 gillnets and 2,000 crab pots. Trained commercial divers and vessels locate derelict gear with side-scan sonar and camera surveys and then physically remove and dispose of the gear from the waters of Puget Sound and the Northwest Straits.

Report Derelict Gear Sightings

Report Online

Reporting Hotline: 1-855-542-3935

For more information on the status of derelict fishing gear removal from Puget Sound, please visit the Northwest Straits Foundation website at http://www.derelictgear.org

Download
Derelict Fishing Gear Removal Guidelines

In July 2009, the Northwest Straits Initiative received $4.6 million federal stimulus grant through the American Recovery and Reinvestment Act (ARRA) and the National Oceanic and Atmospheric Administration to work full-time to essentially rid Puget Sound of most of the derelict commercial fishing nets that had been accumulating for decades. By the time the project ends in December 2010, over 3,000 additional partial gillnets (average size: 7,000 square feet) will have been removed, restoring many hundreds of acres of habitat and preventing thousands of fish, marine birds, marine mammals and invertebrates from being captured.

A map of cleaned areas, summary of activities and a species list with links to web sites with photos and descriptions of the species encountered in this project can be found on the Northwest Straits website at www.derelictgear.org.

What You Can Do

Report derelict fishing gear:

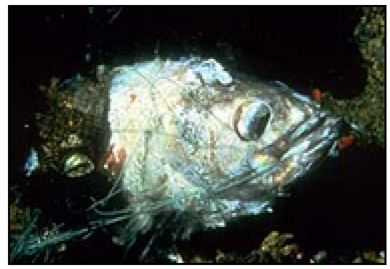
Use the no-fault reporting system to report any derelict gear you encounter:

- Report online
- Call 1-855-542-3935 (WA Dept of Fish and Wildlife) or 360-428-1084 (Northwest Straits)

There are no penalties associated with reporting lost fishing gear.

When you encounter derelict fishing gear:

Stay safely away from it! Do not attempt removal. Recreational divers are strongly cautioned to avoid the gear because of the inherent dangers – divers have died from entanglement in the past.



Record as much information as you can while you're on-site including:

- Location - GPS coordinates/chart location (latitude/longitude), water depth, distance from nearby landmarks and/or common names for the area;
- Type of Gear - Nets (monofilament gillnet or twine-like purse seine, trawl or fish farm pens), Pots/Traps (round or square for crab or shrimp, singular or multiple), Ropes/Lines, Floats, Trawl Doors or others;
- Details - Date and time of sighting, your activity during sighting (fishing, beach walk, swimming, diving, boating), type of seabed, size of the gear, number and type of invertebrates, fish, birds or marine mammals entangled or dead in the gear, perceived level of threat to humans or passing vessels;
- Contact Name - Your name, phone number, address, and/or email address will be very helpful should more information be needed. However, anonymous reports will be accepted;
- Report what you see - even if you're not sure the gear is lost or abandoned.

Prevent your own gear from becoming lost:

Fish and boat only in approved areas; know what's below you when fishing to avoid snagging. Properly dispose of all broken lines/gear on shore. Over 12,000 crab pots are lost in Puget Sound each year. Use escape cord on crab pots (go to www.escapecord.org website for more information). Always report lost gear within 48 hours to aid removal efforts.

Project Partners

Agencies and organizations providing assistance and/or funding to the Derelict Fishing Gear Program include: Northwest Straits Marine Conservation Initiative; Marine Resources Committees of Whatcom, Skagit, San Juan, Snohomish, Clallam, Jefferson, and Island counties; National Oceanic and Atmospheric Administration; U.S. Fish and Wildlife Service; U.S. Environmental Protection Agency; U.S. Navy; Washington Department of Fish and Wildlife; Washington Department of Natural Resources, Washington Department of Ecology; Puget Sound Partnership; Tulalip Tribes; Stillaguamish Tribe; King County; National Fish and Wildlife Foundation; commercial fishing and diving companies, local ports, and private foundations. *Additional support and participation are welcome!*

The "No-Fault" Approach

The focus of the Derelict Fishing Gear Removal Project is not on assessing blame. The goals are to remove lost and abandoned gear, to help restore Puget Sound and the Northwest Straits, to improve public safety, and to assist species recovery. The success of the project will rely on the collective efforts of citizens, government organizations and private businesses that all have an interest in healthy marine life.

What is the Northwest Straits Commission?

The Northwest Straits Marine Conservation Initiative, authorized by Congress, is nationally recognized as an innovative approach to bring sound science and an ecosystem perspective together with citizen energy and entrepreneurship. The Northwest Straits Foundation is a non-profit organization established to support the scientific, restoration, and education projects and programs of the Northwest Straits Marine Conservation Initiative.

NORTHWEST STRAITS
marine conservation initiative

Appendix E. Information about Oregon programs and regulations to recover lost Dungeness crab gear.

Program Information:

Beginning in 2009, a federally-funded and ODFW-managed project was initiated to recover lost crab pots, lines and buoys. The two-year project, called the Oregon Fishing Industry Partnership to Restore Marine Habitat, employed members of crab fishing industry to retrieve lost crabbing gear and develop efficient and resourceful retrieval methods. The below is a summary of this program's results (http://marinedebris.noaa.gov/about/pdfs/regionwc.pdf):

Oregon Fishing Industry Partnership

NOAA continues to support the Oregon Fishing Industry Partnership to Restore Marine Habitat project. With all field operations now completed, the project removed nearly 3,000 derelict crab pots, as well as other debris such as lines and nets. None of the recovered gear went to a landfill. All usable crab pots were returned to their owners, and thanks to the Fishing for Energy partnership, bins were placed in Astoria, Garibaldi, and Newport, enabling fishermen to recycle the gear. All the mangled and unusable pots were recycled for metal and nets and lines were used for energy. Side scan sonar was conducted to assess crab pot density and removal efficacy both offshore near the entrance to the Columbia River and off Newport, OR. Collaborating with the U.S. Coast Guard, project personnel flew in Coast Guard helicopters over the entire Oregon coast to spot lost crab pots, and provide relay this information to removal vessels. Collaborating with the fishing industry, the project supported the removal of over 440 lost pots by volunteer fishers, and conducted outreach and education to the crabbing industry and the general public.

To continue the industry's involvement, the Oregon Dungeness Crab Commission (ODCC) partnered with NOAA and ODFW in 2011 to create the gear recovery reimbursement program. This program offers monetary rewards for pots recovered. So far this year, ODCC has chartered vessels out of the major crabbing ports to retrieve derelict gear that has been reported to them through the season.

Oregon regulations about retrieval of derelict Dungeness crab gear:

Vessels that have a valid crab permit are allowed to retain and sell the legal crab harvested from the derelict gear they recovery if recovered during the season. This incentive to retrieve gear is new. The ODCC just took action this year to allow the legal crab from any derelict gear recovered during the crab season to be retained by Dungeness crab permitted vessels. The retrieving vessel can be any commercial fishing vessel that holds a valid boat license and the crew/captain have valid commercial fishing licenses. The retrieving vessel has to have a crab permit if they retain the legal crab for sale.

***OAR 635-005-0490*:**

Derelict Dungeness Crab Gear

Derelict Dungeness crab gear may be retrieved from the ocean, including the Columbia River, and transported to shore provided that:

(1) The retrieving vessel holds a valid boat license, issued pursuant to ORS 508.260, and the captain and crew of that vessel hold valid commercial fishing license(s), issued pursuant to ORS 508.235.

(2) The number of derelict Dungeness crab gear which may be retrieved per trip are as follows:

(a) From the opening of the ocean Dungeness crab fishery in the area where retrieval takes place until the second Monday in June of the same ocean Dungeness crab season: 25 derelict pots and rings in aggregate;

(b) From the second Monday in June through August 28: 50 derelict pots and rings in aggregate;

(c) August 29 through October 31: an unlimited number of derelict pots and rings may be retrieved.

(3) Upon retrieval from the ocean or Columbia River, the Dungeness crab gear must be un-baited.

(4) Crab from the retrieved Dungeness crab gear shall not be retained, except crab of legal size and sex may be retained by vessels holding a valid Dungeness crab permit, at such times and in such areas that Dungeness crab may otherwise be legally taken for commercial purposes.

(5) Immediately upon retrieval of Dungeness crab gear, the retrieving vessel operator must document in the retrieving vessel's logbook the date and time of pot or ring retrieval, number of retrieved crab pots or rings in aggregate, location of retrieval, and retrieved Dungeness crab gear owner identification information.

(6) Any retrieved Dungeness crab gear must be transported to shore during the same fishing trip that retrieval took place.

GROUNDFISH ADVISORY PANEL REPORT ON UPDATE ON BIOLOGICAL OPINION FOR THE GROUNDFISH FISHERY, INCLUDING CONSIDERATION OF SEABIRD PROTECTION REGULATIONS

The Groundfish Advisory Subpanel (GAP) received a briefing from Ms. Alison Agness and Ms. Bridgette Tuerler on the biological opinion for the groundfish fishery and offers the following comments.

The GAP had no comment on the biological opinion for species other than shorttail albatross and the tory line requirements being considered for fixed gear fisheries. The GAP supports moving forward with the analysis based on requirements imposed on the Alaskan fixed gear fleets. Specifically, fixed gear vessels fishing in Alaska greater than 55 feet in length are required to deploy tory lines to minimize seabird interactions with the gear. The GAP would note that off of Washington, Oregon, and California there are many smaller longline vessels (i.e., <55 feet in length) that may not be able to functionally or safely deploy tory lines. This needs to be considered in the analysis. Additionally, the analysis should look at the amount of effort and catch associated with west coast fixed gear vessels less than 55 feet in length to understand the effect of this proposed requirement.

The GAP understands that the National Marine Fisheries Service is proposing the development of a Pacific Coast Groundfish and Endangered Species Workgroup to develop the biological opinion and conservation requirements that may be considered for the groundfish fishery. The Council may want to appoint members of the GAP and Groundfish Management Team to this workgroup to lend their expertise to this effort.

PFMC
09/16/12

GROUNDFISH MANAGEMENT TEAM REPORT ON UPDATE ON BIOLOGICAL OPINIONS FOR THE GROUNDFISH FISHERY, INCLUDING CONSIDERATION OF SEABIRD PROTECTION REGULATIONS

The Groundfish Management Team (GMT) reviewed and discussed the draft National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) biological opinions (Agenda Item H.4.b, NMFS Draft Biological Opinion, Agenda Item H.4.b, USFWS Draft Biological Opinion) that consider the effects of west coast groundfish fisheries to threatened and endangered marine species, including marine mammals, sea turtles, fish, and seabirds. The GMT would like to express gratitude to the USFWS and NOAA protected resources staff for their presentation and for engaging the team in further discussion on this matter.

The GMT supports the preliminary recommendations in the NMFS draft Biological Opinion, particularly regarding any future improvements that could be made in the reporting, tracking, and retrieval of lost pot gear. However, we focus on the recommendations regarding potential seabird bycatch reduction measures, as these may be measures that the Council can take in a shorter amount of time.

In addition, one of those preliminary recommendations was for a sablefish fixed gear logbook. The Council recommended that such logbooks be required with the 2009-2010 management measures package). A model logbook has been largely developed and reviewed. Competing priorities and funding are reasons why the logbook has not been implemented so far. With resources, the remaining development and review steps could be completed.

The GMT agrees with the draft recommendation to require use of seabird bycatch reduction devices (that is, streamers) on fixed gear vessels 55 feet and greater in order to minimize take of short-tailed albatross for the continuing operation of the Pacific coast groundfish fixed gear longline fishery. We also support adoption of regulatory language for the non-treaty commercial fixed-gear fleet as soon as possible. These measures would have the added benefit of proactively improving the conservation of other seabirds that are not currently considered to be endangered but may interact with groundfish fisheries.

Background

Albatross, like many seabirds, attack baited hooks of longlines after the hooks are deployed. If they get hooked or snagged, they can be pulled underwater with the rest of the gear and drown (USFWS 2008). One known lethal take of short-tailed albatross was reported off the West Coast of the continental U.S. In April 2011, a single short-tailed albatross juvenile was reported as caught by longline gear in the limited entry sablefish fishery, approximately 65 kilometers off the Oregon coast (WCGOP, unpubl. data).

Management Issues

On March 26, 2012, the Council received a statement from the USFWS regarding conservation measures to mitigate impacts on short-tailed albatross (Agenda Item I.3.b Supplemental FWS Report). The Biological Opinion that is being conducted by the USFWS identified a concern with the endangered short-tailed albatross, which is expanding its population as it recovers from extremely low numbers. The expanding population is expected to result in more conflicts with the Pacific coast groundfish fisheries. As take of short-tailed albatross is expected, there is a need for mitigation with the goal of reducing the negative impact to the recovery process. The Endangered Species Act (ESA) directs all Federal agencies to participate in conserving these species. Specifically, section 7(a)(1) of the ESA charges Federal agencies to aid in the conservation of listed species.

We considered the number of vessels (that is, those 55 feet and larger) in the West Coast longline fleet that the proposed streamer regulations would impact (Table 1). After learning that the USFWS recommendations for streamer use were largely based upon vessel safety and current Washington Sea Grant research is being conducted for vessels less than 55 feet, the GMT notes that consideration for vessels under 55 feet would be a good topic for future consideration as new information becomes available.

Table 1. Count of vessels that used longline gear (PacFIN code LGL). Data source: PacFIN vdrfd 2011 data.

State	<26 feet	between 26-54.99 feet	≥55 feet
Washington	4	48	18
Oregon	15	100	12
California	43	163	13
	62 (14.9%)	311 (74.8%)	43 (10.3%)

- This set of numbers uses 416 total vessels that used longline gear.
- It does not include 43 Washington vessels missing a length. That can be resolved later if needed.
- There is some double-counting in that the actual total number is 408 vessels, with a few making landings in more than one state.

The low level of coverage that the 55 foot length requirement (that is, 10.3% of vessels)suggests indicate that further exploration of conservation measures would be prudent. However, there may be other ways to reduce albatross impacts such as requiring the use of streamers based on area of operation (e.g., those vessels operating in federal waters or seaward of the fixed gear RCA). The GMT supports formation of the recommended Pacific Coast Groundfish and Endangered Species Workgroup (PCGW), and recommends that it would benefit greatly from having Council and industry involvement.

Finally, the GMT recommend that the Workgroup coordinate its terms of reference and meeting schedule with the upcoming biennial specifications and management measures process. Additionally, the GMT consulted with Northwest Fisheries Science Center (NWFSC) staff regarding expected reports to the PCGW for two meetings in 2013 and 2014, suggested as follows:

For 2013 meeting: (1) Discuss data collection elements requested by the draft biological opinion that are not already being collected; and (2) Develop Terms of Reference for the PCWG.

For 2014 meeting: (1) Fleet-wide take estimates for all species between 2002 through 2012; and (2) Discuss observed takes/interactions 2010, 2011, 2012, and 2013 resulting from NWFSC updates.

GMT recommendation #1: For non-treaty commercial vessels 55 feet or greater in length using longline gear, require the use of seabird avoidance measures as specified for vessels operating in the Alaska groundfish fishery at 50 CFR §679.24 (e)

GMT recommendation #2: Consider formation of a Pacific Coast Groundfish and Endangered Species Workgroup (PCGW), as an official Council body, or if not, recommend participation from Council staff and advisory body members.

GMT recommendation #3: The PCGW coordinate its terms of reference and meeting schedule with the upcoming specifications and management measures process.

PFMC
09/17/12

Draft

Pacific Coast Groundfish Fisheries
Reasonable and Prudent Measures,
and Terms and Conditions,
to Minimize Take of Short-tailed Albatross
prepared by U.S. Fish and Wildlife Service

Background (which will be included earlier in the consultation):

Continued operations of the Pacific Coast Groundfish Fisheries are expected to harm short-tailed albatross (STAL). The Biological Assessment estimated that 0.8 short-tailed albatross would be harmed per year due to the continued operations of the Pacific Coast Groundfish Fisheries.

The short-tailed albatross population is expanding, and is in the process of recovering from extremely low numbers. This expansion will likely result in more conflict with the Pacific Coast Groundfish Fisheries. As demonstrated in the Alaska fisheries, use of streamer lines (also known as tori lines or bird-scaring lines) is a reasonable measure to minimize take. The goal is to maintain the streamer line over the sinking baited hooks in such a way that the streamer lines prevent seabirds from attacking bait, becoming hooked and subsequently killed. Currently, the most proven and recommended streamer line is the one prescribed by the Commission for the Conservation of Antarctic Marine Living Resources (SC-CAMLR, 2006) and is used in the Alaskan demersal longline fisheries.

We propose a strategy that focuses on reducing overall risk of interaction, producing a smooth transition to the use of streamers, and reducing or eliminating safety concerns. This is why a subset of vessels was chosen for this initial effort to reduce risk. Additionally, use of streamer lines should benefit fishers due to the reduced loss of bait.

The terms and conditions below would implement streamer line use on vessels 55 feet long or greater. At this time, streamer lines methods for smaller vessels are still being developed, that would meet the need for reduced interaction between seabirds and vessels, while providing a safe work environment. Additional regulations or mitigation measures, for the purpose of reducing take of short-tailed albatross and other migratory seabirds, will be recommended once they are developed for smaller vessels. Currently, the technology is insufficient to produce a safe and efficient program for small vessels fishing in the Pacific Coast Groundfish Fisheries.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures (RPM) are necessary and appropriate for NMFS to minimize take of STAL:

RPM 1: The NMFS shall minimize the risk of short-tailed albatross interacting with hooks and lines. Because short-tailed albatross are caught and killed by baited hooks in longline fisheries, minimization measures shall be employed to reduce the probability that they will attack the baited hooks.

RPM 2. NMFS shall establish a multi-stakeholder, Pacific Coast Groundfish and Endangered Species Working Group as an advisory body to the NMFS and FWS for the purposes of reducing risk to short-tailed albatross.

RPM 3: The NMFS shall monitor and report seabird interactions with longline fishing vessels and gear, and report on the efficacy of avoidance and minimization measures.

RPM 4: The NMFS shall facilitate the salvage of short-tailed albatross carcasses taken by longline fishing vessels. Because of their rarity and unique life history traits, every effort should be made to retain short-tailed albatross carcasses for scientific and educational purposes.

Terms and conditions

In order to be exempt from the prohibitions of section 9 of the Act, the NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

Terms and conditions include monitoring, review, reporting, (see 50 CFR 402.14(i)(3)) and disposition of specimens (see 50 CFR 402.14(i)(1)(v)).)

T&C 1 for RPM 1: NMFS will change the voluntary streamer program on longline fishing of the Pacific Coast Groundfish Fisheries to a mandatory program for vessels 55 feet length or greater, and continue the voluntary efforts for smaller vessels. Regulations will be developed by NMFS for compliance and should follow the Alaska streamer line regulations for Federal waters. Regulations shall be implemented as soon as practical, but not to exceed a two-year transition period.

T&C 2 for RPM 1: Continue training workshops on vessel instructions for proper use of streamer lines. Additional topics that shall be covered in training include:

(1) Status of STAL population and observations of the species in the vicinity of the Pacific Coast Groundfish Fisheries fishing area.
(2) STAL notification requirements (see T&C 2 for RPM 3)
(3) Disposition of STAL specimens (see T&C 1 for RPM 4)

T&C 1 for RPM 2: NMFS will develop and lead a Pacific Coast Groundfish and Endangered Species Workgroup. Working group development:

(1) NMFS shall identify points of contact for a Pacific Coast Groundfish and Endangered Species Workgroup (PCGW) within six months of opinion issuance.
(2) Within three months of opinion issuance, NMFS shall invite PFMC and USFWS to provide points of contact, participate in the PCGW, and help develop terms of reference for the workgroup (see d. below). NMFS shall request response within six months of opinion issuance.

(3) The PCGW shall convene on a biennial basis to consider all new information, described in the below measures.
(4) Terms of reference for the PCGW shall be developed by the PCGW members within 12 months of opinion issuance. These terms shall document the purpose and structure of the group, the basis for key recommendations, staff points of contact and their roles and responsibilities, resources needed to accomplish the workgroup purpose, and a breakdown of anticipated work schedules (e.g., for biennial reporting and completing a future consultation following a PCGW recommendation to reinitiate).

T&C 2 for RPM 2: With NMFS as lead, the Pacific Coast Groundfish and Endangered Species Workgroup will be responsible for review of new information and developing recommendations regarding changes to the Pacific Coast Groundfish Fisheries that will reduce risk of harm to STAL. Example recommendations may include developing new analyses or reports, changes to sampling protocols, additional conservation measures to implement, updating species risk assessments, and identify whether reinitiation is warranted.

T&C 1 for RPM 3: NMFS shall update the Pacific Coast Groundfish Observer Program to include specific guidance for endangered or threatened species, namely:

(1) Include the requirement to prioritize monitoring the deployment of longlines to document the efficacy of the streamer lines in minimizing interactions with short-tailed albatrosses.

(2) Biological sampling – interactions: update to include disposition of STAL specimens (see T&C 1 for RPM 4 & Disposition of specimens).

(3) Derelict gear – collect data on all gear lost at seas, including gear type and location of the loss,

NMFS will provide the Service an opportunity to review and approve updated observer instructions prior to implementation.

The results of endangered species monitoring, including monitoring of derelict gear, will be used by NMFS in a biennial report (see T&C 3 for RPM 3 below).

T&C 2 for RPM 3: Implement regulation changes that require mandatory notification by fishers to USFWS Law Enforcement (see next paragraph for contact information by state) and NMFS' Sustainable Fisheries Division, Assistant Regional Administrator (206-526-6150) when take of an endangered or threatened seabird occurs. Regulations should also specify if an observer is on board, they will complete notification requirements.

Washington's USFWS Law Enforcement Office is located at 510 Desmond Dr. SE, Suite 102, Lacey, WA 98503; phone: 360-753-7764. Oregon's USFWS Law Enforcement Office is located at 9025 SW Hillman Court, Suite 3134, Wilsonville, Oregon 97070; phone: 503-682-6131. California's USFWS Law Enforcement Office is located at 2800 Cottage Way, W-2928; Sacramento, California 95825; Phone: 916-414-6660.

T&C 3 for RPM 3: NMFS will complete a biennial report to be submitted to USFWS, 2600 SE 98th Ave, Suite 100, Portland, OR 97266, and to the PCGW. The report shall include new information and document effects of the Pacific Coast Groundfish Fisheries on endangered or threatened species:

(1) NMFS shall include the following data when monitoring predicted fishery interactions and to provide fleet-wide STAL take estimates on a biennial basis.
    i. data from STAL telemetry work,
    ii. NMFS Groundfish observer program's data on observed STAL interactions and take,
    iii. Any additional reported STAL take in the action area
    iv. Pacific Coast Ground Fisheries fishing effort, and
    v. Pacific Coast Ground Fisheries effects on black-footed albatross, to continue the use of this species as an analytical surrogate for short-tailed albatross.
(2) NMFS shall report on the spatial and temporal characteristics of derelict gear observed while implementing the fisheries.
(3) NMFS shall report on vessel operator training efforts.

T&C 4 for RPM 3: NMFS will update the Northwest Fisheries Science Council risk assessment of the U.S. West Coast groundfish fisheries to threatened and endangered marine species as recommended by the PCGW or when reinitiation of consultation is required.

T&C 1 for RPM 4: NMFS shall disseminate the following information to fishers and observers within the Pacific Coast Groundfish Fisheries.

If a dead, injured, or sick short-tailed albatross individual is located, call USFWS 503-231-6179 for handling and disposition instructions. If an observer is on board, they will be responsible for the disposition of dead, injured, or sick birds, otherwise the boat captain will be responsible.

Care should be taken in handling sick or injured specimens to ensure effective treatment and in the handling of dead specimens to preserve biological material in the best possible state for later analysis of cause of death. In conjunction with the care of sick or injured short-tailed albatross or preservation of biological materials from a dead animal, the boat captain or observer has the responsibility to carry out instructions provided by USFWS to ensure that the specimen is not unnecessarily disturbed.

Live birds must be retained in a safe location. Release overboard shall occur if it looks normal and exhibits all of the following traits: the bird is capable of holding its head erect, and the bird responds to noise and motion stimuli; the bird breathes without noise; the bird can flap both wings, and it can retract the wings to a normal folded position on the back; and the bird is capable of elevating itself to stand on both feet, with its toes pointed in the proper direction (forward); and it is dry.

Injured or sick albatross are to be retained in a safe location.

Dead short-tailed albatross must be frozen immediately, with identification tags attached directly to the carcass, and a duplicate identification tag attached to the bag or container holding the carcass. Ideally, the specimen should be frozen at -40 degrees Fahrenheit. Identification tags must include all of the following information: species, date of mortality, name of vessel, location (latitude and longitude) of mortality, observer or captain's name (or both), and any band numbers and colors if the specimen has any leg bands. Leg bands must remain attached to the bird.

If the bird is retained alive or dead, it must be surrendered as soon as possible as directed by the USFWS.

CONSIDERATION OF INSEASON ADJUSTMENTS

Management measures for groundfish are set by the Council with the general understanding these measures will likely need to be adjusted within the biennium to attain, but not exceed, the annual catch limits. This agenda item will consider inseason adjustments to ongoing 2012 fisheries. Potential routine inseason adjustments include adjustments to rockfish conservation area boundaries and adjustments to commercial and recreational fishery catch limits. Adjustments are, in part, based on catch estimate updates and the latest information from the West Coast Groundfish Observer Program.

The Council is also expected to discuss the issuance of 2011 surplus carry-over quota pounds to the 2012 shorebased individual fishing quota (IFQ) fishery. In June, the National Marine Fisheries Service (NMFS) announced that surplus carry-over for sablefish and Pacific whiting were not issued because the agency concluded, based on pre-season projections, the risk of catches exceeding the harvest limits was too high if surplus carry-over were issued (Agenda Item D.8.b, NMFS Report). Under this agenda item, the Groundfish Management Team is expected to provide updated projections for sablefish and Pacific whiting based on the 2012 performance of the fishery to inform whether surplus carry-over can be issued.

Agency reports received by the briefing book deadline include a NMFS report on the progress of the IFQ fishery and a Washington Department of Fish and Wildlife (WDFW) report describing adjustments to the recreational fishery to reduce mortality of yelloweye rockfish.

<u>Council Action:</u>

1. **Consider information on the status of 2012 fisheries and adopt final inseason adjustments.**
2. **Provide guidance on surplus carry-over, as necessary.**

<u>Reference Materials:</u>

1. Agenda Item H.5.b, NMFS Report: West Coast Groundfish IFQ Fishery Catch Summary: Mid-year Report, 2012.
2. Agenda Item H.5.b, WDFW Report: WDFW Report on Inseason Adjustments.

<u>Agenda Order:</u>

a. Agenda Item Overview — Kelly Ames
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Adopt Final Recommendations for Adjustments to 2012 Groundfish Fisheries

PFMC
08/17/12

Agenda Item H.5.b
NMFS Report
September 2012

West Coast Groundfish IFQ Fishery

Mid-year Catch Report (January-June) 2012: Emerging Trends

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National Marine Fisheries Service

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August 23, 2012

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1. Summary and purpose

There have been some notable changes in the IFQ fishery, during the first half of 2012 compared with the same period in 2011. Quota pound transfers have increased considerably, there has been more trawling in shallower waters, diversity of catch has increased, and use of fixed gear has increased. Harvests of petrale sole, chilipepper rockfish, and yellowtail rockfish are up, while those of some traditionally dominant species, including sablefish and dover sole, are down somewhat. However, in total, landings, revenues, and effort are similar to last year's levels.

Several metrics suggest that early in the second year of trawl rationalization, fishers may know better what to expect, and are more extensively utilizing tools of the IFQ system to plan their fishing year. Quota pound (QP) transfer activity has conspicuously increased. The total pounds transferred vessel-to-vessel is up 25%, while the number of those transfers is currently double its level at the same time last year. Average monthly transfer amounts are also much more uniform (less variable) than last year at this time, suggesting better prior information and measured planning on the part of fishers. Dramatic increases in frequencies of trades of bycatch species like canary, widow, and darkblotched rockfish may indicate a drop in saving or stockpiling of QP for these species, and may reflect increased risk pool activity.

Preliminary data indicate that fishers are trawling shallower on average than last year; coastwide average haul depth has decreased for many species. Shallower fishing behavior, and potentially increased encounters with bycatch species suggest higher confidence, perhaps due in part to increased trading of QP, and sufficient assurance that quota pounds of bycatch species are available if needed. It is also important to note that several small changes to the trawl Rockfish Conservation Area have been made since the beginning of the program in 2011, to allow fishing in some previously closed, shallower areas.

The diversity of landings and revenue distributions among species have increased, compared with the same time last year. Relative proportions of total IFQ, groundfish revenue and landings in the non-whiting fleet have increased for some low-percentage species, and a few high-percentage species have somewhat decreased their portion of the total (e.g. dover sole, sablefish). Some previously under-utilized species (e.g. chilipepper rockfish, yellowtail rockfish, and others) are bringing in a larger portion of the total landings and revenue than at the same time last year.

Use of fixed gear is increasing in the IFQ fishery. According to preliminary data, the proportion of IFQ sablefish landed with fixed gear has increased nine percent over the same time last year, and as a result, revenue from fixed gear, IFQ sablefish has increased by 16 percent. These changes in gear use for sablefish translated in small overall changes to the distributions of landings and revenue among gear types for the entire non-whiting fleet.

Aggregate measures of landings, revenue, effort and catch per unit effort are very similar to the same time last year. Retention rates have not changed appreciably, and show only minor, apparently random fluctuations among species.

The purpose of this report is to summarize and illustrate current catch data and trends for the West Coast Groundfish IFQ Fishery in 2012, and compare them to the same period in the 2011 fishery. This is not meant to be an exhaustive report, but to present an early examination of the data, and divide catch estimates among strata which are of interest to many stakeholders.

2. Data used in this report

Data used in this report originated from four sources, and only pertain to the shorebased non-whiting and shorebased (or shoreside) whiting fleets, of the West Coast Groundfish IFQ Fishery. Data from the at-sea whiting fisheries (catcher-processor and mothership) are not included. Landings and revenue data, along with the surrounding gear, area, port, and species information, originated from both electronic fish tickets, and paper fish tickets (landing receipts). Electronic fish ticket data were provided by the Pacific States Marine Fisheries Commission (PSMFC), for IFQ landings that were not represented in the Pacific Fisheries Information Network (PacFIN) database, which houses data from traditional, paper fish tickets. Information regarding total catch of IFQ species categories, discarded catch, retention rates, participation, effort and transfers of quota pounds (QP) originated from the National Marine Fisheries Service's (NMFS) IFQ Vessel Accounts (VA) database . Depth of catch data were provided by the West Coast Groundfish Observer Program (WCGOP) of the Northwest Fishery Science Center, within the National Marine Fisheries Service (NMFS). Data reported from each of these sources in 2012 are preliminary, and are subject to change and correction.

Landed and discarded catch are reported in round weight. Revenue is reported as ex-vessel revenue, and is not adjusted for inflation or other factors. Discarded catch was discarded at sea, and dockside discard is not included in this report. Total catch refers simply to the sum of landed and discarded catch. Bycatch refers to fish that were caught along with the intended target species, whether they were landed or discarded. The terms landing receipt, fish ticket, and ticket are synonymous in this report. One trip was defined as a unique vessel-landing-day; this was done to avoid overestimation of counts of trips due to single landings which were reported on two separate receipts ("split tickets"). Non-whiting and shoreside directed whiting fleets were separated by weight of landings by species in each trip. If a trip contained greater than 50 percent Pacific whiting, and was landed by trawl gear, it was considered a directed whiting trip, and those landings and revenue are presented under the shoreside whiting fleet in this report (as within PacFIN). Vessel counts shown in this report were taken from the NMFS, IFQ vessel accounts database, to avoid high-biased counts from other sources, most likely the result of multiple vessel ID numbers recorded on fish tickets for some vessels.

The results in this report should be considered preliminary due to the recent nature of the data, and since they originated from several different sources, which are at differing stages of completeness. The same metrics calculated from different sources will often differ to some degree, especially when reported inseason. The most recent discarded catch estimates may be slight underestimates, due to potential inseason reporting lag behind landings. This report is based on the best currently available scientific and management information.

3. Landings and revenue

3.1. Landings and revenue by fleet

Aggregate measures of mid-year landings and revenue are very similar to the same time last year (Figure 1, Table 1). Monthly trajectories of landings and revenue through June, by both the non-whiting and shorebased whiting fleets are also very similar to the same time in 2011, although April of 2012 was a bit higher than 2011 and June was a bit lower. Total groundfish landings on non-whiting trips through June were three percent higher in 2012 than the same period in 2011, while revenues were four percent higher. Landings and revenue for shorebased whiting were lower than the same time last year, presumably due to a lower whiting allocation (125.4 million pounds in 2012 vs. 204.6 million pounds in 2011), and business decisions, as the whiting season only began in mid-June.

3.2. Landings and revenue by port

Distributions of landings and revenue by port group are shown in Figure 2 and Table 2. There was a considerable increase in non-whiting landings and revenue in Westport during the first half of 2012 versus the previous year (increases were seen for arrowtooth flounder, Dover sole and sablefish), and some substantial differences in a few other port groups. Astoria landings were slightly lower than 2011, although revenue was slightly higher. Changes in landings and revenue were different across species, but increases in revenue were apparent for Pacific cod, petrale sole and yellowtail rockfish, compared to the same time last year. The Newport, Tillamook and Garibaldi group saw both higher landings and revenue than the same time last year. Petrale sole showed a particular increase in landings and revenue in this port group, while sablefish, and several other species were also important for increased revenue over the same time last year. Charleston, Eureka, and some smaller southern ports saw small increases in revenue compared with last year, while Ilwaco and Chinook, Brookings and Crescent City, and Fort Bragg showed decreases.

3.3. Landings and revenue by gear

Use of fixed gear has increased in the IFQ fishery, compared with mid-year in 2011. The proportion of IFQ sablefish landed with fixed gear in the first half of 2012 increased nine percent over the same period in 2011, and as a result, revenue from fixed gear those sablefish has increased by 16 percent (Figure 3, Table 3). These changes in gear use for sablefish translated in small overall changes to the distributions of landings and revenue among gear types for the entire non-whiting fleet (Figure 4, Table 4).

3.4. Landings and revenue by species

The distributions of groundfish landings and revenue, among the species landed in the non-whiting IFQ fleet were more diverse in the first half of 2012 than the same period in 2011 (Figures 5 and 6, Table 5). For landings, Shannon diversity (or entropy) index values were H=2.12 in early 2012 versus H=1.93 for the same time in 2011. For revenue, values were H=1.97 in early 2012 versus H=1.71 for 2011.

This was due both to a small increase in species richness (number of species) and the evenness of their distribution. There were a few more groundfish species landed (54 in 2012 versus 50 in 2011), and several of the species with highest proportion of landings and or revenue decreased noticeably, while some of those less utilized species simultaneously increased (Figures 5 and 6, Table 5).

The more diverse revenue distribution among species coincides with several individual changes in price and allocation of species, between mid-year 2011 and 2012 (e.g. decreased sablefish prices since 2011). Increased revenue diversity could also, more indirectly reflect an increased general focus on landing more typically low-utilized species, to compensate for lower prices and allocations in 2012 of sablefish, and lower prices of petrale sole, the two highest priced species in the fishery.

The proportion of overall groundfish revenue in the IFQ fishery from some high-revenue species dropped during the first half of 2012 compared with 2011. For example, the proportion of revenue from sablefish dropped from 45% to 38%, and the proportion from Dover sole dropped from 28% to 26% (Table 5), while some other lower-proportion species have increased. For example, petrale sole rose from 7% to 12%, chilipepper rockfish rose from 0.1% to 1.4%, and yellowtail rockfish rose from 0.5 percent to 1.4 percent.

Although average 2012 petrale sole prices have dropped by 11 cents per pound (Table 6) compared with the same period of 2011, landings have been much higher so far this year (coinciding with a 21% higher 2012 allocation), and have thus brought more revenue (171% of the same time last year).

The aggregate, average sablefish price per pound in the IFQ fishery has dropped by 12 cents since the same time last year, and landings and revenue are both lower than mid-year 2011 (Table 6). The northern sablefish allocation is approximately three percent lower in 2012 as well.

Looking at chilipepper rockfish, the price has increased 18 cents per pound since the same time in 2011, and both landings and revenue have increased substantially, with landings at 11 times early 2011 levels, and revenue almost 15 times, rising from a rank of twentieth by revenue, in the non-whiting fleet, to eleventh (Table 5).

Yellowtail rockfish rose from being the thirteenth ranked species by revenue, to eighth, and from 0.5 percent of non-whiting revenue to nearly two percent, although average yellowtail prices dropped three cents lower so far in 2012, compared to the first half of 2011 (Table 5).

Changes in chilipepper and yellowtail rockfish catch patterns were obvious beginning in December of 2011, but it wasn't clear whether this was strictly an end-of-year phenomenon, or something more persistent.

4. Effort and participation

There has been little change in trip-level measures of non-whiting fleet participation, effort, and catch per unit effort between mid-year 2011 and mid-year 2012; the aggregate number of trips, total catch, and catch per trip for mid-year 2012 were all within five percent of the levels mid-year in 2011 (Figure 8, Table 8). Monthly non-whiting fleet participation (Figure 7, Table 7) has been nearly equal, except that vessel counts dipped somewhat in June. Overall, total non-whiting vessel counts were slightly higher during January through June of 2012, than the same period of 2011 (68 in 2012 versus 64 in 2011). Monthly counts of trips also differed little from 2011.

Monthly average catch per trip was substantially lower during March and higher in April, than during the same months in 2011. Differences in monthly catch per trip coincided with changes in catch composition. Lower catch per trip during March reflected lower monthly catch of Dover sole (1.4 M lbs. versus 1.9 M lbs.), arrowtooth flounder, lingcod, and sablefish (north of 40°10' N. lat., 268,000 lbs. versus 268,000 lbs.), (in order of largest to smallest difference). April catch per trip was higher in 2012 than in 2011, reflecting higher catch of several of the same species; Dover sole (3.1 M lbs. versus 2.3 M lbs.), arrowtooth flounder, sablefish (north of 40°10' N. lat.), Pacific cod, petrale sole (99,000 lbs. versus 23,000 lbs.), and yellowtail rockfish during that month (in order from largest to smallest difference). Data from the NMFS vessel accounts database were used for effort and participation, and cover IFQ species categories only.

5. Quota pound transfer activity

Some of the most interesting changes in the IFQ fishery, during the first half of 2012, involve transfers of quota pounds among vessel accounts. These data suggest that fishers may know better what to expect this year, and are more extensively utilizing tools of the IFQ system to plan their fishing year. Quota pound transfer activity has conspicuously increased. The total pounds transferred vessel-to-vessel is up 25%, while the number of those transfers is approximately double its level at the same time last year (Figure 9, Tables 9 and 10). These increases in QP transfers may also reflect increased risk pool activity, but sufficient data are not available to confirm or elaborate.

Average monthly transfer amounts are also much more uniform (less variable) than last year at this time, suggesting better prior information and more measured planning on the part of fishers. Figure 9 shows monthly average transfer values, monthly counts of transfers, and total monthly fleet transfer amounts, both with whiting included (left panels) and excluded (right panels). From January through October of 2011, the monthly average pounds per transfer fluctuated wildly, from as high as 972,000 pounds in January, and as low as 9,200 pounds in February, with the variation gradually decreasing until monthly levels became nearly equal during October, November, and December of 2011. The general picture was very similar with whiting excluded, although monthly variation decreased faster; the average transfer values stabilized much earlier, by April.

The number of transfers per month has remained steadily higher each month, so far in 2012 (47 transfers higher on average; and as much as 13 times higher, or as little as 137 percent higher) versus the same period in 2011. The situation is very similar, whether whiting transfers are included or excluded.

Dramatic increases in frequencies of transfers of bycatch species like canary, widow, and darkblotched rockfish could indicate a sharp drop in saving or stockpiling of QP for these species, and also might reflect increased risk pool activity (Table 11). For example, there have been 98 vessel-account to vessel-account (VA-to-VA) transfers of canary rockfish during January through June of 2012, versus only 36 at the same time last year. By July of last year, canary rockfish was the sixteenth most transferred (of 29) among IFQ species categories; as of July in 2012, it had become the fourth most transferred species. For darkblotched rockfish, we see a similar situation. Through July of 2012, there had been 86 transfers of darkblotched rockfish, when at the same time in 2011, there had only been 6. The situation is also similar for widow rockfish (100 transfers through July of 2012, vs 42 in 2011), and several other species.

Sablefish and petrale sole, the two most valuable species in the fishery, remain the two most transferred species, respectively, during January through July of both 2011 and 2012.

6. Total catch, attainment and retention rates

Although total IFQ fishery catch is lower than the same time last year (approximately 13 million pounds lower), this difference is almost entirely attributable to whiting catch in the shorebased whiting fleet at this early point in the season. There is also a lower whiting allocation (corresponding with the lower U.S. TAC) to the fishery in 2012 than 2011 (Table 12). Total fishery attainment is virtually unchanged, versus mid-year in 2011. Catch by the shorebased whiting fleet is not a main focus of this report, since it just started fishing in June.

There have been few notable differences in total catch, by species, in the non-whiting fleet, between the first half of 2011 and 2012 (Table 12, Figure 10). One species showing a difference in catch is petrale sole. Both catch and attainment of the petrale sole allocation have both been tracking higher throughout the first half of 2012 than 2011. Catch of petrale sole as of June 31, 2012 was approximately 1.1 million pounds, versus approximately 0.6 million pounds at the same time last year. Due to a higher allocation in 2012, attainment is only 14 percent higher, in spite of the large increase in catch. Another species showing a noticeable difference in catch is chilipepper rockfish, whose total catch has increased from approximately 24,000 pounds to 287,000 pounds, and whose attainment has increased by nine percent. Attainment of sablefish, south of 36° N. lat., is currently 15 percent lower than at the same time in 2011, when catch was at approximately 287,000 pounds; this year it was at 54,000 pounds by June 31. Yellowtail rockfish catch has been much higher during the first half of this year, than mid-year in 2011 (approximately 567,000 pounds, versus 335,000 pounds, respectively). The increased catch translates into little difference in terms of attainment, with an increase of only three percent, for this currently low-utilized species.

Figure 10 shows percent changes in species attainment of their respective IFQ fleet allocations (including both non-whiting and whiting fleets), relative to the same time last year (top), as well as percent changes in species retention rates for the non-whiting fleet only, during the same time periods (bottom). Table 13 shows those same percent changes in retention rates, along with the raw amounts landed, discarded, and total catch. Both Figure 10 and Table 12 reveal approximately zero change in the overall non-whiting fishery retention rate, and relatively small changes in retention for each species, which appear to fluctuate somewhat randomly. These retention rates are subject to change as observer discard data continue to be updated.

7. Depth of catch by species

Preliminary data indicate that fishers are trawling shallower on average than last year; coastwide average haul depth has decreased for many species. Shallower fishing behavior, and the corresponding potential for increased encounters with many rebuilding stocks suggests higher confidence of fishers, perhaps due in part to increased trading of QP, and sufficient assurance that quota pounds of bycatch species are available if needed.

Figure 11 shows average trawl depth, averaged across hauls that were positive (encounters) for each IFQ species category, for mid-year 2011 and 2012. Table 14 shows the values displayed in Figure 11. There was a reduction in average trawl depth for 24 of the 28 IFQ species categories shown (an estimate for shortspine thornyheads south of 40°10' was not available). The differences in average haul depth ranged between 121 fathoms shallower, and 16 fathoms deeper than the same time in 2011. Fishing activity using non-trawl gear (i.e. fixed gear) did not show a clear difference in average haul depth between years.

It is also important to note that several small modifications were made to both the seaward and shoreward boundaries of the trawl Rockfish Conservation Area (RCA) at several Council meetings, throughout 2011 and 2012, which enabled fishing in shallower waters during some periods of 2012 than during 2011.

Figure 12 shows coastwide mean haul depth values and variation, for IFQ species caught using trawl gear, during January through May of 2012. This is provided to express the levels of variation in encounter depth by species, which could not be clearly shown in Figure 11, while comparing average trawl depth between years.

8. Acknowledgements

I would like to thank Dave Colpo of the Pacific States Marine Fisheries Commission (PSMFC), Brad Stenberg of the Pacific Fisheries Information Network (also PSMFC); Janell Majewski and Marlene Bellman of the West Coast Groundfish Observer Program, Northwest Fisheries Science Center, National Marine Fisheries Service (NWFSC); Jeff Cowen, of the NWFSC, National Marine Fisheries Service (NMFS), and Sarah Towne of the Northwest Region (NWR) in NMFS for their support, in supplying data for this report.

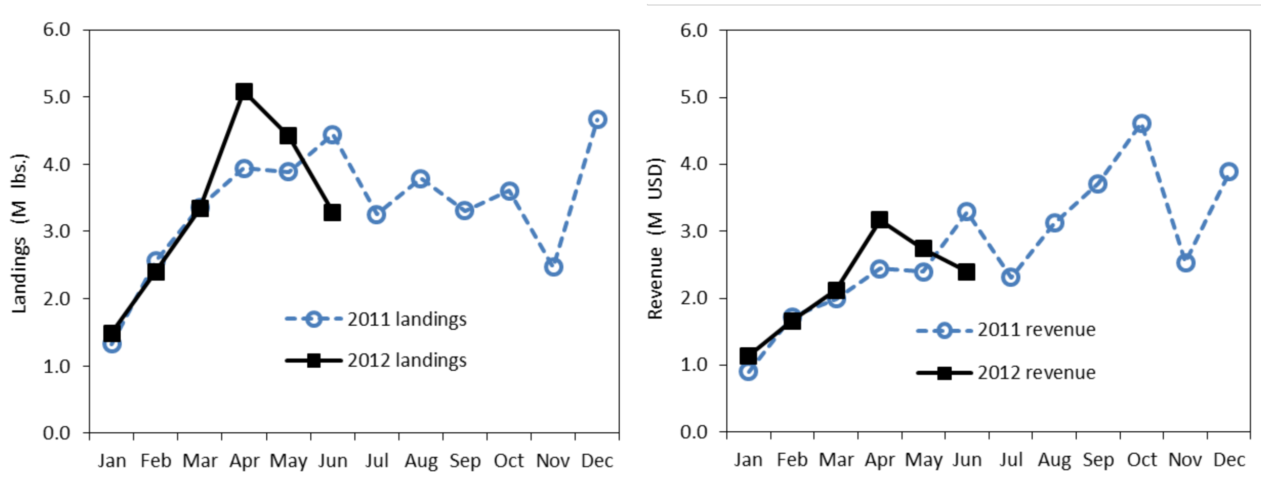


Figure 1. Monthly landings (left) and revenue (right) during January through June of 2012 and 2011, for the non-whiting fleet of the shorebased IFQ fishery.

Table 1. Monthly landings and revenue during January through June of 2012 and 2011, for the non-whiting (top) and whiting (bottom) fleets of the shorebased IFQ fishery. The "Land % 2011" column expresses 2012 landings as a percentage of 2011 landings; the "Rev % 2011" column expresses 2012 revenue in the same way.

Non-whiting

Month	2011 landings	2012 landings	2011 revenue	2012 revenue	Land % 2011	Rev % 2011
Jan	1,324,638	1,490,200	902,457	1,142,216	112%	127%
Feb	2,564,693	2,404,286	1,719,893	1,658,039	94%	96%
Mar	3,360,889	3,335,362	1,991,797	2,121,902	99%	107%
Apr	3,942,465	5,080,809	2,443,745	3,165,813	129%	130%
May	3,884,997	4,419,924	2,395,262	2,743,147	114%	115%
Jun	4,446,585	3,282,856	3,293,042	2,394,554	74%	73%
Total (Jan-June)	19,524,267	20,013,437	12,746,196	13,225,672	103%	104%

Whiting

Month	2011 landings	2012 landings	2011 revenue	2012 revenue	Land % 2011	Rev % 2011
June	24,045,023	11,122,649	2,731,383	1,326,054	46%	49%

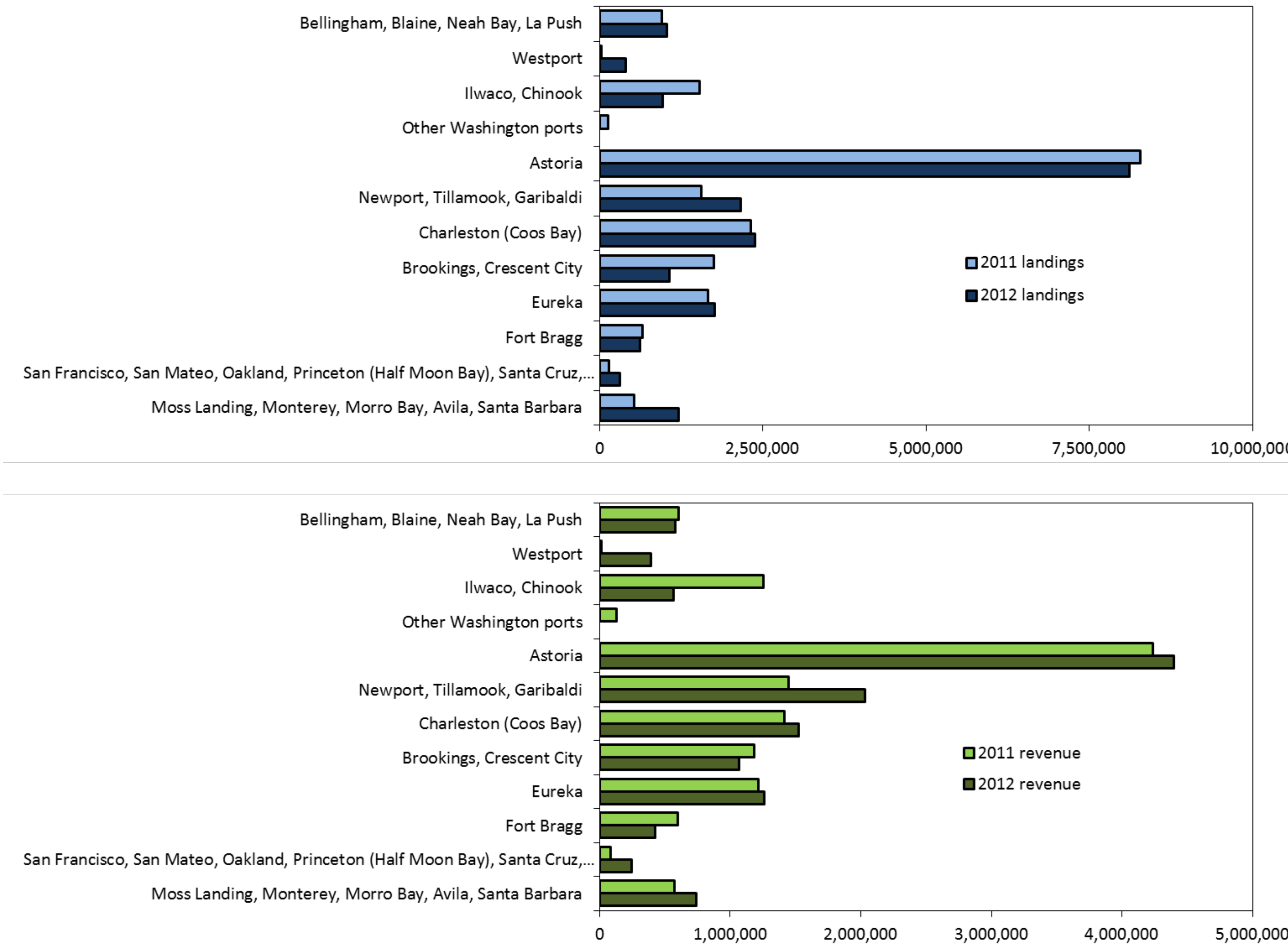


Figure 2. Landings and revenue by port group, by the non-whiting fleet, in the shorebased IFQ fishery. Port groups are arranged by latitude.

Table 2. Landings and revenue by port group, by the non-whiting (top) and shorebased whiting fleet (bottom), in the shorebased, groundfish IFQ fishery, for January through June of 2011, and the same period of 2012. Port groups are arranged by latitude. The two columns each labeled "percent" express either 2012 landings or revenue (whichever appears immediately to left) as a percent of 2011 values.

Port group (non-whiting)	**2011 landings**	**2012 landings**	**Difference**	**Percent**	**2011 revenue**	**2012 revenue**	**Difference**	**Percent**
Bellingham, Blaine, Neah Bay, La Push	948,420	1,035,586	87,166	109%	605,806	578,163	-27,643	95%
Westport	21,155	396,298	375,143	1873%	12,646	393,531	380,885	3112%
Ilwaco, Chinook	1,532,617	965,460	-567,157	63%	1,253,901	566,724	-687,177	45%
Other Washington ports	130,220	0	-130,220	0%	127,621	0	-127,621	0%
Astoria	8,282,457	8,114,636	-167,821	98%	4,234,926	4,400,962	166,036	104%
Newport, Tillamook, Garibaldi	1,552,194	2,158,718	606,524	139%	1,444,524	2,032,114	587,590	141%
Charleston (Coos Bay)	2,312,115	2,380,935	68,820	103%	1,413,685	1,526,815	113,130	108%
Brookings, Crescent City	1,751,401	1,066,661	-684,740	61%	1,180,214	1,065,958	-114,256	90%
Eureka	1,664,103	1,767,263	103,160	106%	1,218,356	1,257,458	39,102	103%
Fort Bragg	659,881	616,354	-43,527	93%	597,396	423,155	-174,241	71%
San Francisco, San Mateo, Oakland, Princeton (Half Moon Bay), Santa Cruz, Bodega Bay	143,928	305,238	161,310	212%	81,829	243,162	161,333	297%
Moss Landing, Monterey, Morro Bay, Avila, Santa Barbara	525,776	1,206,288	680,513	229%	575,292	737,630	162,338	128%
Total (Jan-June)	19,524,267	20,013,437	489,171	103%	12,746,196	13,225,672	479,476	104%

Port group (shorebased whiting)	**2011 landings**	**2012 landings**	**Difference**	**Percent**	**2011 revenue**	**2012 revenue**	**Difference**	**Percent**
Westport	4,657,841	5,873,467	1,215,626	126%	588,216	568,964	-19,252	97%
Ilwaco, Chinook	704,185		-704,185	0%	64,908		-64,908	0%
Astoria	12,884,796	4,362,987	-8,521,809	34%	1,480,280	654,144	-826,136	44%
Newport, Tillamook, Garibaldi	4,302,970	886,195	-3,416,775	21%	444,145	102,946	-341,199	23%
Charleston (Coos Bay)	1,495,231		-1,495,231	0%	153,834		-153,834	0%
Total (Jan-June)	24,045,023	11,122,649	-12,922,374	46%	2,731,383	1,326,054	-1,405,329	49%

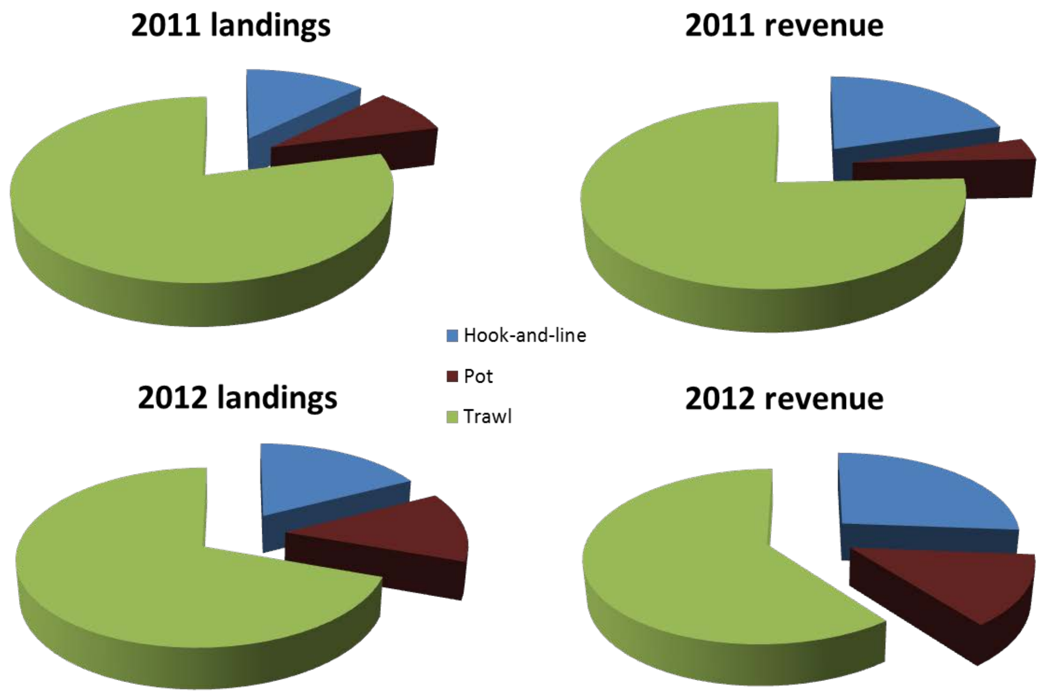


Figure 3. Landings and revenue composition of sablefish catch, by gear group, for non-whiting, IFQ trips during January through June only, in 2011 and 2012.

Table 3. Landings and revenue statistics of sablefish catch, by gear group, for non-whiting, IFQ trips during January through June only, in 2011 and 2012.

Gear group	2011 landings	Land % total	2011 revenue	Rev % total	2011 price lb.
Hook-and-line	277,218	13%	1,164,929	20%	4.20
Pot	187,037	8%	223,420	4%	1.19
Trawl	1,741,726	79%	4,322,463	76%	2.48
Total (Jan-June)	2,205,981	100%	5,710,812	100%	2.59

Gear group	2012 landings	Land % total	2012 revenue	Rev % total	2012 price lb.
Hook-and-line	351,414	17%	1,304,432	26%	3.71
Pot	260,820	13%	661,658	13%	2.54
Trawl	1,402,643	70%	3,007,000	60%	2.14
Total (Jan-June)	2,014,877	100%	4,973,090	100%	2.47

Gear group	Landing % 2011	Rev % 2011	Price % 2011	Δ land comp	Δ rev comp
Hook-and-line	127%	112%	88%	5%	6%
Pot	139%	296%	212%	4%	9%
Trawl	81%	70%	86%	-9%	-15%
Total (Jan-June)	91%	87%	95%	0%	0%

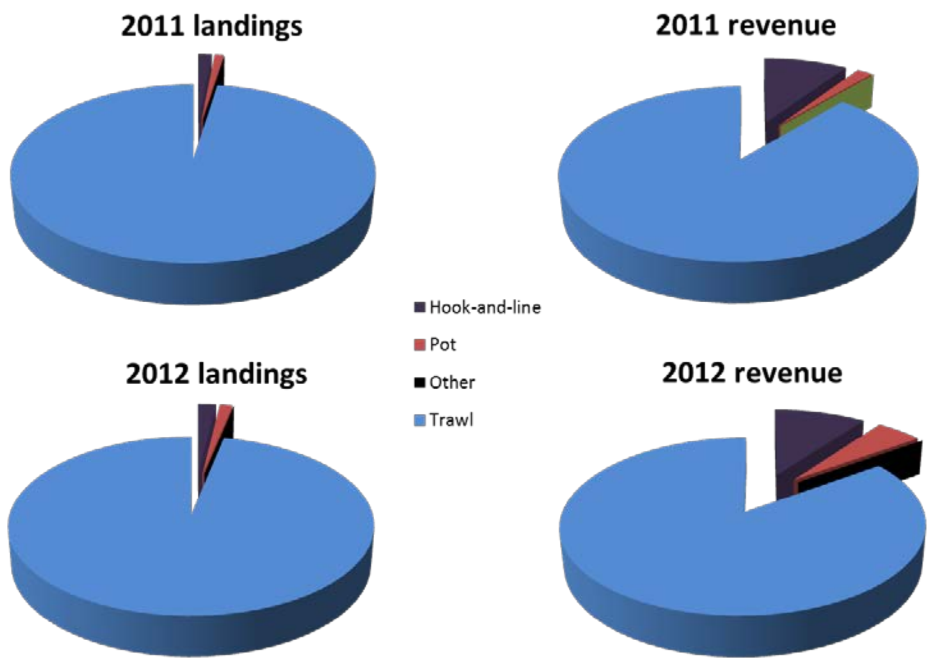


Figure 4. Landings and revenue composition of groundfish catch, by gear group, for non-whiting, IFQ trips during January through June only, of 2011 and 2012.

Table 4. Landings and revenue statistics of groundfish catch, by gear group, for non-whiting, IFQ trips during January through June only, in 2011 and 2012.

Gear group	2011 landings	Land % total	2011 revenue	Rev % total	2011 price lb.
Hook-and-line	290,493	1%	1,188,130	9%	4.09
Pot	188,197	1%	224,578	2%	1.19
Other	na	na	na	na	na
Trawl	19,045,577	98%	11,333,488	89%	0.60
Total (Jan-June)	19,524,267	100%	12,746,196	100%	0.65

Gear group	2012 landings	Land % total	2012 revenue	Rev % total	2012 price lb.
Hook-and-line	379,479	2%	1,319,649	10%	3.48
Pot	262,866	1%	663,800	5%	2.53
Other	38	0%	20	0%	0.53
Trawl	19,371,054	97%	11,242,203	85%	0.58
Total (Jan-June)	20,013,437	100%	13,225,672	100%	0.66

Gear group	Landing % 2011	Rev % 2011	Price % 2011	Δ land comp	Δ rev comp
Hook-and-line	131%	111%	85%	0%	1%
Pot	140%	296%	212%	0%	3%
Other	na	na	na	na	na
Trawl	102%	99%	98%	-1%	-4%
Total (Jan-June)	103%	104%	101%	na	na

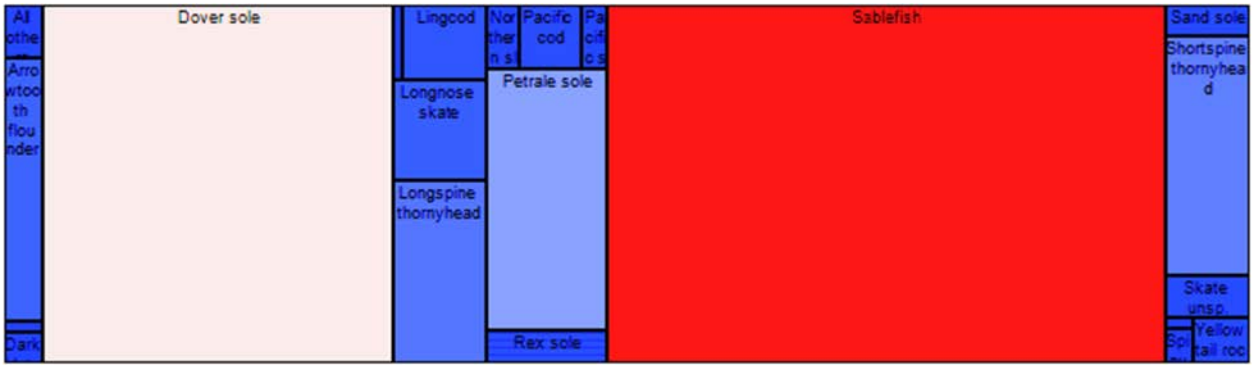


Figure 5. Treemap showing revenue distribution by species name, within the non-whiting fleet of the shorebased IFQ fishery, during the period of January through June of 2011.

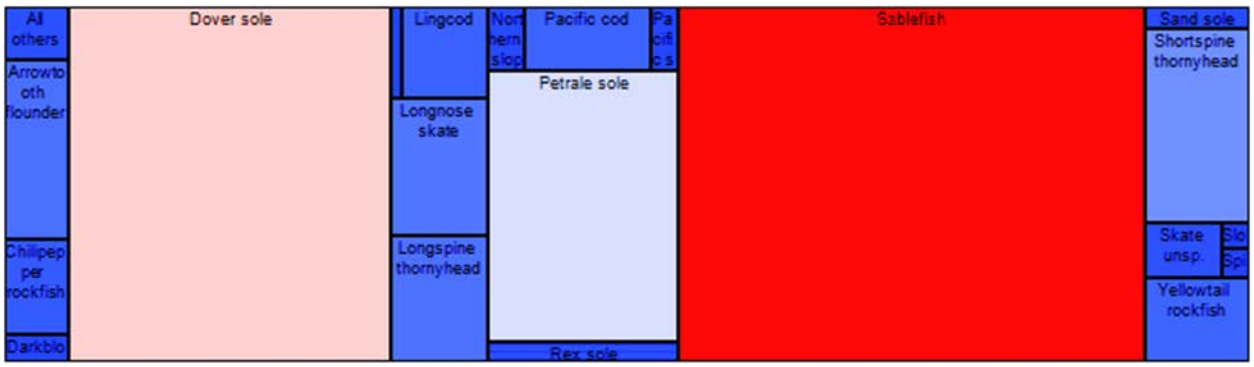


Figure 6. Treemap showing revenue distribution by species name, within the non-whiting fleet of the shorebased IFQ fishery, during the period of January through June of 2012.

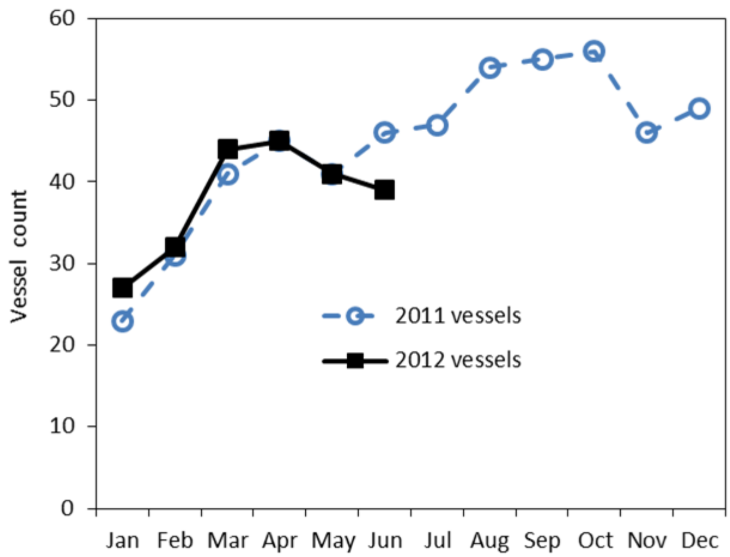
Table 5. Distribution of revenue among species, for the non-whiting IFQ fleet, for January through June of 2011 and 2012.

Species	2011 revenue	2011 rev comp	2011 rank	2012 revenue	2012 rev comp	Rev % 2011	Δ rev comp	2012 rank
Sablefish	5,710,812	44.8%	1	4,973,090	37.6%	87%	-7.2%	1
Dover sole	3,609,720	28.3%	2	3,433,406	26.0%	95%	-2.4%	2
Petrale sole	908,019	7.1%	3	1,548,631	11.7%	171%	4.6%	3
Shortspine thornyhead	559,574	4.4%	4	590,249	4.5%	105%	0.1%	4
Longnose skate	258,114	2.0%	7	391,685	3.0%	152%	0.9%	5
Longspine thornyhead	476,917	3.7%	5	354,597	2.7%	74%	-1.1%	6
Arrowtooth flounder	300,363	2.4%	6	351,407	2.7%	117%	0.3%	7
Yellowtail rockfish	69,289	0.5%	13	257,764	1.9%	372%	1.4%	8
Pacific cod	116,736	0.9%	9	244,333	1.8%	209%	0.9%	9
Lingcod	179,710	1.4%	8	232,627	1.8%	129%	0.3%	10
Chilipepper rockfish	12,704	0.1%	20	188,150	1.4%	1481%	1.3%	11
Skate unsp.	99,057	0.8%	11	125,428	0.9%	127%	0.2%	12
Rex sole	109,488	0.9%	10	110,615	0.8%	101%	0.0%	13
Northern slope rockfish unsp.	64,336	0.5%	14	73,262	0.6%	114%	0.0%	14
Sand sole	73,223	0.6%	12	71,780	0.5%	98%	0.0%	15
Pacific sanddab	47,624	0.4%	15	50,792	0.4%	107%	0.0%	16
Darkblotched rockfish	32,942	0.3%	16	49,893	0.4%	151%	0.1%	17
English sole	20,780	0.2%	18	30,521	0.2%	147%	0.1%	18
Spiny dogfish	27,220	0.2%	17	22,754	0.2%	84%	0.0%	19
Slope rockfish unsp.	8,885	0.1%	23	20,445	0.2%	230%	0.1%	20
All others	60,686	0.5%	na	104,243	0.8%	168%	0.3%	na
Total	12,746,196	100.0%	na	13,225,672	100.0%	104%	na	na

Table 6. Aggregate revenue, landings, and price of groundfish species landed in the non-whiting IFQ fleet for January through June of 2011 and 2012.

Species	2011 revenue	2011 landings	2011 price	2012 revenue	2012 landings	2012 price	Δ price
Sablefish	5,710,812	2,205,981	2.59	4,973,090	2,014,877	2.47	-0.12
Dover sole	3,609,720	8,923,850	0.40	3,433,406	8,472,858	0.41	0.00
Petrale sole	908,019	623,868	1.46	1,548,631	1,098,578	1.41	-0.05
Shortspine thornyhead	559,574	793,837	0.70	590,249	731,740	0.81	0.10
Longnose skate	258,114	853,965	0.30	391,685	1,006,981	0.39	0.09
Longspine thornyhead	476,917	1,125,747	0.42	354,597	817,708	0.43	0.01
Arrowtooth flounder	300,363	3,048,576	0.10	351,407	2,878,062	0.12	0.02
Yellowtail rockfish	69,289	123,939	0.56	257,764	483,881	0.53	-0.03
Pacific cod	116,736	214,152	0.55	244,333	409,601	0.60	0.05
Lingcod	179,710	217,499	0.83	232,627	307,579	0.76	-0.07
Chilipepper rockfish	12,704	24,231	0.52	188,150	267,951	0.70	0.18
Skate unsp.	99,057	274,533	0.36	125,428	270,678	0.46	0.10
Rex sole	109,488	316,278	0.35	110,615	325,493	0.34	-0.01
Northern slope rockfish unspecified	64,336	132,977	0.48	73,262	150,054	0.49	0.00
Sand sole	73,223	74,359	0.98	71,780	74,990	0.96	-0.03
Pacific sanddab	47,624	101,621	0.47	50,792	102,495	0.50	0.03
Darkblotched rockfish	32,942	68,461	0.48	49,893	100,152	0.50	0.02
English sole	20,780	66,613	0.31	30,521	94,201	0.32	0.01
Spiny dogfish	27,220	97,797	0.28	22,754	88,080	0.26	-0.02
Slope rockfish unsp.	8,885	14,207	0.63	20,445	34,849	0.59	-0.04
All others	60,686	221,776	0.27	104,243	282,629	0.37	0.10
Total	12,746,196	19,524,267	0.65	13,225,672	20,013,437	0.66	0.01

Table 7 (right). Monthly vessel counts for 2011 and 2012 in the non-whiting fleet of the shorebased IFQ fishery. Totals reflect January through June only.



Month	2011 vessels	2012 vessels
Jan	23	27
Feb	31	32
Mar	41	44
Apr	45	45
May	41	41
Jun	46	39
Jul	47	
Aug	54	
Sep	55	
Oct	56	
Nov	46	
Dec	49	
Total (Jan- Jun)	64	68

Figure 7 (left). Monthly vessel counts for 2011 and 2012 in the non-whiting fleet of the shorebased IFQ fishery.

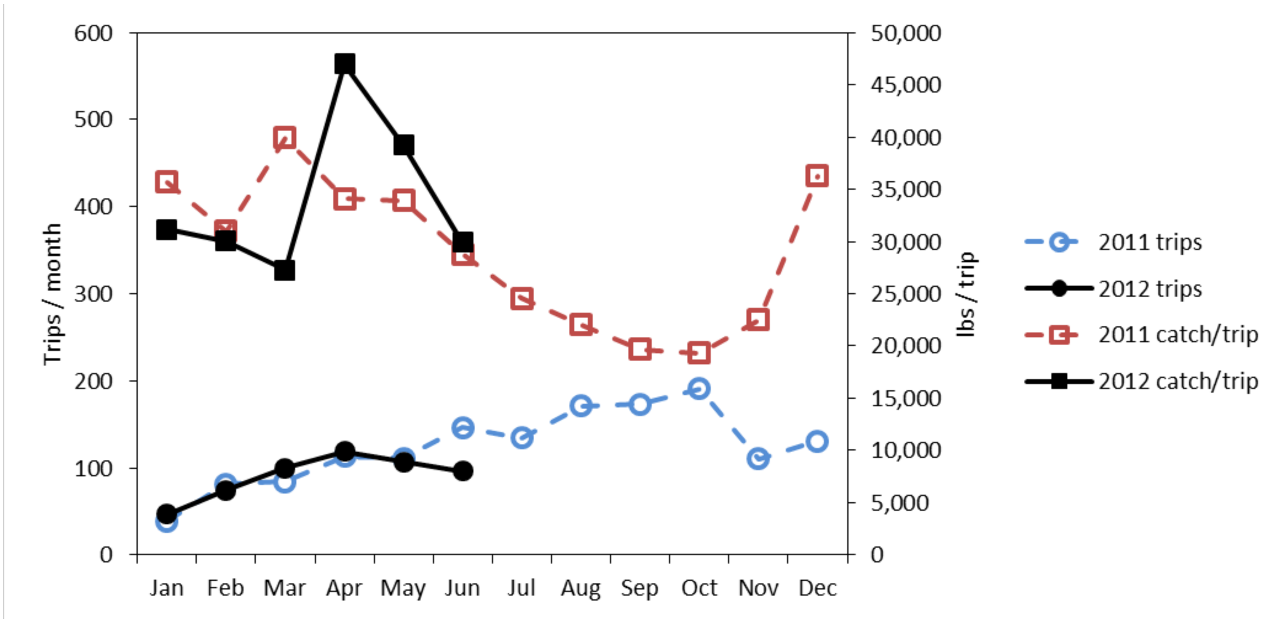


Figure 8. Monthly indicators of non-whiting fleet effort and catch per unit effort, as number of trips (bottom, circles) and catch per trip (top, squares), comparing January through June of 2011, versus 2012.

Table 8. Monthly total catch, and indicators of non-whiting fleet effort and catch per unit effort, as number of trips (bottom, circles) and catch per trip (top, squares), comparing January through June of 2011, versus 2012.

Month	2011 trips	2011 catch	2011 catch/ trip	2012 trips	2012 catch	2012 catch/ trip	Trips %	Catch %	Catch/ trip %
Jan	39	1,391,286	35,674	47	1,465,150	31,173	121%	105%	87%
Feb	81	2,507,351	30,955	74	2,221,771	30,024	91%	89%	97%
Mar	84	3,354,758	39,938	100	2,724,019	27,240	119%	81%	68%
Apr	113	3,853,779	34,104	119	5,592,977	47,000	105%	145%	138%
May	111	3,767,659	33,943	107	4,195,947	39,214	96%	111%	116%
Jun	146	4,201,510	28,777	96	2,872,536	29,922	66%	68%	104%
Jul	134	3,289,497	24,548						
Aug	171	3,766,677	22,027						
Sep	173	3,400,229	19,655						
Oct	191	3,694,772	19,344						
Nov	110	2,476,666	22,515						
Dec	131	4,753,227	36,284						
Total (Jan-June)	574	19,076,343	33,899	543	19,072,400	34,096	95%	100%	101%

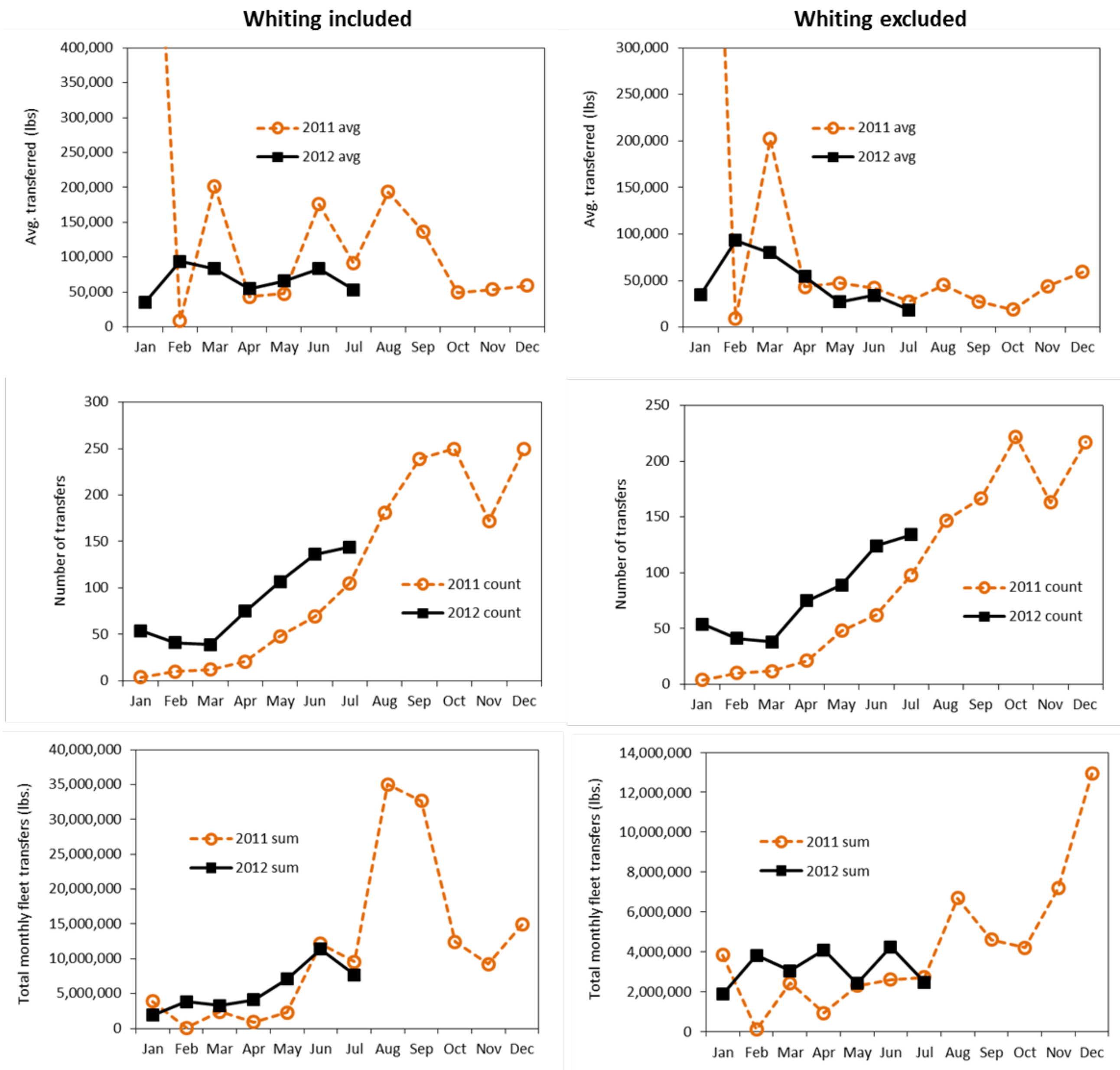


Figure 9. Metrics describing monthly IFQ quota pound transfers from January through June of 2011 and 2012 (vessel account to vessel account), including and excluding Pacific whiting.

Table 9. Metrics describing monthly IFQ quota pound transfers from January through June of 2011 and 2012 (vessel account to vessel account), including Pacific whiting.

Month	2011 sum lbs.	2011 avg.	2011 S.E.	2011 count	2012 sum lbs.	2012 avg.	2012 S.E.	2012 count
Jan	3,888,590	972,148	164,305	4	1,899,208	35,171	10,747	54
Feb	92,054	9,205	5,642	10	3,849,071	93,880	35,453	41
Mar	2,425,391	202,116	165,943	12	3,262,853	83,663	37,328	39
Apr	911,906	43,424	14,010	21	4,122,711	54,969	19,102	75
May	2,290,497	47,719	14,273	48	7,058,958	65,972	21,502	107
Jun	12,137,481	175,906	65,015	69	11,395,389	83,790	27,848	136
Jul	9,574,841	91,189	36,609	105	7,683,296	53,356	25,669	144
Aug	35,051,632	193,655	48,905	181				
Sep	32,670,687	136,697	24,796	239				
Oct	12,430,138	49,721	11,394	250				
Nov	9,234,473	53,689	16,741	172				
Dec	14,883,439	59,534	14,674	250				
Jan-July total	31,320,760	na	na	269	39,271,486	na	na	596

Table 10. Metrics describing monthly IFQ quota pound transfers from January through June of 2011 and 2012 (vessel account to vessel account), excluding Pacific whiting.

Month	2011 sum lbs.	2011 avg.	2011 S.E.	2011 count	2012 sum lbs.	2012 avg.	2012 S.E.	2012 count
Jan	3,833,222	958,306	164,305	4	1,866,022	34,556	10,548	54
Feb	92,054	9,205	5,642	10	3,816,273	93,080	35,156	41
Mar	2,425,159	202,097	165,945	12	3,033,578	79,831	35,565	38
Apr	911,627	43,411	14,010	21	4,080,763	54,410	19,033	75
May	2,278,838	47,476	14,106	48	2,408,179	27,058	8,990	89
Jun	2,604,395	42,006	18,892	62	4,243,676	34,223	14,674	124
Jul	2,701,377	27,565	10,171	98	2,462,898	18,380	2,883	134
Aug	6,676,483	45,418	18,691	147				
Sep	4,608,517	27,596	9,933	167				
Oct	4,199,835	18,918	4,084	222				
Nov	7,178,761	44,041	17,154	163				
Dec	12,925,232	59,563	16,230	217				
Jan-July total	14,846,672	na	na	255	21,911,389	na	na	555

Table 11. Total IFQ quota pound transfers by species, during January through June of 2011 and 2012 (vessel account to vessel account), including Pacific whiting. The table is sorted by the count of QP transfers during January through June of 2012.

IFQ species category	2011 sum lbs.	2011 rank sum	2011 count	2011 rank ct.	2012 sum lbs.	2012 rank sum	2012 count	2012 rank ct.
Sablefish North of 36° N.	812,989	7	80	1	1,451,367	5	105	1
Petrale sole	379,531	11	79	2	956,418	8	101	2
Widow rockfish	81,434	16	42	16	248,659	16	100	3
Canary rockfish	4,330	25	36	17	17,625	24	98	4
Darkblotched rockfish	56,476	18	58	6	144,198	19	86	5
Longspine thornyheads North of 34°27' N.	800,796	8	57	8	1,133,931	7	73	6
Pacific whiting	16,474,088	1	59	5	17,360,097	1	66	7
Shortspine thornyheads North of 34°27' N.	491,116	10	64	3	591,971	12	60	8
Sablefish South of 36° N.	160,373	13	26	20	363,178	13	56	9
Lingcod	283,561	12	44	13	685,537	11	55	10
Pacific halibut (IBQ) North of 40°10' N.	29,359	22	31	19	54,293	23	55	10
Pacific ocean perch North of 40°10' N.	30,408	21	53	10	57,532	22	55	10
Bocaccio rockfish South of 40°10' N.	2,196	26	6	27	17,040	25	49	13
Dover sole	4,454,662	2	64	3	6,437,768	2	45	14
Pacific cod	894,199	6	43	15	730,303	10	45	14
Yelloweye rockfish	87	28	10	22	228	28	43	16
Yellowtail rockfish North of 40°10' N.	972,805	5	44	13	1,341,513	6	43	16
Arrowtooth flounder	2,012,074	4	55	9	3,347,985	3	37	18
Minor shelf rockfish North of 40°10' N.	76,521	17	33	18	124,433	20	35	19
Other flatfish	745,450	9	58	6	854,331	9	33	20
Minor slope rockfish North of 40°10' N.	152,840	14	49	11	210,157	17	30	21
Minor slope rockfish South of 40°10' N.	27,459	23	11	21	102,573	21	28	22
Chilipepper rockfish South of 40°10' N.	112,196	15	9	24	352,866	14	26	23
Starry flounder	48,399	19	10	22	157,859	18	26	23
Cowcod South of 40°10' N.	38	29	4	29	187	29	25	25
English sole	2,175,297	3	45	12	2,220,868	4	24	26
Minor shelf rockfish South of 40°10' N.	6,399	24	8	25	8,927	27	24	26
Splitnose rockfish South of 40°10' N.	34,182	20	7	26	286,906	15	24	26
Shortspine thornyheads South of 34°27' N.	1,495	27	5	28	12,736	26	20	29
Total	31,320,760	na	na	na	39,271,486	na	na	na

Table 12. Total catch and attainment of IFQ fishery allocations, by IFQ species categories, divided by fleet, for the period of January through June, in 2011 and 2012.

Species Category	2011 NW	2011 W	2011 Total	2011 Allocation	2011 Attain.	2012 NW	2012 W	2012 Total	2012 Allocation	2012 Attain.	Annual dif.	Attain dif. %
Arrowtooth flounder	3,333,841	1,478	3,335,319	27,406,105	12%	3,153,094	3,391	3,156,485	20,861,131	15%	-178,834	3%
Bocaccio rockfish South of 40°10' N.	1,716		1,716	132,277	1%	10,291		10,291	132,277	8%	8,575	6%
Canary rockfish	693	281	974	57,100	2%	3,886	101	3,987	57,761	7%	3,013	5%
Chilipepper rockfish South of 40°10' N.	24,427		24,427	3,252,370	1%	286,758		286,758	2,934,904	10%	262,331	9%
Cowcod South of 40°10' N.	8		8	3,968	0%	2		2	3,968	0%	-6	0%
Darkblotched rockfish	69,835	269	70,104	552,997	13%	107,532	508	108,040	548,808	20%	37,936	7%
Dover sole	9,200,257	39	9,200,296	49,018,682	19%	8,645,605	12	8,645,617	49,018,682	18%	-554,679	-1%
English sole	80,517	1	80,518	41,166,808	0%	92,328		92,328	21,037,611	0%	11,810	0%
Lingcod	228,178	1,217	229,395	4,107,873	6%	334,416	821	335,237	3,991,800	8%	105,842	3%
Longspine thornyheads North of 34°27' N.	1,195,507	0	1,195,507	4,334,839	28%	860,765	620	861,385	4,219,648	20%	-334,122	-7%
Minor shelf rockfish North of 40°10' N.	11,320	70	11,390	1,150,813	1%	31,056	1,214	32,270	1,150,813	3%	20,880	2%
Minor shelf rockfish South of 40°10' N.	443		443	189,598	0%	6,907		6,907	189,598	4%	6,464	3%
Minor slope rockfish North of 40°10' N.	141,129	4,740	145,869	1,828,779	8%	155,783	9,662	165,445	1,828,779	9%	19,576	1%
Minor slope rockfish South of 40°10' N.	17,279		17,279	831,958	2%	48,112	87	48,199	831,958	6%	30,920	4%
Other flatfish	559,436	914	560,350	9,253,683	6%	496,991	91	497,082	9,253,683	5%	-63,268	-1%
Pacific cod	214,173	5	214,178	2,502,247	9%	377,084	12	377,096	2,502,247	15%	162,918	7%
Pacific halibut (IBQ) North of 40°10' N.	30,597	52	30,649	257,524	12%	40,618	2,636	43,254	232,856	19%	12,605	7%
Pacific ocean perch North of 40°10' N.	37,535	24	37,559	263,148	14%	49,883	513	50,396	263,441	19%	12,837	5%
Pacific whiting	157,707	23,832,545	23,990,252	204,628,442	12%	199,743	10,660,493	10,860,236	125,447,480	9%	-13,130,016	-3%
Petrale sole	634,466		634,466	1,920,226	33%	1,102,243		1,102,243	2,324,995	47%	467,777	14%
Sablefish North of 36° N.	1,947,194	633	1,947,827	5,613,719	35%	1,650,860	267	1,651,127	5,438,797	30%	-296,700	-4%
Sablefish South of 36° N.	228,372		228,372	1,170,390	20%	54,453		54,453	1,133,352	5%	-173,919	-15%
Shortspine thornyheads North of 34°27' N.	804,255	1,384	805,639	3,156,138	26%	746,540	875	747,415	3,120,533	24%	-58,224	-2%
Shortspine thornyheads South of 34,°27' N.			0	110,231	0%			0	110,231	0%	0	0%
Splitnose rockfish South of 40°10' N.	11,077		11,077	3,045,245	0%	28,022		28,022	3,206,513	1%	16,945	1%
Starry flounder	13,011		13,011	1,471,586	1%	11,347		11,347	1,480,404	1%	-1,664	0%
Widow rockfish	9,403	3,108	12,511	755,348	2%	30,387	2,403	32,790	755,352	4%	20,279	3%
Yelloweye rockfish	43		43	1,323	3%	8		8	1,323	1%	-35	-3%
Yellowtail rockfish North of 40°10' N.	123,924	210,906	334,830	6,821,455	5%	547,686	19,793	567,479	6,850,556	8%	232,649	3%
Total	19,076,343	24,057,666	43,134,009	375,004,872	12%	19,072,400	10,703,499	29,775,899	268,929,501	11%	-13,358,110	0%

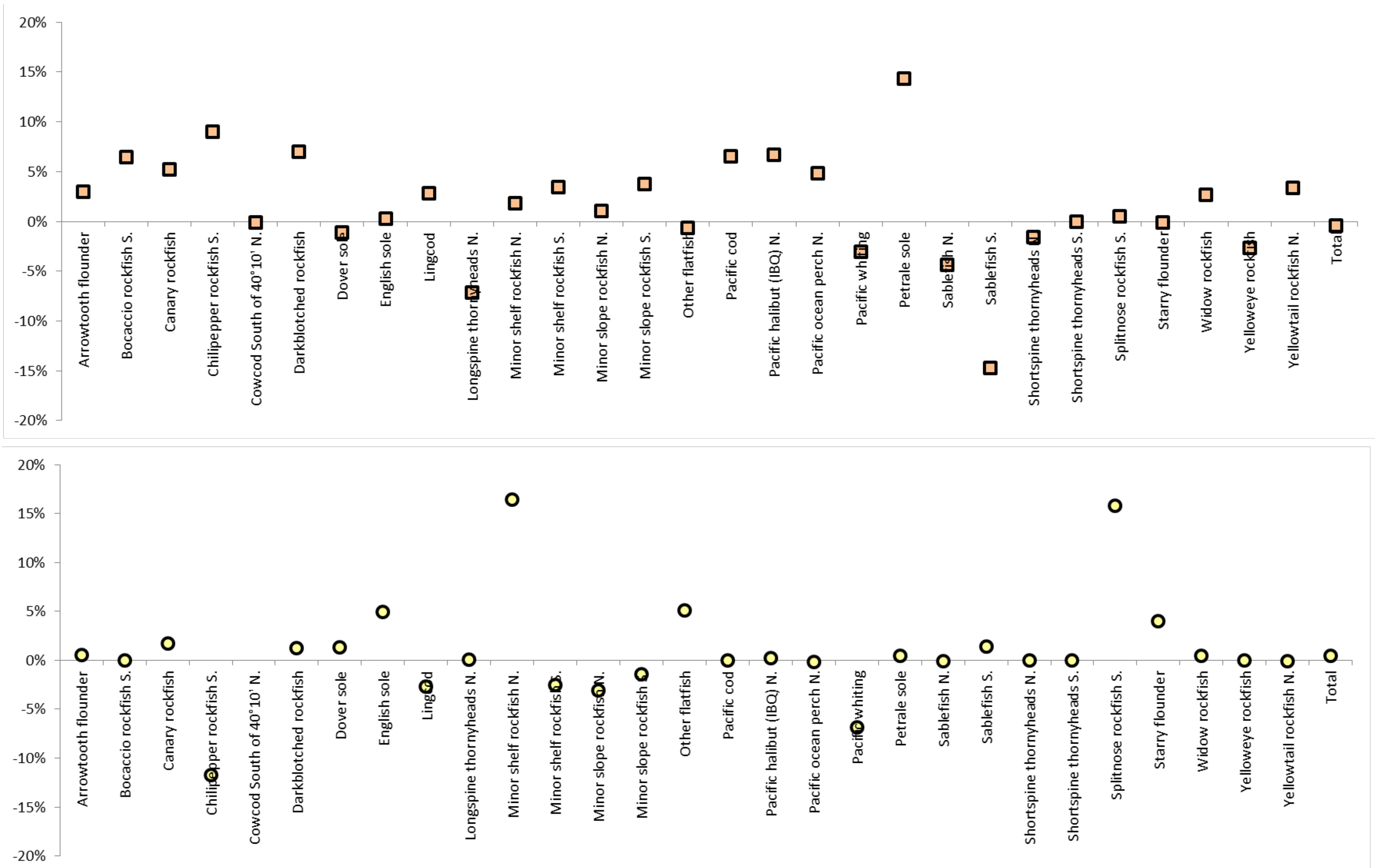


Figure 10. Percent changes in mid-year attainment of IFQ fishery allocations by species for 2011 and 2012 (top, orange-filled squares), and percent changes in retention rates for the non-whiting fleet, in the same fishery, over the same period (bottom, yellow-filled circles).

Table 13. Total catch, landings, discards, and retention rates for the non-whiting fleet, in the IFQ fishery, during January through June of 2011 and 2012.

Species category	2011 Total catch	2011 Landed	2011 Discarded	2011 Retention	2012 Total catch	2012 Landed	2012 Discarded	2012 Retention	Retention dif.
Arrowtooth flounder	3,333,841	3,144,111	189,730	94%	3,153,094	2,991,238	161,856	95%	1%
Bocaccio rockfish South of 40°10' N.	1,716	1,701	15	NA	10,291	10,286	5	NA	NA
Canary rockfish	693	667	26	96%	3,886	3,807	79	98%	2%
Chilipepper rockfish South of 40°10' N.	24,427	24,221	206	99%	286,758	250,682	36,076	87%	-12%
Cowcod South of 40°10' N.	8	8	0	100%	2	1	1	50%	-50%
Darkblotched rockfish	69,835	68,229	1,606	98%	107,532	106,383	1,149	99%	1%
Dover sole	9,200,257	9,043,493	156,764	98%	8,645,605	8,615,091	30,514	100%	1%
English sole	80,517	66,063	14,454	82%	92,328	80,316	12,012	87%	5%
Lingcod	228,178	217,299	10,879	95%	334,416	309,529	24,887	93%	-3%
Longspine thornyheads North of 34°27' N.	1,195,507	1,129,052	66,455	94%	860,765	813,729	47,036	95%	0%
Minor shelf rockfish North of 40°10' N.	11,320	8,436	2,884	75%	31,056	28,256	2,800	91%	16%
Minor shelf rockfish South of 40°10' N.	443	19	424	4%	6,907	120	6,787	2%	-3%
Minor slope rockfish North of 40°10' N.	141,129	135,498	5,631	96%	155,783	144,781	11,002	93%	-3%
Minor slope rockfish South of 40°10' N.	17,279	17,113	166	99%	48,112	46,958	1,154	98%	-1%
Other flatfish	559,436	506,616	52,820	91%	496,991	475,480	21,511	96%	5%
Pacific cod	214,173	214,153	20	100%	377,084	377,072	12	100%	0%
Pacific halibut (IBQ) North of 40°10' N.	30,597	30	30,567	0%	40,618	136	40,482	0%	0%
Pacific ocean perch North of 40°10' N.	37,535	37,335	200	99%	49,883	49,529	354	99%	0%
Pacific whiting	157,707	27,354	130,353	17%	199,743	20,916	178,827	10%	-7%
Petrale sole	634,466	629,957	4,509	99%	1,102,243	1,099,589	2,654	100%	0%
Sablefish North of 36° N.	1,947,194	1,936,078	11,116	99%	1,650,860	1,640,239	10,621	99%	0%
Sablefish South of 36° N.	228,372	224,576	3,796	98%	54,453	54,295	158	100%	1%
Shortspine thornyheads North of 34°27' N.	804,255	797,025	7,230	99%	746,540	739,948	6,592	99%	0%
Shortspine thornyheads South of 34°27' N.	-	-	-	na	-	-	-	na	na
Splitnose rockfish South of 40°10' N.	11,077	2,739	8,338	25%	28,022	11,367	16,655	41%	16%
Starry flounder	13,011	12,402	609	95%	11,347	11,268	79	99%	4%
Widow rockfish	9,403	9,353	50	99%	30,387	30,367	20	100%	0%
Yelloweye rockfish	43	43	0	100%	8	8	0	100%	0%
Yellowtail rockfish North of 40°10' N.	123,924	123,924	0	100%	547,686	547,267	419	100%	0%
Total	19,076,343	18,377,495	698,848	96%	19,072,400	18,458,658	613,742	97%	0%

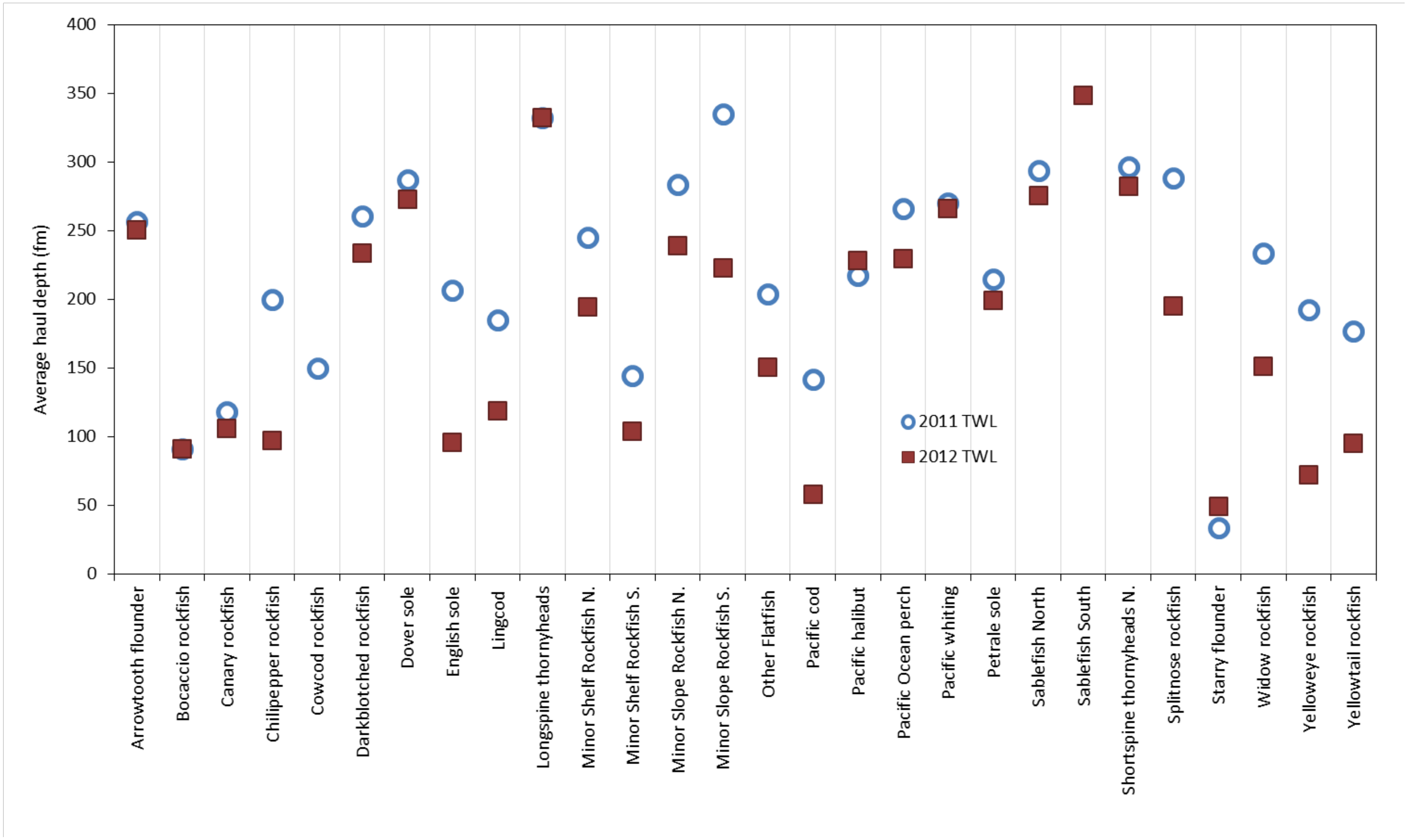


Figure 11. Comparison of average haul depths by IFQ species category, for trawl hauls made during January through May of 2011, and 2012.

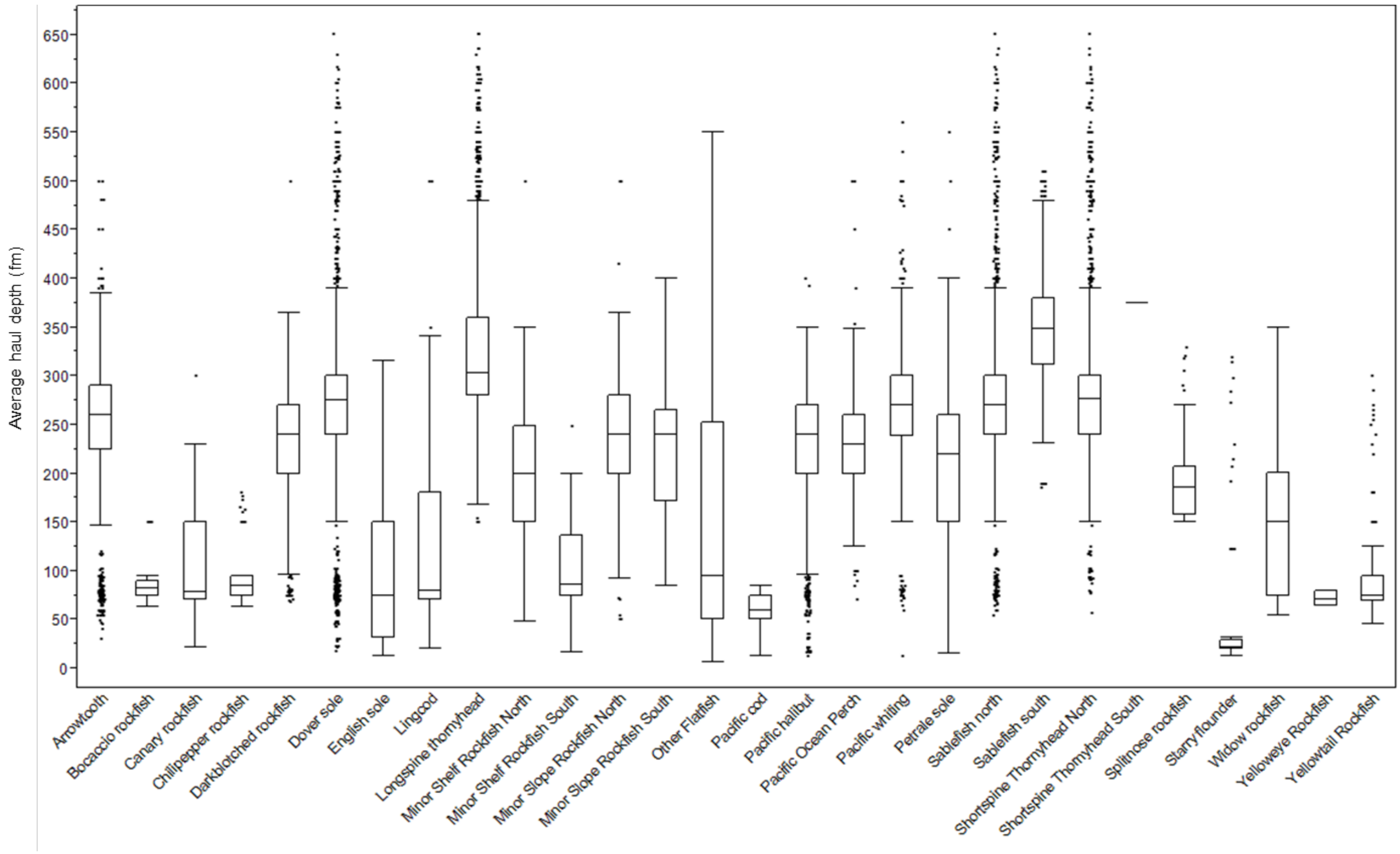


Figure 12. Boxplot showing coastwide mean haul depth values and variation, for IFQ species caught using trawl gear, during January through May of 2012.

Table 14. Coastwide mean haul depth by species category and gear type, for species caught in the IFQ fishery, during January through May of 2011 and 2012.

IFQ species category	2011 NTW	2011 TWL	2012 NTW	2012 TWL	NTW dif.	TWL dif.
Arrowtooth flounder	281.3	256.7	285.7	250.7	4.4	-6.0
Bocaccio rockfish		91.4		90.9		-0.4
Canary rockfish		117.9		106.2		-11.6
Chilipepper rockfish		200.1		97.1		-103.0
Cowcod rockfish		150.0				
Darkblotched rockfish	398.8	260.8	300.0	233.7	-98.8	-27.1
Dover sole	347.8	286.9	310.3	273.1	-37.5	-13.8
English sole	216.5	206.5	346.3	96.0	129.8	-110.6
Lingcod	186.7	184.8	227.3	119.0	40.7	-65.8
Longspine thornyheads	489.0	332.0	460.8	332.5	-28.2	0.5
Minor Shelf Rockfish N.	247.5	244.9	279.6	194.5	32.1	-50.4
Minor Shelf Rockfish S.		144.3	396.5	103.8		-40.5
Minor Slope Rockfish N.	402.7	283.6	272.4	239.4	-130.3	-44.3
Minor Slope Rockfish S.	261.2	335.2	320.3	223.1	59.2	-112.1
Other Flatfish	247.5	203.7	346.3	150.4	98.8	-53.3
Pacific cod		141.6		58.3		-83.3
Pacific halibut	255.8	217.3	257.6	228.3	1.8	11.0
Pacific Ocean perch	396.6	265.9	284.5	229.7	-112.1	-36.2
Pacific whiting	374.2	270.1	346.3	265.9	-27.9	-4.2
Petrale sole	395.8	214.7	346.3	198.9	-49.6	-15.7
Sablefish North	433.8	293.8	378.3	275.6	-55.5	-18.2
Sablefish South	366.6			348.6		
Shortspine thornyheads N.	431.7	296.3	394.2	282.1	-37.5	-14.2
Splitnose rockfish	215.0	288.3		195.1		-93.2
Starry flounder		33.5	346.3	49.0		15.5
Widow rockfish		233.8		151.2		-82.6
Yelloweye rockfish		192.8		72.0		-120.8
Yellowtail rockfish		177.2	445.0	95.0		-82.1

GROUNDFISH ADVISORY SUBPANEL REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

The Groundfish Advisory Subpanel (GAP) met with the Groundfish Management Team (GMT) to discuss progress of this year's fishery and possible inseason adjustments. The GAP offers the following recommendations and comments on proposed inseason adjustments to ongoing groundfish fisheries.

Open Access Fixed Gear South of 36º N Lat.

Current catch projections indicate the open access (OA) fixed gear fishery south of 36º N lat. is tracking at only 42% attainment of its fixed gear harvest guideline. Therefore, the GAP supports the GMT recommendation to increase the current OA trip limits of 300 lbs/per day, one landing per week up to 1,350 lbs, not to exceed 2,700 lbs per 2 months to **350 lbs/day, one landing per week up to 1,750 lbs, not to exceed 3,500 lbs/2 months beginning on November 1, 2012 for the remainder of the year.**

Recreational Fishery South of 34º27' N Lat.

Current catch projections indicate that the recreational fishery south of Point Conception is tracking higher than normal for cowcod. The GAP supports the California Department of Fish and Game (CDFG) recommendation to move the Rockfish Conservation Area for that fishery from the current allowable depth of 60 fathoms to **50 fathoms beginning as soon as is possible for the remainder of the year.** CDFG staff indicates cowcod interactions would decrease by 33% with this move into the shallower water.

Implementation of the Surplus Carryover Provision from 2011 to 2012 in the Limited Entry Trawl Individual Fishing Quota (IFQ) Fishery

The GAP discussed the National Marine Fisheries Service (NMFS) decision on the issuance of surplus carryover quota from the 2011 IFQ fishery to the 2012 fishery. The GAP reiterates its concern from June that surplus carryover quota for Pacific whiting and sablefish were not issued this year. Many fishermen intentionally left quota unharvested last year expecting that this quota would be added to accounts this year. To not issue this surplus quota this year was a costly surprise to many IFQ fishermen.

From our June statement:

> "The GAP understands the reasons for the decision to not issue surplus carryover quota for Pacific whiting and also understands that a remedy to this problem is being pursued in the new international forum for Pacific whiting. The GAP also requests input through the Council process on this remedy at a time when such input is expedient.

"The GAP also understands that the NMFS decision keeps open the possibility of issuing some, or all of the surplus carryover sablefish quota later this year if analysis of projected impacts indicates less risk of exceeding the annual catch limit (ACL). The GAP has heard that the sablefish carry-over amounts are 85 mt north of 36º N. latitude and 20 mt in the south."

The following tables are from the Groundfish Management Team (GMT) statement and reflect the inseason estimates. These figures would suggest there is ample buffer to initiate carryover for sablefish this year. *(Note: The OA Daily-Trip-Limit line for sablefish South of 36° N lat. includes inseason adjustments, thus it is a different figure than what is in the GMT statement.)*

2012 Inseason Estimate for Sablefish North of 36 (mt)									
Sector	**Estimate a/**	**Allocations b/**	**% of Allocation**	**ACL**	**% of ACL**	**ABC**	**% ABC**	**% OFL**	**OFL**
Tribal	535	535	100%						
Research	30	16	190%						
Recreational	1	6.1	8%						
LE DTL c/	275	273	101%						
LE Primary d/	1,472	1,549	95%						
OA c/	382	450	85%						
IFQ e/	2,319	2,467.00	94%						
At-Sea whiting e/	5	50	10%						
Totals before carryover	5,018			5347	94%				
Carryover	***85***								
Totals including carryover	***5,103***				***95%***				
a/ Commercial fishery estimates include landings and discard mortality.									
b/ The fixed gear shares are reduced to account for discard mortality and the resulting value is the landing target. The landing target is used by the GMT to develop trip limits.									
c/ Modeled estimates									
d/ Based on historical attainment									
e/ Based on 2011 attainment									
e/ Based on 2011 attainment									

2012 Inseason Estimate for Sablefish South of 36 (mt)									
Sector	**Estimate a/**	**Share b/**	**% of Share**	**ACL**	**% of ACL**	**ABC**	**% ABC**	**% OFL**	**OFL**
Incidental Open Access	6	6	100%						
Research	2	2	100%						
EFP	0	26	0%						
LE DTL c/	415	390	0%						
OA DTL c/ e/	171	309	55%						
IFQ d/	442	514	86%						
Totals	1037			**1258**	**82%**				
Carryover	***20***								
Totals including carryover	***1,057***				***84%***				
a/ Commercial fishery estimates include landings and discard mortality.									
b/ The fixed gear shares are reduced to account for discard mortality and the resulting value is the landing target. The landing target is used by the GMT to develop trip limits.									
c/ Modeled estimates.									
d/ Value from the 2011 fishery.									
e/ This figure differs from the GMT statement because it includes in-season adjustments.									

It would appear that for sablefish and whiting, enough fish will be left on the table and any carryover would not exceed the trawl sector's allocation or the overall ACL. Furthermore, given that there is a 6 percent drop in sablefish attainment north of 36° N lat. relative to last year at this time, the GAP perceives no problem with a carryover.

The GAP notes that many things have changed since last year. The sablefish market is soft, leading to low attainment, and the market is unlikely to rebound before the end of the year. Quota trading also has stalled due to the soft market. All of these factors lead us to believe that the ACL for sablefish will not be exceeded. Therefore, the risk of exceeding the sablefish ACL due to issuing carryover of surplus quota pounds is low.

As a first principle, the GAP notes that implementation of the carryover provision does not present a biological risk to stock sustainability given how quota is managed in the IFQ fishery. Further, there is less risk of technical overfishing of sablefish due to issuing sablefish carryover quota pounds since the attainment of the coastwide OFL is even less likely than exceeding the northern or southern ACLs this year.

Tribal reapportionment

The GAP also heard from National Marine Fisheries Service (NMFS) representative Kevin Duffy regarding tribal whiting reapportionment for 2012. It is the GAP's understanding that NMFS has met or will meet with tribal representatives during the September Council meeting to discuss this as well as other issues. To date, the tribal harvest for 2012 is less than 1,000 mt of the 48,556 mt allocated to the tribes. Consistent with the regulations, it is anticipated that NMFS will make a decision regarding reapportionment by late September and that a decision on reapportionment can become effective almost immediately as an automatic action. Any decision by NMFS would be distributed via publication through the NMFS listserve and also posted on the NMFS website.

At this time, the GAP requests NMFS follow through with a reapportionment decision in order to attain full utilization of the Pacific whiting resource. The GAP also requests that any reapportionment be done at one time, instead of several incremental releases, so that businesses can make plans and in order to access the resource in a timely manner. If a single reapportionment is not doable, the GAP requests that the bulk of the reapportionment amount be done in the first release.

PFMC
09/17/12

GROUNDFISH MANAGEMENT TEAM REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS

ACTION ITEMS

1. California Recreational

The scorecard was updated to reflect the 2011 estimated mortalities for bocaccio and cowcod in the California recreational fishery. These values represent the best estimates of projected impacts for 2012. Although the current number of cowcod encounters is tracking the same as last year, where final mortality was 0.83 mt, there is still some uncertainty in the data, given the lack of Recreational Fishery Information Network (RecFIN) estimates for 2012. As such, the California Department of Fish and Game (CDFG) is proposing to modify the rockfish conservation area (RCA) from 60 to 50 fm to ensure that impacts will stay within projections for the remainder of the year.

This action is being proposed as a precautionary measure to address uncertainty in the catch estimates and reduce the potential for cowcod mortality to exceed the non-trawl allocation in 2012. The Groundfish Management Team (GMT) notes that this shallower RCA modification was also analyzed in the 2013-14 Biennial Harvest Specifications and Management Measures and ultimately adopted as the final preferred season structure beginning on January 1, 2013. This action would simply implement that depth restriction sooner to ensure cowcod impacts remain within projections.

The GMT recommends prohibiting recreational fishing for all groundfish (except California scorpionfish and other flatfish) in the Southern Management Area (South of 34°27' N. lat.) seaward of a boundary line approximating the 50 fm depth contour, as soon as possible through the end of the year.

2. Limited Entry and Open Access Sablefish Daily Trip Limit (DTL) Fisheries

Introduction
This section discusses 2012 inseason considerations for the four fixed gear, DTL fisheries, including both limited entry (LE) and open access (OA), north and south of 36° N. latitude for 2012. Hereafter, they are referred to as: LE North, LE South, OA North, and OA South. Current projections under No Action (as of September 6, 2012), for the sablefish DTL fisheries are shown in Table 1 and Figure 1.

Current No Action Projections
The current projection for the OA North fishery is 88 percent of the landing target (368 mt vs. 419 mt target, Table 2, Figure 1). The sum of the projections for the LE South and OA South is 77 percent of the sum of those two landing targets (529 mt sum of predictions versus 687 mt sum of targets). A landing target is a harvest guideline that has been reduced to account for estimated discard mortality. Although the LE South is projected to take 107 percent of its target (403 mt vs. 378 mt), the OA South is currently predicted to take only 41 percent of its target (126 mt vs. 309 mt). The Council manages the two southern DTL fisheries under a sharing that was weighted to the LE. Alternative trip limits are therefore presented for OA South (see below).

The current 2012 no action projected landings for the LE DTL North is 266 mt, or 1 mt ton above the 265 mt landing target (100.5 percent of that target). Prices so far in 2012 have been much lower than 2011 and the model takes this into account (Appendix A; Figure 2).

Table 1. Current annual landings projections, corresponding attainment, and targets, in the fixed gear, DTL fisheries under No Action, for 2012 (in mt). Trip limits (in pounds) are only listed for September through December. Note that the far right column is the sum of the LE South and the OA South, which are managed in sum.

	LE N	OA N	LE S	OA S	South sum
Projection	266	368	403	126	529
Target (LT)	265	419	378	309	687
Difference	1	-51	25	-183	-158
Percent	101%	88%	107%	41%	77%
Bimonthly limit	1600	1800	-	2700	-
Weekly limit	800	900	1800	1350	-
Daily limit	-	300	-	300	-

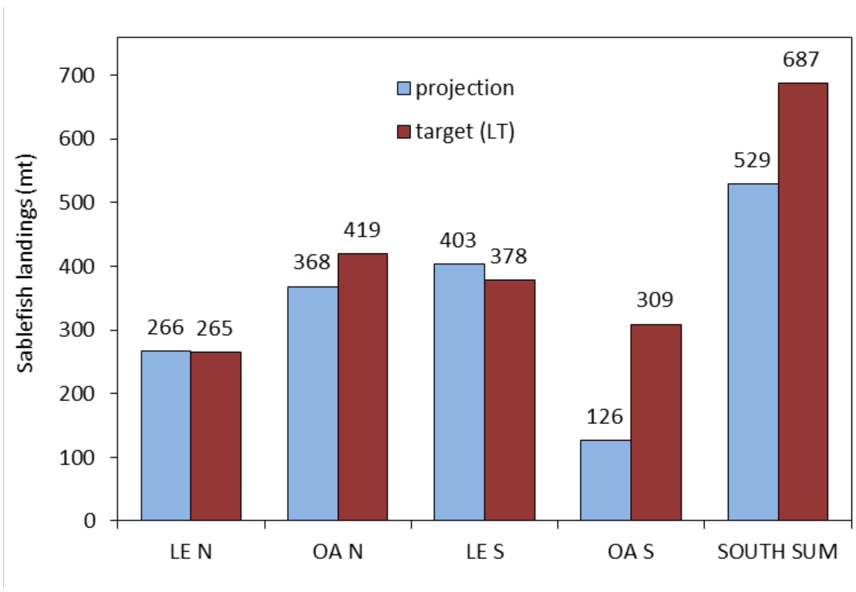


Figure 1. Current landings projections and targets for the fixed gear, DTL fisheries under No Action, in 2012. Note that the two far right columns show the sum of the LE South and the OA South, which are managed in sum.

Note that the sum of tier amounts for the sablefish primary in 2012 is 1,500 metric tons, and the projected remainder, based on the average of 2004 through 2011 is five percent, or 75 mt. If this estimated remainder is correct, it would imply a potential buffer of 74 mt to allow for uncertainty in primary, LE N, and OA N landing projections, as well as discard mortality estimates, when considering expected attainment of the northern sablefish ACL. Late-breaking catch estimates from the PacFIN Quota Species Monitoring (QSM) system, which were posted at this meeting, indicate that these projections may be slightly conservative.

Alternative trip limits for OA South

The OA South fishery is currently predicted to harvest 41 percent of its target (126 mt vs. 309 mt). Although the Council has recently managed the two southern DTL fisheries under a sharing that was weighted to the LE and the LE South projection is at 107 percent of its target, there should be room for a trip limit increase in the OA South for November and December, to allow further attainment of the harvest guideline. Projections for two alternatives (No Action and Alternative 1) are shown below in Table 2. Increasing the trip limits during November and December under Alternative 1 would increase the projected catch by 35 mt, from 126 mt to 161 mt, and increase attainment from 41 to 52 percent. Although the OA South fishery has a history of volatility, recent model improvements in fit, and the limited time duration of this increase make for limited risk.

Table 2. Landings projections, corresponding targets, and attainment under No Action, and Alternative 1 in the OA South sablefish DTL fishery for 2012. Trip limits are only listed for November through December. Note that the right column under each alternative is the sum of the LE South and the OA South, which are managed in sum.

Alternative	**No Action**		**Alternative 1**	
Fishery	**OA S**	**South Sum**	**OA S**	**South Sum**
Projection	126	529	161	564
Target	309	687	309	687
Difference	-183	-158	-148	-123
Percent	41%	77%	52%	82%
Bimonthly limit	2,700	--	3,500	--
Weekly limit	1,350	--	1,750	--
Daily limit	300	--	350	--

The GMT recommends increasing the trip limits in the open access, fixed gear, sablefish DTL fishery, south of 36° N. lat., from "300 pounds per day, or one landing per week of up to 1,350 lb, not to exceed 2,700 pounds per two months" to "350 pounds per day, or one landing per week of up to 1,750 pounds, not to exceed 3,500 pounds per two months" starting November 1 through the rest of the year.

3. Sablefish Surplus Carryover

Table 3 displays the GMT's best estimates of sablefish mortality for 2012 compared to the respective annual catch limits (ACLs). These estimates are prior to any potential inseason action recommended by the Council (increased open access trip limits in the south) and any potential issuance of 2011 shorebased carryover. Percent attainment of the sablefish ACLs is estimated at 94 and 80 percent north and south of 36° N. latitude, respectively.

Table 3. The GMT's best estimate for sablefish mortality (A) north and (B) south of 36° N. latitude in 2012, compared to the respective ACLs.

(A) 2012 Inseason Estimate for Sablefish North of 36° N. lat (mt)

Sector	**Estimate a/**	**Allocations b/**	**% of Allocation**	**ACL**	**% of ACL**
Tribal	535	535	100%		
Research	30	16	190%		
Recreational	1	6.1	8%		
LE DTL c/	275	273	101%		
LE Primary d/	1,472	1,549	95%		
OA c/	382	450	85%		
IFQ e/	2,319	2,467	94%		
At-Sea whiting e/	5	50	10%		
Totals	**5,018**			**5,347**	**94%**

a/ Commercial fishery estimates include landings and discard mortality.
b/ The fixed gear shares are reduced to account for discard mortality and the resulting value is the landing target. The landing target is used by the GMT to develop trip limits.

c/ Modeled estimates

d/ Based on historical attainment

e/ Based on 2011 attainment

(B) 2012 Inseason Estimate for Sablefish South of 36° N. lat (mt)

Sector	**Estimate a/**	**Share b/**	**% of Share**	**ACL**	**% of ACL**
Incidental Open Access	6	6	100%		
Research	2	2	100%		
EFP	0	26	0%		
LE DTL c/	415	390	107%		
OA DTL c/	136	309	44%		
IFQ d/	442	514	86%		
Totals	**1,002**			**1,258**	**80%**

a/ Commercial fishery estimates include landings and discard mortality.
b/ The fixed gear shares are reduced to account for discard mortality and the resulting value is the landing target. The landing target is used by the GMT to develop trip limits.
c/ Modeled estimates.
d/ Value from the 2011 fishery.

The GMT's best estimate of sablefish mortality for the shorebased IFQ sectors are based on 2011 attainment (Table 3). The GMT explored other information to determine whether 2011 attainment is a reasonable expectation. An IFQ projection model was developed for the 2013-2014 Environmental Impact Statement; however, it is currently not configured to perform inseason projections. The model projected approximately 90 percent and 70 percent of the shorebased trawl allocations north and south of 36° N. latitude, respectively, would be attained. While the modeling and projection is based on the variables for 2013-2014 (for example, ACLs, allocations, etc.), the projections are similar to those recommended by the GMT for 2012.

The GMT acknowledges there are many variables that could influence projected attainment of the shorebased IFQ allocations (for example market conditions, weather, etc.) and there is uncertainty in the estimates. Should the entire shorebased trawl allocation be attained in addition to the surplus carryover, the north and south ACL attainments would be 98 percent and 90 percent, respectively.

Table 4 displays the projections for the ACLs, acceptable biological catch (ABC), and overfishing limit (OFL) under various scenarios including: 1) No Action, 2) proposed inseason action (increased open access trip limits in the south), 3) No Action projection with 2011 shorebased carryover issuance (no trip limit adjustment), and 4) Inseason action with 2011 shorebased carryover issuance (both inseason adjustment and carryover issuance). None of the harvest specifications are projected to be attained under the various scenarios.

The NMFS report from June 2012 indicated that issuance of surplus carryover would be consistent with the conservation requirements of the Magnuson-Stevens Act as long as projected catches were not expected to exceed the ACL (Agenda Item D.8.b, NMFS Report, June 2012). The GMT notes that under all scenarios, the projected impacts are not expected to exceed the ACL. **The GMT recommends considering sablefish surplus carryover based on 2012 projections for sablefish catch.**

Table 4. Percent attainment of the ACLs, ABC, and OFL under various scenarios.

Projection Scenario	**N. ACL %**	**S. ACL %**	**ABC %**	**OFL %**
No Action	94	80	73	70
Including Inseason Action a/	94	82	73	70
No Action Projection with a 2011 Shorebased Carryover	95	83	74	71
Inseason Action with a 2011 Shorebased Carryover	95	84	75	71

a/ The term inseason action refers to the southern open access trip limit adjustment proposed earlier.

Table 5 is provided to illustrate the potential results of an averaging approach, similar to the Option 5 approach presented in the NMFS Report under Agenda Item H.2 (Agenda Item H.2.b, Supplemental NMFS Report 2). In this case, the cumulative estimate of sablefish catch for 2011 and 2012 is 96.9 percent of the cumulative 2-year ACL. A multi-year average approach would be a fairly straightforward approach.

Table 5. Example of what a multi-year averaging approach would look like, based on the GMT's best estimates for 2011 and 2012. The cumulative 2011-2012 attainment (96.9 percent) is below the cumulative ACL.

	Annual			**Cumulative**		
	ACL	**Best est.**	**%**	**ACL**	**Best est.**	**%**
2011	5,515	5,432	98.5%			
2012	5,347	5,096	95.3%	10,862	10,528	96.9%

INFORMATIONAL

Scorecard update

The current scorecard reflects updates to Washington and California recreational fisheries, and research updates (Appendix B), as described below.

Research updates

The International Pacific Halibut Commission (IPHC) stock assessment survey is complete for 2012. The total catch of yelloweye rockfish in the IPHC survey was 0.4 mt, less than the scorecard projection (1.1 mt) from June 2012. The Oregon Department of Fish and Wildlife (ODFW) was unable to secure funding for their research project for 2012. There had been 1.0 mt of yelloweye projected for that project. Total yelloweye rockfish research impacts have been reduced from 3.3 mt to 1.7 mt. No updates were available for other research cells in the scorecard.

WA Recreational

The overfished species scorecard has been updated to reflect a change in the projected catch for yelloweye rockfish in the Washington recreational fishery. Catch estimates through July 2012 show that yelloweye catch is at 3.02 mt, which exceeds the Washington recreational harvest guideline of 2.6 mt. In response to the overage, WDFW took emergency action to close the recreational bottomfish fishery in the north coast management areas (Marine Catch Areas 3 and 4) effective September 4, 2012 through the remainder of the year. Additional information is presented under Agenda Item H.5.b, WDFW Report. The overfished species scorecard has been updated to 3.3 mt for yelloweye rockfish which reflects the actual catch through July and projected catch for August. WDFW is not requesting concurrent federal action be taken.

OR Recreational

Oregon has examined recreational catch estimates through July 2012 and reports that catch is tracking according to projections and no updates to the overfished species scorecard are proposed for Oregon recreational fisheries at this time.

CA Recreational

The scorecard was updated to reflect the 2011 estimated mortalities for bocaccio and cowcod in the California recreational fishery (see page 1 for details).

IFQ fishery catch

The NMFS submitted a mid-year IFQ report for the Council briefing book (http://www.pcouncil.org/wp-content/uploads/H5b_NMFS_RPT_SEP2012BB.pdf), which compares IFQ catch and some other available metrics between the first half of 2012 to the same period in 2011.
http://www.pcouncil.org/wp-content/uploads/H5b_NMFS_RPT_SEP2012BB.pdf

Aggregate IFQ catch including both whiting and non-whiting fleets by IFQ species categories, is refreshed daily and is always available at: https://www.webapps.nwfsc.noaa.gov/ifq/.

Summary of GMT Recommendations

1. **California Recreational**: **Prohibit recreational fishing for all groundfish (except California scorpionfish and other flatfish) in the Southern Management Area (South of 34°27' N. lat.) seaward of a boundary line approximating the 50 fm depth contour, as soon as possible through the end of the year.**

2. **Commercial Sablefish South: Increase the trip limits in the open access fixed gear sablefish DTL fishery south of 36° N. lat. from "300 pounds per day, or one landing per week of up to 1,350 lb, not to exceed 2,700 pounds per two months" to "350 pounds per day, or one landing per week of up to 1,750 pounds, not to exceed 3,500 pounds per two months" starting November 1 through the end of the year.**

3. **Commercial Shorebased IFQ: Consider sablefish surplus carryover based on 2012 projections for sablefish catch.**

Appendix A: Current assumptions and recent improvements to the limited entry DTL model.

The current 2012 no-action projection for the LE North fishery assumes actual 2012 prices through August, and ratio-imputed prices for the remainder of the year (based on the relationship between 2011 and 2012 prices by period for May through August; Appendix A, Figure 2).

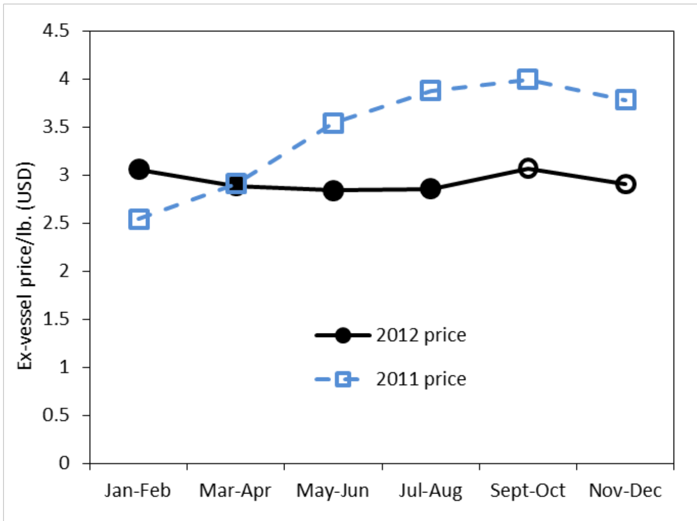


Figure 2. Ex-vessel sablefish prices for 2011 and 2012, used in modeling the LE North DTL fishery, by bimonthly period. Blue, open squares connected by dashed lines are 2011 prices. Black, filled circles are 2012 prices. Open black circles are imputed 2012 prices, based on the average ratio of 2012 to 2011 prices in May through August.

The retrospective accuracy of the projection model was improved in June from 84 percent to 92 percent (R^2 predicted versus actual bimonthly landings) with the addition of ex-vessel price to the model in June. Over the retrospective period, when values of predictor variables are known, the actual annual catch differs from the predicted annual catch by an average of ±9 percent of the prediction (max=21 percent, min=0.4 percent). However, additional uncertainty exists with the imputation of price for the remainder of the forecast year, where we do not have known values from PacFIN.

In addition to the model improvements in June, NMFS staff have recently completed a major revision of the LE N model, which is in testing. The new model has expanded forecasting abilities to accommodate changes in participation and effort; preliminary results show further improvements in model fit (to 95 percent). Bimonthly participation in this fishery has been steadily increasing annually to new highs in the past few years, especially in 2010 and 2011 (Appendix A, Figure 3).

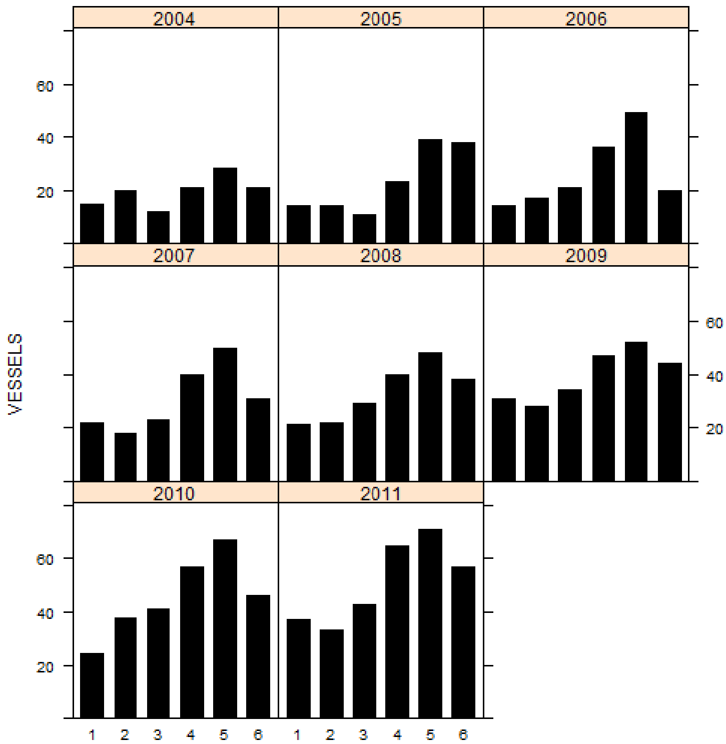


Figure 3. Numbers of participating vessels per bimonthly period and year, showing increased participation in the LE North DTL fishery, most recently during 2010 and 2011.

Appendix B. Scorecard for September 2012.

Appendix 2. Scorecard for September of 2012. Allocations[a] and projected mortality impacts (mt) of overfished groundfish species for 2012.

Fishery	Bocaccio b/		Canary		Cowcod b/		Dkbl		Petrale		POP		Widow		Yelloweye	
***Date*: 16 Sept 2012**	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts	Allocation a/	Projected Impacts
Off the Top Deductions	13.4	2.4	20.0	18.7	0.3	0.1	18.7	17.2	65.4	97.1	12.8	12.8	61.0	64.9	5.9	**4.2**
EFPc/	11.0	0.0	1.3	0.0	0.2	0.0	1.5	0.0	2.0	0.0	0.1	0.0	11.0	0.0	0.1	0.0
Research d/	1.7	1.7	7.2	7.2	0.1	0.1	2.1	2.1	17.0	17.0	1.8	1.8	1.6	1.6	3.3	**1.7**
Incidental OA e/	0.7	0.7	2.0	2.0	--	--	15.0	15.0	1.0	0.1	0.0	0.1	3.3	3.3	0.2	0.2
Tribal f/			9.5	9.5			0.1	0.1	45.4	80.0	10.9	10.9	45.0	60.0	2.3	2.3
Trawl Allocations	60.0	60.0	34.8	34.8	1.8	1.8	263.0	263.0	1,060.0	1,060.0	137.0	137.0	491.0	491.0	0.6	0.6
---SB Trawl	60.0	60.0	26.2	26.2	1.8	1.8	248.9	248.9	1,054.6	1,054.6	119.6	119.6	342.1	342.1	0.6	0.6
---At-Sea Trawl			8.6	8.6			14.5	14.5	5.0	5.0	17.4	17.4	147.9	147.9		
a) At-sea whiting MS			3.6	3.4			6.0	6.0			7.2	7.2	61.2	61.2		
b) At-sea whiting CP			5.0	4.8			8.5	8.5			10.2	10.2	86.7	86.7		
Non-Trawl Allocation	189.6	103.4	29.8	21.4	0.9	0.8	14.0	4.3	35.0	0.0	7.0	0.3	49.0	10.0	10.5	10.4
Non-Nearshore	57.9		2.3												1.3	
LE FG				1.5				3.6				0.3		0.1		0.6
OA FG				0.2				0.5				0.0		0.0		0.1
Directed OA: Nearshore	0.7	0.4	4.0	4.8		0.0		0.2						0.2	1.1	1.0
Recreational Groundfish																
WA			2.0	1.0				--		--		--		--	2.6	**3.3**
OR			7.0	4.6				--		--		--		1.0	2.4	2.3
CA	131.0	**103.0**	14.5	9.3		**0.8**		--		--		--		8.7	3.1	3.1
TOTAL	263.0	**165.8**	84.6	74.9	3.0	**2.7**	295.7	284.5	1,160.4	1,157.1	156.8	150.1	601.0	565.9	17.0	**15.2**
2012 Harvest Specification g/	**274**	**274**	**107**	**107**	**3.0**	**3.0**	**296**	**296**	**1,160**	**1,160**	**157**	**157**	**600**	**600**	**17**	**17**
Difference	11.0	**108.2**	22.4	32.1	0.0	**0.3**	0.3	11.5	-0.4	2.9	0.2	6.9	-1.0	34.1	0.0	**1.8**
Percent of OY	96.0%	60.5%	79.1%	70.0%	100.0%	91.0%	99.9%	96.1%	100.0%	99.8%	99.9%	95.6%	100.2%	94.3%	100.0%	89.4%

Key		
	(hatched)	= not applicable
	--	= trace, less than 0.1 mt
	(black)	= Fixed Values
	(light blue)	= off the top deductions

a/ Formal allocations are represented in the black shaded cells and are specified in regulation in Tables 1b and 1e. The other values in the allocation columns are 1) off the top deductions, 2) set asides from the trawl allocation (at-sea petrale only) 3) ad-hoc allocations recommended in the 2011-12 EIS process, 4) HG for the recreational fisheries for canary and YE.

b/ South of 40°10' N. lat.

c/ EFPs are amounts set aside to accommodate anticipated applications. Values in this table represent the estimates from the 11-12 biennial cycle, which are currently specified in regulation.

d/ Includes NMFS trawl shelf-slope surveys, the IPHC halibut survey, and expected impacts from SRPs and LOAs.

e/ The GMT's best estimate of impacts as analyzed in the 2011-2012 Environmental Impact Statement (Appendix B), which are currently specified in regulation.

f/ Tribal values in the allocation column represent the the values in regulation. Projected impacts are the tribes best estimate of catch.

g/ The POP ACL is 183 mt, while the HG is 157 mt

PFMC
09/17/12

OREGON DEPARTMENT OF FISH AND WILDLIFE REPORT ON THE INDIVIDUAL FISHING QUOTA (IFQ) PROGRAM OFF OREGON

The Oregon Department of Fish and Wildlife (ODFW) examined components of the Individual Fishing Quota (IFQ) Program in Oregon during 2011 and the first half of 2012. Changes in fishing behavior were expected as the west coast groundfish trawl fishery made the transition from a fishery managed using bimonthly trip limits to one managed under the IFQ program. Changes in fishing behavior and landing statistics were analyzed since the inception of the shorebased IFQ Program. Some of the potential impacts analyzed include: geographic consolidation of fleets, changes in landings and infrastructure, effort shifts to other fisheries, and changes in gear types used. The purpose of this report is to compare the IFQ fishery off Oregon during 2011 and the first half of 2012 with the limited entry shorebased-trawl fisheries off Oregon during 2006 to 2010 (i.e., pre-IFQ). Note that the 2011 IFQ fishery began January 11th and the 2012 IFQ fishery began January 1st. This report is intended to supplement IFQ updates that have recently been provided by ODFW, the Groundfish Management Team (GMT) and the National Marine Fisheries Service (NMFS; see Agenda Item D.8.b., Supplemental GMT Report, June 2012 and Agenda Item G.7.b, Supplemental ODFW Report, September 2011). The scope of this report is primarily focused on tracking mid-year landing patterns. Annual analyses of the IFQ Fishery off Oregon and the West Coast are available in previous reports by ODFW and NMFS (see Agenda Item D.8.b, Supplemental ODFW Report, June 2012 and Agenda Item F.6.b, Supplemental NMFS Report, March 2012).

Data were obtained from the Pacific Fisheries Information Network (PacFIN) and from Oregon commercial landing receipts (see Data Sources section). Only data associated with Oregon landings are presented herein. This analysis is restricted to limited entry groundfish trawl vessels and their past and present activities within the limited entry shorebased groundfish trawl (LET) fishery, and within other federal and state managed fisheries. It should be noted that trends described in this report for Oregon may differ from patterns observed for Washington and California. Additionally, patterns observed during 2011 and 2012 may change during subsequent years, as the IFQ fishery evolves, regulations change, Annual Catch Limits (ACLs) vary, and as catches in alternative fisheries (e.g., crab and shrimp) fluctuate.

LIMITED ENTRY NON-WHITING IFQ FISHERY

Mid-Year Landings and Revenue—The limited entry non-whiting IFQ fishery is defined as vessels taking part in the IFQ fishery, fishing with a limited entry trawl permit and using either trawl or fixed gear. In this fishery, overall trends observed during the first half of 2012 are remarkably similar to activity that occurred during the first half of 2011. However, both IFQ years (2011 and 2012) deviate from historical (2006-2010) landing patterns in terms of statewide and vessel landing volumes, revenue, and activity. Overall, 2012 non-whiting IFQ landings and revenues (13.2 million pounds; $7.6 million) were less than the historical mid-year average (16.3 million pounds; $8.3 million; Table 1). Total mid-year ex-vessel landings and revenue were similar during 2011 and 2012 (13.3 million pounds; $7.4 million), as were the number of participants (41 and 42 vessels, respectfully). Relative to the historical average, 2012 had fewer participants (-40%), fewer trips (-48%), decreased landing volume (-19%), and slightly lower total ex-vessel revenue (-8%).

Table 1. Oregon mid-year (January 1 to June 30th) landing statistics (pounds and dollars), by year, for the non-whiting groundfish trawl fishery (2006-2010) and the non-whiting IFQ fishery (2011 and 2012), along with the 2006-2010 average (AVG 06-10). Source: Data were obtained from PacFIN.

	2006	2007	2008	2009	2010	AVG 06-10	2011	2012
Vessels (No.)	63	68	69	74	70	69	41	42
Trips (No.)	473	546	636	849	655	632	337	327
Pounds (millions)	10.5	13	17.8	21.6	18.8	16	13.3	13.2
Revenue($ millions)	$5.9	$6.6	$9.5	$10.4	$8.8	$8.0	$7.4	$7.6
Pounds/Trip	22,144	25,866	28,050	25,434	28,692	26,037	39,502	40,415
Revenue/Trip	$12,413	$13,214	$14,985	$12,221	$13,464	$13,259	$21,982	$23,221

One interesting pattern that has emerged with the implementation of the IFQ program is the increased larger volume, higher revenue trips. Historically, the average landing volume ranged from 22,000 pounds to 28,000 pounds (average = 26,000) and average trip revenues ranged from $12,000-$15,000 during the first half of the year (average = $13,300). In 2011, the trip landing size increased 52%, and in 2012 by 55%, relative to the five-year average. Furthermore, the average trip revenue increased 66% during the first half of 2011 ($22,000) and 75% during 2012 ($23,200), relative to 2006-2010 ex-vessel revenues (average = $13,300). One key component of the IFQ fishery is the added flexibility that allows participants to fish during optimal conditions (e.g. ideal weather or high market prices) while no longer being constrained by bimonthly trip limits. When constrained by these trip limits, management windows restricted the quantity of fish landed during a given time period and vessels made smaller landings in order to stay within these limits. Under the IFQ program, vessels can maximize catch to the extent of vessel and quota pound limits, allowing for more efficient trips with higher volume landings.

Monthly Landings—Historically, monthly landings and revenue patterns were influenced by the bimonthly trip limit management windows, with the lowest landings typically occurring in January and December (Figure 1). The implementation of the IFQ program created new landing patterns, which were influenced by a combination of factors, including (but not limited to): market prices, weather, or participation in other ventures (e.g., state or Alaska fisheries, and limited entry fixed gear tier sablefish fishery). Early 2012 landings were exceptionally low, particularly in January (1 million pounds), which had the lowest monthly landings since 2006; with January 2011 having only slightly higher landings (1.2 million pounds). Furthermore, both 2011 and 2012 had over a 30% decrease in landing volume during the first quarter, relative to the historical average. However, landings increased dramatically during April 2012 (3.5 million pounds landed), representing the seventh highest monthly landing since 2006 while exceeding the 2006-2010 average (3.2 million pounds). Activity during May 2011 and 2012 were similar (approximately 2.7 million pounds), although both years were below the May five year average (3 million pounds). Interestingly, June 2012 landings (1.9 million pounds) were lower than June 2011 (2.5 million pounds) and the historical average (2006-2010 average; 2.5 million pounds).

Monthly Revenue—Monthly revenues in the non-whiting IFQ fleet typically follow a similar, albeit smoother, trend as landing patterns. Landings and revenues were suppressed during the first quarter of 2012 for the non-whiting IFQ fisheries relative to the five-year average. However, it should be noted that vessels have the capacity to participate in multiple fisheries, including state managed fisheries, and although IFQ groundfish revenues were low, these vessels may have pursued other fisheries such as Dungeness crab during this time period (see Spillover section below). Revenues during the first quarter of 2011 and 2012 were similar ($3.1 and $3.2 million, respectfully), but were less than the historical average ($4.1 million; Figure 1). Revenues rebounded in April 2012 ($1.8 million), with the highest earning so far this year, surpassing the April 2006-2010 average ($1.4 million; Figure 1). Note that September and October 2011 revenues were disproportionately higher than the pounds landed for those months. This is partially due to the high proportion of sablefish landings during this period. Nearly 31% of the total 2011 non-whiting IFQ sablefish were landed during September and October alone; which is a significantly higher proportion relative to historical patterns during the same two months (19%).

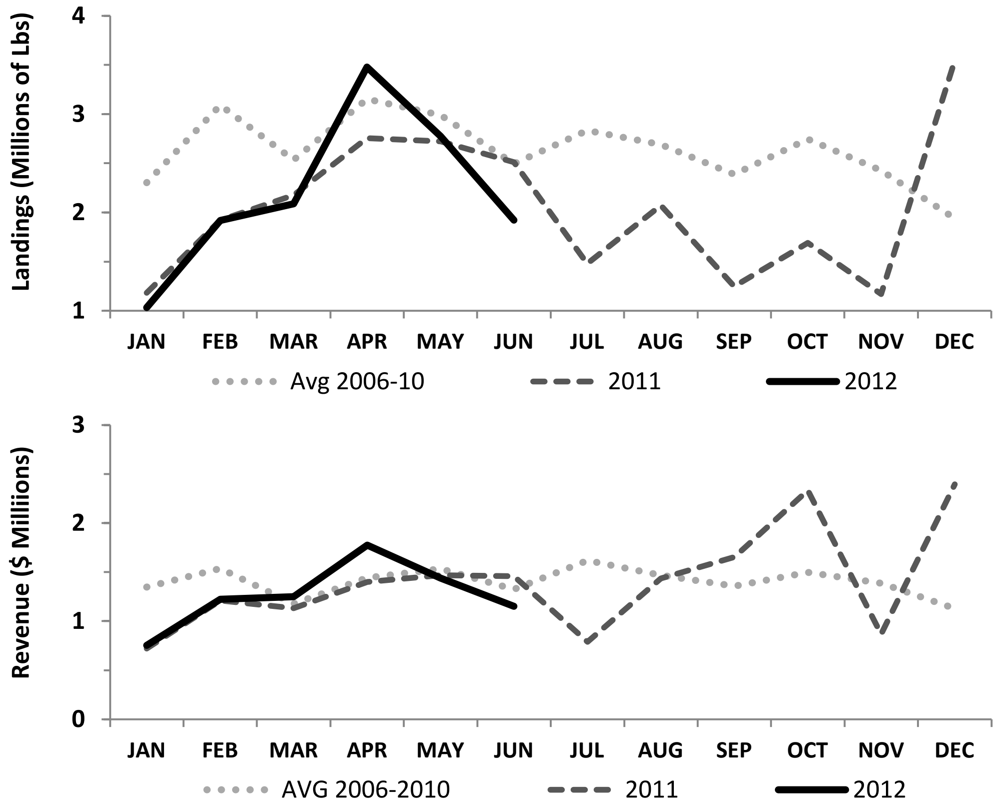


Figure 1. Landings (millions of pounds; top) and revenue (bottom), by month, for the non-whiting groundfish trawl fishery (2006-2010 average) and the non-whiting IFQ fishery off Oregon during 2011 and the first half (January - June) of 2012. Source: Data were obtained from PacFIN.

Landings by Species—As noted in other reports, the composition of landed species has changed upon the implementation of the IFQ program relative to the pre-IFQ patterns (Agenda Item D.8.b, Supplemental ODFW Report, June 2012 and Agenda Item H.5.b, NMFS Report, September 2012). The inherent design of a quota program encourages individual accountability, so it is not surprising to see reductions in bycatch species catch. During the first six months of 2012, yelloweye rockfish landings decreased by 84%, relative to the historical average. At the same time, the IFQ program allows opportunity to access species that were previously restricted due to bycatch concerns. For example, prior to the IFQ program, yellowtail rockfish was constrained by widow rockfish bycatch. Both species occupy similar habitats and are often caught concurrently. As a result, bimonthly trip limits restricted landings of both species. The implementation of the IFQ program, in conjunction with the successful rebuilding of widow rockfish, provided the opportunity to target yellowtail rockfish by trawl. During the first half of 2011, yellowtail rockfish catch increased substantially (753%) relative to the 2006-2010 average. The 2012 increase in catch relative to the five-year average was even more dramatic (i.e., 1,715% increase) (Table 2). This pattern is further exemplified with a spatial comparison of 2010 (pre-

IFQ) versus 2011 (IFQ) yellowtail catch (Figure 2). The mean yellowtail catch per tow was much lower in 2010 (146 ± 21 pounds) than in 2011 (1,553 ± 165 pounds). Furthermore, the maximum catch per tow increased from 1,800 pounds (2010) to 20,000 pounds (2011), suggesting more yellowtail targeting occurred with IFQ implementation (i.e., larger catch volumes per tow in 2011 than was observed prior to the IFQ program).

Table 2. Top ten species with the greatest percent change (%Δ) during the first half of 2011 and 2012 landings (pounds), relative to the historical average (2006-2010) during the same six month time period. Data are ranked by percent change in 2012 and only landings greater than 500 pounds are reported. Source: Data were obtained from PacFIN.

Rank	Species	AVG 06-10 (Lbs)	2011 (Lbs)	2012 (Lbs)	% Δ 2011	% Δ 2012
1	Spiny dogfish	1,881	96,805	39,616	5045%	2006%
2	Yellowtail RF	12,827	109,401	232,803	753%	1715%
3	Greenstriped RF	1,324	5,712	6,096	331%	360%
4	Pacific cod	60,089	212,810	252,331	254%	320%
5	Canary	830	595	2,128	-28%	156%
6	Blackgill RF	1,646	1,281	4,035	-22%	145%
7	Lingcod	54,832	70,721	132,354	29%	141%
8	Aurora RF	4,299	13,975	9,688	225%	125%
9	Slope RF	4,563	2,111	8,883	-54%	95%
10	Widow RF	4,212	7,327	7,431	74%	76%

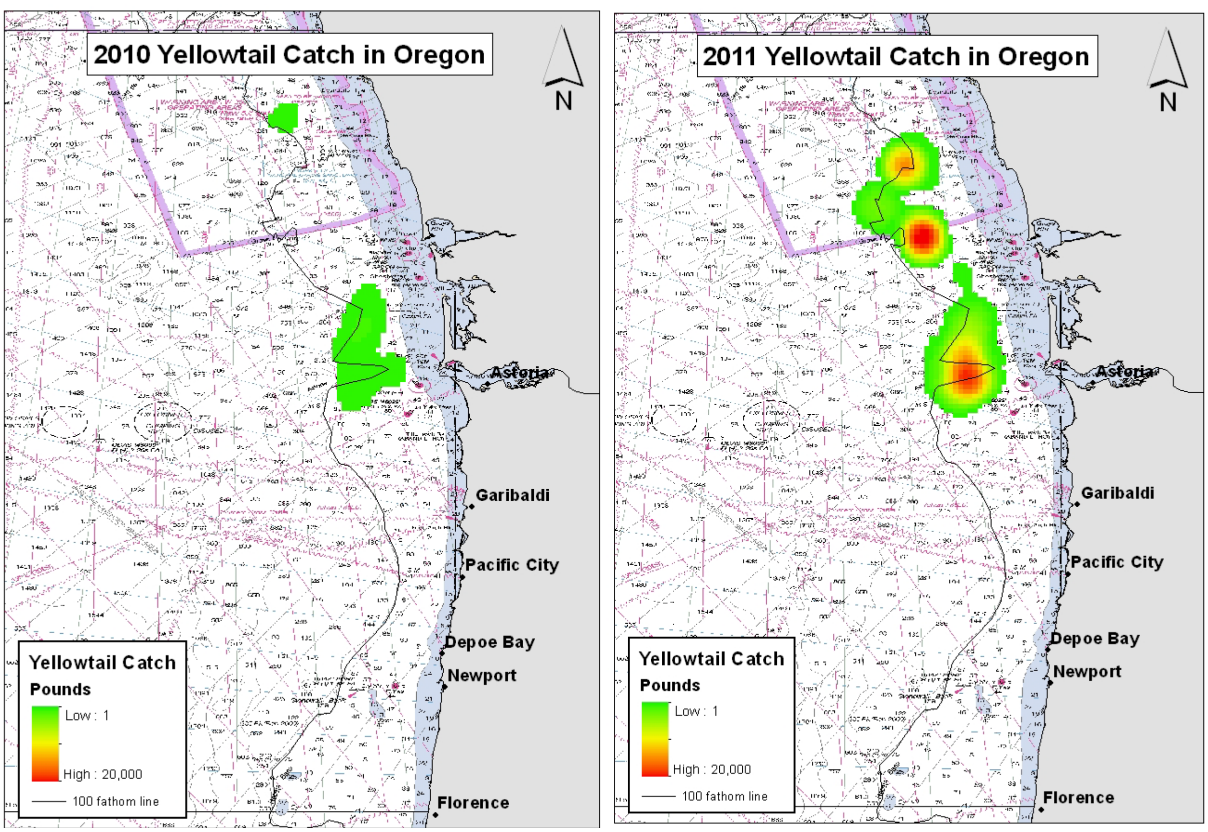


Figure 2. Kernel density analysis of total yellowtail rockfish catch (pooled tows; search radius = 0.25km) landed in Oregon prior to the implementation of the IFQ program (2010; left), and during the first year of the IFQ program (2011; right). Source: Data were obtained from PacFIN.

Port Landings and Revenue—Oregon ports were categorized into four port groups: Astoria (Astoria, Cannon Beach, Gearhart/Seaside, Tillamook/Garibaldi, Pacific City, Nehalem Bay, Netarts, and Salmon River), Newport (Siletz Bay, Depoe Bay, Newport, Waldport, and Yachats), Coos Bay (Bandon, Charleston, Coos Bay, Florence, and Winchester Bay), and Brookings (Brookings, Gold Beach, and Port Orford). Port groupings match those used in the Environmental Impact Statement for Amendment 20 to the Groundfish Fishery Management Plan.

Astoria—Landings from January to June of 2011 and 2012 followed a very similar pattern, with only a 1% difference in total mid-year landing volume among the IFQ years (Table 3; Figure 3). From 2011 to 2012, vessel participation increased slightly (12%), along with total mid-year revenues (6.4%), although there was a slight decline in trip activity (-3%). However, vessel participation and trip activity in 2012 were approximately 30% less than the historical average (2006-2010), while landings only decreased slightly (-5%). Interestingly, total ex-vessel revenues were 13% higher than the historical average.

Newport—In contrast to Astoria, mid-year 2011 and 2012 Newport landings and revenue increased significantly relative to the five-year average, with a 36% increase in landing volume and a 42% increase in total mid-year revenue (Table 3). These increases were accompanied by a slight increase in vessel participation (1 vessel) and a large increase in trip activity (31%) among IFQ years. The first quarter of 2012 closely mirrored historical landing trends, while the second quarter followed the same landing trends that emerged during 2011 (Figure 3). Similar to Astoria, Newport showed increased landings and revenue for both IFQ years relative to the five-year average, although 2012 trip activity was less than average. In 2012, Newport had the largest percent reduction in vessel participation (-67%) among all port groups, which leads to a similar reduction in trip activity (-65%). It should be noted that although 2012 landings and revenue were less than average (-30%), increased landings and revenue were observed during the second year of the IFQ program, relative to the first.

Coos Bay—Landings from January to June 2011 and 2012 followed a similar pattern, with only a 2% difference in total mid-year landing volume between IFQ years (Table 3; Figure 3). During these IFQ years, vessel participation remained constant (14 vessels) and total mid-year revenues remained nearly the same (< 1% change); trip activity increased slightly (5%) in 2012 relative to 2011. One interesting trend for Coos Bay was the shift to later landings during 2012 relative to 2011 Like Newport, 2012 Coos Bay landings and revenues were less than the mid-year average (-39% and -28%, respectively).

Brookings—During the first half of 2011 compared with 2012, Brookings exhibited a decline in trip activity (-46%), landings (-45%), and revenue (-42%). Vessel participation in Brookings increased, however, from five vessels in 2011 to six vessels in 2012 (Table 3). These negative trends observed during the first half of 2012 contrasted sharply with patterns observed during the inaugural year of the IFQ program in this port; the first six months of 2011 had above average landings (16%) and revenues (29%).

Table 3. Mid-year (January-June) non-whiting groundfish landings (millions of pounds) and revenue ($ millions), by port group, for the non-whiting IFQ fishery (2011 and 2012), and the limited entry trawl fishery (2006-2010 average) off Oregon. Note that 2011 and 2012 includes IFQ landings for both trawl and fixed gear. Fixed gear includes longline and pot gear. Source: Data were obtained from PacFIN.

Port	Year(s)	Vessels (No.)	Trips (No.)	Pounds (millions)	Revenue ($ millions)
	Avg 2006-10	28	264	8.5	3.9
Astoria	2011	17	175	8.1	4.1
	2012	19	170	8.1	4.4
	Avg 2006-10	18	132	2.9	1.7
Newport	2011	5	35	1.4	0.9
	2012	6	46	1.9	1.2
	Avg 2006-10	19	180	3.8	2.0
Coos Bay	2011	14	85	2.3	1.4
	2012	14	89	2.4	1.4
	Avg 2006-10	9	55	1.3	0.8
Brookings	2011	5	41	1.5	1.0
	2012	6	22	0.8	0.6

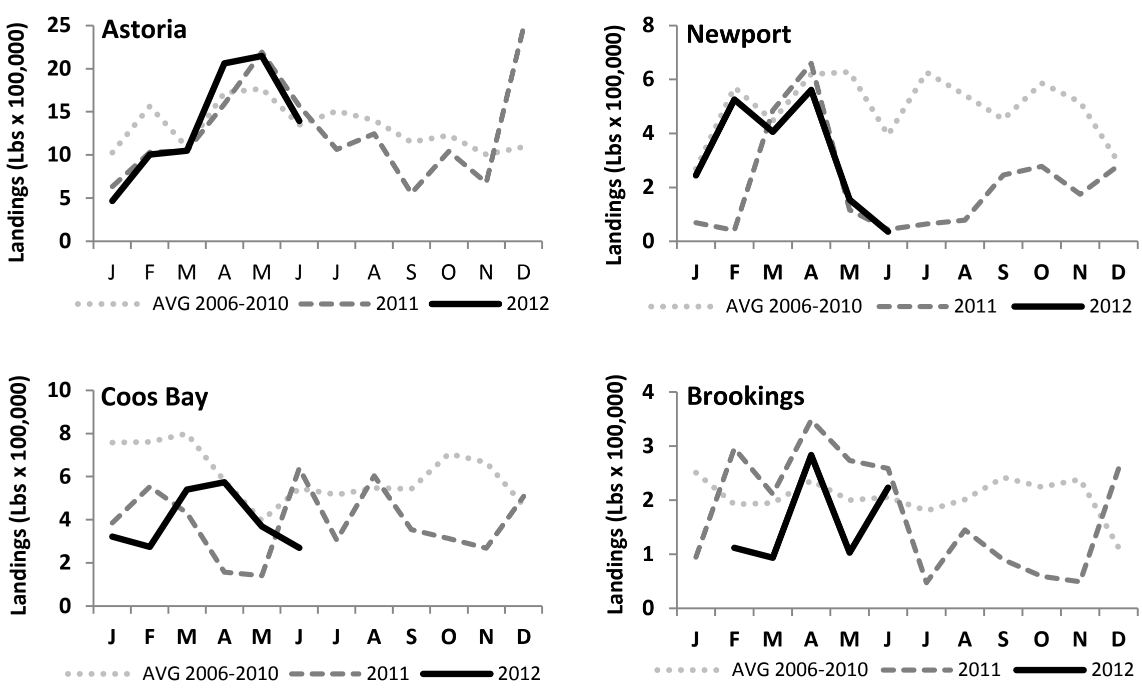


Figure 3. Monthly non-whiting groundfish landings (pounds), by port group, for the non-whiting IFQ fishery (2011 and 2012), and the limited entry trawl fishery (2006-2010) off Oregon. Note that 2011 and 2012 includes IFQ landings for both trawl and fixed gear. Source: Data were obtained from PacFIN.

In summary, from 2011 to 2012, vessel participation increased or remained unchanged in all ports, although the total participants in each port were less than the historical average. During 2012, each port's landings were less than the historical average (2006-2010) with only a slight decrease in Astoria landings, followed by Newport, Brookings, and Coos Bay. Although 2012 landings were less than average, total landing volumes in Astoria and Coos Bay differed little (< 2%) from the first six months of 2011 to 2012. In contrast, landing volumes in Newport and Brookings deviated substantially between the first two years of the IFQ program; Newport exhibited a strong positive trend whereas Brookings exhibited a strong negative trend. Revenues varied among ports with Astoria, Newport, and Coos Bay showing higher earnings during the first half of 2012 relative to 2011, and Brookings showing a severe decrease in earnings during the same time period. Overall, revenues during the first half of 2012 relative the pre-IFQ average increased for Astoria, but decreased for Newport, Coos Bay, and Brookings.

Gear Switching— In the West Coast Groundfish IFQ Program, the ability to utilize trawl and fixed gear to harvest quota pounds, referred to as 'gear switching', has increased participation of IFQ vessels using fixed gear (i.e., both trawl vessels switching to fixed gear for certain trips and traditional fixed gear vessels purchasing "trawl" permits and entering the IFQ fishery). Throughout 2011 (January – December), 11 vessels using fixed gear made 62-IFQ trips, and landed 714,692 pounds while earning $2.8 million. Only 6% of the total IFQ fixed gear landings were made during the first half of 2011, with 94% of the landings made during the second half of 2011 (Figure 4). Interestingly, the first half of 2012 had the same number of participants (3 vessels) and approximately the same number of trips as the first half of 2011. However, the total 2012 IFQ fixed gear landings and revenue increased tenfold (Table 4). During the first six months of 2011, 3 vessels made 4 trips and landed 9,000 pounds, earning $29,000. In contrast, during the first half of 2012, 3 vessels made 5 trips and landed 98,000 pounds, earning nearly $300,000 in ex-vessel revenues.

Table 4. IFQ fixed gear landings, revenue, and number of trips and vessels, during the first half (January –June) 2011 and 2012 in the non-whiting IFQ fishery off Oregon, along with the percent increase (%Δ) during IFQ years. Fixed gear includes longline and pot gear. Source: Data were obtained from PacFIN.

	2011	**2012**	**% Δ 2011 to 12**
Vessels (No.)	3	3	0%
Trips (No.)	4	5	25%
Pounds	9,237	97,900	960%
Revenue	$28,882	$287,549	896%

Throughout 2011 (January-December), IFQ fixed gear landings occurred in all ports, with the exception of Brookings. The majority of 2011 IFQ fixed gear landings occurred in Newport (55%), followed by Coos Bay (27%), and Astoria (18%). In 2011, IFQ fixed gear activity peaked in October with 8 vessels making 29 trips, which comprised nearly half (42%) of all IFQ groundfish trips during that month (Figure 4). During that single month, IFQ fixed gear vessels earned 63% ($1,470,322) of the total 2011 Oregon non-whiting IFQ revenues, and landed 22% (378,045 pounds) of the total 2011 non-whiting IFQ pounds (Figure 4). September 2011 was also an active IFQ fixed gear month; 7 vessels made 23 trips, and landed 21% (260,951 pounds) of the total non-whiting IFQ pounds while earning 61% ($1,003,128) of non-whiting IFQ revenues in Oregon for the month.

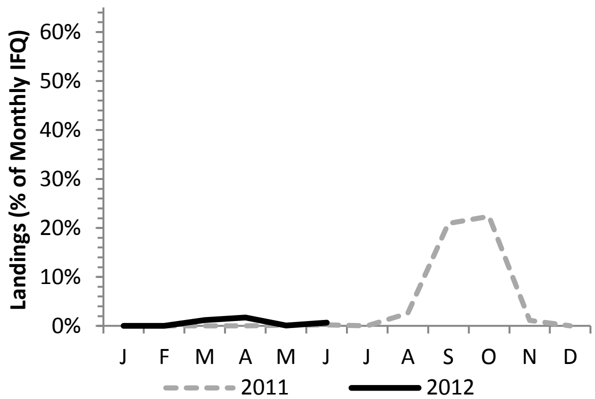


Figure 4. Monthly IFQ fixed gear landings and revenue, expressed as a proportion of total IFQ landings and revenue during 2011 and first half (January – June) of 2012 in the non-whiting IFQ groundfish fishery off Oregon. Fixed gear includes longline and pot gear. Source: Data were obtained from PacFIN.

One potential reason for the increased fixed gear IFQ landings during September and October 2011 may be the closing of the sablefish tier fishery on October 31. Most vessels obtain their sablefish tier limits well before the closing date, and in 2011 nearly 90% of the Oregon fleet reached their tier limits by the end of August. If able to obtain a trawl permit and quota pounds, these vessels may choose to switch to the IFQ fishery once they have landed all their tier limits. For example, a vessel may reach their tier limit in the summer, and then switch to the IFQ fishery in the fall. Although only a few Oregon participants met these criteria (< 3 vessels) in 2011, these vessels landed 50% of the IFQ fixed gear volume and earned 50% of revenues during October alone. In 2012, there are multiple vessels that have both types of limited entry permits (i.e., trawl and tier) and if this year follows the same pattern as 2011, there may be increased IFQ fixed gear landings and activity during early fall.

LIMITED ENTRY SHORESIDE WHITING IFQ FISHERY

Mid-Year Landings—Many shoreside-whiting participants chose to fish later in the year after the implementation of the IFQ program relative to the pre-IFQ fishery. Under the West Coast Groundfish IFQ Program, participants may catch their quota at any time during the year, rather than race for fish in the derby-style fishery that had occurred for this fleet prior to IFQ. The flexibility of the IFQ program allows fishermen the opportunity to fish during optimal weather conditions, to fish in other fisheries during early summer, and/or delay their whiting season until later in the year when larger fish may be caught.

The limited entry shoreside whiting fishery historically (2006-2010) opened in June and peaked in July. In contrast, with the implementation of the IFQ program in 2011, peak activity shifted to later in than year, with the highest volume (46.7 million pounds) and the most activity (221 trips) occurring in August. Although the 2012 whiting season has recently begun, current landings and activity suggest that the 2012 shoreside-whiting fishery may be even more delayed than in 2011 (Figure 5). The 2012 January-July revenues ($3.5 million) are about half of what they were during the same time period in 2011 ($7 million). It is clear that total landings in 2012 will be lower than observed in 2011, because the Pacific whiting ACL was reduced from 290,903 metric tons in 2011 to 186,037 metric tons in 2012. However, it may be too early in the season to predict when peak landings may occur for this fishery, even though initial landings were delayed. A more in depth analysis of the Oregon 2011 Shoreside whiting IFQ fishery is available in a previous report (see Agenda Item D.8.b, Supplemental ODFW Report, June 2012).

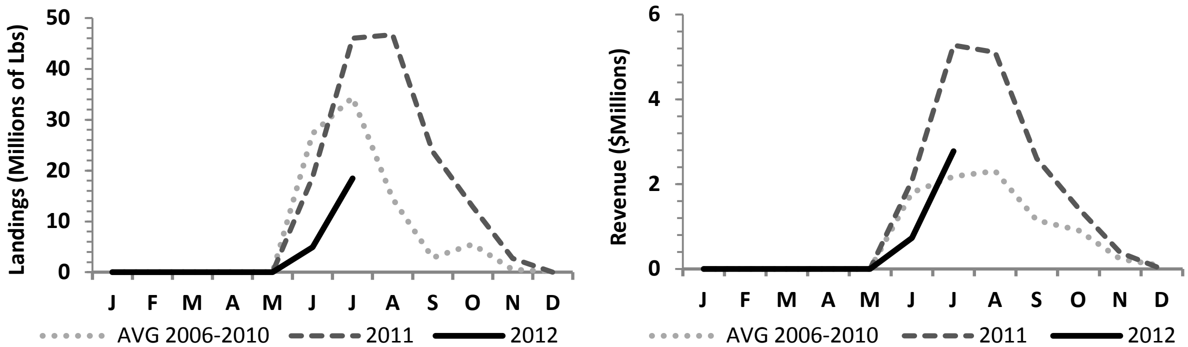


Figure 5. Monthly shoreside whiting landings (millions of pounds) and revenue, of the shoreside whiting groundfish trawl fishery (2006-2010 average) and the whiting IFQ fishery off Oregon during 2011 and the first seven months (January - July) of 2012. Source: Data were obtained from PacFIN.

SPILLOVER FROM IFQ TO STATE FISHERIES

One component of the IFQ fishery is the added flexibility that allows participants to fish during optimal conditions (e.g. ideal weather or high market prices), no longer constraining them to bimonthly trip limits. This added flexibility provides participants the opportunity to fish in other fisheries, which may result in effort shift, or spillover. One example is the spillover of vessels holding LET (2006-2010) or IFQ (2011-2012) permits into state managed fisheries, specifically pink shrimp and Dungeness crab. Historically, many LET permit holders participated in a combination of groundfish, pink shrimp and/or crab fisheries, although trip limits constrained the amount of effort, time, and resources that could be allocated to switching to state managed fisheries. With the inception of the IFQ program, participants are no longer constrained by opportunity costs associated with switching fisheries. IFQ participants are able to operate in state fisheries during peak seasons and delay harvest of groundfish quota pounds until it is more economically viable to do so.

***Pink Shrimp*—**The first year of the IFQ program coincided with an exceptional shrimp season that had the highest landing volume since 1989 (ODFW Report: The 2012 Annual Pink Shrimp Review), and mid-year data suggests another possible strong shrimp year is unfolding in 2012 (Bob Hannah, ODFW, pers comm.). During the first three months (April-June) of the 2012 shrimp fishery, IFQ participation increased by 3 vessels relative to 2011, while no change was observed among non-IFQ participants during the same time period (Table 5). In 2012, IFQ participants made 10% more pink shrimp trips than in 2011, while the non-IFQ fleet made slightly fewer trips (-2%). Furthermore, the IFQ fleet made approximately the same number of landings and revenue during 2011 and 2012, while the non-IFQ fleet had decreased landings (-8%) and earned less revenue (-6%) during the same time period. Relative to the historical average (2006-2010), significantly more pink shrimp were landed in 2011 and 2012, with above average landings during both years.

Table 5. Mid-year (April-June) Oregon Pink Shrimp landings statistics, by year and by fishery participation, of the non-whiting groundfish trawl fishery (2005-06 to 2009-10 crab seasons) and the IFQ fishery (2010-11 to 2011-12 crab seasons). Source: Data were obtained from PacFIN and from Oregon state commercial landing receipts (ODFW).

Year(s)	Vessels (No.)		Trips (No.)		Pounds (millions)		Revenue ($ millions)	
	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ
AVG 2006-10	15	25	88	288	2.9	6.6	1.2	2.7
2011	15	39	112	465	5.3	15.8	2.7	8.2
2012	18	39	124	471	5.3	14.5	2.6	7.7

Dungeness Crab-- During the 2011-2012 season, IFQ participants in the Dungeness crab fleet had a reduction in vessel participation (-17%), trips (-51%), total landings (-54%), and revenue (-34%) relative to the historical average. In contrast, non-IFQ participants in the Dungeness crab fleet had no reduction in vessel participation, an increase in total ex-vessel revenue (27%), and only slight reductions in total landing volume (-16%) and trips (-6%), relative to the historical average (2005-06 to 2009-10 seasons; Table 6). It should be noted that prior to the implementation of the IFQ program, LET participants typically comprised 10% of the Dungeness crab fleet. In 2012 IFQ participants comprised only 8% of the fleet, the lowest proportion of the crab fleet in the last six years.

Table 6. Oregon Dungeness Crab landings statistics, by year and by fishery participation (IFQ and Non-IFQ participants), of the non-whiting groundfish trawl fishery (2005-2010) and the non-whiting shoreside IFQ fishery (2011-2012). Note that crab seasons in this report run from December to June 30. Source: Data were obtained from PacFIN and from Oregon state commercial landing receipts (ODFW).

Year(s)	Vessels (No.)		Trips (No.)		Pounds (millions)		Revenue ($ millions)	
	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ	IFQ	Non-IFQ
AVG 2006-10	31	287	342	6,155	2.6	16	4.7	30
2011	37	304	365	6,593	3.3	17.8	6.9	41.6
2012	26	286	167	5,813	1.2	13	3.1	38.6

An additional way to evaluate spillover is to identify the number of fisheries each vessel participates in; specifically in regards to groundfish, pink shrimp, and Dungeness crab fisheries. With the implementation of the IFQ program a larger proportion of the fleet is relying on the added flexibility built into the program. In other words, during 2011, 26% of the Oregon IFQ fleet participated in all three fisheries (groundfish, shrimp, and crab; Figure 6). Historically (2006-2010), only 15% of the fleet participated in all three of these fisheries. Furthermore, nearly half the fleet (46%) participated in solely groundfish from 2006-2010 (average) and in 2011 only one-third (33%) of the fleet utilized this strategy. The increased participation in three fisheries during 2011, combined with decreased participants choosing to pursue solely groundfish, may suggest IFQ participants are beginning to change their fishing strategies and behavior.

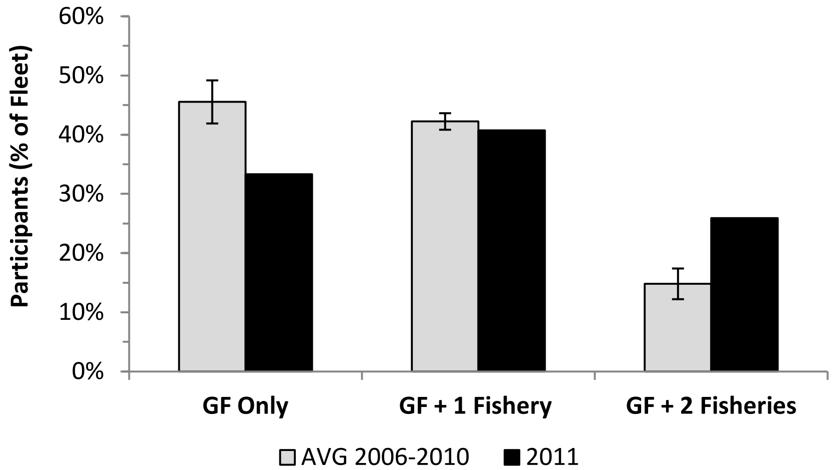


Figure 6. Vessel participation, as a proportion of annual fleet participation, in multiple fisheries (non-whiting groundfish, pink shrimp, and Dungeness Crab) among the LET (2006-2010 average ± SE) and IFQ groundfish fishery participants (2011) off Oregon. Source: Data were obtained from PacFIN and from Oregon state commercial landing receipts (ODFW).

DISCUSSION AND POTENTIAL MANAGEMENT IMPLICATIONS

Preliminary data shows that the overall trends observed during the first half of 2012 are remarkably similar to activity that occurred during the first half of 2011. However, both IFQ years deviate from historical (2006-2010) landing patterns in terms of statewide and vessel landing volumes, revenue, and activity. Mid-year 2012 landings for all ports are less than the historical average, while revenues for three out of the four port groups were also less than the 2006 to 2010 average. However, from 2011 to 2012, three out of the four port groups exhibited positive increases in landings and revenue. Landings in Astoria remained fairly constant from the first half of 2011 to mid-year 2012, although revenues increased. Newport landings and revenues increased and Coos Bay landings and revenues remained approximately the same, while Brookings landings and revenues declined from 2011 to 2012.

During the first half of 2012, fixed gear landings and revenue increase tenfold, relative to the first six months of 2011, even though both IFQ years had the similar participation (number of vessels) and activity (number of trips). It should be noted that in 2011, only 6% of the total IFQ fixed gear landings were made during the first half of the year, with 94% of the landings made during the second half of 2011. If 2012 follows a similar pattern, there may be increased activity and landings by IFQ fixed gear boats in the fall, and overall landings by this gear group may be substantially higher. This pattern of increased fixed-gear landings during September and October may be correlated with the end of the sablefish tier fishery; although this fishery closes in October, 90% of sablefish tier vessels catch their limits by the end of August.

The 2011-2012 Dungeness crab fishery had the lowest proportion of LET/IFQ participants since 2006. And, during the first half of 2012, IFQ participation in the pink shrimp fishery was slightly less than the historical average. In both state managed fisheries, IFQ participation and landing activity is not necessarily reflective of trends in each fleet. For example, the total Dungeness crab ex-vessel revenues increased during the 2011-2012 season, while they decreased among IFQ participants in the crab fishery. Furthermore, during the first half of 2012, IFQ participants in the shrimp fishery had a 79% increase in landings, relative to the historical average (2006-2010) while the non-IFQ portion of the fleet had a 107% increase in landings, relative to the historical average. While exceptional years in these fisheries may encourage increased participation, other factors are influencing whether an IFQ participant chooses to pursue state managed fisheries.

DATA SOURCES

Data in this report were derived from multiple sources: groundfish landings data from 2006 through June 2012 were obtained from the Pacific Fisheries Information Network (PacFIN) database, along with data used for spatial analysis from 2010-2011. State managed fisheries data, which includes Dungeness crab and pink shrimp, were obtained from Oregon commercial landing receipts. The revenue described in this report refers to ex-vessel revenue and is not adjusted for inflation. Shoreside whiting and non-whiting IFQ landings were delineated by two factors: gear type and proportion of Pacific whiting catch on a given landing. In other words, if trawl gear was used to catch greater than 50 percent Pacific whiting, then that trip was designated as a shoreside whiting trip and the data is summarized in the Pacific whiting section of this report. All other landings by vessels using trawl gear with a limited entry permit were considered part of the shoreside non-whiting fleet during 2006-2010. In 2011 and 2012, shoreside whiting and non-whiting IFQ landings were identified via electronic landing receipts. It should be noted that 2011 and 2012 IFQ landings were made using both trawl and fixed gear (which includes longline and pot gear). Fixed gear landings were delineated as either limited entry, non-nearshore fixed gear landings or as IFQ fixed gear landings for this analysis. Analysis based on the limited entry, non-nearshore fixed gear fishery (e.g. non-IFQ fixed gear landings) are specified herein, and all other landings were made under the IFQ program. Because 2011 and 2012 is recent, this data may change slightly as updates are made.

ACKNOWLEGEMENTS

We would like to extend a thank you to Dave Colpo and Kara McLean, of the Pacific States Marine Fisheries Commission (PSMFC), along with Mathew T.O. Blume, of the ODFW Marine Resources Program.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE REPORT ON INSEASON ADJUSTMENTS

In late July, the Washington Department of Fish and Wildlife (WDFW) reviewed catch estimates for its recreational bottomfish fisheries for the months of May and June and determined that the fishery had likely exceeded its harvest guideline for yelloweye rockfish.

We reviewed the June 2012 scorecard and consulted with other fishery managers to determine whether there could be additional yelloweye rockfish available. In addition to the amount of residual in the current scorecard, the amount of yelloweye caught this year in research activities is about half of what was projected.

We also reviewed our catch projections for the remainder of the year. We anticipate only 0.2 mt of yelloweye catch in August as the fishery is constrained to inshore of 20 fms. With the 20 fm restriction in place and the high likelihood that the overall yelloweye catch will remain below the annual catch limit, WDFW decided to keep this important source of economic activity open through Labor Day weekend. With bottomfish retention closed beginning in September, additional yelloweye catch throughout the year is expected to be minimal.

Recreational bottomfish anglers provide a major source of economic activity for communities like Neah Bay. August is the end of the short window where the weather and other conditions bring in anglers and fishing dependent business make the bulk of their income. August brings in roughly 15 percent of Neah Bay's bottomfish effort. After Labor Day, fishing activity drops substantially with that percentage dropping to 6 percent in September and to zero in October. The September closure on its own may be a significant hit to fishery-dependent business. An August closure could have reduced overall fishing activity by more than 20 percent.

So, on July 26, WDFW adopted an emergency rule to close the recreational bottomfish fishery in our north coast area (i.e., WDFW Marine Catch Areas 3 and 4), effective September 4, 2012, for the remainder of the year.

We will do a post-season review of our catch estimate and projections for 2013, and anticipate requesting inseason action to adjust the management measures for the north coast bottomfish fishery for 2013.

Agenda Item H.6
Situation Summary
September 2012

PHASE 1 REPORT FOR GROUNDFISH ESSENTIAL FISH HABITAT REVIEW

The Pacific Coast groundfish essential fish habitat (EFH) review was initiated in December 2010. The Essential Fish Habitat Review Committee (EFHRC) met in person or via conference call several times since then, and compiled a report summarizing new and newly-available information regarding physical and biogenic habitats, habitat models, trophic interactions, and fishing and non-fishing activities that may affect groundfish EFH.

At its April 2012 meeting, the Council approved an amended review schedule, adopted for public review a draft request for proposals (RFP), provided guidance on conflict of interest and recusals, and heard a report on the information and data compiled to date.

The draft RFP was revised by Council staff, based on comments received in response to the public review opportunity. The revised RFP is included as Agenda Item H.6.a, Attachment 1: Revised RFP. Three sets of comments were received on the draft RFP, and are included as Agenda Item H.6.a, Attachment 2.

At the September meeting, the Council will be considering the Phase 1 EFH review report (Agenda Item H.6.b, EFHRC Report 1), as well as an outline (Agenda Item H.6.b, NMFS Report) for a proposed NMFS-led effort to synthesize and analyze the information contained in the Phase 1 Report. The Council will also consider for approval the revised RFP.

Dr. Waldo Wakefield, a member of the EFHRC, will summarize the Phase 1 Report, as well as the NMFS Science Center Synthesis Outline. The Chair of the EFHRC, Mr. Brad Pettinger, will provide a supplemental EFHRC report.

<u>Council Action</u>:

1. **Consider the Phase 1 report.**
2. **Consider and approve the revised RFP.**
3. **Consider the NMFS Science Center Synthesis Outline.**

<u>Reference Materials</u>:

1. Agenda Item H.6.a Attachment 1, Draft Request for Proposals (RFP) to Modify Essential Fish Habitat for Pacific Coast Groundfish.
2. Agenda Item H.6.a Attachment 2, Public Comments on the Draft RFP.
3. Agenda Item H.6.b, EFHRC Report 1: Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat Report to the Pacific Fishery Management Council Phase 1: New Information.
4. Agenda Item H.6.b , NMFS Report: NMFS Science Center Synthesis Outline: NMFS Science Center Analysis of the Council's EFHRC Groundfish EFH Phase 1 Report.
5. Agenda Item H.6.c, Public Comment.

Agenda Order:

a. Agenda Item Overview — Kerry Griffin
b. Report of the Essential Fish Habitat Review Committee — Brad Pettinger and Waldo Wakefield
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action**: Consider the Phase I Report, Request for Proposals, and the EFH Elements for Analysis by the NWFSC

PFMC
08/26/12

Agenda Item H.6.a
Attachment 1
September 2012

DRAFT REQUEST FOR PROPOSALS (RFP) TO MODIFY ESSENTIAL FISH HABITAT FOR PACIFIC COAST GROUNDFISH

Introduction and Background

The Pacific Fishery Management Council's (Council) Essential Fish Habitat Review Committee (EFHRC) is conducting a review of essential fish habitat (EFH) for Pacific Coast Groundfish managed under the Council's Pacific Coast Groundfish Fishery Management Plan (FMP). This review is being conducted consistent with the Magnuson-Stevens Act and the National Marine Fisheries Service regulatory guidance (50 CFR §600), which states that reviews of EFH should be conducted at least every five years. New scientific research and updated fish and habitat surveys that have occurred since groundfish EFH was established in 2006 may provide new rationale to consider additional measures

Phase I of the review includes a compilation of new and newly-available information, and an assessment of how it compares with the information used to inform the previous EFH identification and descriptions. Upon conclusion of Phase I and issuance of the Phase I report, the Council will issue an RFP to solicit proposals to modify Pacific Coast groundfish EFH. In addition to the Phase I report, data and information (including GIS files if available) gathered in this phase by the EFHRC, will be made available to the public. The report and associated information and data products should be used in developing proposals submitted in response to this RFP.

Phase II of the EFH review includes evaluation and consideration of proposed modifications to groundfish EFH or its components, based on the new information compiled in Phase I. Proposals may address any of the components identified in the EFH regulations at 50 CFR 600.815(a)(1) – (a)(10). These include:

- Description and identification of EFH
- Council-managed fishing activities that may adversely affect EFH (including practicable measures to minimize adverse effects)
- Non-fishing activities that may adversely affect EFH
- Cumulative impacts
- Conservation and enhancement measures
- Impacts to prey species of Pacific Coast groundfishes
- Habitat areas of particular concern (HAPC)
- Research and information needs

The Council will accept proposals from state, Federal, and Tribal entities, non-governmental organizations, academic institutions, and the public. The Council's EFHRC will conduct an evaluation of proposals received by the deadline, and may develop its own proposal, if warranted. The EFHRC will develop recommendations to be considered by the Council at the appropriate meeting. At that point, the EFH review process will be concluded and the Council will decide whether sufficient new information exists to pursue modifying groundfish EFH, through an FMP amendment or other appropriate process.

Section 7.2 and Appendix B in the FMP describes groundfish EFH, which is generally between the shore line or the limit of saltwater intrusion out to depths of 3,500 m as well as seamounts in depths greater than 3,500 m. HAPCs have been identified for four habitat types: estuaries, canopy kelp, seagrass, and rocky reefs. In addition, several "Areas of Interest" HAPCs have also been identified. Figure 7.2 in the FMP is a map of the approximate location of habitat types identified as HAPCs. The coordinates defining the Area of Interest HAPCs are presented in FMP Appendix B. Several ecologically important areas have been closed to certain bottom contact gear to protect EFH, and are currently categorized as either bottom trawl closed areas or bottom contact closed areas. There are currently 50 such areas along the West Coast; maps showing their locations and coordinates defining their boundaries are in the FMP Appendix C. The bottom trawl footprint closure covers all areas westward of the 1,280 m (700 fm) contour, out to the 3,500 m (1,914 fm) contour, within the EEZ, designed to minimize adverse fishing effects on EFH. The FMP is available on the Council website at:
http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-19/

Protocol for Submitting and Reviewing Proposals to Modify Groundfish EFH
Proposals will be reviewed in the context of sections A, B, and C, as outlined below. The EFHRC will review all proposals, but will not conduct any analyses of those proposals. Any proposal that depends on analysis of the available data must include documentation and explanation of the methods and outcomes of the analysis.

A. Submission
   1. Proposals for Council review and consideration must be received (tentatively) by a date to be determined and announced by the Council.
   2. Proposals may originate from individuals, non-government organizations, businesses or business organizations, or Federal, state, or Tribal agencies.

B. Proposal Contents

   Proposals may be based on the information compiled by the EFHRC, although other information (including proprietary information not available to the public) may be used as a basis for the proposal. However, any proprietary information used to develop a proposal must be available to the EFHRC and ultimately the Council, for review and evaluation. To the extent possible, proposals should include the following information:

   1. Date of proposal.
   2. Proponent's name, mailing address, email address, and telephone number, including contacts for any cooperating agencies or entities.
   3. An explanation why the proposal is warranted, including:
      a. Description of the proposal's objectives.
      b. How it is consistent with the Council's responsibility to identify and protect EFH, and to minimize to the extent practicable, the adverse effects to EFH from Council-managed fishing activities.

c. How new or newly-available information indicates that the EFH description, its components, or associated management measures should be modified.

4. A detailed description of the proposed action(s), including, where applicable:

   a. Spatial changes to currently protected areas such as boundary modifications, elimination of current areas of EFH, HAPC, or ecologically important habitat closed areas, or addition of new areas of EFH, HAPC, or ecologically important habitat closed areas. Latitude and longitude coordinates (DDD° mm.mmm′) and maps, including before and after change, and digital files if available (e.g., GIS shape files, navigation plotter data).

   b. Gear regulation changes, (e.g., allowing or disallowing gear types, tow technique, mesh size, weight of gear, time of bottom contact, tow time, number of pots or hooks).

   c. Changes to the description and identification of groundfish EFH and its components.

   d. Other changes.

5. Any relevant and applicable information on the following characteristics and topics, including the attendant impacts of the proposed action; or at a minimum, explaining how information in the EFH review report supports the proposal:

   a. Biological and ecological characteristics (e.g., habitat function, vulnerability, index of recovery, species associations, including reference to any ESA-listed species, prey species, and biogenic components).

   b. Geological characteristics (e.g., substrate type, grain size, relief, morphology, depth).

   c. Physical oceanographic characteristics (e.g., temperature, salinity, circulation, waves).

   d. Chemical characteristics (e.g., nutrients, dissolved oxygen).

   e. Socioeconomic characteristics (see 6.e below).

6. A discussion of the following topics, as relevant to the proposed actions:

   a. The importance of habitat types to any groundfish FMP stocks for their spawning, breeding, feeding, or growth to maturity.

   b. The presence and location of important habitat (as defined in 6.a, above).

   c. The presence and location of habitat that is vulnerable to the effects of fishing and other activities.

   d. The presence and location of unique, rare, or threatened habitat.

   e. The socioeconomic and management-related effects of proposed actions, including changes in the location and intensity of bottom contact fishing effort, the displacement or change in revenue from fishing, and social and economic effects to fishing communities attributable to the location and extent of closed areas.

Proponents are encouraged to collaborate with socioeconomic experts as well as affected fishermen and communities in order to identify socioeconomic costs and benefits. Information on landings and revenues by port area can be found on the Council's website: http://www.pcouncil.org/groundfish/background/document-library/historical-landings-and-revenue-in-groundfish-fisheries/

C. Review and Evaluation

1. The EFHRC will evaluate all proposals with regard to the technical sufficiency and potential biological, ecological, and socioeconomic significance of the proposal. The evaluation will include identifying any deficiencies that should be addressed if the Council desires a full assessment of the proposal for potential adoption. The Groundfish Management Team (GMT), Groundfish Advisory Subpanel (GAP), Habitat Committee (HC), Enforcement Consultants (EC), and Scientific and Statistical Committee (SSC) may also review proposals and provide comments on methodology and relevance to management issues, and make recommendations to the Council accordingly. Public comment will also be accepted at Council meetings.
2. The EFHRC will review proposals and provide an evaluation of the proposals for consideration by the Council. The Council is scheduled to take final action at the June 2013 Council meeting, thereby concluding the EFH periodic review process.
3. Only those proposals that were received by the RFP deadline may be considered by the EFHRC and the Council.
4. The Council will determine an appropriate process (e.g., biennial specifications, SAFE document, FMP amendment, etc.) for further analysis and consideration of modifications to EFH at the June 2013 meeting (tentatively).
5. In evaluating proposals, the EFHRC will consider the following questions:

    a. Is the proposal complete?
    b. Is the proposal consistent with the goals and objectives of the FMP and the Council's responsibility to identify and protect EFH and minimize the adverse effects to EFH from Council-managed fishing activities?
    c. Are the coordinates consistent with the proposed actions and do they map out correctly?
    d. What habitat types are affected by the proposal?
    e. Are the data and analyses sufficient to evaluate the proposal effects and objectives, and if not, why?
    f. How well does the available information, including the nature of the data, support the proposal?
    g. What are the biological, ecological, and socioeconomic effects (beneficial and detrimental) of the proposal? For example:

i. What is the importance of affected habitat types to any groundfish FMP stocks for their spawning, breeding, feeding, or growth to maturity?

ii. What is the distribution and abundance of important habitat within the areas addressed by the proposal, including substrate types, biogenic habitats, prey items, etc.?

iii. To what extent is the habitat vulnerable to the effects of fishing and other activities?

iv. Are there unique, rare, or threatened habitats in areas addressed by the proposal?

v. What are the changes in location and intensity of fishing effort that may adversely affect EFH?

vi. What is the estimated displacement, gain, or loss of revenue from fishing?

vii. What has been the degree of collaboration with affected fishermen, conservation interests, communities, and other stakeholders, to identify socioeconomic costs and benefits?

h. If models are used in the proposal, are they consistent with the best available information?

i. How will fishing communities and other stakeholders be affected by the proposal?

j. How will Tribal Usual and Accustomed Areas be affected by the proposal, and how was that determined?

k. How will overfished stocks be affected by the proposal?

l. Is a monitoring plan part of the proposal?

m. Has there been coordination with appropriate state, Tribal, and Federal enforcement, management, and science staff?

n. Are there components of the proposal that require additional expertise beyond the EFHRC for a comprehensive evaluation?

o. Does the proposal address data gaps identified in the original risk analysis such that there is an increased understanding of EFH for one or more species? (e.g., does new data document the importance of a habitat type to groundfish, or has data quality improved enough to change understanding of habitat distribution?).

p. Does the proposal address data quality regarding habitat use (e.g., improves from level 1 (presence/absence) to level 2 (density) or higher?)

q. Does the proposal demonstrate that some elements of groundfish EFH may no longer be precautionary and comprehensive? (e.g., distribution/density no longer matches closed areas, new information shows that some habitats are not being adequately protected, or new information on recovery shows that a habitat type is more or less sensitive than previously known).

Only those proposals received by the RFP deadline will be considered by the EFHRC, for inclusion in its Phase II report to the Council. Proposals may be submitted by mail, email, or fax and must be received at the Council office by close of business on the date to be determined by the Council. Submit proposals to:

Pacific Fishery Management Council
Attention: Kerry Griffin
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384
PFMC.comments@noaa.gov
Phone: 503-820-2280
Fax: 503-820-2299

June 29, 2012

Dr. Donald McIsaac
Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

Submitted Electronically to: pfmc.comments@noaa.gov

RE: Comments on Draft Request for Proposals on Groundfish EFH

Dear Dr. McIsaac:

Thank you for the opportunity to comment on the Draft Request for Proposals (RFP) to modify Groundfish Essential Fish Habitat (EFH). We appreciate the work that has gone into the RFP thus far, and the Council's commitment to proactively manage and protect groundfish habitat. We offer the following comments with the intention of improving the EFH review process.

1. Authorize the EFHRC to Conduct Its Own Analysis

Our primary concern is that the RFP appears to rely solely on proposal authors to provide substantive analysis of the implications of newly-available data and the effectiveness of the authors' own proposal at responding to the new data, in light of the legal requirements to protect groundfish EFH in the Magnuson-Stevens Act.

As currently drafted, the RFP appears to charge the EFH Review Committee (EFHRC) with simply reviewing the description and justifications contained in proposals, rather than analyzing the substantive merits of the proposals. In particular, the Draft RFP states that "The EFHRC will review all proposals, but will not conduct any analyses." (p. 2) Instead, the EFHRC's plan for review appears to be based primarily on any analyses completed by the proposer. This passing of the responsibility from the managers to the public is inappropriate, as it is NMFS and the Council (through the EFHRC) that are responsible for conducting these analyses.

NMFS is ultimately responsible for ensuring that management measures minimize adverse effects of fishing to the extent practicable based on the best available scientific information. However, the current Draft RFP provides no indication that NMFS will be putting forward its own proposal to meet this ongoing statutory mandate, and instead places the burden on the public to assess the new information and make proposals for modifications accordingly.

2. Task the EFHRC With Developing and Publicizing a Method for Analyzing Existing Management Measures and New Proposals

We understand based on Council discussion and Council Operating Procedure 22 that the EFHRC is tasked with evaluating the suite of current management measures in place to protect EFH. The Council has indicated—and we agree—that this analysis should be included in the Phase I report and completed prior to the issuance of the RFP.

As a precursor to analyzing existing management measures, however, it is crucial that the EFHRC develop a methodology for analyzing management measures' effectiveness, and define any metrics that will be applied in the analysis. The Draft RFP should clearly task the EFHRC with developing a method and metrics, to be published in the Phase I report. Doing so will ensure that the Phase I report not only contains the EFHRC's conclusions about the effectiveness of existing management measures, but also the criteria and metrics with which those conclusions were reached.

Moreover, the method and metrics used by the EFHRC in evaluating existing management measures should be the same method and metrics used to evaluate proposals for changes to EFH designations and management measures. This will ensure consistency between the backward-looking analysis of existing measures, and the forward-looking analysis of potential changes. Consistency is necessary so that proposals concerning similar aspects of EFH regulation can be compared against each other and against the status quo.

Defining and publishing the EFHRC's methods and metrics will also clarify for agencies, individuals, and organizations wishing to submit proposals what the criteria will be, for evaluation of their proposals. In the absence of a clear set of analytic tools and metrics that the EFHRC will be using to evaluate the current regulations or future proposals in the RFP, proposal authors will be left to simply guess how their proposals will be evaluated.

The current RFP does contain some general guidance as to how proposals will be adopted, but the current lack of quantitative or qualitative specificity leaves too much up for interpretation. For example, in C.5.g. there is a list of general questions that could be answered in many ways, ranging from qualitative to quantitative. It is not indicated precisely how the EFHRC will be addressing the "importance of affected habitat types," the vulnerability of habitat types, displacement, gain, or loss of revenue from fishing, or the changes in location and intensity of fishing effort. This leaves the proponents unclear which methods they are expected to use, and puts an unfair burden on the proponents to develop analytic methods to assess their own proposal in a vacuum. For example, by what metrics will the EFHRC be evaluating how fishing communities and other stakeholders will be affected by the proposal? The RFP needs to spell out more precisely how the EFHRC will evaluate each proposal, the specific criteria they will be evaluating, and which datasets and metrics will be used to evaluate each criterion. In turn, the datasets and metrics should be presented in the EFHRC Phase I Report.

We urge the Council to amend the Draft RFP and add language to specifically task the EFHRC with developing and spelling out—in the Phase I report—the methods and metrics that it will use to analyze the effectiveness of existing management measures, and any changes proposed going forward.

3. Allow the Council to Consider Revised Proposals

After the RFP deadline, the Council should be able to consider revisions of proposals that were received by the RFP deadline (p.4). Proponents may choose to modify their original proposals and resubmit them to the Council prior to final Council action, in response to feedback from the EFHRC's review, or in response to further discussion and consultation with other stakeholders, agencies, and organizations. The RFP should in no way preclude such a resubmission to the Council, as the proposal development will be most successful if iterative. As such, we request that the phrase "and the Council" be removed from C.3 of the draft RFP. This will allow for resubmission of modified proposals, but will not require the EFHRC to review every resubmission.

4. Other Comments on Specific Points in the Draft RFP

The following bullets address specific points in the Draft RFP, which we believe need changing before the Council finalizes the RFP.

- We are now aware that the Council has shifted the timeline such that the RFP would not be released until April 2013, so the deadlines in the draft RFP should be revised accordingly. We request a window of at least 90 days between the release of the RFP and the deadline.

- The RFP should provide detailed instructions for obtaining the full Phase I report, as well as downloading all data included therein from a publicly available database.

- Part B.5 is excessively vague, as it does not specify what it means by "characteristics." This term should be defined with reference to the areas subject to modification by the proposal. Also, discussion should be allowed of any information that supports the proposal, not just information contained in the EFHRC Phase I report.

- The RFP should clarify that Sections 5 and 6 are offered as guidance, and that the failure to include certain information in these sections will not render a proposal incomplete.

- We are concerned about the manner in which the RFP addresses socioeconomic impacts. Part C.6.e. regarding socioeconomic and management-related effects asks for information that is difficult to obtain, as even the best socioeconomic experts are unable to predict the "changes in the location and intensity of bottom contact fishing effort" associated with modifying management boundaries. In the initial establishment of EFH regulations through Amendment 19, the Council used a metric of displaced revenue, though this should not be conflated with socioeconomic effects, as displaced revenue indicates a shift in fishing effort rather than a loss of revenue. Also, while it is useful to encourage proponents to confer with affected fishermen and communities, it would be inappropriate to rely on any such anecdotal information regarding socioeconomic costs and benefits in the proposal evaluation, unless collected using established scientific techniques. If proposals are to include a discussion of socioeconomic information, the Phase I Report should be the primary source of this information. However, we note that the information on landings and revenues by port area as referenced in the RFP does not appear to be at an appropriate scale relevant to spatial scale of proposals, and we hope to see spatial economic data in the EFHRC Phase I Report. All links to relevant information should be included together. Again, socioeconomic and management effects would better be assessed through a consistent set of metrics and methods by NMFS and the Council, rather than placing the burden of analysis and data collection on the proponents.

- In several sections of section C.5, the draft RFP suggests that the EFHRC will be reviewing proposals to a higher standard than requirements in the EFH statute and regulatory guidance (questions e,k,l,m,o,p,q). While these issues may be of interest to the Council, they should in no way be used to indicate that an EFH proposal is deficient or incomplete. In particular, this section includes some "yes" or "no" questions that the EFHRC will ask when evaluating proposals. These should be reframed to ask "to what extent", rather than a "yes" or "no." For example, it is unclear what type of "coordination" is expected with "appropriate state, Tribal, and Federal enforcement, management, and science staff. Does this mean a draft proposal has been shared with such entities and their review incorporated before submission to the EFHRC? In addition, C.5.l asks whether the proposal includes a monitoring plan, yet there is no indication of whether inclusion of a monitoring plan is desired or how it would be evaluated—particularly as monitoring is not mentioned anywhere in Part 4 under the description of the proposed action.

Overall, we commend the work of the EFHRC and Council thus far, as the RFP is off to a good start. However, it is simply inappropriate to place the burden of analysis on the proposal authors. This is the role of the Council and NMFS, and the EFHRC accordingly should be authorized to conduct its own substantive analysis of proposals. The EFHRC's analysis should be conducted with defined methods and metrics—much more specific than the language currently in the RFP—and those methods and metrics should be the same as the ones used to evaluate the effectiveness of current EFH designation and management measures.

We appreciate the opportunity to comment and look forward to participating productively throughout the EFH 5-year review.

Sincerely,

Geoffrey G. Shester, Ph.D.
California Program Director
Oceana

Seth Atkinson
Staff Attorney
Natural Resources Defense Council

U.S DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
National Marine Sanctuary Program

West Coast Region
99 Pacific Street, Bldg. 200, Suite K
Monterey, CA 93940

June 28, 2012

Sent via email to:
pfmc.comments@noaa.gov

Pacific Fishery Management Council
Attn: EFH RFP Comments
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220

RE: Comments on Draft Request for Proposals to Modify Existing Essential Fish Habitat for Pacific Coast Groundfish

Dear Mr. Griffin:

NOAA's Office of National Marine Sanctuaries (Sanctuaries) manages five sanctuary sites along the west coast (Channel Islands, Monterey Bay, Gulf of the Farallones, Cordell Bank and Olympic Coast national marine sanctuaries), included within the West Coast Regional Office. I am supplying comments for the Draft Request for Proposals (RFP) Modify Essential Fish Habitat (EFH) for Pacific Coast Groundfish posted on May 21, 2012, on behalf of these sites. We greatly appreciate that NOAA Sanctuaries have been represented on the Pacific Fishery Management Council's (PFMC) EFH Review Committee (EFHRC) and these comments, both general and specific, are meant to clarify the process for the entire west coast region.

I understand there has been a recent decision by the Pacific Fishery Management Council (PFMC) to delay issuing the EFH RFP until a more thorough synthesis of new habitat and fishing effort information can be completed by the Northwest Fisheries Science Center. We therefore request that PFMC staff consider extending the deadline for comments (or providing additional opportunity for comments at a later date) and revisiting the "Review and Approval" component on the draft RFP with the EFHRC. This would ensure that the RFP, and the scope of and timeline for the review, coincide with the release of the new information.

Sanctuary staff have participated in the EFHRC meetings and comments submitted in this letter augment initial comments made by sanctuary representatives during the formulation of the draft RFP. Although most elements in the draft RFP are sensible and straightforward, some remain a concern for our research and resource protection staff from several sanctuaries. In particular, the "proposal contents" outlined in section B.6.a-e, which request a discussion of a list of topics relevant to a proposed action, do not seem to be appropriate given that proposals would be evaluated based on a non-standardized analysis of this type of information. Also, a request for this level of analysis appears to be premature and the level of detail required may be overly restrictive.

Olympic Coast
National Marine Sanctuary
115 E. Railroad Ave., Ste 301
Port Angeles, WA 98362

Cordell Bank
National Marine Sanctuary
P.O. Box 159
Olema, CA 94950

Gulf of the Farallones
National Marine Sanctuary
Building 991, Presidio of SF
San Francisco, CA 94129

Monterey Bay
National Marine Sanctuary
299 Foam Street
Monterey, CA 93940

Channel Islands
National Marine Sanctuary
113 Harbor Way
Santa Barbara, CA 93109

The professionals who are producing the EFH review report (Phase I), and the subsequent agency staff who would conduct an analysis, should Phase II be initiated, are the appropriate individuals who should be charged with the tasks of determining the importance of habitat types to any groundfish Fishery Management Plan (FMP) stocks as well as the socioeconomic and management-related effects of proposed actions. This should be done only after the scope of all the proposals is known so that proposed actions can be analyzed both individually and cumulatively. This type of information is more appropriate during Phase II or during a process conducted under the National Environmental Policy Act, such as an FMP amendment if it's determined that such an action is warranted.

The effects analysis of all proposals should be viewed as preliminary since the cumulative effects of several actions or proposals combined will have different effects than individual ones. For example, how a proposed action will affect a particular FMP may be very different if combined with the effects of another proposal. Similarly, the cumulative socioeconomic effects will differ when proposals are combined, particularly if changes in the location and intensity of effort, or displacement or change in revenue, are recommended. These types of effects analyses are required for NEPA compliance and should be done during Phase II of the process. Therefore, the effects analysis of all proposals should be merely preliminary rather than in depth.

Of particular concern to us is item B.6.e, where the RFP seems to request that the proposer conduct an analysis or synthesis of "socioeconomic and management-related effects of proposed actions, including changes in the location and intensity of bottom contact fishing effort, the displacement or change in revenue from fishing, and social and economic effects to fishing communities." A standardized application of how these actions are being evaluated should be applied. Otherwise the proposer is left to make decisions on which data are useful for analysis and which are not. For example, it is difficult for a proposer to understand if the "Information on landings and revenues by port area" found on the PFMC's website should be considered the expected source of information for any socioeconomic analysis. Can or should other data be used? If a recent report on the socioeconomic profile of commercial fishing has been conducted for particular areas, can that be used instead? Without criteria for what type of information or data can be used for analysis, the proposer could end up doing a complete analysis that is deemed irrelevant and rejected.

The RFP needs to address the question of whether existing EFH closed areas should be continued under existing protections.

Thank you for the opportunity to comment on the RFP and for allowing NOAA Sanctuary representatives to participate on the EFH review committee.

Specific comments are attached.

Sincerely,

William J. Douros
Regional Director

Specific Comments from the Office of National Marine Sanctuaries on the Draft Request for Proposals (RFP) to Modify Essential Fish Habitat (EFH) for Pacific Coast Groundfish

1. Under Section A on who can submit a proposal, can coalitions or groups of different agencies, NGOs and fishermen submit a combined proposal?

2. Is a proposal limited to specific areas identified, or can a proposal have a suite of potential areas for consideration with recommendations that one of each type be considered for additional protections?

3. Section B of the draft RFP currently states: "Proposals may be based on the information compiled by the EFHRC, although other information (including proprietary information not available to the public) may be used as a basis for the proposal. However, any proprietary information used to develop a proposal must be available to the EFHRC and ultimately the Council, for review and evaluation."
   a. Will the raw data be made available from the EFHRC report so that additional analysis can be conducted?
   b. How should conflicting information for a particular area be handled? If there is finer scale information or visualization of areas that is not congruent with the EFHRC report, how and when should that be communicated to the PFMC?

4. Section B also states: "To the extent possible, proposals should include the following information…."
   a. For many areas, information on each of these aspects will not be available. Is this a desired list, not a mandatory list for each area?
   b. Will information NOT submitted during the data call be admissible as evidence? And if so, how should that be handled?
   c. How should information from the fishing community, based on expert local knowledge be entered in as evidence?

5. The information provided in sections B.1-5 should be sufficient for the EFHRC to review proposals. Most elements of section B.6 should not be included in the RFP as currently stated. We suggest, at a minimum, striking B.6.e in its entirety. Information about socioeconomic characteristics and most of the additional elements in section B.6 could be addressed in B.5.a-e.

6. Section B.4.a requests a detailed description of the "spatial changes to currently protected areas such as boundary modifications, elimination of current areas of EFH, HAPC, or ecologically important habitat closed areas, or addition of new areas of EFH, HAPC, or ecologically important habitat closed areas". Can proposals recommend some areas be omitted and exchanged for different HAPCs or ecologically important areas?

7. How are research needs being addressed during EFH? For many areas, there is insufficient information/data or knowledge to understand the impacts to groundfish EFH.

a. In many cases, additional research is needed for areas that are suspected of being essential EFH. How should such areas be handled?
b. Is research targeting EFH areas able to determine the effects on groundfish EFH?

8. In Section C.1, it states: "The EFHRC will evaluate all proposals . . ." and " . . . any deficiencies that should be addressed if the Council desires a full assessment . . ." This would appear to suggest these initial proposals are more 'pre-proposal' level and further analysis, such as with socioeconomics noted in the body of the letter, would be more appropriate at this stage.

9. Section C.5.l states: "Is a monitoring plan part of the proposal?"
   a. Is there any current monitoring by the PFMC or NMFS to determine effectiveness of EFH?
   b. Are there plans in the future for research/monitoring?

10. Section C.5.o also asks: "Are the data gaps identified in the original risk analysis filled?" This would appear to raise the bar beyond the 'Best Available Information' and might preclude further consideration of a proposal. We would recommend this section be removed. We recognize the need to fill all data gaps, but such efforts are long-term goals and should not be used to disqualify a proposal.

11. In the last paragraph of the RFP, the deadline for receiving proposals should be amended to reflect the postponement of release of this RFP. So December 20, 2012 should be replaced with the appropriate timeframe.

Alliance of Communities for Sustainable Fisheries
256 Figueroa Street #1, Monterey, CA 93940
(831) 373-5238
www.alliancefisheries.com

Pacific Fishery Management Council June 21, 2012
Att: Kerry Griffin
7700 NE Ambassador Place, suite 101
Portland, OR 97220-1384

Re: Comment on groundfish EFH Guidelines

Dear Mr. Griffin,
On behalf of the Alliance of Communities for Sustainable Fisheries, I am writing to request one clarification, or additional information, in the draft guidelines.
Can the guidelines provide more information as to what is meant by “rare”, “unique”, and “threatened” habitats? In particular, if a certain habitat is uncommon regionally, but found more commonly in other areas of the California Current Ecosystem, or the world, would this habitat still meet the Council’s definition of unique or rare?

Thank you for accepting this request for clarification.

Kathy Fosmark
Co-chair
ACSF

Supporting Associations & Organizations

- Pacific Coast Federation of Fishermen’s Association
- Ventura County Commercial Fishermen’s Association
- Port San Luis Commercial Fishermen’s Association
- Morro Bay Commercial Fishermen’s Association
- Monterey Commercial Fishermen’s Association
- Fishermen’s Association of Moss Landing
- Fishermen’s Marketing Association
- Santa Cruz Commercial Fishermen’s Marketing Association
- Half Moon Bay Fishermen’s Marketing Association
- Western Fishboat Owners Association
- West Coast Seafood Processors Association
- Federation of Independent Seafood Harvesters
- Golden Gate Fishermen's Association
- California Fisheries Coalition
- California Wetfish Producers Association
- Recreational Fishing Alliance
- Carmel River Steelhead Association
- Port San Luis Harbor District
- City of Morro Bay Harbor
- City of Monterey Harbor
- Moss Landing Harbor District
- Santa Cruz Port District
- Pillar Pt. Harbor, San Mateo County Harbor District

Information to Support the Five-Year Review of Essential Fish Habitat for Pacific Coast Groundfish

Pacific Fisheries Management Council
Pacific Coast Groundfish
Essential Fish Habitat Review Committee

(E. Bowlby, R. Eder, C. Goldfinger, G. Greene, M. Mackey, D. Matthews, B. Pettinger, J. Schumacker, G. Shester, J. Stadler, W. Wakefield, M. Yoklavich, and alternates)

With support from:

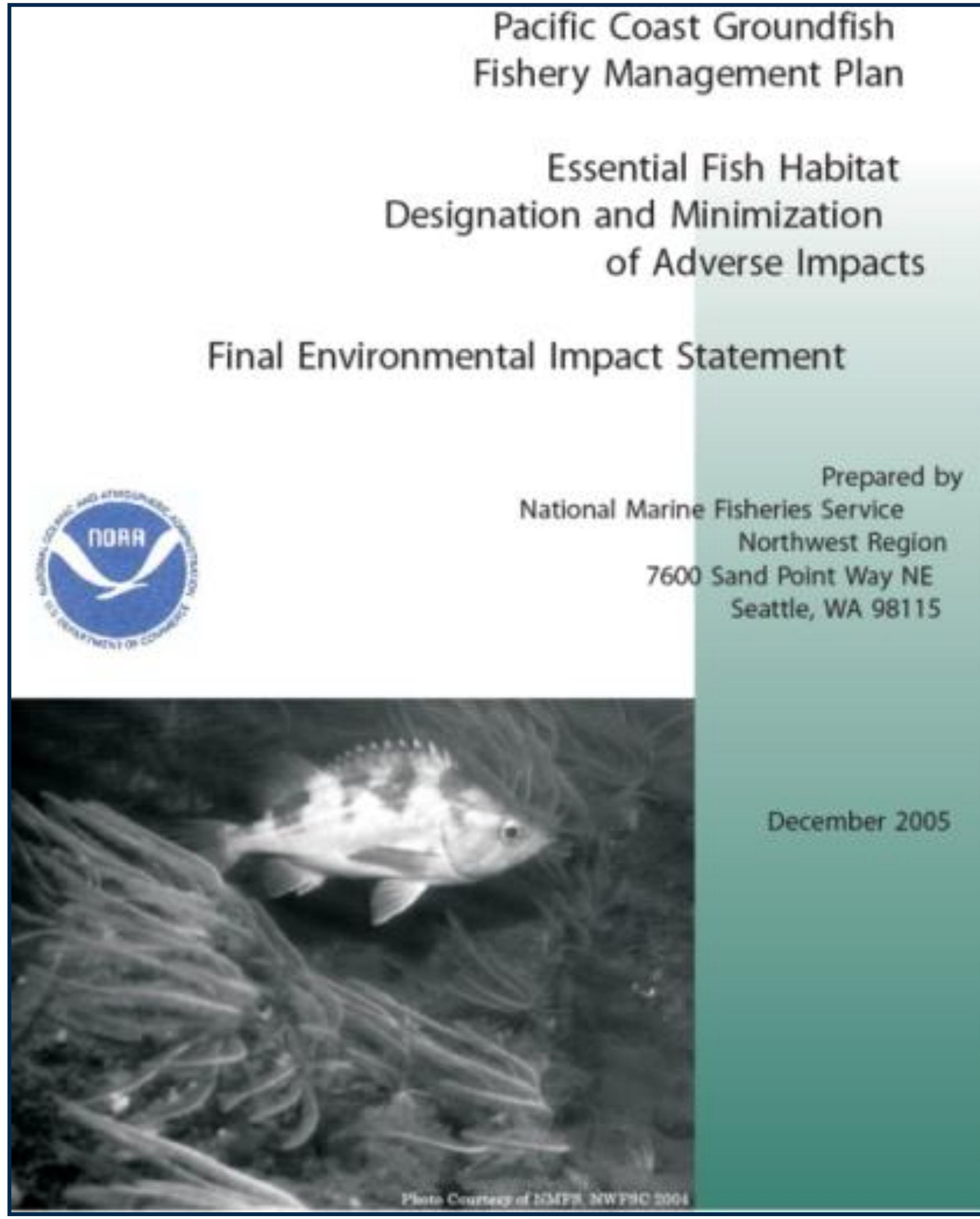
- **Chris Romsos - OSU College of Earth, Ocean & Atmospheric Science**
- **Joseph Bizzarro - UW School of Aquatic and Fishery Sciences**
- **Curt Whitmire - NOAA NMFS NW Fisheries Science Center**
- **Marlene Bellman - NOAA NMFS NW Fisheries Science Center**

Background for Essential Fish Habitat (EFH)

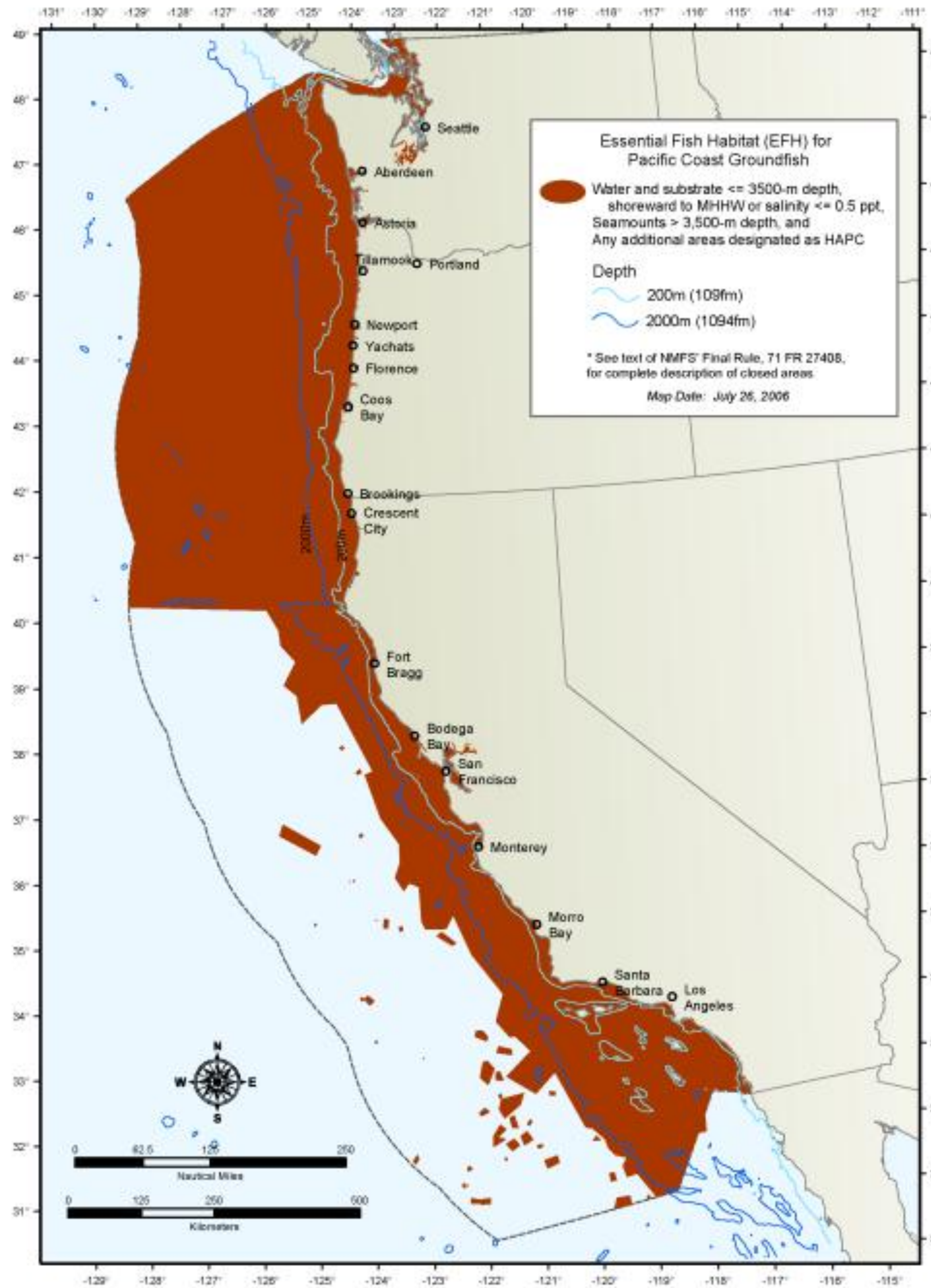
- EFH regulatory guidance requires a periodic review and update of EFH at least every five years
- This review must be based on the best scientific information available
- EFH is: "*Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity*."

Pacific Coast Groundfish EFH was most recently reviewed in 2005, and EFH designations were approved by NMFS in 2006

(Amendment 19)

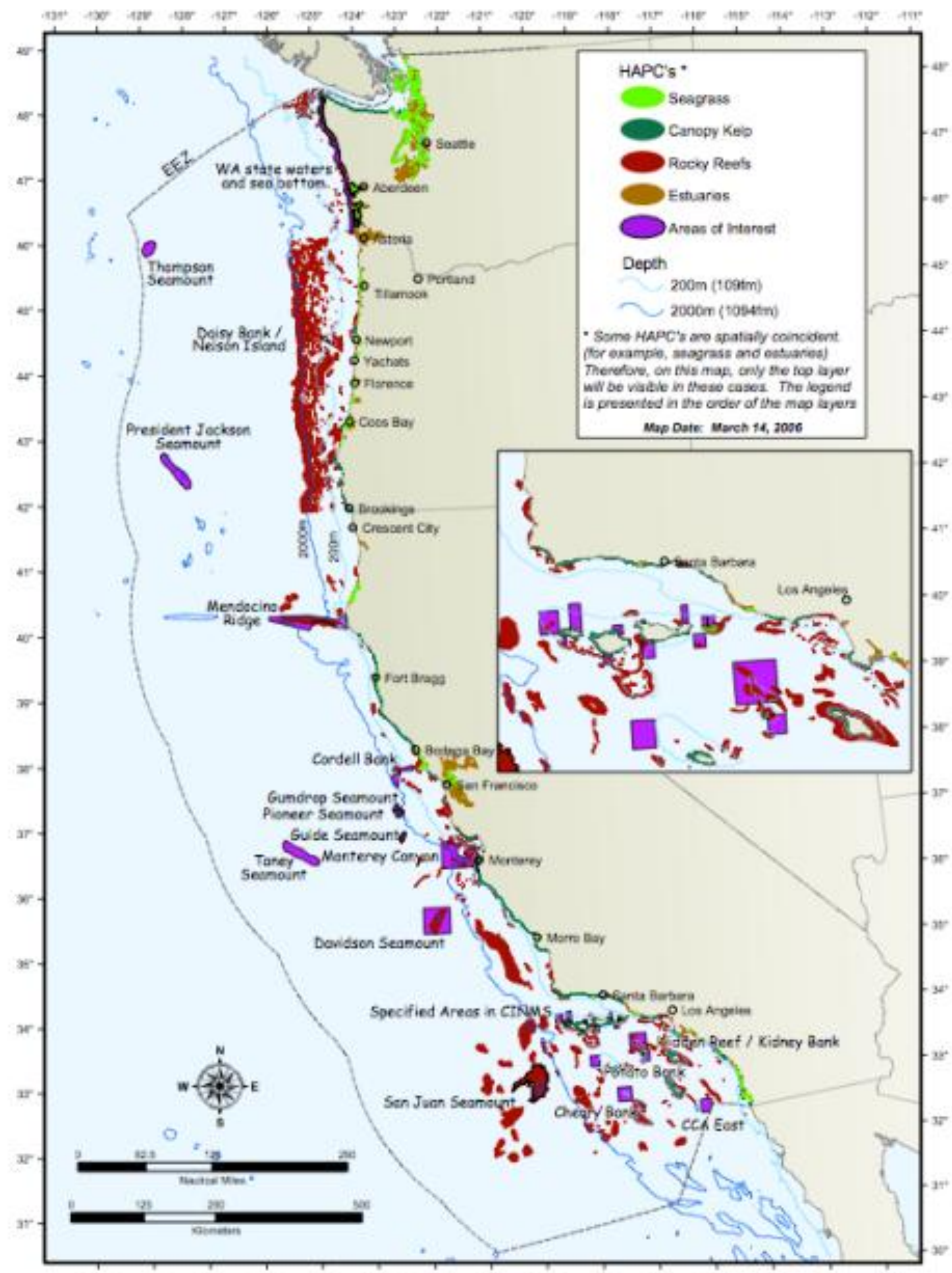


EFH for 82 Species of Pacific Coast Groundfish 2006



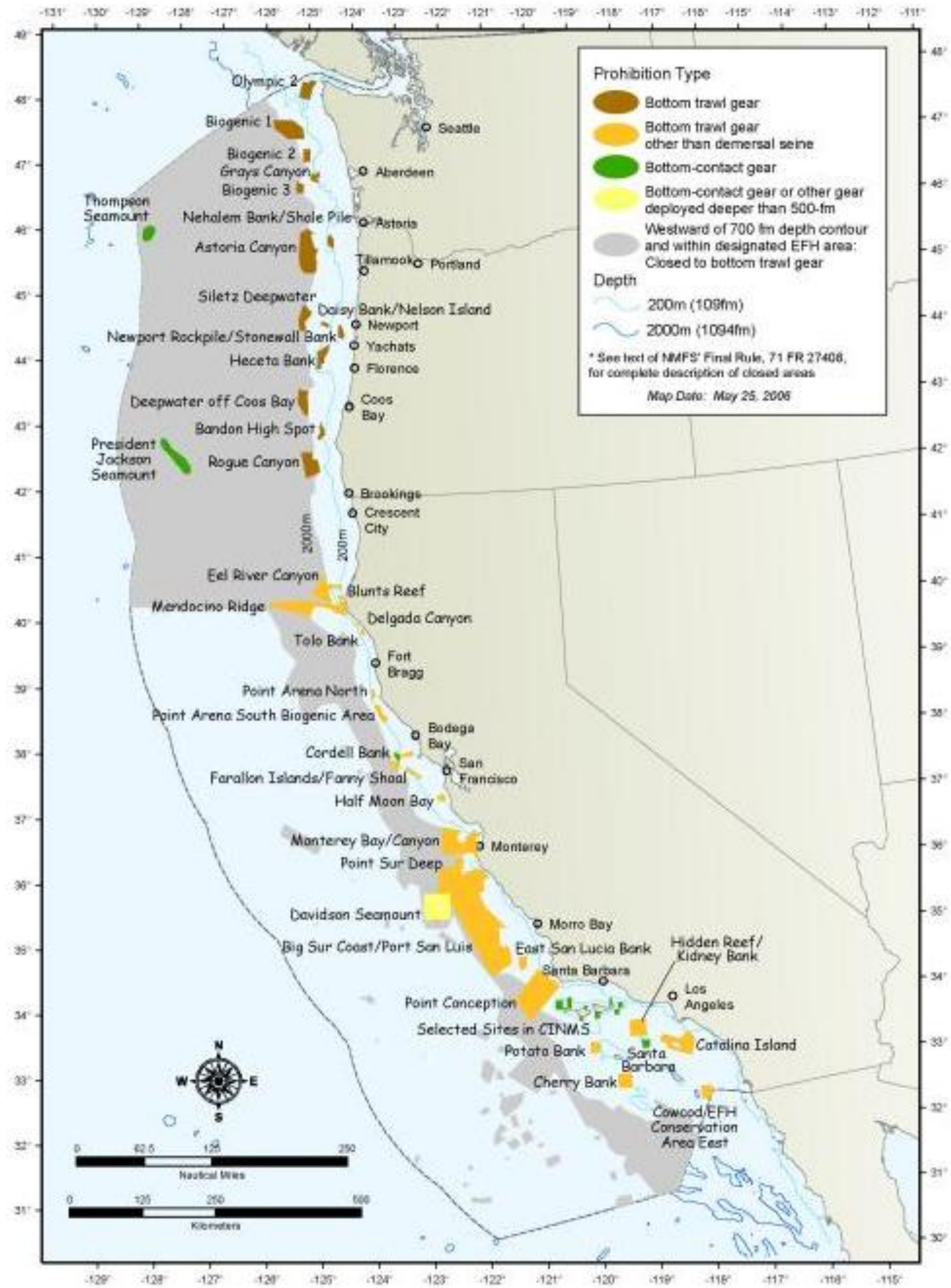
Groundfish HAPCs

- Seagrass
- Canopy Kelp
- Rocky Reefs
- Estuaries
- Areas of Interest



EFH Closures to Protect Pacific Coast Groundfish Habitat 2006

- Bottom trawl gear
- BTG other than demersal seine
- Bottom contact gear
- BCG or other gear deployed deeper than 500 fm
- Westward of 700 fm depth contour and within EFH area; Closed to BTG



A recommended schedule based on a three-phase approach

- **Phase I** – Information and data gathering, culminating in a report to the PFMC in September 2012; Council considers report
- **Phase II**
  - Sept 2012-April 2013: NMFS synthesizes and interprets data and information in the Phase 1 report
  - April 2013: NMFS presents synthesis to Council
  - *Release of Request for Proposals (RFP) to modify EFH*
  - EFHRC reviews proposals and submits Phase II Report to Council; Council determines whether or not to revise EFH
- **Phase III** – If Council decides to amend EFH, that begins Phase III; May require an FMP amendment

Agenda Item H.6.b
EFHRC Report 1
September 2012

Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat

Report to the Pacific Fishery Management Council

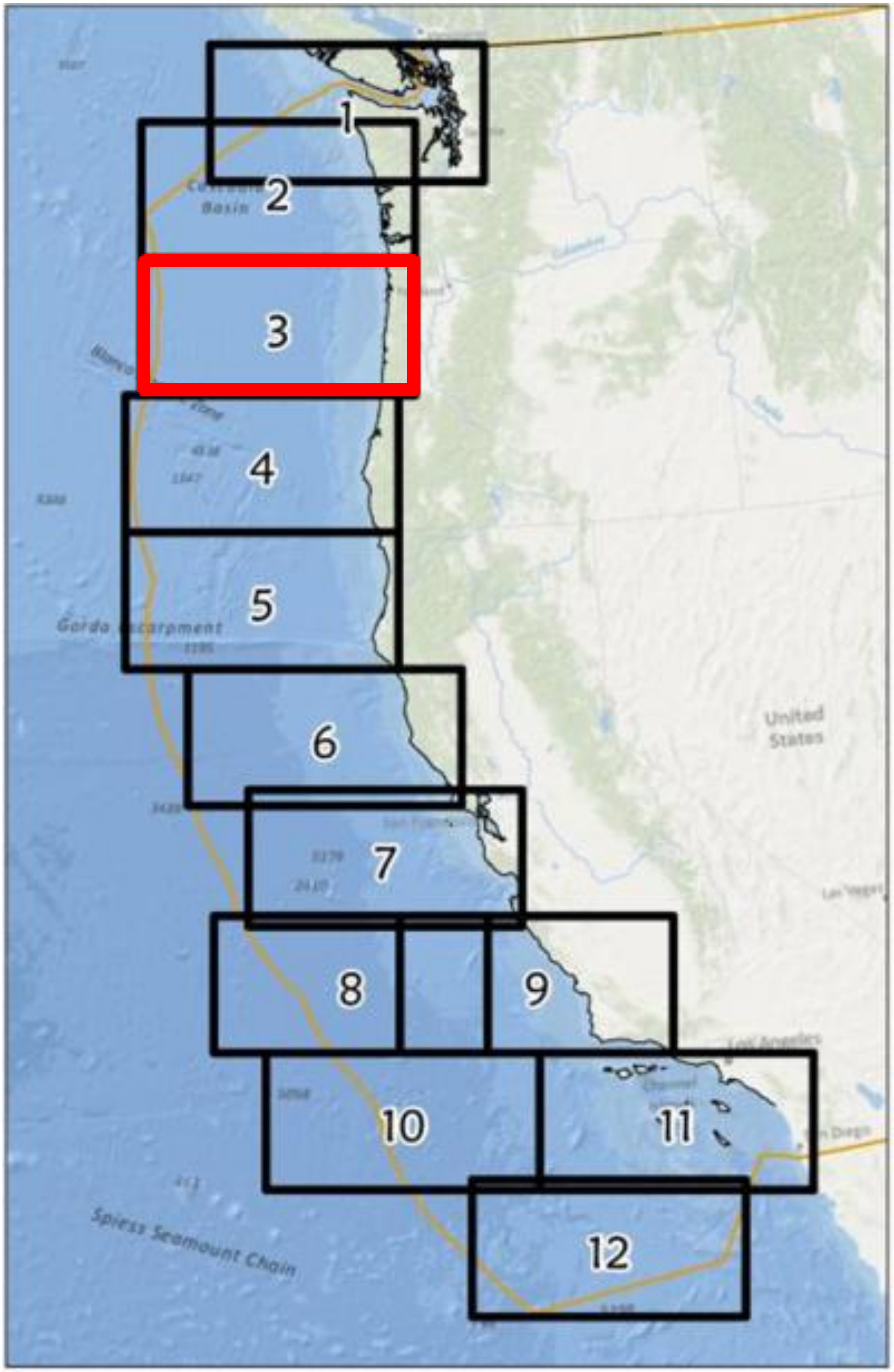
Phase 1: New Information

Groundfish Essential Fish Habitat Review Committee

August 23, 2012

Phase I Products

12 comparison map panels encompassing the US EEZ for seafloor habitat show change in knowledge between 2005 and 2011

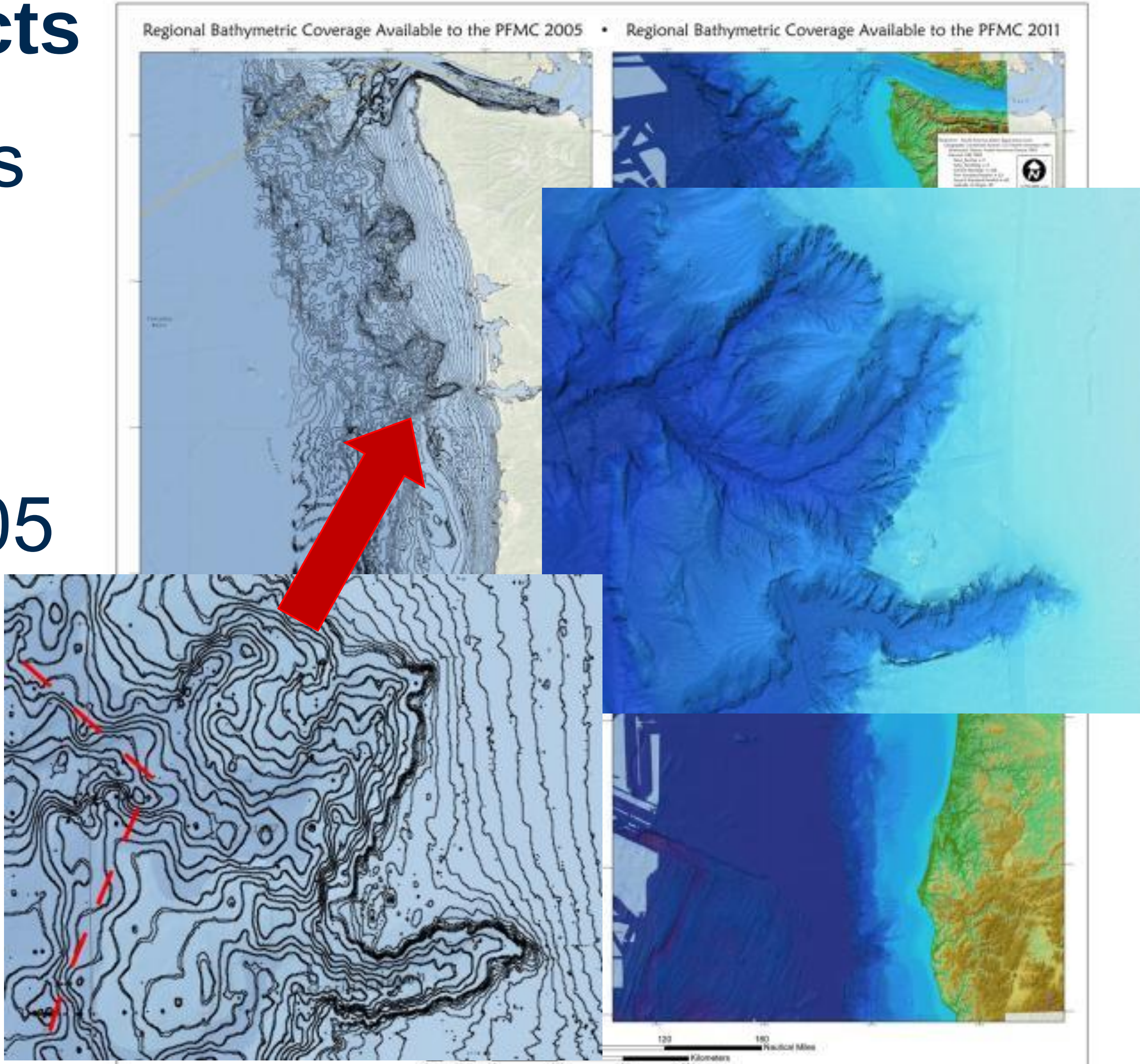


Findings regarding physical habitat:

- Washington:
  - 176 new sources of bathymetry and imagery
    - Puget Sound and continental slope areas
  - 42 new sources of habitat maps
    - OCNMS and San Juan Islands
    - Outer coast nearshore from historic data
- Oregon:
  - 86 new sources of bathymetry and imagery
    - State and Nearshore up to ~60% from ~6 to 7% in 2005
    - Academic mapping offshore
  - 30 new sources of habitat maps
    - All nearshore sources mapped for habitat, ~60% state waters
    - Offshore shelf and slope – a few new hard areas identified
- California:
  - 431 new sources of bathymetry and imagery
    - CA State waters coverage level is at 100% of mainland waters
  - 191 new sources of habitat maps
    - Tier 2 CSUMB maps complete, Tier 3 USGS maps in progress

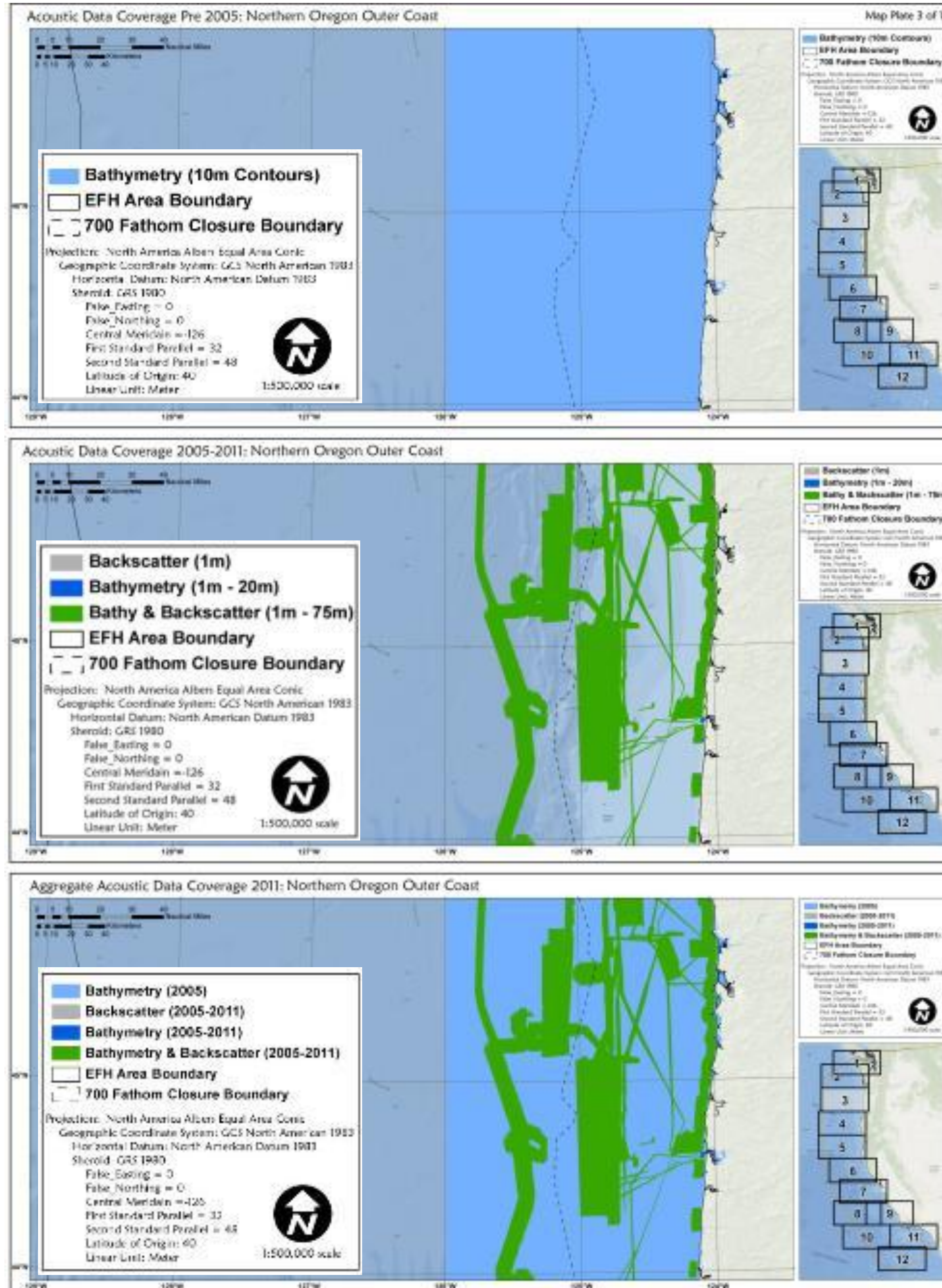
Phase I Products

- Comparisons for regional bathymetric coverage between 2005 and 2011

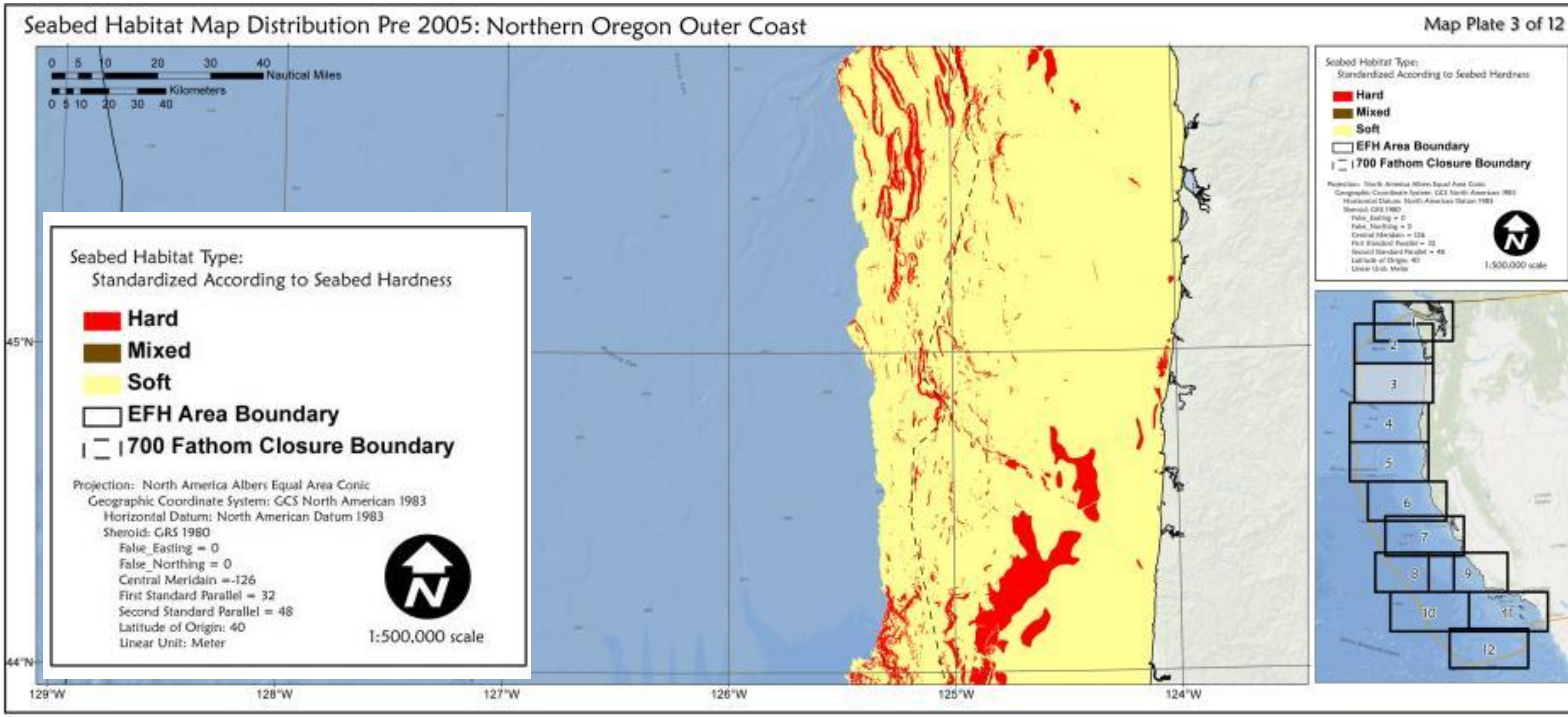


Phase I Products

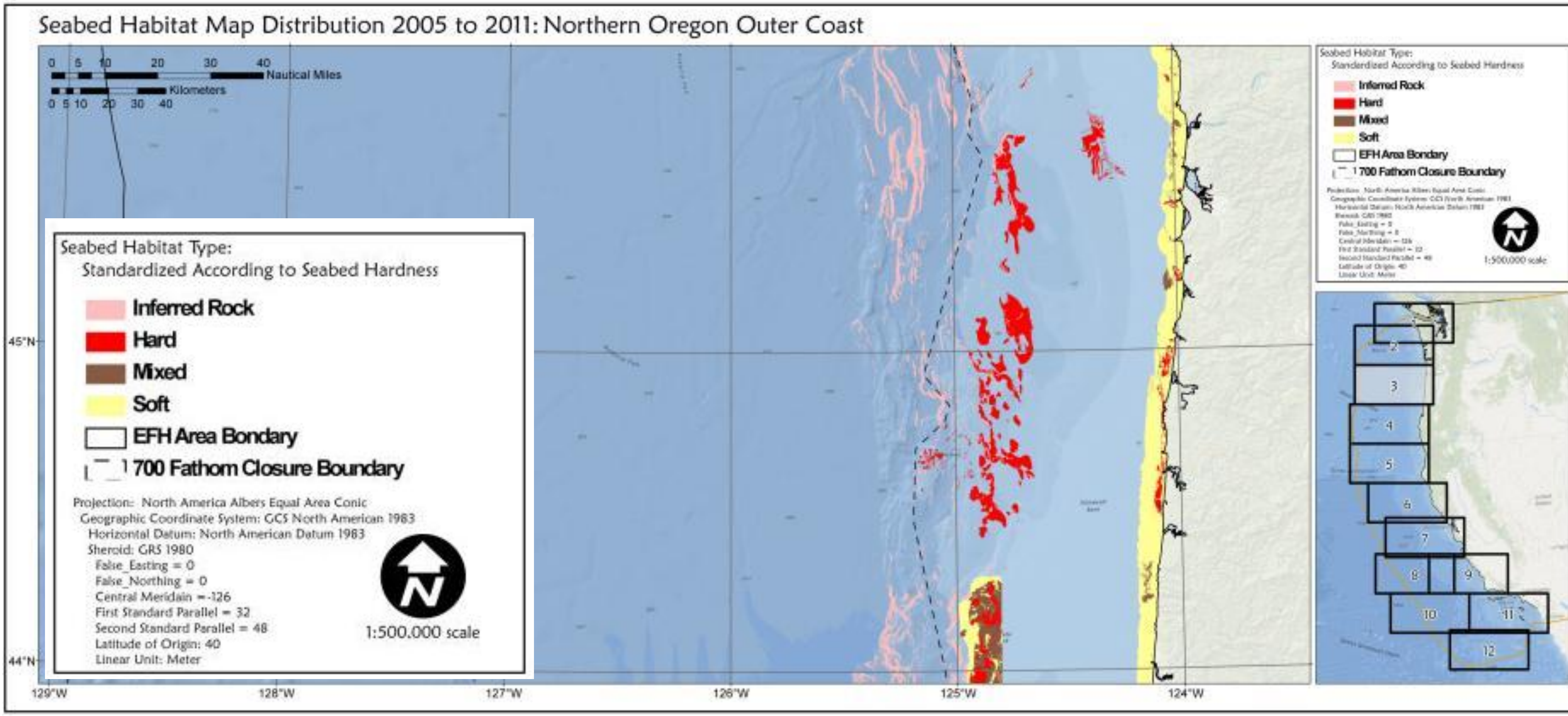
- Comparisons for regional survey coverage between 2005 and 2011



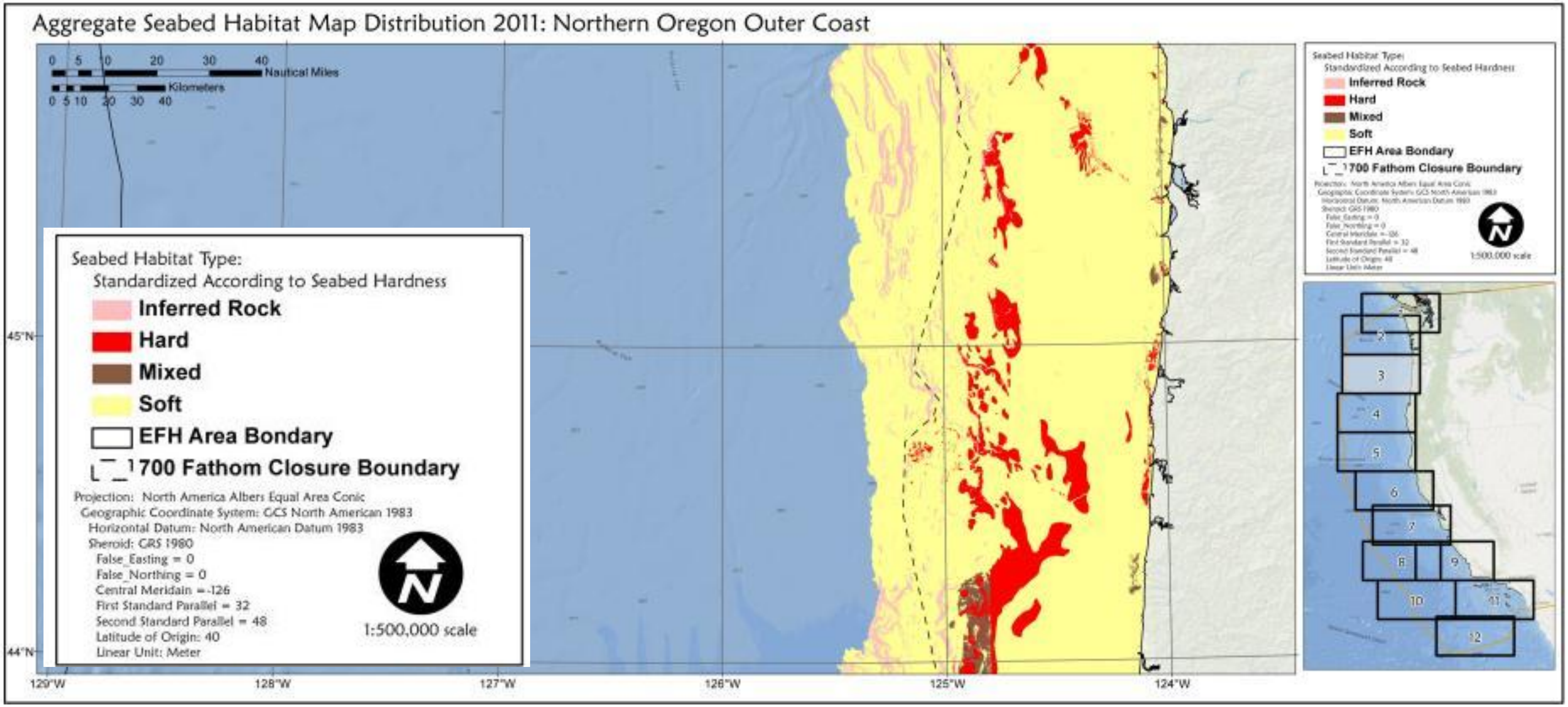
Seafloor Habitat Map 2005
Map Plate 3 of 12, Northern Oregon Coast



Seafloor Habitat Map 2005 to 2011
Map Plate 3 of 12, Northern Oregon Coast



Aggregate Seafloor Habitat Map 2011
Map Plate 3 of 12, Northern Oregon Coast



Other Phase I products developed for the Groundfish EFH 5-year review

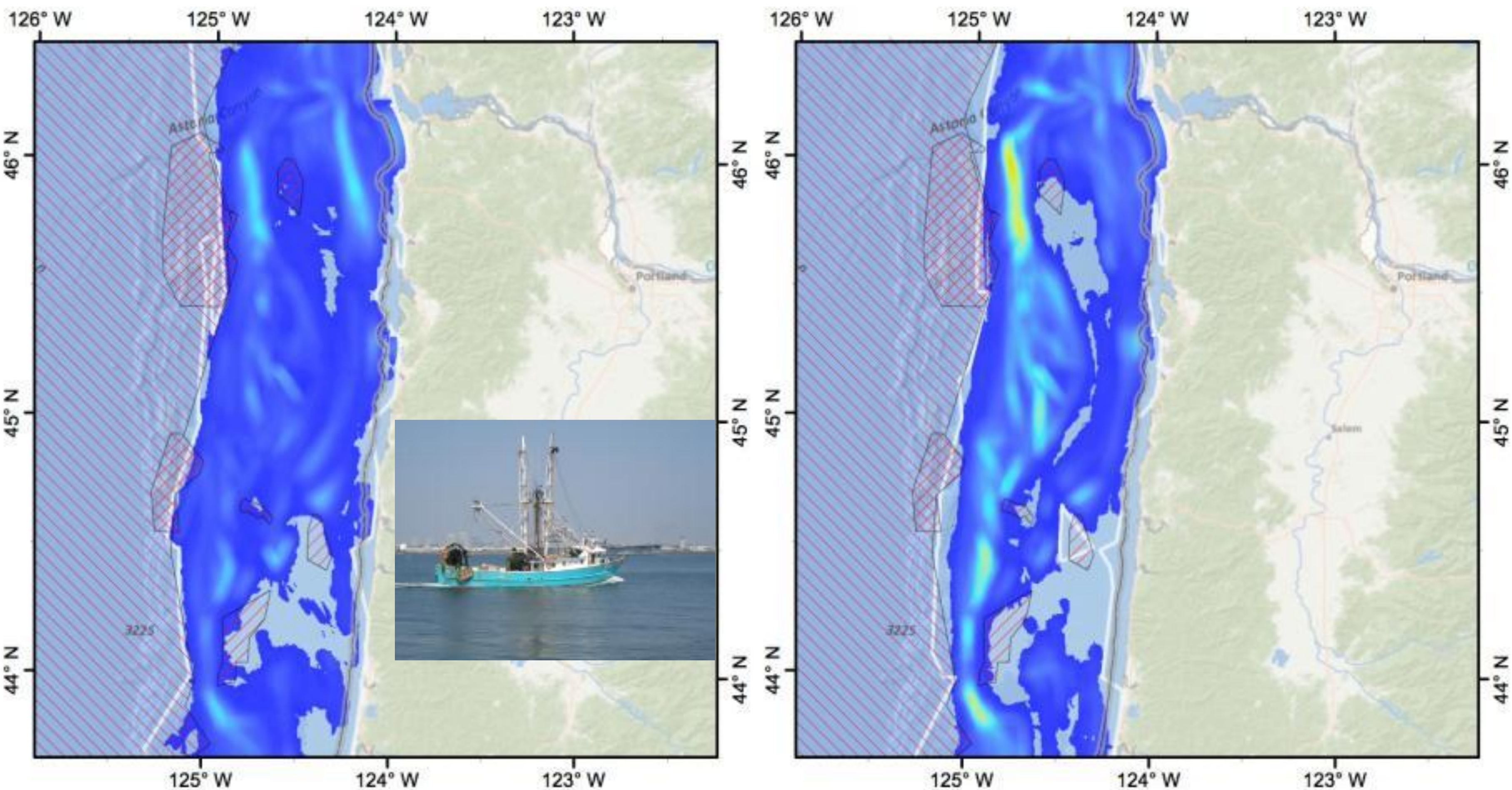
- Footprints and intensity of commercial trawl and fixed gear fishing effort

- Fishery observer derived catch of corals and sponges in the bottom trawl fishery

Before: 2002–2006

Bottom Trawl Fishing Effort (PacFIN)

After:2006 –2010



B2

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Effort (km/km²)

High : 221.931

Low : 0.008

Extent Polygon

EFH Cons. Area

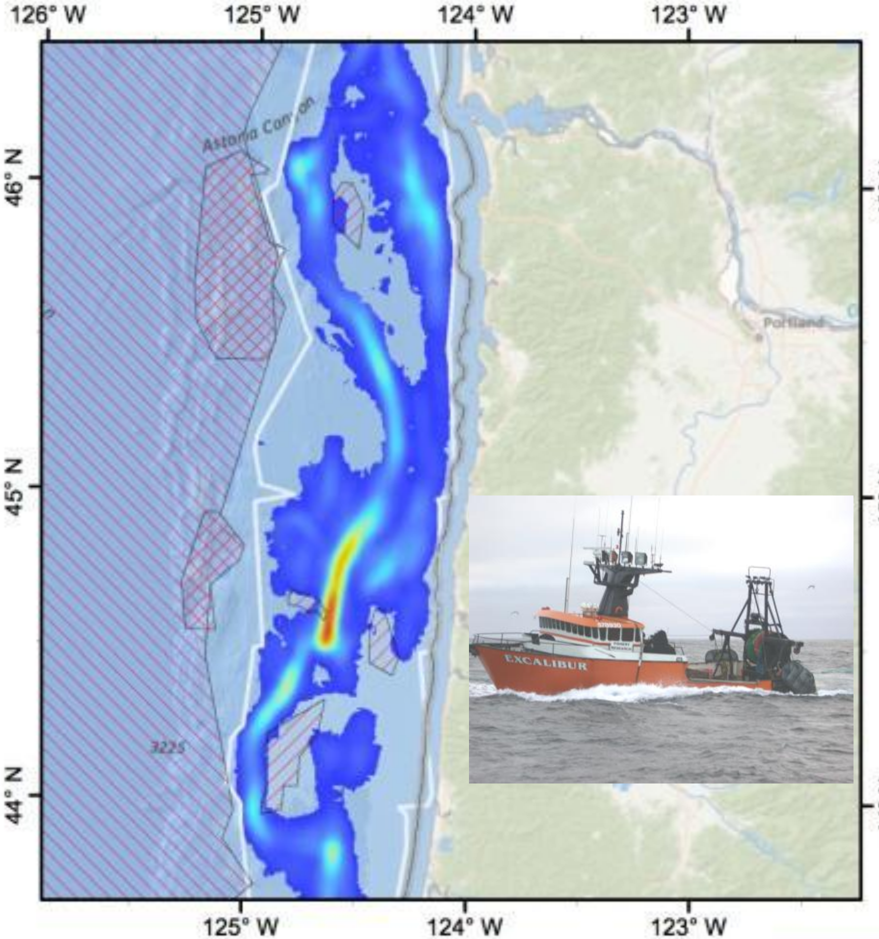
State Territorial Sea

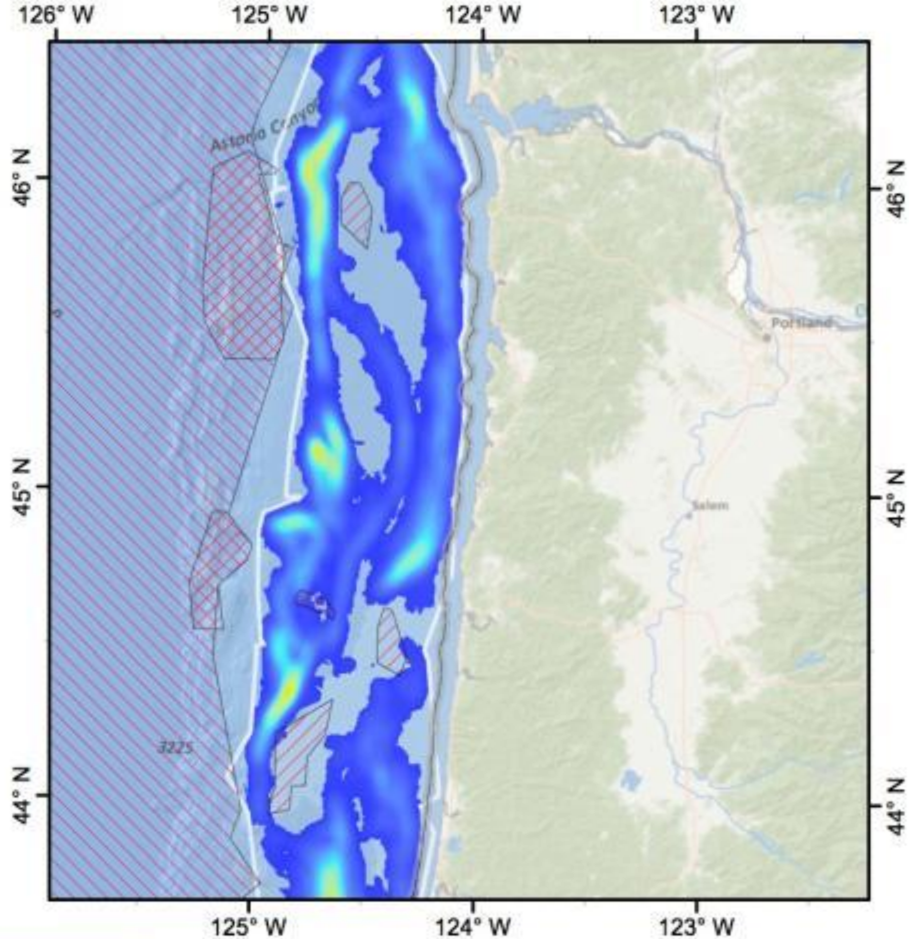
Map 2 of 8

Search Radius: 3,000 m
Cell Size: 500 m

Authors C. Whitmire & M. Bellman (NOAA Fisheries NWFSC)

Before: 2002–2006 **Mid-Water Trawl Fishing Effort (At-Sea & Shoreside Sectors)** **After: 2006–2010**





B2

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Effort (km/km^2)

High : 53.669

Low : 0.008

Extent Polygon

EFH Cons. Area

State Territorial Sea

Map 2 of 4

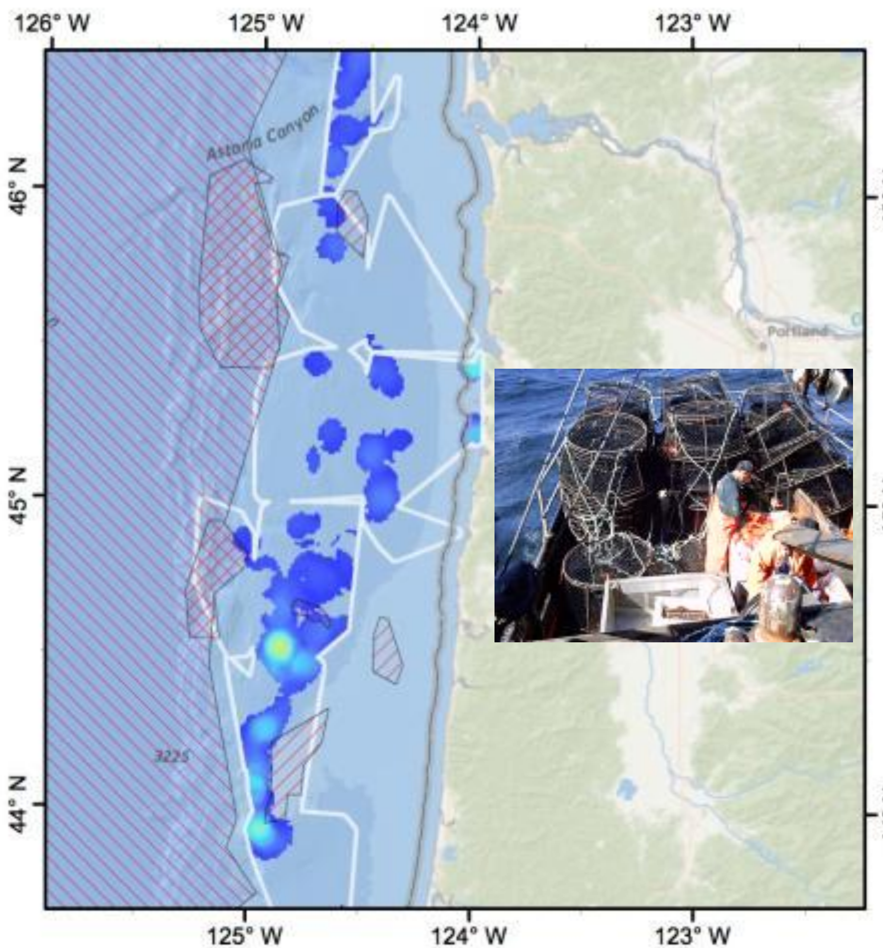
Search Radius: 3,000 m
Cell Size: 500 m

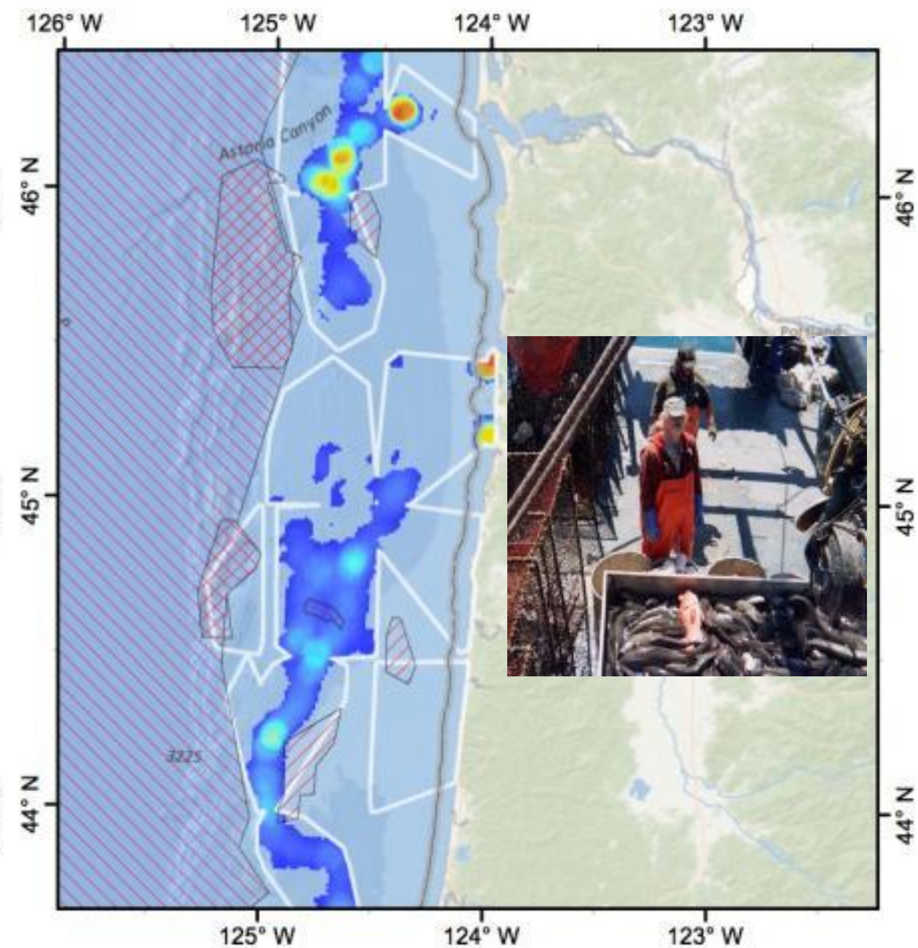
Authors C. Whitmire & M. Bellman (NOAA Fisheries NWFSC)

Before: 2002–2006

Fixed Gear Fishing Effort (WCGOP)

After: 2006–2010





B2

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Effort (locations/km^2)

High : 4.38

Low : 0.04

Extent Polygon

EFH Cons. Area

State Territorial Sea

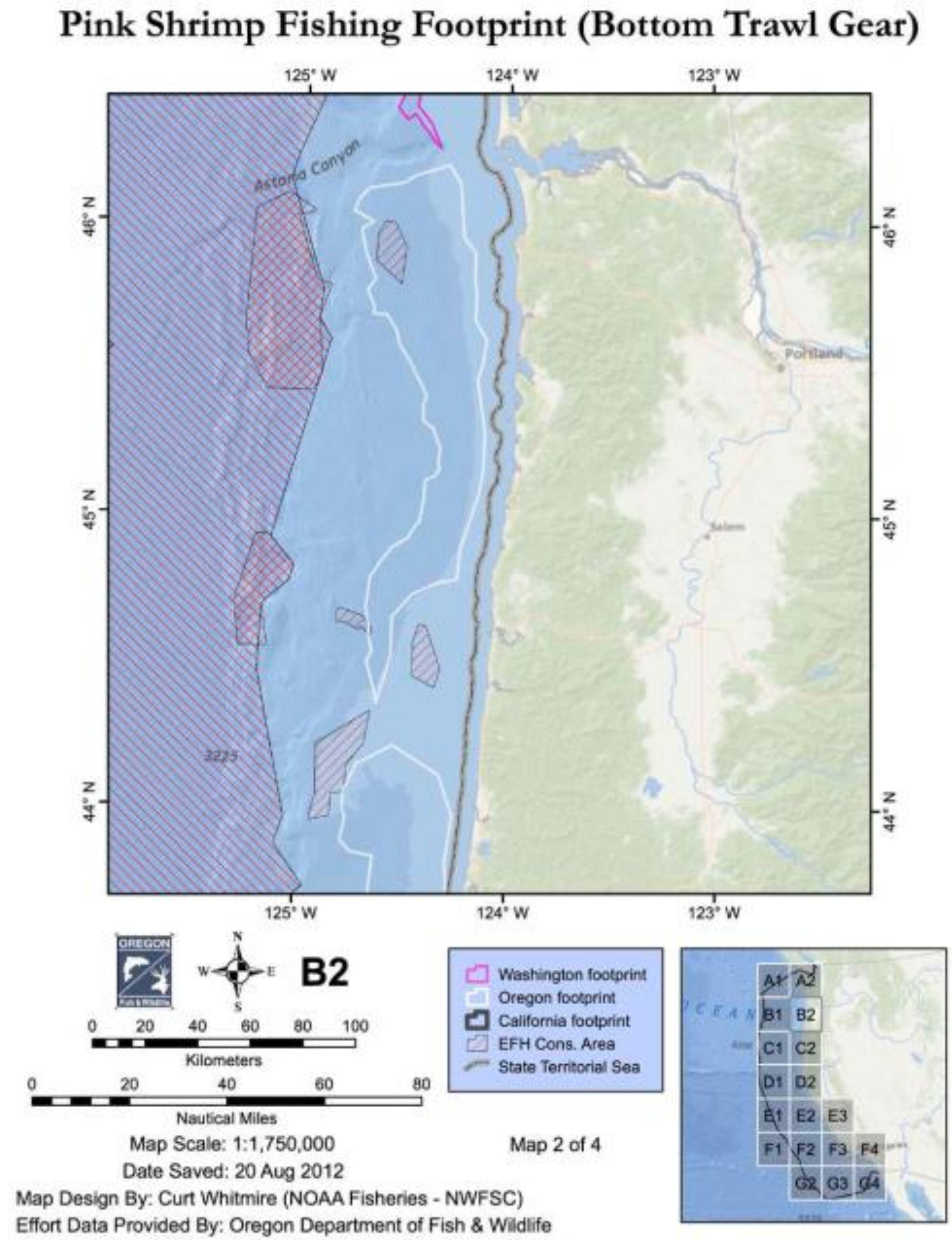
Map 2 of 9

Search Radius: 5,000 m
Cell Size: 1,000 m

Authors C. Whitmire & M. Bellman (NOAA Fisheries NWFSC)

Non-Magnuson Act Fisheries Effects - the EFHRC requested spatial footprints of state• -managed bottom contact gear fisheries

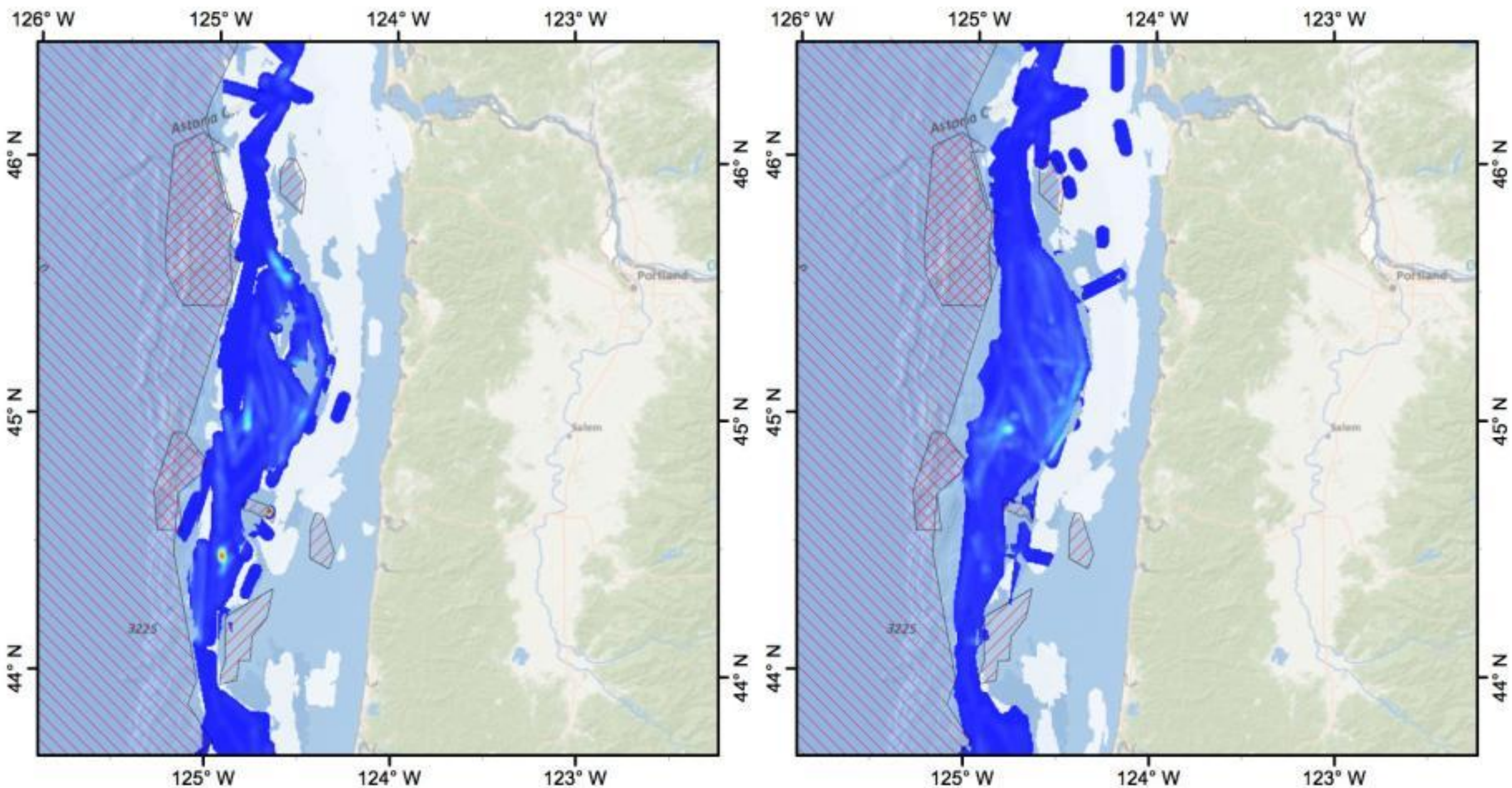
Example from Oregon pink shrimp fishery



Before: 2002–2006

Standardized Coral & Sponge Bycatch (WCGOP - Trawl)

After: 2006–2010



B2

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Author: Curt Whitmire (NOAA Fisheries - NWFSC)

CPUE (lb/km)

High : 16.1607

Low : 0.0634

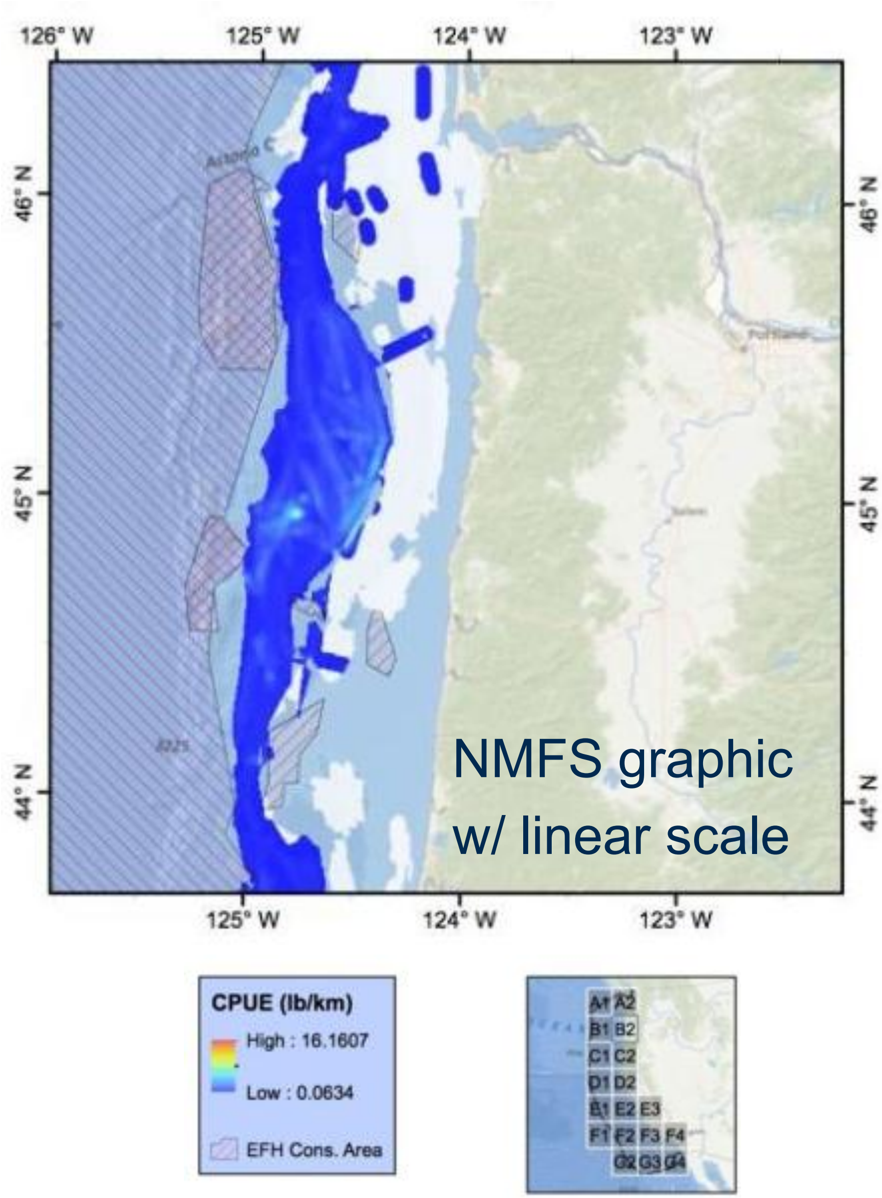
EFH Cons. Area

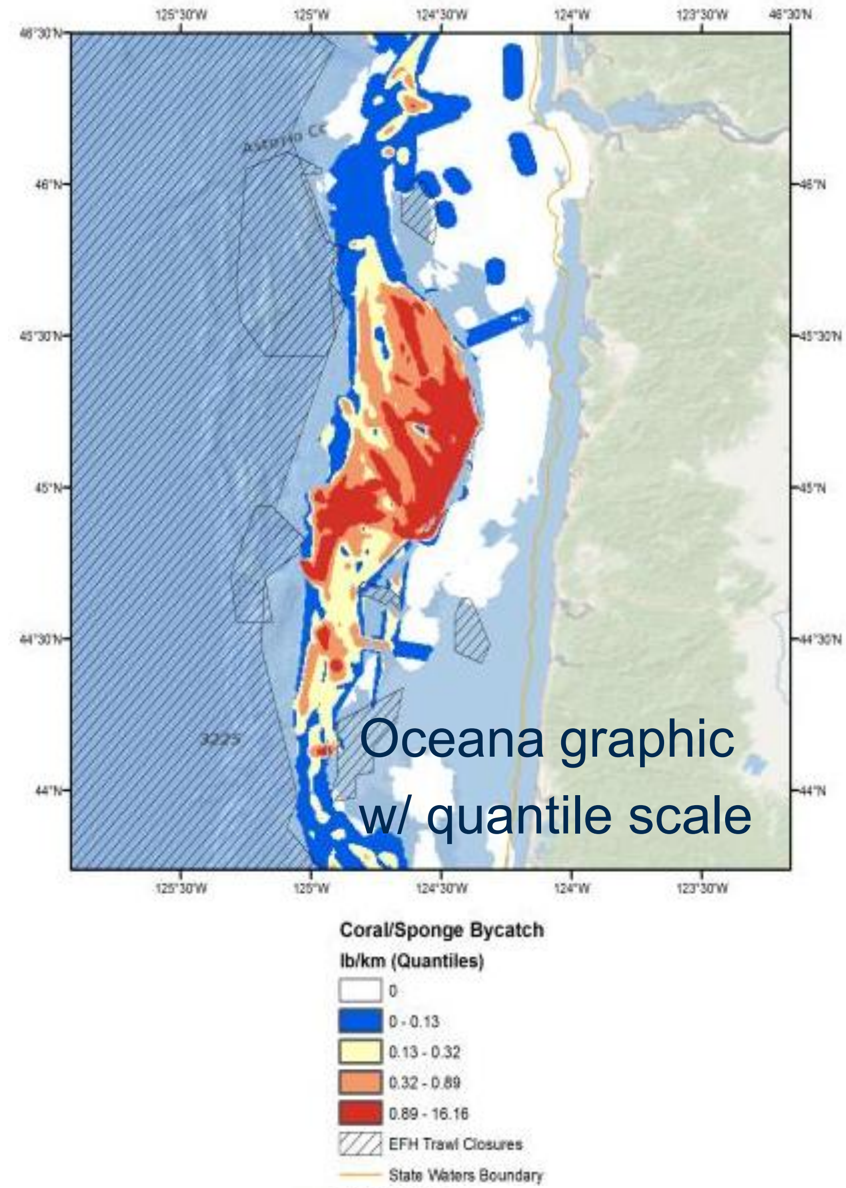
Map 2 of 8

Search Radius: 3,000 m

Cell Size: 500 m

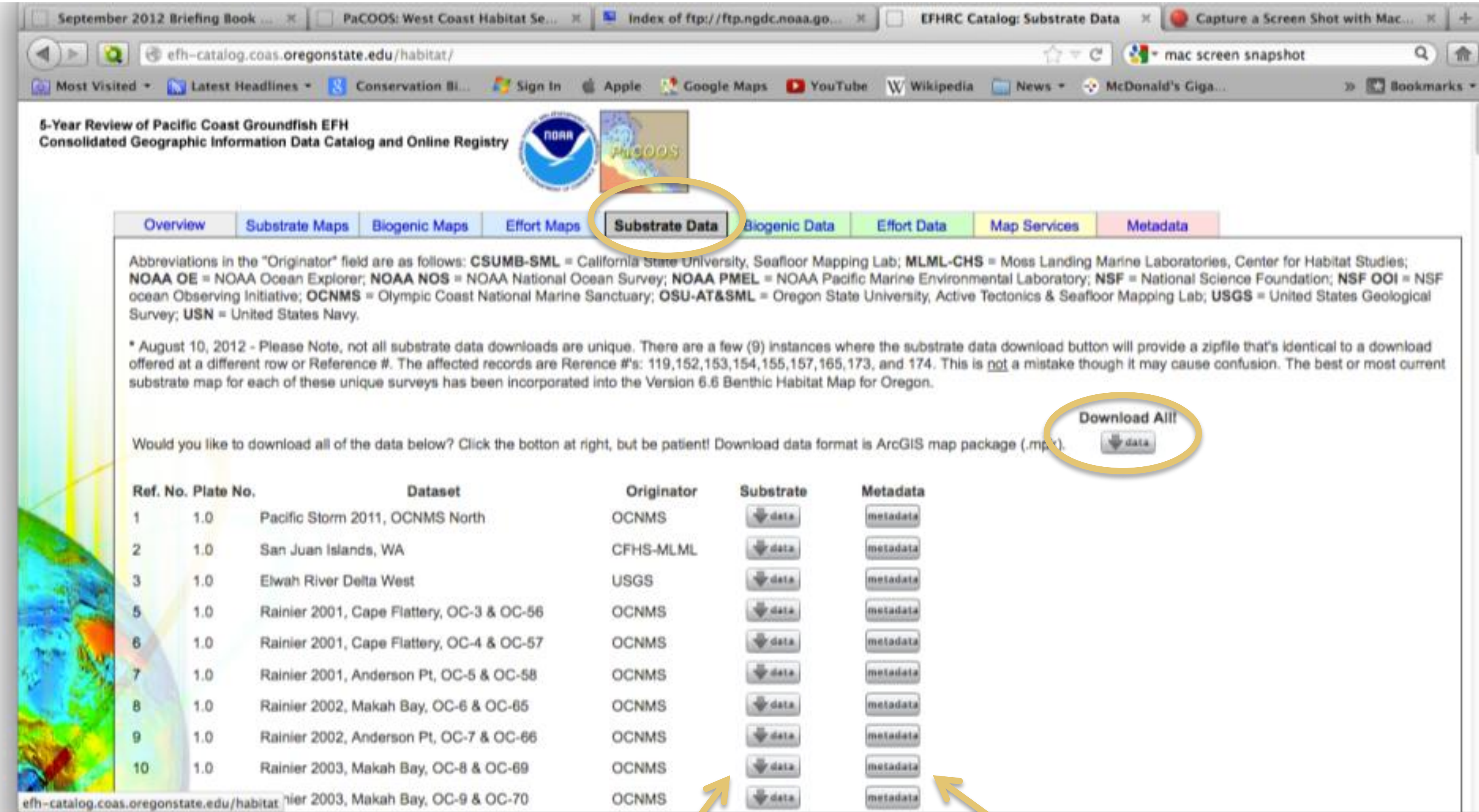
Comparing Two Different Color Scales for Coral & Sponge Bycatch in the Pacific Coast Bottom Trawl Fishery (2006-2010)





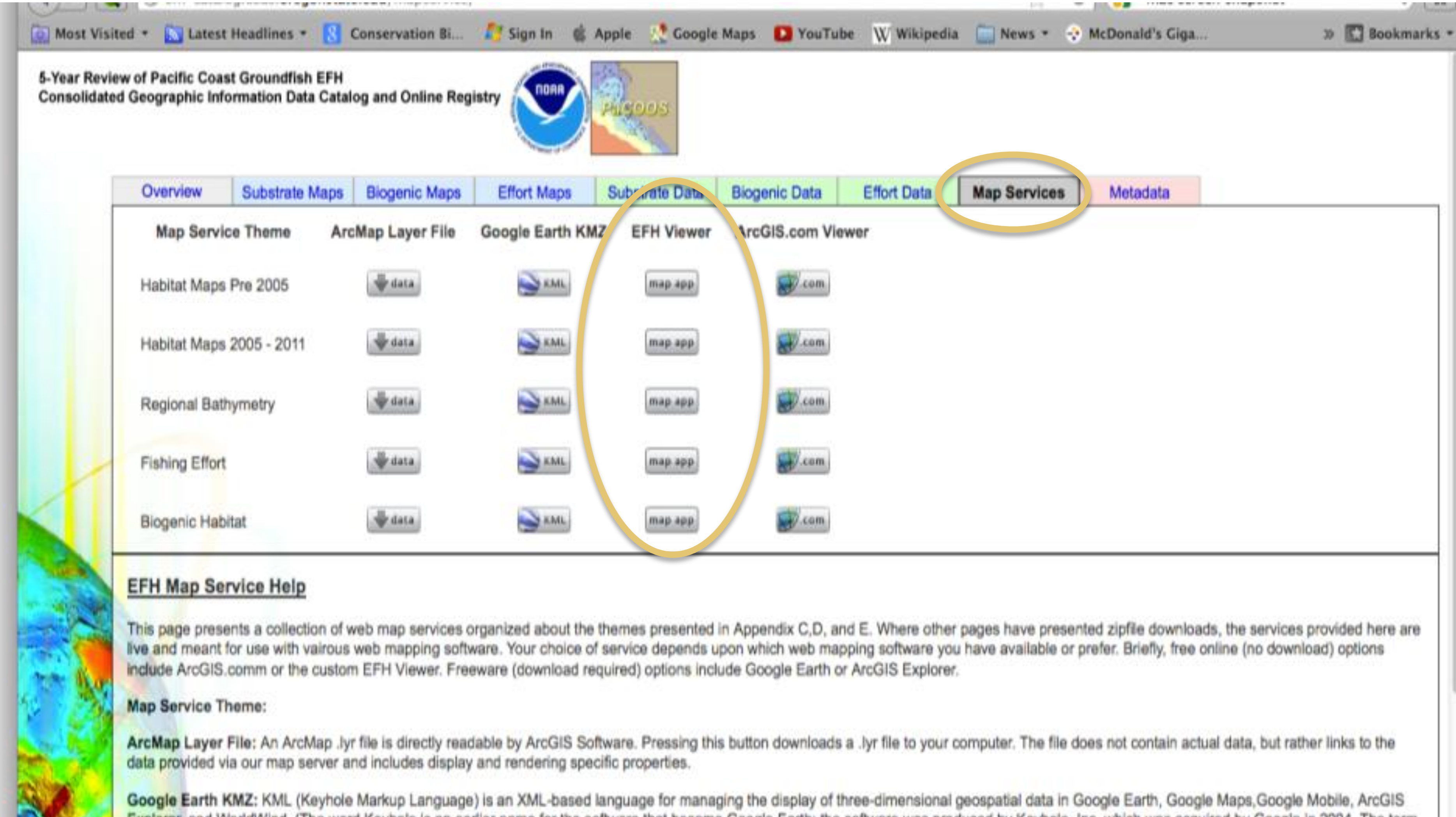
Consolidated GIS Data Catalog and Online Registry: A Data Portal to the EFH Database

http://efh-catalog.coas.oregonstate.edu/overview

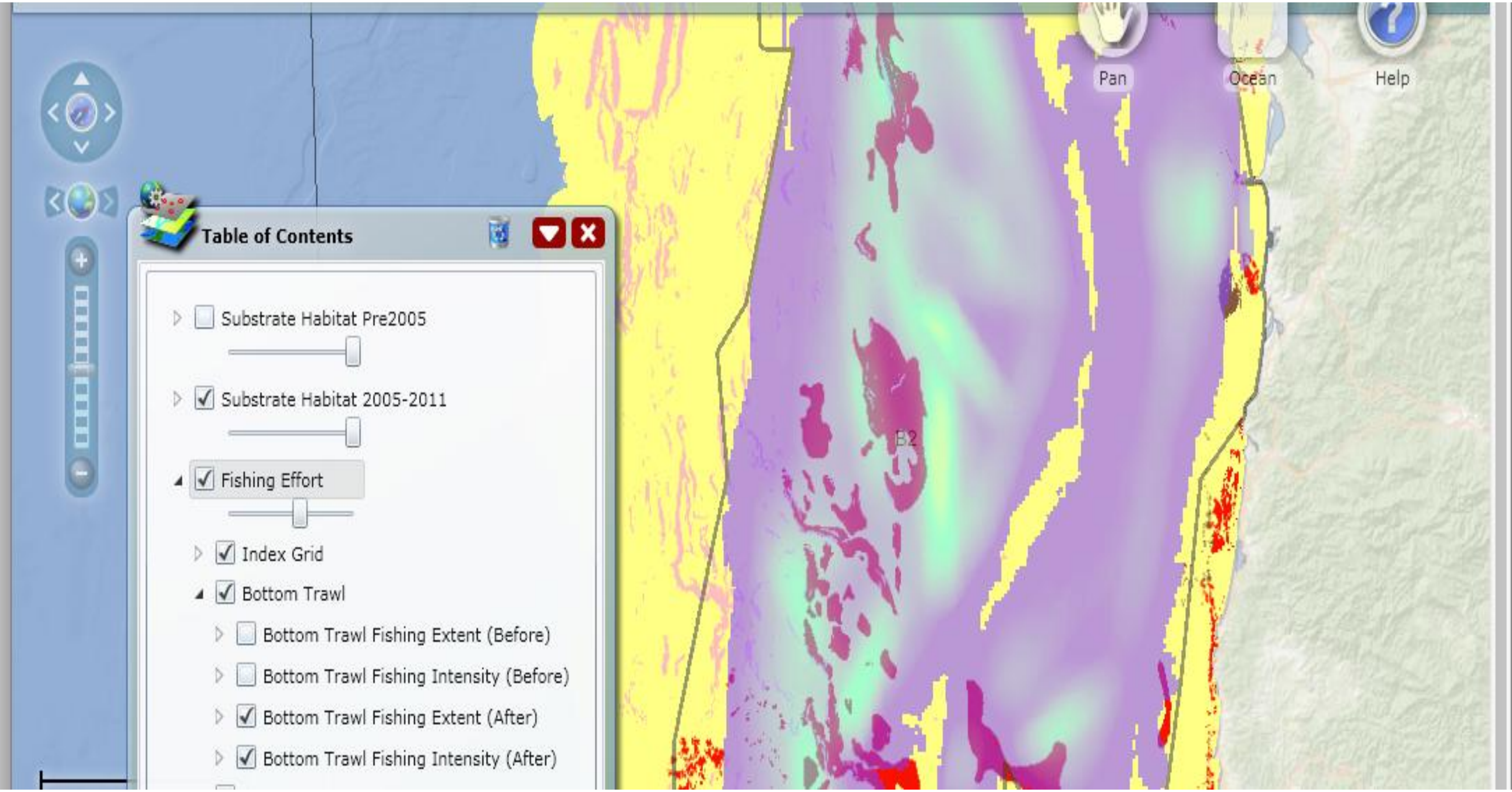


Download GIS Data and link to Metadata

Map Services: View data in Free online viewers



Interactive Map Site
Bottom Trawl Intensity and Extent Overlay on Substrate



Additional Phase I Products in Support of 2011 Five-Year Review

- Life history summaries using updated information for 91 groundfish species:
  - Followed species grouping for FMP, flatfishes (65), other flatfishes (66), rockfishes (90), other rockfishes (85), and other groundfishes(120)
- Significant updates have been made to the Habitat Use Database that was developed for the 2005 groundfish EFH EIS.

Additional Phase I Products in Support of 2011 Five-Year Review

Available Habitat Relevant Models, e.g.,

- Habitat suitability probability models
- Ecopath/Ecosim models
- Atlantis model

Additional Phase I Products in Support of 2011 Five-Year Review

Newly Identified Non-Fishing Threats and Potential Adverse Effects to EFH beyond those identified in FMP:

- Alternative energy development
- Desalination
- Activities that contribute to climate change and ocean acidification
- LNG

Additional Phase I Products in Support of 2011 Five-Year Review

Prey species (loss of prey species may be an adverse effect on EFH)

- Summary of new information on prey species

Recommendations

1. Analyze new information gathered in the EFHRC Phase 1 Report in order to inform decisions to modify the 2006 groundfish EFH regulations.
2. Conduct visual, no-take surveys of fishes and habitats inside and outside current EFH closures, in order to evaluate the effectiveness of these conservations areas.
3. Conduct high-resolution seafloor mapping (bathymetry, back-scatter, and associated interpreted substrata types), particularly on the shelf and slope associated with EFH conservation areas.
4. Improve the Habitat Use Database (HUD):
5. Improve understanding of habitat condition, including adverse effects of fishing gear to EFH, across the geographic range of groundfishes.
6. Advance understanding of the effects of a changing climate on groundfishes.
7. Evaluate potential adverse effects from fishing and non-fishing activities on the major prey species in the diets of groundfishes.

Acknowledgements

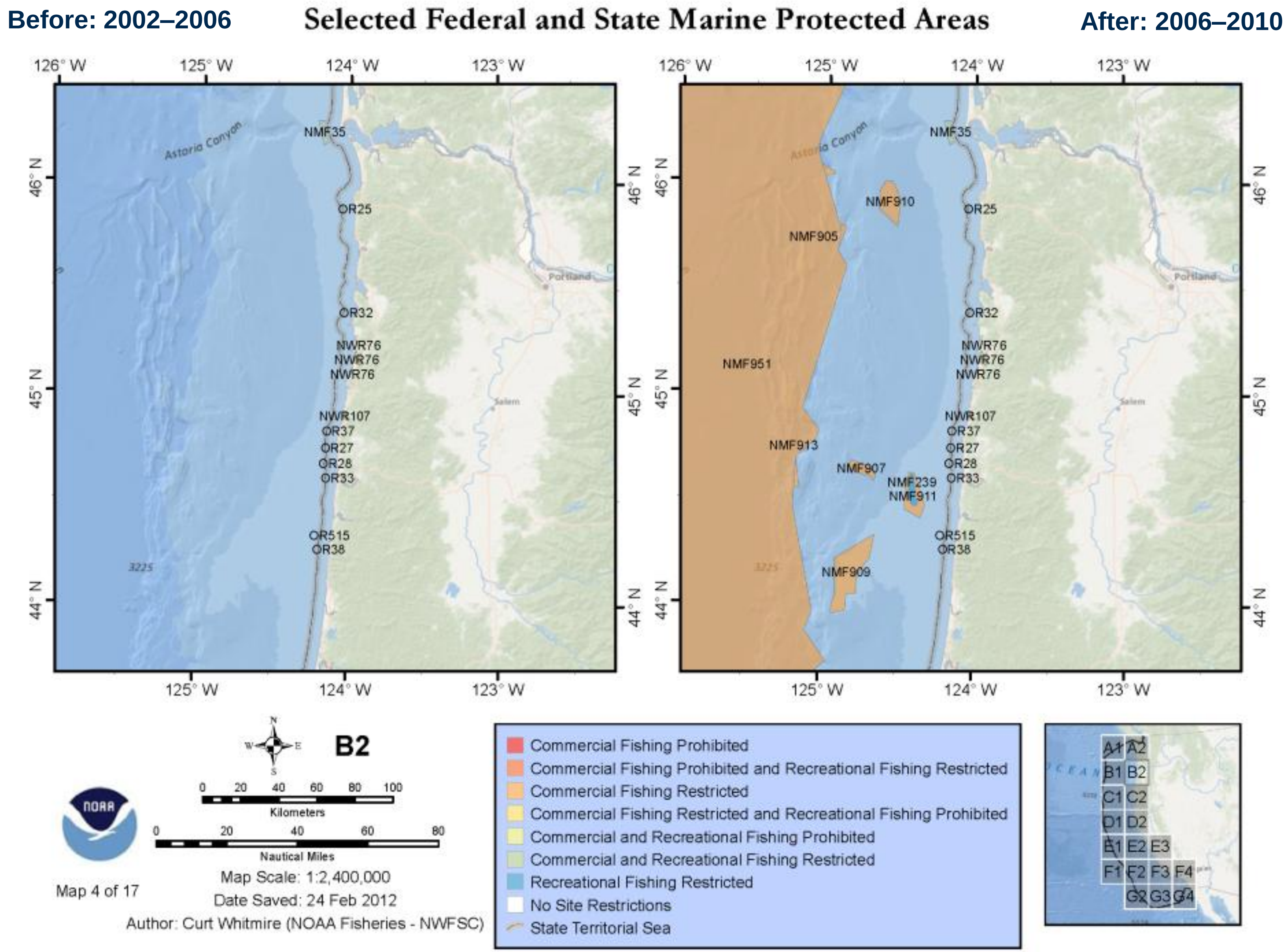
- Funding from the NMFS Office of Habitat Conservation to the NW and SW Fisheries Science Centers
- NMFS NW and SW Regions
- Pacific Fisheries Management Council

  K. Griffin, C. Tracy
- NMFS NW and SW Science Centers
- Oregon State University Cooperative Institute for Marine Resources Studies
- University of California Santa Cruz Cooperative Institute for Marine Ecosystems and Climate

How does meeting the terms of confidentiality impact the display of bottom trawl effort?

	Inside + Outside				Outside	
Latitude Range	BEFORE	% Coast	AFTER	% Coast	BEFORE	AFTER
48 - 49	83,719	8.3%	32,379	2.9%	1.0%	6.9%
47 - 48	87,351	8.7%	117,673	10.7%	0.5%	0.4%
46 - 47	106,758	10.6%	151,336	13.8%	0.1%	0.1%
45 - 46	87,864	8.7%	150,592	13.7%	0.8%	1.4%
44 - 45	57,119	5.7%	95,984	8.7%	1.1%	0.5%
43 - 44	58,631	5.8%	105,058	9.6%	1.7%	0.5%
42 - 43	57,289	5.7%	61,419	5.6%	2.1%	3.1%
41 - 42	93,191	9.2%	94,557	8.6%	0.1%	0.2%
40 - 41	72,037	7.1%	79,091	7.2%	0.2%	0.2%
39 - 40	50,802	5.0%	41,962	3.8%	0.4%	0.5%
38 - 39	38,028	3.8%	31,016	2.8%	1.4%	1.6%
37 - 38	90,268	8.9%	69,626	6.3%	0.4%	1.9%
36 - 37	46,183	4.6%	20,613	1.9%	0.5%	12.0%
35 - 36	19,774	2.0%	4,880	0.4%	4.5%	58.8%
34 - 35	52,194	5.2%	39,560	3.6%	6.7%	9.4%
33 - 34	8,434	0.8%	2,022	0.2%	2.2%	4.6%
32 - 33	0	NA	0	NA	NA	NA
Coastwide	1,009,642	100.0%	1,097,767	100.0%	1.1%	1.8%

Selected Federal and State Marine Protected Areas



Agenda Item H.6.b
EFHRC Report 1
September 2012

Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat Report to the Pacific Fishery Management Council Phase 1: New Information

Groundfish Essential Fish Habitat Review Committee

August 23, 2012

EXECUTIVE SUMMARY

The designations and detailed descriptions of essential fish habitat (EFH) in the fishery management plans (FMPs) are used during the EFH consultation process to determine where and for what species EFH has been designated in the project area. The analyses of the adverse effects from the proposed action, and potential conservation measures that avoid, minimize, or offset those effects, are informed by the information contained in the FMP.

The regulatory guidelines for implementing the EFH provisions of the Magnuson-Stevens Act (MSA) state that Regional Fishery Management Councils and the National Marine Fisheries Service (NMFS) should periodically review the EFH provisions of FMPs and revise or amend EFH provisions as warranted, based on available information (50 CFR 600.815(a)(10)). This review included evaluating published scientific literature and unpublished reports, soliciting input from interested parties, and searching for previously unavailable information on groundfish stocks identified in the Pacific Coast Groundfish FMP. The Council may provide suggested changes to existing EFH to NMFS for their approval, if the information warrants changes. The regulatory guidance provides that a complete review should be conducted periodically, but at least once every five years. Pacific Coast Groundfish EFH was first designated in 1998 by the Council as part of Amendment 11 to the groundfish FMP. This review was initiated in 2010.

This Phase 1 report summarizes the results of the review of information that is new or newly available since the last Groundfish EFH Review was concluded in 2006. The report includes a description of the general requirements and elements of EFH, including guidance for periodic reviews; a summary of existing descriptions of EFH for Pacific Coast groundfish; updated maps of seafloor habitat types and bathymetry; the currently available information on the distribution of Pacific Coast groundfish; a summary of models to predict groundfish distribution relative to habitat types, as well as trophic and ecosystem models useful for groundfish EFH; summaries of new information on the life history and habitat requirements of the 91 species in the Pacific Groundfish FMP; updated information on threats to groundfish EFH and prey species, both from fishing and non-fishing activities; and identification of research needs to further refine groundfish EFH.

The second phase of this review will consider potential changes to EFH, based on the new information produced in Phase 1, and presents those to the Council. The EFH review is concluded at that point. In Phase 2, the Council may issue a request for proposals (RFP) to all interested parties for changes to the identification and description of EFH that are based on the information in the Phase 1 report. If the Council determines that changes to EFH identification and descriptions are necessary, it then proceeds with a third phase that utilizes the appropriate management tool to revise EFH.

ES-2: CURRENT DESIGNATIONS FOR PACIFIC COAST GROUNDFISH EFH, HAPC, AND ECOLOGICALLY IMPORTANT HABITAT CLOSED AREAS

Section 2 summarizes existing EFH for Pacific Coast Groundfish contained in Amendment 19 (Figure ES-1) (PFMC 2008; NMFS 2005) and the 2006 Final Rule (71 FR 27408), including habitat areas of particular concern (HAPC) (Figure ES-2) and EFH closed areas (Figure ES-3. Amendment 19 provided descriptions of EFH for each species and life stage that were developed through an extensive review and synthesis of the literature available in 2005 (PFMC 2008). Appendix B provided a review of life history for each species, text descriptions, and tables that summarize, for each species, the habitats used by each life history stage and the important features of those habitats.

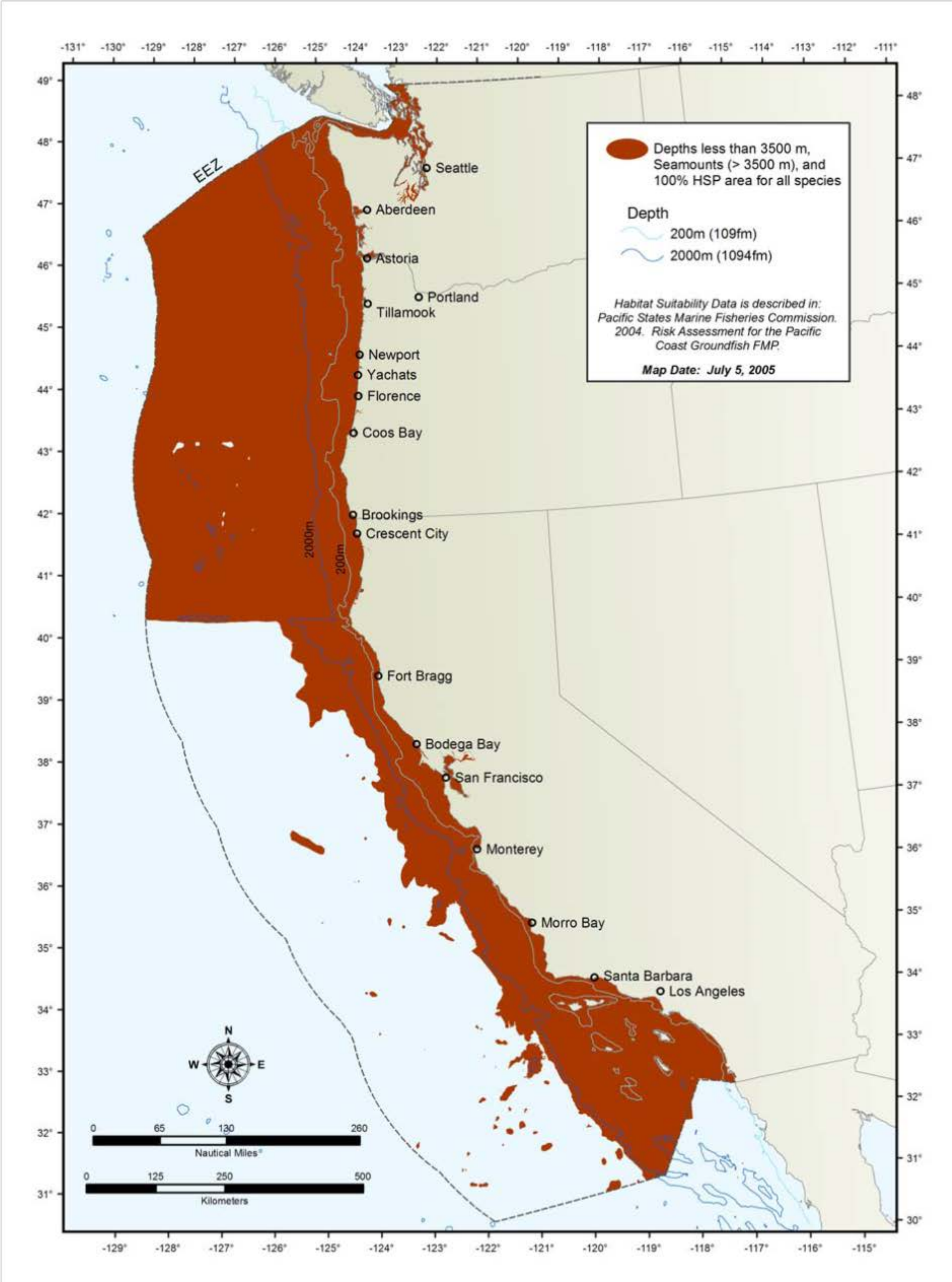


Figure ES-1. Current essential fish habitat description for the Pacific Coast groundfish.

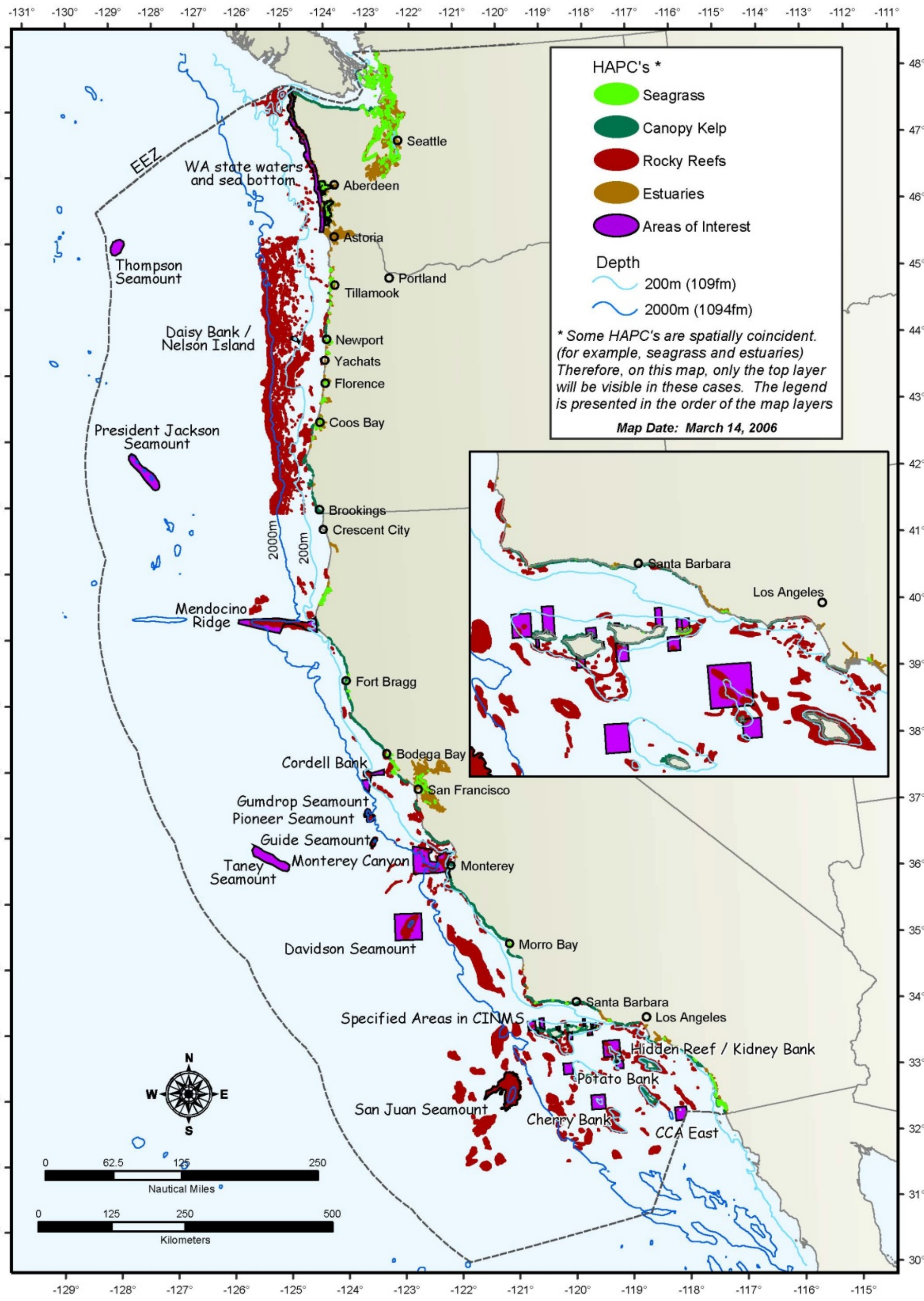
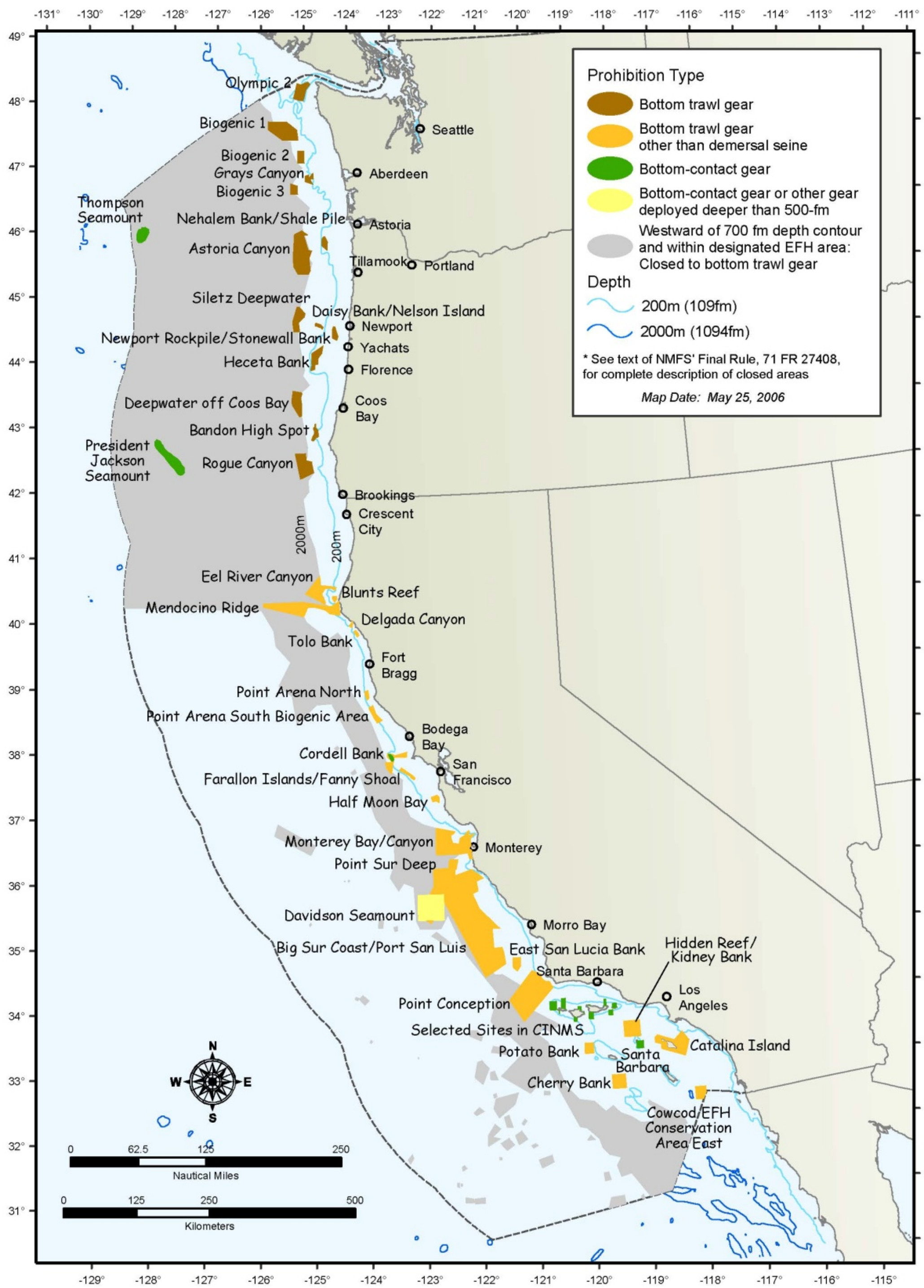


Figure ES-2. Groundfish HAPC.



EFH area closures to protect Pacific Coast groundfish habitat - Coastwide.

Figure ES-3. Ecologically important habitat closed areas.

ES-3 REVIEW OF NEW INFORMATION ON GROUNDFISH ESSENTIAL FISH HABITAT

Section 3 presents new information on habitats that has become available since the EFH designation in 2006 for the 91 species of Pacific coast groundfishes. There are five sub-sections, each accompanied by comprehensive Appendices:

- Section 3.1 summarizes an inventory of responses to the NMFS data call (Appendix B).
- Section 3.2 describes (in both text and maps) new information on the distribution of seafloor habitat types, including data on bathymetry, physical habitat interpretations, and biogenic components of habitat (Appendices C, D, E, and F).
- Section 3.3 includes summaries of recent information related to habitats for each life-history stage of the five species groups designated in the FMP for Pacific Coast groundfishes (i.e., flatfishes, other flatfishes, rockfishes, other rockfishes, and other groundfishes) (Appendix G).
- Section 3.4 is a review of new modeling efforts relevant to the determination and designation of EHF for Pacific groundfishes (Appendix H).
- Section 3.5 is an update on the Habitat Use Database (HUD) (Appendix I).

ES-3.1 Inventory of Responses to NMFS Data Call

Thirty-nine sources of data relevant to groundfish EFH that had become available since 2006 were received through the NMFS data call (see Appendix B for details on each item). All of these data can be used to revise the descriptions of EFH and HAPC or to evaluate risk to EFH. Information associated with the NMFS data call comprised four general categories:

1. Four sources of new information on the distribution and extent of seafloor maps, seafloor data, and interpreted Pacific Coast groundfish habitat types were received.
2. Eight sources of new and updated fishery-independent data were received on groundfish species and associated components of habitat.
3. Twenty sources of new and updated information or data were received on the distribution of habitats, including two coast-wide oceanographic datasets, 12 surveys of deepwater, structure-forming invertebrates, two models of deep coral distributions, an assessment of 146 West Coast estuaries, an online data library and maps of California, and two visual surveys of fish and habitats.

Seven sources of new and updated information were received on existing and emerging threats to Pacific Coast groundfish EFH. These included five fishery-dependent datasets and two sources of information on non-fishery threats.

ES-3.2: Bathymetry and Seafloor Habitat Maps

Pacific coast-wide comparative maps of bathymetry (Figure ES-4) acoustic coverage (Figure ES-5) and seafloor substrate (Figure ES-6) and biogenic habitat observations (ES-7 to ES-9) in 2005 and 2011 were compiled for the Exclusive Economic Zone (EEZ) off Washington, Oregon and California from all available sources. Seafloor imagery consisted of gridded bathymetry data sets (Digital Elevation Models or DEMs), and backscatter imagery. Contour data, either interpolated or derived from DEMs, were not included.

The map products displayed in this report were intended to provide a coast-wide overview of available data, and the methods chosen for display were designed to illustrate the range of values on that scale. There are other methods for displaying the same data that may provide alternative interpretations of temporal or spatial differences depending on such factors as geographic scale, value bins, or display algorithms. A data portal is available to allow access to maps and data from this report so that interested parties can manipulate data for specific purposes: http://efh-catalog.coas.oregonstate.edu/overview/.

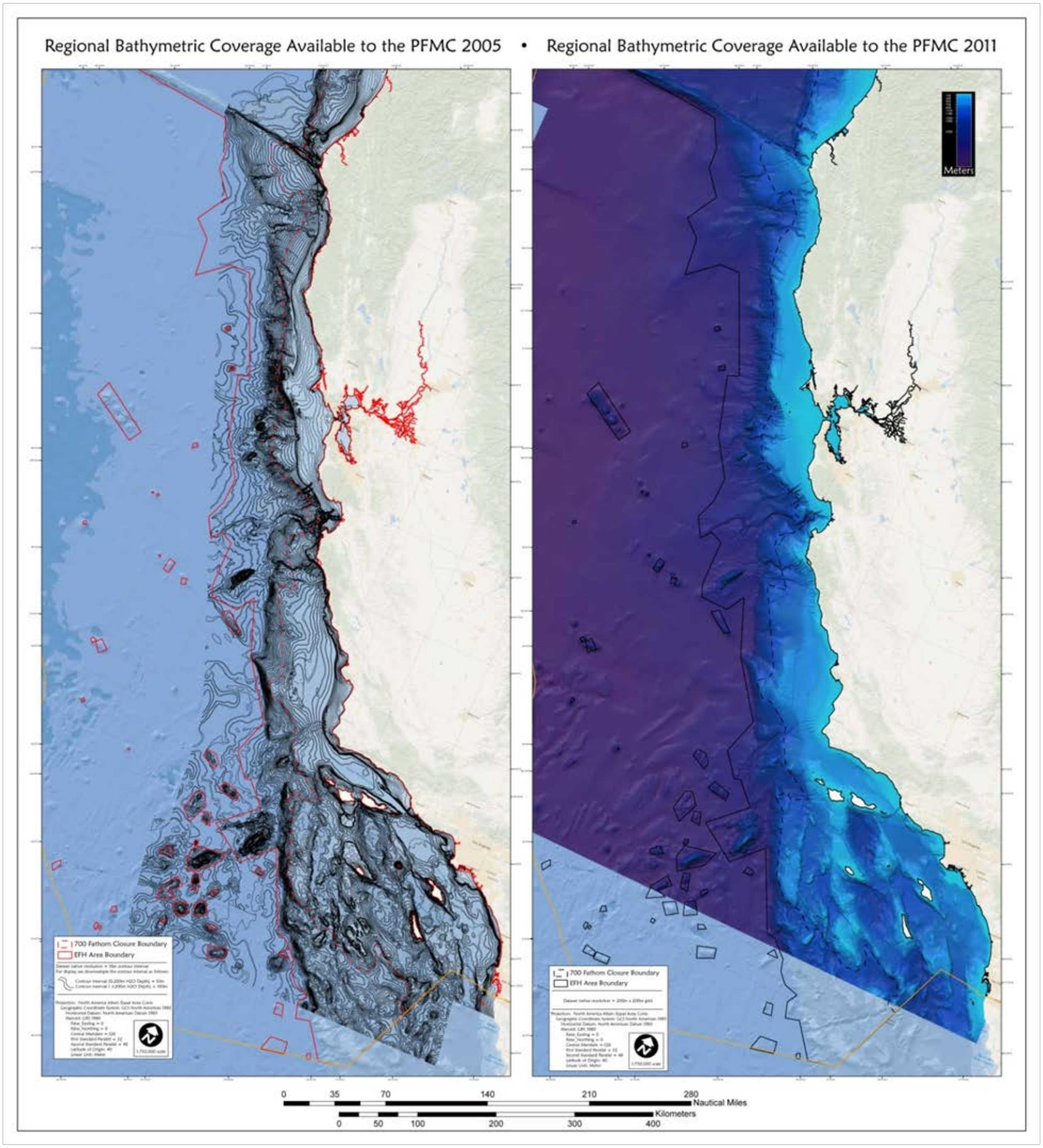


Figure ES-4. California regional bathemetry pre-2005 and post 2005; from Appendix C-3.

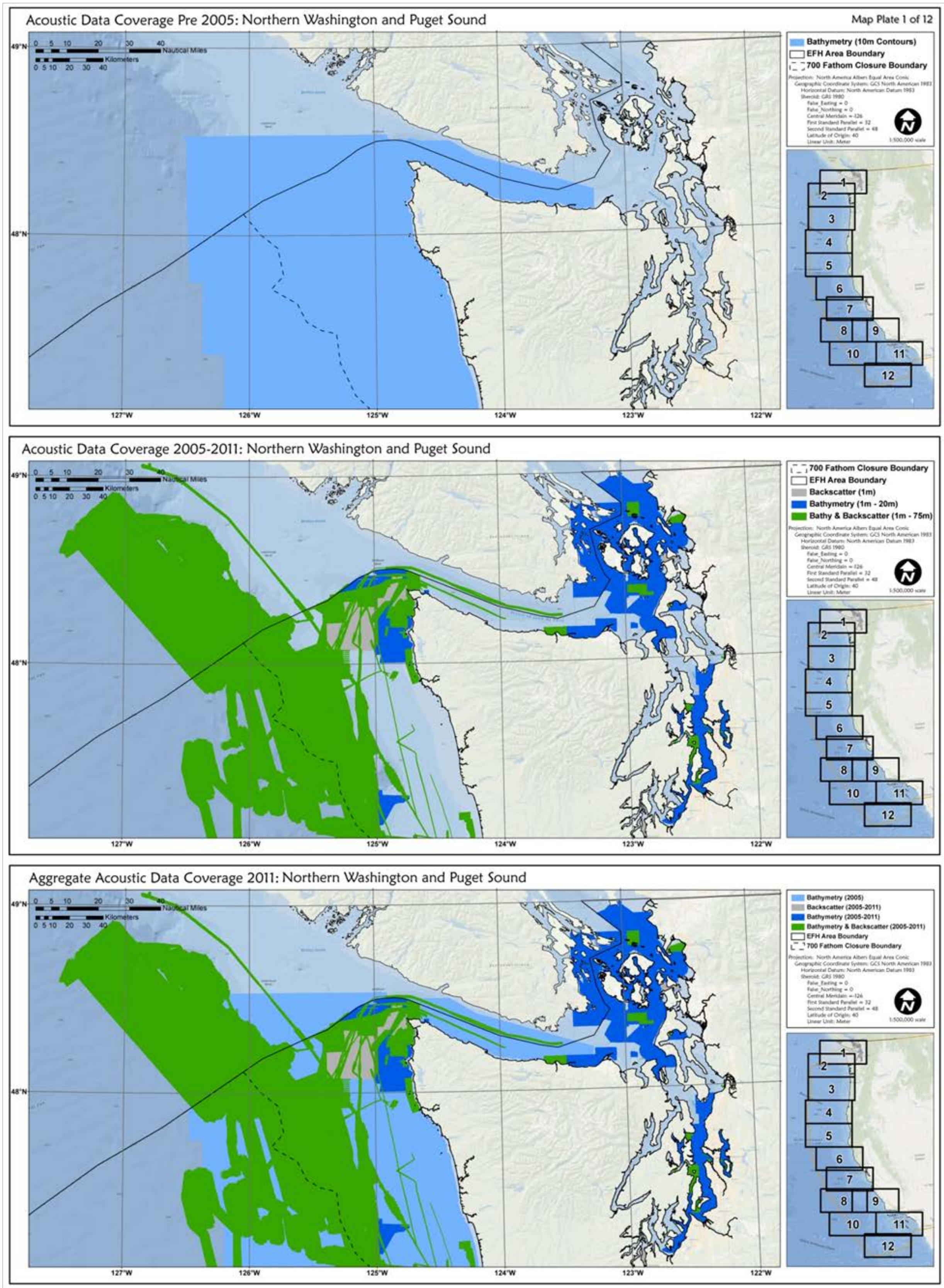


Figure ES-5. Example of imagry plate From Appendix C-1.

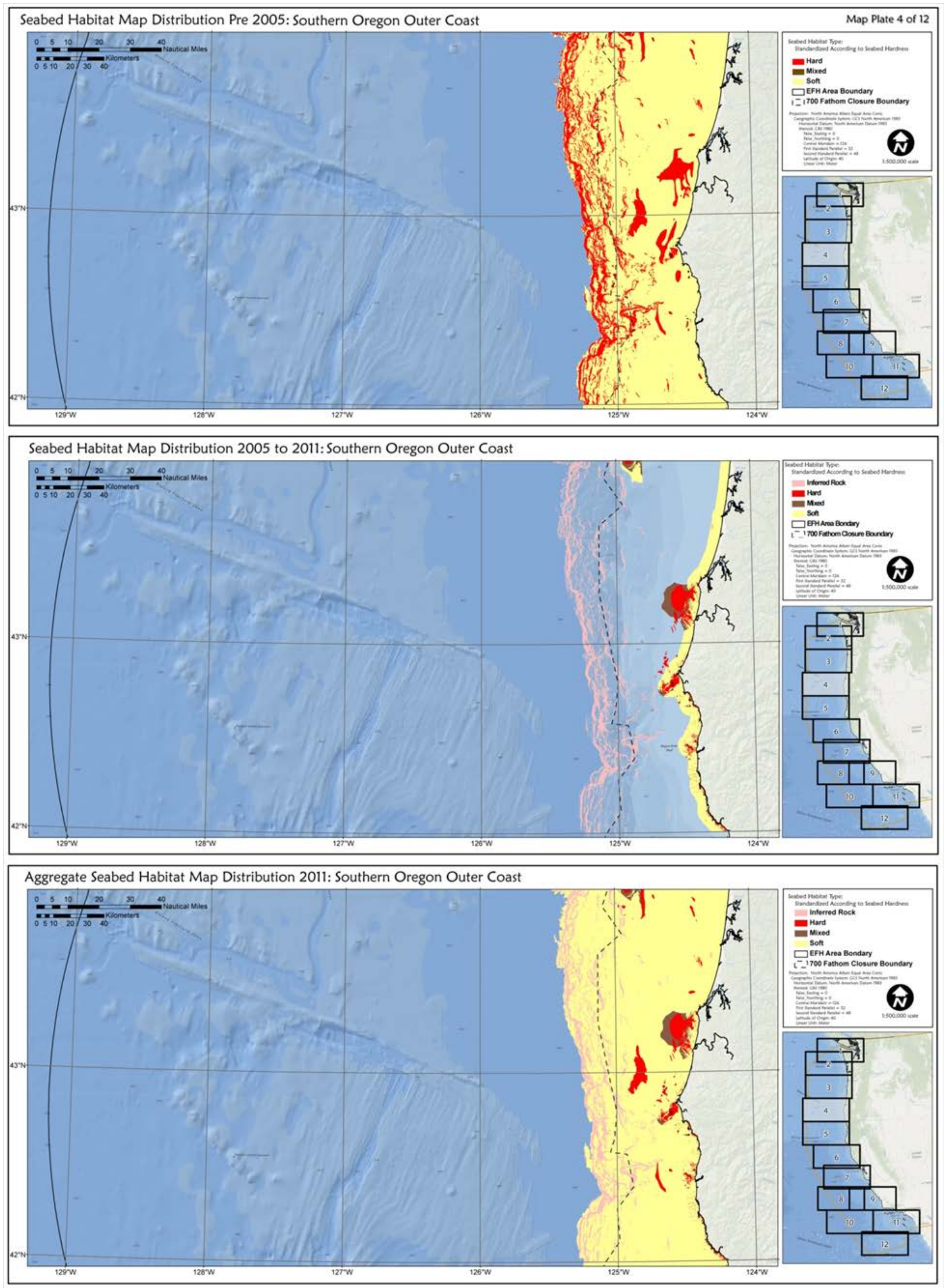


Figure ES-6. Example of bathymetry/substrate habitat plate from Appendix C-2.

Appendix D maps depict the spatial distribution of selected observations of corals and sponges from visual surveys conducted by a number of agencies and institutions and by a variety of collection methods. Many of the locations of observations are included in a national database prepared under the auspices of NOAA's Deep-Sea Coral Research and Technology Program (NOAA 2011). Although there are a number of records of additional observations recorded at various research institutes, this database is currently the most comprehensive source of electronically available records of coral and, to a lesser extent, sponge observations in the region.

Compared to the 2006 groundfish EFH review, this database represents a major advancement in access and dissemination of records of coral and sponge presence in the region. Furthermore, this database was not available during the Amendment 19 process.

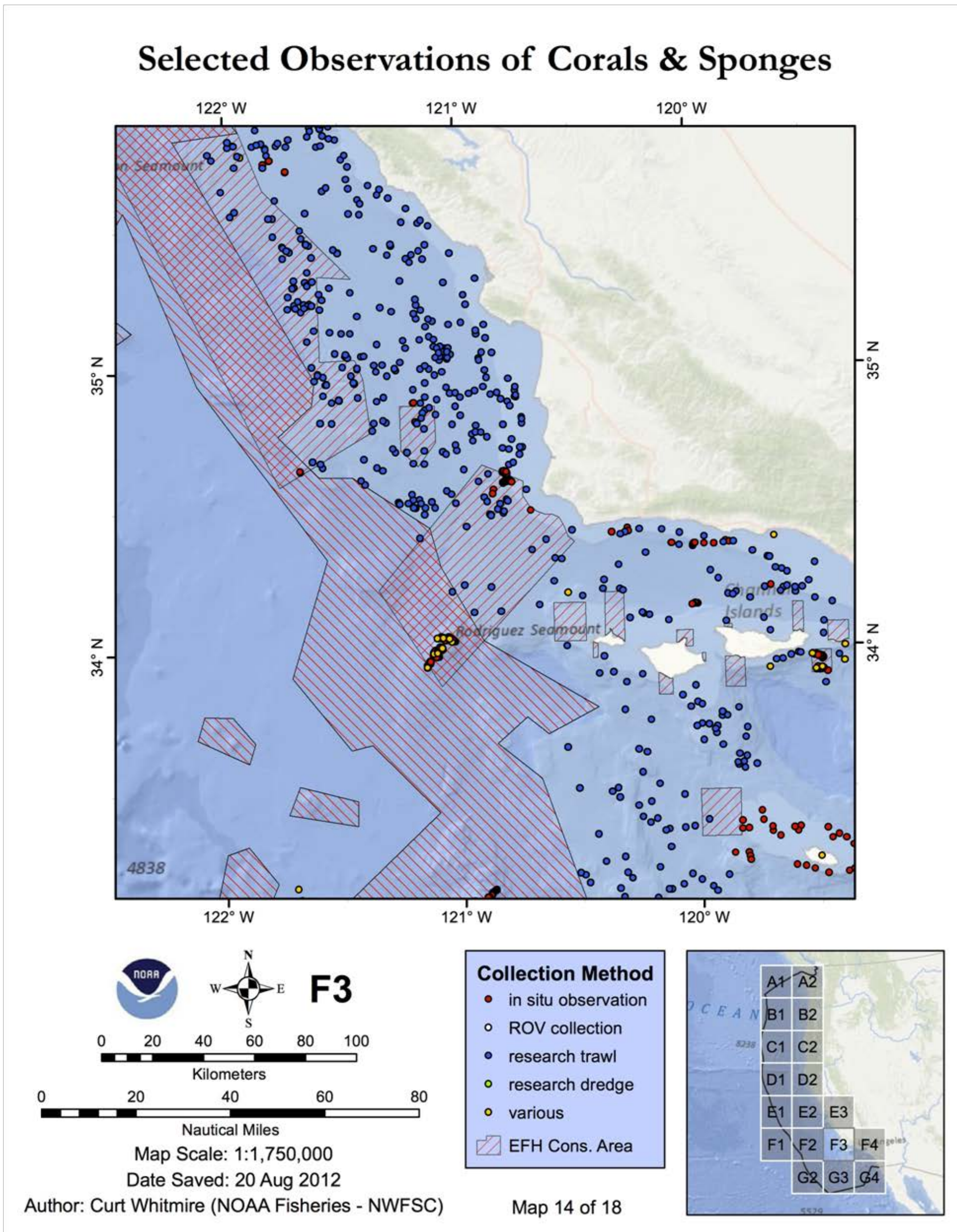


Figure ES-7. Example of map from Appendix D, selected observations of corals and sponges.

Appendix E plates depict the spatial distribution of standardized survey catch of corals and sponges within two time periods: "Before" (2003-05 survey cycles) and "After" (2006-10 survey cycles) implementation of Amendment 19 regulations. The sole data source for the map layers is catch records from the WCGBTS.

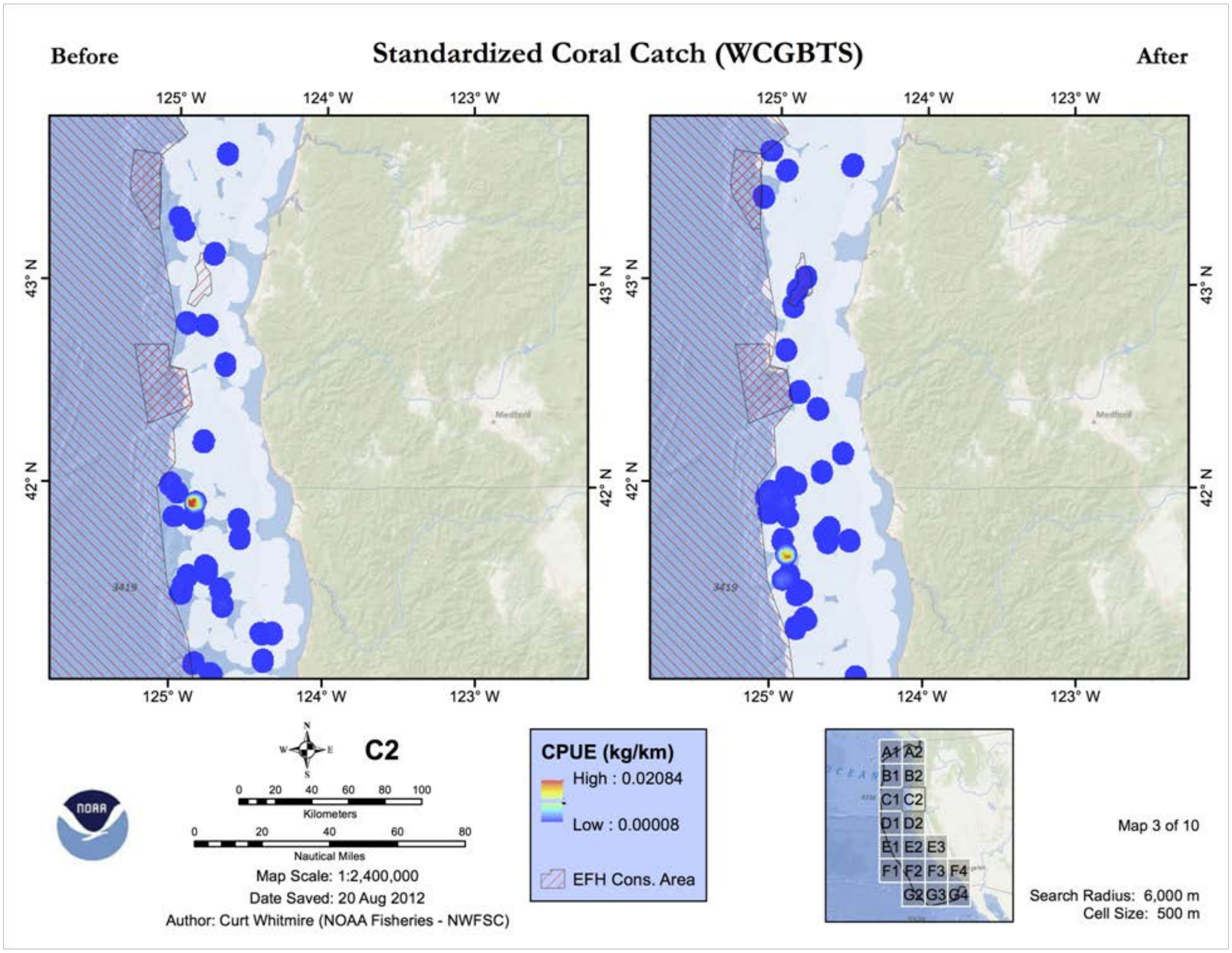


Figure ES-8. Example of plate from Appendix E-2 showing the distribution of coral CPUE (excluding sea pen/whips) off the Northern California Coast pre- and post- Amendment 19.

Appendix F Plates depict the spatial distribution of standardized commercial bycatch of corals and sponges within two time periods: "Before" (3 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of limited-entry trawl tows were compiled from one source: observer records from the WCGOP database. The WCGOP database includes records of trips for vessels using a variety of bottom trawl gear configurations, including small and large footrope groundfish trawl, set-back flatfish net, and double rigged shrimp trawl, to name a few. Records of tows using mid-water trawl gear were not included in this analysis, since observers recorded no bycatch of corals or sponges using this gear type.

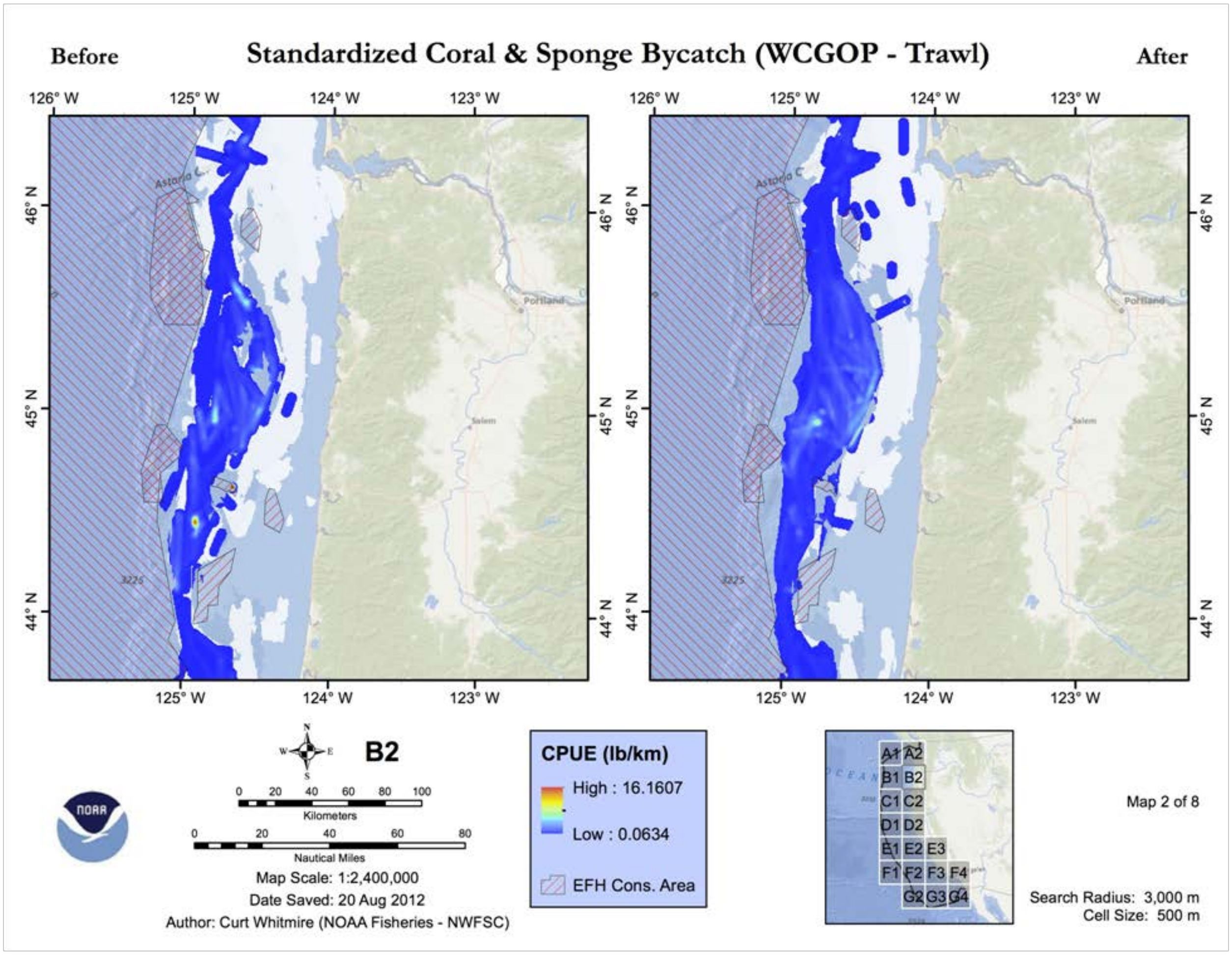


Figure ES-9. Example plate from Appendix F-1: the distribution of coral and sponge CPUE (lb/km) as bycatch from the West Coast Groundfish Trawl Observer Program before and after the implementation of Amendment 19 regulations.

ES-3.3: Associations of Groundfish with Habitats

Knowledge of spatial associations (e.g., range and depth designations, distribution and abundance estimates, habitat associations, environmental correlates) and trophic interactions (e.g., diet composition, predators, foraging habitat, trophic position) is necessary for an accurate description of EFH. A thorough search was conducted for each of the 91 current FMP species in order to identify and compile all relevant new literature.

Thorough species accounts that incorporate all relevant information for each life stage (i.e., eggs, larvae, juveniles, adults) were constructed for the four flatfish species (Appendix G-1), Other Flatfish (Appendix G-2), Rockfishes (Appendix G-3), Other Rockfishes (Appendix G-4), and Other Groundfish (Appendix G-5). These are included as analogs to the species accounts provided by McCain et al. 2005 (incorporated into the groundfish FMP) as a way to gauge the possible future utility of such an effort for all 91 species. The summaries generally synthesize new information on spatial associations and trophic interactions that are pertinent to the designation of EFH for each of the five designated groundfish groups.

ES-3.4: Modeling Distribution of Seafloor Habitat Types

Since 2005, a significant amount of research and modeling has been conducted regarding biogenic habitat. Habitat surveys have been conducted using sidescan and multibeam sonar, human-occupied submersibles, and remotely operated vehicles (ROVs). Several surveys have documented the interactions between groundfishes, other demersal fishes, invertebrates, and benthic habitats. Of particular importance in the future will be the determination of the distribution and abundance of biogenic species including deep water corals and their role and importance to the groundfish ecosystem.

The EFHRC considered using new modeling applications that could be useful for assessing groundfish habitat suitability. Models can be used to infer distribution of habitats or species in areas that lack data and to increase the precision of distribution maps.

A habitat suitability probability (HSP) model, termed the "EFH Model" (PFMC 2011a), was developed in 2004 by NMFS and outside contractors, and used in the 2008 West Coast Groundfish FMP (MRAG Americas Inc. et al. 2004). The model incorporated three basic variables (seafloor substratum type, depth, and location) to describe and identify EFH for each life stage of federally managed groundfishes and presents this information graphically as an HSP profile (PFMC 2011a). Based on the observed distribution of a groundfish species/life–stage in relation to the input variables, locations along the West Coast were assigned a suitability value between 0 and 100 percent in the creation of the HSP profile. These scores and their differences among locations were used to develop a proxy for the areas that can be regarded as "essential." The EFH Model provided spatially explicit HSP estimates for 160 of 328 groundfish species/life stage combinations, including the adults of all FMU species (PFMC 2011a). The remaining 168 species/life stages were not completed because of insufficient data. In 2005, when the HSPs of all species/life stages were combined, all waters and bottom areas at depths less than 3,500 m were determined to be groundfish EFH.

Ecopath, typically coupled with the dynamic companion model Ecosim, has become the standard for trophodynamic modeling not only off the West Coast but also throughout the world's marine and freshwater regions. Ecopath is a static (typically steady–state) mass balance model of trophic structure that integrates information from diet composition studies, bioenergetics models, fisheries statistics, biomass surveys, and stock–assessments (Field 2004). It represents the initial or reference state of a food web. Ecosim is a dynamic model in which biomass pools and vital rates change through time in response to simulated perturbations. Different species or functional groups are represented in Ecopath as biomass pools with their relative sizes regulated by gains (consumption, production, immigration) and losses (mortality, emigration). Biomass pools are typically linked by predation, though in some cases reproduction and maturation information is also included. Fisheries act as super–predators, removing biomass from the system. The Ecopath model framework allows investigators to evaluate how well conventional wisdom about a system of interest holds when basic bookkeeping tools are applied, to pool together species and into a coherent food web, and to evaluate trophic interactions (Field 2004). The combined model allows users to simulate ecological or management scenarios, such as the response of the system to changes in primary productivity, habitat availability, climate change, or fishing intensity (Harvey et al. 2010).

The primary tool used in integrated ecosystem modeling (especially in Australia and the United States) is the Atlantis Model (Fulton et al. 2004). Although it was originally focused on biophysical and fisheries aspects of an ecosystem, Atlantis has been further developed to consider all parts of marine ecosystems (i.e., biophysical, economic and social). The systematic exploration of the optimum level of model complexity is one of the key strengths of the Atlantis Model. It can be used to identify which aspects of spatial and temporal resolution, functional group aggregation, and representation of ecological processes are vital to model performance. The Atlantis modeling approach primarily has been used to address fisheries management questions, but increasingly is being implemented to consider other facets of marine ecosystem use and function (CSIRO 2011).

ES-3.5: Habitat Use Database

The Habitat Use Database (HUD) was developed byNMFS NWFSC scientists as part of the 2005 Pacific Coast Groundfish Essential Fish Habitat Environmental Impact Statement (EFH EIS) (NMFS 2005). Specifically, the HUD was designed to address the need for habitat-use analysis supporting groundfish EFH, HAPCs, and fishing and non-fishing impacts components of the EFH EIS. The 2005 database captured information on habitat use by groundfishes covered under the FMP as documented in the updated life history descriptions found in Appendix B.2 of the EFH Final EIS, (NMFS 2005). The groundfish life history descriptions are the product of a literature review that collected and organized information on the range, habitat, migrations and movements, reproduction, growth and development, and trophic interactions for each of the FMU species by life stage.

In addition to providing wide public access to the HUD through PaCOOS, the NWFSC also made data updates and amendments, platform changes, and taxonomic additions to the database over the period from 2006 to present. The 2011 HUD now includes species other than FMP species, specifically species identified under Oregon's Nearshore Strategy (Don et al., 2006).

Since 2005, 126 new species from the potential list of 247 species were added to the HUD as new species records (Appendix I-2). Therefore, in summary the taxonomic richness or "scope" of the 2011 HUD grew from 193 to 323 with the addition of the four new species to the groundfish FMP, the four coastal pelagic species, and the 126 Oregon Nearshore Plan species (Appendix I-3; note the loss of four predator species in the 2011 HUD).

ES-4.0: FISHING ACTIVITIES THAT MAY AFFECT EFH

The MSA requires FMCs for each FMP to identify fishing activities that may adversely affect EFH and to minimize adverse effects of those activities to the extent practicable. Fishing activities should include those regulated under the Pacific Coast Groundfish FMP that affect EFH identified under any FMPs, as well as those fishing activities regulated under other FMPs that affect EFH designated under the Pacific Coast Groundfish FMP.

Sections 4.1 and 4.2 document Fishing Effects on EFH by Gear Type and by Habitat Type, respectively.

ES-4.3: Information on Habitat Effects of Fishing Gear

Since 2005, there have been several new publications, including peer-reviewed literature, white papers and technical memorandums, relevant to West Coast groundfish fisheries that have studied: 1) the effects of fishing gear on benthic habitats; 2) predictive modeling of biogenic habitats; and 3) the effects of fishing gear-related marine debris on habitats. An annotated bibliography of recent articles is presented in Appendix J.
The recent studies on the effects of fishing gear on benthic habitats are primarily focused on the effects of trawling and marine debris

ES-4.4: Magnuson Act Fisheries Effects

Figures in Appendix K-1 depict the spatial distribution of commercial bottom trawl effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Appendix K-2 depicts similar comparisons for mi-water trawl fisheries and Appendix K-3 depicts similar comparisons for fixed gear fisheries.

ES-4.5: Non-Magnuson Act Fisheries Effects

The EFHRC requested spatial footprints of state-managed bottom contact gear fisheries, for use in the groundfish EFH review. Information was either provided or available on line for the Washington's Dungeness crab and spot prawn fisheries, the Oregon's Dungeness crab, hagfish, and pink shrimp fisheries, and California's California halibut fishery.

ES-5.0: Newly Identified Threats to EFH

The MSA requires FMCs and NMFS to identify non-fishing activities that may adversely affect EFH, as well as actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, mitigate, or otherwise offset the adverse effects. Appendix D to the FMP includes 31 such activities and associated conservation measures, and The EFHRC identified four additional non-fishing activities: alternative energy development, liquefied natural gas projects, desalination, and activities that contribute to climate change and ocean acidification. The report contains sections on potential adverse effects to EFH and potential conservation measures for the newly identified threats.

ES-6.0: PREY SPECIES

The EFH guidance does not explicitly specify criteria for identifying "major" prey species. However, even with clear guidance, identifying which prey items constitute major prey for Pacific Coast groundfishes is highly dependent on the quality and availability of data on diet composition. While some groundfish species have diet composition samples taken over a broad geographic and temporal range, diet analysis for many species has been limited to a single time of year at a single location with a small sample size, and for some groundfish there is no diet data available. This makes broader generalizations about the diet across the range of the species uncertain, even when the studies are aggregated across species. Therefore, even where quantitative data do exist, the EFHRC did not attempt to identify "major" prey or distinguish "major" prey from other prey. For this report, the EFHRC took a general approach and identified prey at broader taxonomic levels, based on a pre-existing literature reviews.

There is not a large body of literature on Pacific groundfish diets since 2006; however significant details on diet composition from the literature were not included in the Amendment 19 documentation. In addition, several groundfish stock assessments were completed in 2009 and 2011, some of which included information on groundfish diet composition.

ES-7: INFORMATION AND RESEARCH NEEDS

The following information and research are recommended in order to improve the designation, monitoring, and effectiveness of groundfish EFH:

1. Recommendations to analyze the new information gathered in the EFHRC groundfish EFH Phase 1 Report, in order to inform decisions to modify the 2006 groundfish EFH regulations.

2. Recommendation to conduct visual, no-take surveys of fishes and habitats inside and outside current EFH closures in order to evaluate the effectiveness of these conservations areas.

3. Recommendation to conduct high-resolution seafloor mapping (bathymetry, back-scatter, and associated interpreted substrata types), particularly on the shelf and slope associated with groundfish EFH conservation areas.

4. Recommendation to improve the Habitat Use Database (HUD):

5. Recommendation to improve our understanding of habitat condition, including adverse effects of fishing gear to EFH, across the geographic range of groundfish,

6. Recommendation to advance our understanding of the affects of a changing climate on West Coast groundfishes.

7. Recommendation to evaluate potential adverse effects from fishing and non-fishing activities on the major prey species in the diets of west coast groundfish.

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LIST OF ACRONYMS AND ABBREVIATIONS

ASHOP	At-Sea Hake Observer Program
ATSML	Active Tectonics and Seafloor Mapping Lab
AUV	autonomous underwater vehicle
BCCA	bottom contact closed area
BTCA	bottom trawl closed area
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CDFG	California Department of Fish and Game
CHS	Center for Habitat Studies
CHTG	California halibut trawl grounds
CPS	coastal pelagic species
CPUC	catch per unit catch (of groundfish)
CPUE	catch per unit effort
CRCP	Coral Reef Conservation Program
CSMP	California Seafloor Mapping Project
CSUMB	California State University Monterey Bay (SFL:) (SML: Seafloor Mapping Lab)
DEM	digital elevation models
DSC	deep-sea coral
DSCRTP	Deep Sea Coral Research and Technology Program
EEZ	exclusive economic zone
EFH	essential fish habitat
EFHRC	Essential Fish Habitat Review Committee
EIS	environmental impact statement
EMF	electromagnetic field
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
FMC	Fishery Management Council
FMP	fishery management plan
FMU	fishery management unit
GHG	greenhouse gases
GIS	geographic information system
HAPC	habitat area of particular concern
HSP	habitat suitability probability
HU	hydrologic unit
HUD	Habatat Use Database
IP	intrinsic potential
LEI	long-term effect index
LNG	liquefied natural gas
LWD	large woody debris
MHHW	mean high high water (sea level)
MPA	marine protected area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSF	multi-stage flash (distillation)
mt	metric ton
NCC	Northern California Current
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NPFMC	North Pacific Fishery Management Council

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

NWFSC	Northwest Fisheries Science Center (NMFS)
NWR	Northwest Region (NMFS)
OCNMS	Olympic Coast National Marine Sanctuary
ONMS	Office of National Marine Sanctuaries
PaCOOS	Pacific Coast Ocean Observing System
PFMC	Pacific Fishery Management Council
ppt	parts per thousand
PS	Puget Sound
PSMFC	Pacific States Marine Fisheries Commission
RO	reverse osmosis (distillation)
ROV	remotely operated vehicle
SAV	submerged aquatic vegetation
SCV	submerged combustion vaporization
SFMI	structure forming marine invertebrates
SGH	surficial geologic habitat
SWFSC	Southwest Fisheries Science Center (NMFS)
SWR	Southwest Region (NMFS)
USGS	United States Geological Survey
WCGBTS	West Coast groundfish bottom trawl survey
WCGOP	West Coast Groundfish Observer Program

1.0 INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 USC 1801 et seq) defines essential fish habitat (EFH) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity," and requires Fishery Management Councils (FMCs) to describe and identify EFH in fishery management plans (FMPs). The FMPs should identify EFH based on current distribution, habitat components, historical presence, or other factors, and should also identify habitat requirements at each life stage and research needs. FMPs must evaluate potential adverse impacts from both fishing and non-fishing activities, as well as minimize adverse effects of fishing to the extent practicable. FMPs should identify habitat areas of particular concern (HAPC) within EFH based on the habitat's ecological function, sensitivity to human-induced disturbance, rarity, or whether development activities may stress a particular habitat. The National Marine Fisheries Service (NMFS) has approval authority for the designations provided by the FMCs.

The Pacific Fishery Management Council (Council) has, in Amendment 19 of the Groundfish FMP (Amendment 19) (PFMC 2008), identified EFH for over 80 species of Pacific Coast groundfish. In estuarine and marine areas, groundfish EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the limits of the exclusive economic zone (EEZ) offshore of Washington, Oregon, and California or to depths of 3,500 m, whichever is nearer shore, plus some seamounts in greater depths HAPC. As recommended by the Council, the Secretary of Commerce (Secretary) designated Pacific Coast groundfish EFH as all waters out to the limit of the EEZ in 1998 (FMP Amendment 11, Appendix B) (64 FR 6597), then made major revisions under Amendment 19 (71 FR 27408; PFMC 2008)).

This Phase 1 report summarizes the results of the review of information that is new or newly available since the last Groundfish EFH Review was concluded in 2006. The report includes a description of the general requirements and elements of EFH, including guidance for periodic reviews; a summary of existing descriptions of EFH for Pacific Coast groundfish; updated maps of seafloor habitat types and bathymetry; the currently available information on the distribution of Pacific Coast groundfish; a summary of models to predict groundfish distribution relative to habitat types, as well as trophic and ecosystem models useful for groundfish EFH; summaries of new information on the life history and habitat requirements of the 91 species in the Pacific Groundfish FMP (Table 1); updated information on threats to groundfish EFH and prey species, both from fishing and non-fishing activities; and identification of research needs to further refine groundfish EFH.

Appendix A lists the people that contributed to this report, including members of the EFHRC, and their affiliations, and a chronology of EFHRC meetings and results.

Table 1. List of groundfish species and stocks managed under the Pacific Coast Groundfish Fishery Management Plan (species added to the FMP since 2005 marked with **).

Flatfishes	**Other rockfishes**
Arrowtooth flounder, *Atheresthes stomias*	Aurora rockfish, *Sebastes aurora*
Dover sole, *Microstomus pacificus*	Bank rockfish, *Sebastes rufus*
English sole, *Parophrys vetulus*	Black-and-yellow rockfish, *Sebastes chrysomelas*
Petrale sole, *Eopsetta jordani*	Blue rockfish, *Sebastes mystinus*
	Bronzespotted rockfish, *Sebastes gilli*
Other flatfishes	Brown rockfish, *Sebastes auriculatus*
Butter sole, *Isopsetta isolepis*	Calico rockfish, *Sebastes dallii*
Curlfin sole, *Pleuronichthys decurrens*	California scorpionfish, *Scorpaena guttata*
Flathead sole, *Hippoglossoides elassodon*	**Chameleon rockfish, *Sebastes phillipsi*
Pacific sanddab, *Citharichthys sordidus*	China rockfish, *Sebastes nebulosus*
Rex sole, *Glyptocephalus zachirus*	Copper rockfish, *Sebastes caurinus*
Rock sole, *Lepidopsetta bilineata*	Dusky rockfish, *Sebastes ciliatus*
Sand sole, *Psettichthys melanostictus*	**Dwarf-red rockfish, *Sebastes rufinanus*
Starry flounder, *Platichthys stellatus*	Flag rockfish, *Sebastes rubrivinctus*
	**Freckled rockfish, *Sebastes lentiginosus*
Rockfishes	Gopher rockfish, *Sebastes carnatus*
Black rockfish, *Sebastes melanops*	Grass rockfish, *Sebastes rastrelliger*
Blackgill rockfish, *Sebastes melanostomus*	Greenblotched rockfish, *Sebastes rosenblatti*
Bocaccio, *Sebastes paucispinis*	Greenspotted rockfish, *Sebastes chlorostictus*
Canary rockfish, *Sebastes pinniger*	Greenstriped rockfish, *Sebastes elongates*
Chilipepper, *Sebastes goodie*	**Halfbanded rockfish, *Sebastes semicinctus*
Cowcod, *Sebastes levis*	Harlequin rockfish, *Sebastes variegatus*
Darkblotched rockfish, *Sebastes crameri*	Honeycomb rockfish, *Sebastes umbrosus*
Longspine thornyhead, *Sebastolobus altivelis*	Kelp rockfish, *Sebastes atrovirens*
Pacific ocean perch, *Sebastes alutus*	Mexican rockfish, *Sebastes macdonaldi*
Shortbelly rockfish, *Sebastes jordani*	Olive rockfish, *Sebastes serranoides*
Shortspine thornyhead, *Sebastolobus alascanus*	Pink rockfish, *Sebastes eos*
Splitnose rockfish, *Sebastes diploproa*	**Pinkrose rockfish, *Sebastes simulator*
Widow rockfish *Sebastes entomelas*	**Puget Sound rockfish, *Sebastes emphaeus*
Yelloweye rockfish, *Sebastes ruberrimus*	**Pygmy rockfish, *Sebastes wilsoni*
Yellowtail rockfish, *Sebastes flavidus*	Quillback rockfish, *Sebastes maliger*
	Redbanded rockfish, *Sebastes babcocki*
Other groundfishes	Redstripe rockfish, *Sebastes proriger*
Cabezon, *Scorpaenichthys marmoratus*	Rosethorn rockfish, *Sebastes helvomaculatus*
Lingcod, *Ophiodon elongatus*	Rosy rockfish, *Sebastes rosaceus*
Pacific cod, *Gadus macrocephalus*	Rougheye rockfish, *Sebastes aleutianus*
Pacific hake, *Merluccius productus*	**Semaphore rockfish, *Sebastes melanosema*
Sablefish, *Anoplopoma fimbria*	Sharpchin rockfish, *Sebastes zacentrus*
Big skate, *Raja binoculata*	Shortraker rockfish, *Sebastes borealis*
California skate, *Raja inornata*	Silvergray rockfish, *Sebastes brevispinis*
Kelp greenling, *Hexagrammos decagrammus*	Speckled rockfish, *Sebastes ovalis*
Leopard shark, *Triakis semifasciata*	Squarespot rockfish, *Sebastes hopkinsi*
Longnose skate, *Raja rhina*	Starry rockfish, *Sebastes constellatus*
Pacific flatnose, *Antimora microlepis*	Stripetail rockfish, *Sebastes saxicola*
Pacific grenadier, *Coryphaenoides acrolepis*	**Swordspine rockfish, *Sebastes ensifer*
Spiny dogfish, *Squalus acanthias*	Tiger rockfish, *Sebastes nigrocinctus*
Spotted ratfish, *Hydrolagus colliei*	Treefish, *Sebastes serriceps*
Tope, *Galeorhinus galeus*	Vermilion rockfish, *Sebastes miniatus*
	Yellowmouth rockfish, *Sebastes reedi*

1.1 Essential Fish Habitat Consultation

Federal agencies must consult with NMFS on activities that may adversely affect EFH, regardless of whether or not those activities occur within designated EFH. In other words, an activity can adversely affect EFH without occurring within EFH. An adverse effect means any impact that reduces either the quantity or quality of EFH (50 CFR 600.810). For those activities that would adversely affect EFH, NMFS then provides EFH conservation recommendations to the Federal agency to avoid, minimize, or offset those adverse effects. The Federal agency must respond to NMFS within 30 days of receiving EFH conservation recommendations, including a description of measures proposed for avoiding, mitigating, or offsetting the impact to EFH. For responses that are inconsistent with the EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects. Fishery Management Councils may also comment on proposed actions that may adversely affect EFH of a fishery resource curently withing an FMP. Although state agencies are not required to consult with NMFS on activities that may adversely affect EFH, NMFS is obligated to provide conservation recommendations to state agencies if NMFS receives information that an activity will adversely affect EFH. Whenever possible, NMFS utilizes existing coordination procedures to transmit EFH conservation recommendations.

The designations and detailed descriptions of EFH in the FMPs are used during the EFH consultation process to determine where and for what species EFH has been designated in the project area. The analyses of the adverse effects from the proposed action, and potential conservation measures that avoid, minimize, or offset those effects, are informed by the information contained in the FMP.

1.2 Essential Fish Habitat Periodic Reviews

The regulatory guidelines for implementing the EFH provisions of the MSA state that Regional FMCs and NMFS should periodically review the EFH provisions of FMPs and revise or amend EFH provisions as warranted, based on available information (50 CFR 600.815(a)(10)). This review included evaluating published scientific literature and unpublished reports, soliciting input from interested parties, and searching for previously unavailable information on groundfish stocks identified in the FMP. The Council may provide suggested changes to existing EFH to NMFS for their approval, if the information warrants changes. The regulatory guidance provides that a complete review should be conducted periodically, but at least once every five years. Pacific Coast groundfish EFH was first designated in 1998 by the Council as part of Amendment 11 to the Pacific Coast Groundfish FMP. The current review was initiated in 2010.

Since EFH for Pacific Coast groundfish was first designated, NMFS has taken steps to clarify the process for designating and refining EFH. In 2002, NMFS published final rules to implement the EFH provisions of the MSA (50 CFR Part 600), and, in 2006, issued a memo providing additional guidance to refine the description and identification of EFH (NMFS 2006). The 5-year review presented was guided by these two clarifying documents.

The primary purpose of an EFH review is to examine new or newly available information, especially as it relates to the information that was used as the basis for the current EFH designations. The review should focus on the components of EFH identified in the regulatory guidance (50 CFR 600.815):

(1) EFH description and identification
(2) MSA fishing activities
(3) Non-MSA fishing activities
(4) Non-fishing activities
(5) Cumulative impacts analysis
(6) Conservation and enhancement
(7) Identification of major prey species
(8) Identification of HAPCs
(9) Research and information needs

The periodic review provides FMCs and NMFS with the information that may lead to improvements in the identification and description of EFH. For this review, the Council has adopted a phased approach, in which the first phase consists of issuing a data call and compiling new and newly available information, then, when possible, comparing it with the suite of information that was available at the previous review. The second phase considers potential changes to EFH, based on the new information produced in the

Phase 1, and presents those to the Council. In Phase 2, the Council may issue a request for proposals (RFP) to all interested parties for changes to the identification and description of EFH that are based on the information in the Phase 1 report. If the Council determines that changes to EFH identification and descriptions are necessary, it then proceeds with a third phase that utilizes the appropriate management tool to revise EFH.

1.3 Methods/Approach

The NWFSC and SWFSC received funding from the NMFS Office of Habitat Conservation to support two part-time researchers through NOAA cooperative institutes. These contractors assisted NMFS in identifying, gathering, summarizing, reporting, and serving data that are relevant to the 5-year review of Pacific Coast groundfish EFH. This included data that were identified in response to a NMFS data request issued in February 2011. These researchers, along with NMFS researchers and the EFHRC identified and summarized new and updated information on:

- the distribution and extent of seafloor maps of bathymetry and interpreted Pacific Coast groundfish habitat types;
- the distribution and extent of groundfish fishing effort;
- the distribution of biogenic habitat;
- spatial management boundaries;
- prey species for groundfish; and
- associations of groundfish with habitats of different types.

In addition to the contractors, NMFS researchers, and members of the EFHRC, significant contributions to Phase 1 of the review were received from the Deep Sea Coral Status Report and the NOAA-led effort for Integrated Ecosystem Assessment of the California Current. The NWFSC and SWFSC, in collaboration with the NMFS Regions and the Council's EFHRC, provided assistance and direction in accomplishing the overall task of identifying and summarizing new and updated information and data relevant to the 5-year review of Pacific Coast groundfish EFH.

A schedule to complete Phase 1 of the groundfish EFH review, while subject to modification as necessary, was approved by the Council at its April 2012 meeting (Table 2).

Table 2. Working schedule for Phase 1 of the Pacific Council groundfish EFH review.

Timing/Due Date	**Action**
April 2011	Council approves the process, and solicits for information and data (deadline: July 1, 2011)
Summer 2011	NMFS Science Center (or contractor) compiles and synthesizes data and information, initiates review. EFHRC starts reviewing interim products
Dec 31, 2011	NMFS Science Center (or contractor) product due
April, 2012	EFHRC provides progress update to Council
Jan-August 2012	EFHRC drafts report summarizing new data and information; including how it compares with existing information, maps, etc.
September 2012	Council adopts interim report and consideres revised RFP
Sept 2012-Mar 2013	NMFS NWFSC synthesizes information in Phase 1 Report
April 2013	NMFS NWFSC presents synthesis report to Council; Council decides whether or not to issue an RFP for any changes to existing GF EFH, HAPCs, etc. (END PHASE I)

1.3.1 Phase 1

Phase 1 of the groundfish EFH review is intended primarily to inform the Council of significant changes in knowledge since the last EFH review was completed in 2006. Phase 1 was not intended to develop alternatives to groundfish EFH for Council consideration. Some issues to consider when evaluating new information used to support existing EFH designations include changes in the number of species in the

Groundfish FMP, fishery status of the species (e.g., overfished or rebuilt), and errors to current EFH descriptions or identifications. While Phase 1 will not include a comprehensive analysis of data to develop alternatives, examples of applications of new information are provided to demonstrate their utility, inform development of proposals, and set priorities for modification of EFH components.

1.3.2 Phase 2

The Council may solicit proposals to modify EFH components, based on the new and newly available information presented to the Council, its advisory bodies, and the public during Phase 1. The EFHRC will review these proposals and may generate additional proposals if it determines that 1) submitted proposals do not address obvious candidates for changes to EFH, and 2) if the available information warrants it. The EFHRC will prepare a Phase 2 report for presentation to the Council at the November 2013 meeting. The Council will consider the report, public comment, and advisory body recommendations, and decide whether new information warrants changes to groundfish EFH. The EFH periodic review is effectively concluded when the Council accepts the Phase 2 report from the EFHRC. Should the Council recommend changes to existing EFH identification or descriptions, it will determine an appropriate process (e.g., FMP amendment, management measure specifications, SAFE Report, etc.) for further analysis and consideration of proposals

1.3.3 Phase 3

If the Council decides to adopt changes to groundfish EFH, Phase 3 of this review will include a process to identify relevant issues, develop and analyze alternatives in a NEPA document, and take final action to amend the Groundfish FMP. Identification of relevant issues will be based largely on the Phase 1 EFH Review and subsequent Phase 2 proposals. Selection of alternatives will be based on Phase 2 proposals and additional input from agencies, advisory bodies, and the public. Analysis of alternatives may use information from Phase 1 and 2, but will also include more specific and detailed analysis of biological, economic, and cumulative effects.

2.0 CURRENT DESIGNATIONS FOR PACIFIC COAST GROUNDFISH EFH, HAPC, AND ECOLOGICALLY IMPORTANT HABITAT CLOSED AREAS

This section summarizes existing EFH for Pacific Coast Groundfish contained in Amendment 19 (NMFS 2005; PFMC 2008) and the 2006 Final Rule (71 FR 27408). Amendment 19 provided descriptions of EFH for each species and life stage that were developed through an extensive review and synthesis of the literature available in 2005 (PFMC 2008). Appendix B provided a review of life history for each species, text descriptions, and tables that summarize, for each species, the habitats used by each life history stage and the important features of those habitats.

2.1 Description and identification of EFH for Pacific Coast Groundfish

The Pacific Coast Groundfish FMP manages 90-plus species over a large and ecologically diverse area. Information on the life histories and habitats of these species varies in completeness, so while some species are well-studied, there is relatively little information on certain other species. Information about the habitats and life histories of the species managed by the FMP will certainly change over time, with varying degrees of improvement in information for each species. For these reasons, it was impractical for the Council to include descriptions identifying EFH for each life stage of the managed species in the body of Amendment 19. Therefore, the FMP included a description of the overall area identified as groundfish EFH and described the assessment methodology supporting this designation. Life histories and EFH identifications for each of the individual species are provided in Appendix B to Amendment 19.

The overall extent of groundfish EFH for all FMU species (Figure 1) is identified as all waters and substrate within the following areas:

- Depths less than or equal to 3,500 m (1,914 fathoms) to mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow.
- Seamounts in depths greater than 3,500 m as mapped in the EFH assessment GIS.
- Areas designated as HAPCs not already identified by the above criteria.

This EFH identification was precautionary because it was based on the then-known maximum depth distribution of all life stages of FMU species (50 CFR 600.815(a)(1)(B)).. This precautionary approach was taken because uncertainty existed about the relative value of different habitats to individual groundfish species/life stages, and thus the actual extent of groundfish EFH. This approach incorporated all areas for which the habitat suitability probability (HSP) values were greater than 0% for any species or life stage. The HSP model characterizes habitat in terms of three variables: depth, latitude, and substrate (both physical and biogenic substrate, where possible). For the purposes of the model, these three characteristics provide a reasonable representation of the essential features of habitat that influence the occurrence of fish.

Depending on these characteristics and the observed distributions of fish in relation to them, each location (a parcel or polygon of habitat in the GIS) is assigned a suitability value between zero and 100 percent. The higher the HSP, the more likely the habitat is suitable for the habitat needs of a given groundfish species (see Amendment 19 for a more detailed discussion of the HSP model).

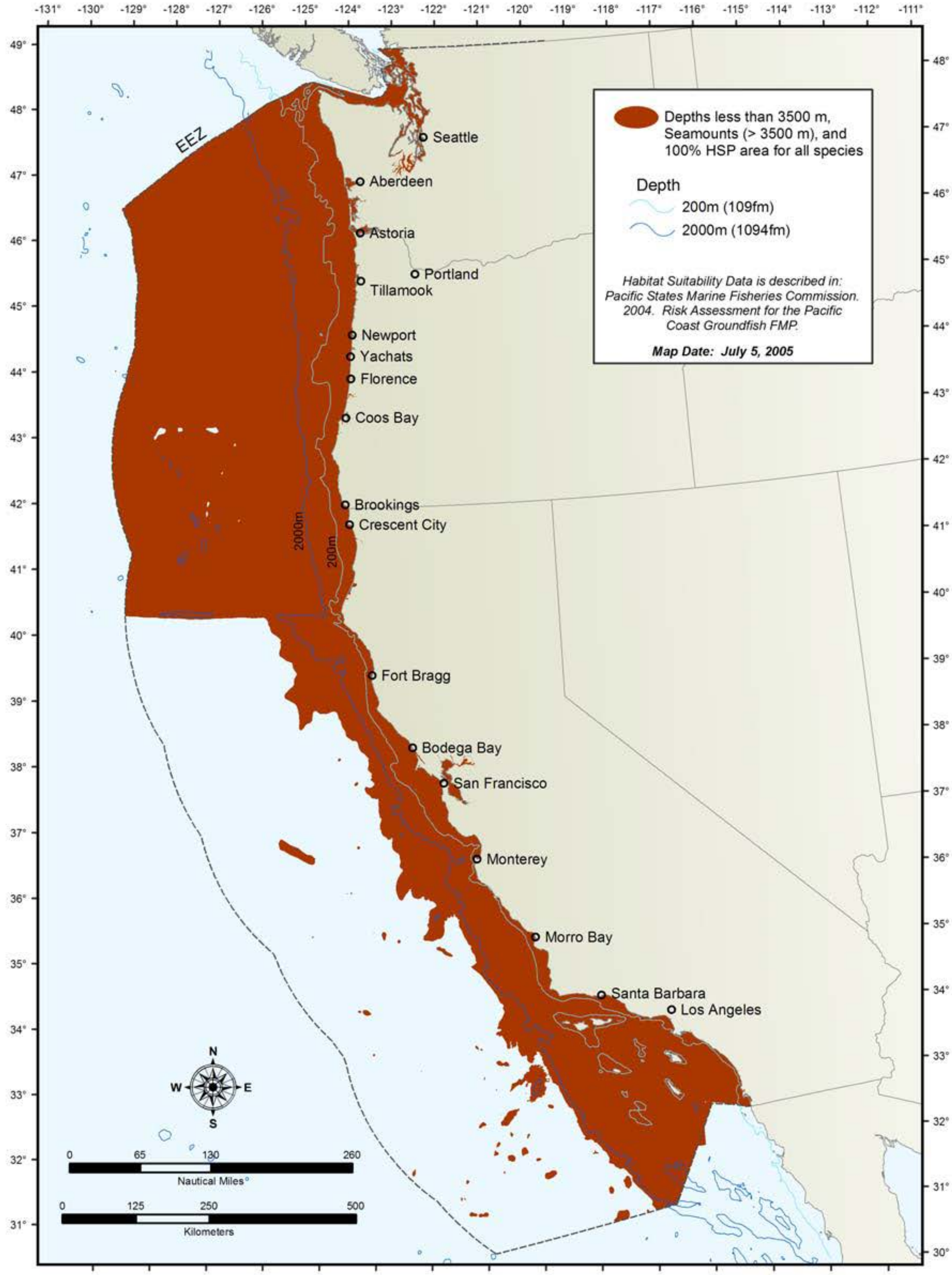


Figure 1. Current essential fish habitat description for the Pacific Coast groundfish.

2.1.1 Habitat Areas of Particular Concern

According to the regulations that implement the EFH provisions of the MSA, FMPs should identify specific types or areas of habitat within EFH as habitat areas of particular concern based on one or more of the following considerations (50 CFR 600.815(a)(8)):

- The importance of the ecological function provided by the habitat.
- The extent to which the habitat is sensitive to human-induced environmental degradation.
- Whether, and to what extent, development activities are or will be stressing the habitat type.
- The rarity of the habitat type.

Based on these considerations, the Council designated both areas and habitat types as groundfish HAPCs. In some cases, HAPCs identified by means of specific habitat type may overlap with the designation of a specific area. The HAPC designation covers the net area identified by habitat type or area. Designating HAPCs facilitates the consultation process by identifying ecologically important, sensitive, stressed or rare habitats that should be given particular attention when considering potential fishing and nonfishing impacts. Their identification is a valuable tool the Council can use to address these impacts.

HAPCs based on habitat type may vary in location and extent over time. For this reason, the mapped extent of these areas offers only a first approximation of their location. Defining criteria of habitat-type HAPCs are described below, which may be applied in specific circumstances to determine whether a given area is designated as a groundfish HAPC. HAPCs include all waters, substrates, and associated biological communities falling within the area defined by the criteria below.

Figure 2 shows the location of these HAPCs. For HAPCs defined by habitat type, as opposed to discrete areas, this map offers a first approximation of their location and extent. The precision of the underlying data used to create these maps, and the fact that the extent of HAPCs defined by key benthic organisms (canopy kelp, seagrass) can change along with changes in the distribution of these organisms, means that at fine scales the map may not accurately represent their location and extent. Defining criteria are provided in the following descriptions of HAPCs, which can be used in conjunction with the map to determine if a specific location is within one of these HAPCs. The areas of interest HAPCs are defined by discrete boundaries. The coordinates defining these boundaries are listed in Appendix B to the groundfish FMP (PFMC 2011a). Figure 2 shows the location and extent of the HAPC described below. See Amendment 19 for a more detailed description of these HAPCs.

2.1.1.1 Estuaries

Estuaries are protected nearshore areas such as bays, sounds, inlets, and river mouths, influenced by ocean and freshwater. Because of tidal cycles and freshwater runoff, salinity varies within estuaries and results in great diversity, offering freshwater, brackish and marine habitats within close proximity (Haertel and Osterberg 1967). Estuaries tend to be shallow, protected, nutrient rich, and are biologically productive, providing important habitat for marine organisms, including groundfish.

Defining Characteristics

The inland extent of the estuary HAPC is defined as MHHW, or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow. The seaward extent is an imaginary line closing the mouth of a river, bay, or sound; and to the seaward limit of wetland emergents, shrubs, or trees occurring beyond the lines closing rivers, bays, or sounds. This HAPC also includes those estuary-influenced offshore areas of continuously diluted seawater. This definition is based on Cowardin, et al. (1979).

2.1.1.2 Canopy Kelp

Of the habitats associated with the rocky substrate on the continental shelf, kelp forests are of primary importance to the ecosystem and serve as important groundfish habitat. Kelp forest communities are found relatively close to shore along the open coast or the shore if ishland and inland seas. These subtidal communities provide vertically-structured habitat throughout the water column: a canopy of tangled blades from the surface to a depth of ten feet, a mid-water, stipe region, and the holdfast region at the seafloor. Kelp stands provide nurseries, feeding grounds, and shelter to a variety of groundfish species and their prey (Ebeling, *et al.* 1980; Feder, *et al.* 1974). Kelp forest communities are highly productive relative to other habitats, including wetlands, shallow and deep sand bottoms, and rock-bottom artificial reefs (Bond, *et al.* 1998). Their net primary production is an important component to the energy flow within food webs. Foster and Schiel (1985) reported that the net primary productivity of kelp beds may be the highest of any marine community. The net primary production of seaweeds in a kelp forest is available to consumers as living tissue on attached plants, as drift in the form of whole plants or detached pieces, and as dissolved organic matter exuded by attached and drifting plants (Foster and Schiel 1985).

Defining Characteristics
The canopy kelp HAPC includes those waters, substrate, and other biogenic habitat associated with canopy-forming kelp species (e.g., *Macrocystis* spp. and *Nereocystis* spp.).

2.1.1.3 Seagrass

Seagrass species found on the West Coast of the U.S. include eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), and surfgrass (*Phyllospadix* spp.). These grasses are vascular plants, not seaweeds, forming dense beds of leafy shoots year-round in the lower intertidal and subtidal areas. Eelgrass is found on soft-bottom substrates in intertidal and shallow subtidal areas of estuaries and occasionally in other nearshore areas, such as the Channel Islands and Santa Barbara littoral. Surfgrass is found on hard-bottom substrates along higher energy coasts. Studies have shown seagrass beds to be among the areas of highest primary productivity in the world (Herke and Rogers 1993; Hoss and Thayer 1993).

Defining Characteristics
The seagrass HAPC includes those waters, substrate, and other biogenic features associated with eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), or surfgrass (*Phyllospadix* spp.). [1]

2.1.1.4 Rocky Reefs

Rocky habitats are generally categorized as either nearshore or offshore in reference to the proximity of the habitat to the coastline. Rocky habitat may be composed of bedrock, boulders, or smaller rocks, such as cobble and gravel. Hard substrates are one of the least abundant benthic habitats, yet they are among the most important habitats for groundfish.

Defining Characteristics
The rocky reefs HAPC includes those waters, substrates and other biogenic features associated with hard substrate (bedrock, boulders, cobble, gravel, etc.) to MHHW. A first approximation of its extent is provided by the substrate data in the groundfish EFH assessment GIS. However, at finer scales, through

[1] The extent and effect of non-native species in seagrass HAPC, such as *Zostera japonica*, may be considered in conservation recommendations NMFS makes to other Federal and state agencies.

direct observation, it may be possible to further distinguish between hard and soft substrate in order to define the extent of this HAPC.

2.1.1.5 Areas of Interest

Areas of interest are discrete areas that are of special interest due to their unique geological and ecological characteristics. The following areas of interest are designated HAPCs (see Amendment 19 for a more detailed description of these areas of interest):

- Off of Washington: All waters and sea bottom in state waters shoreward from the three nautical mile boundary of the territorial sea shoreward to MHHW.
- Off of Oregon: Daisy Bank/Nelson Island, Thompson Seamount, President Jackson Seamount.
- Off of California: all seamounts, including Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Taney Seamount, Davidson Seamount, and San Juan Seamount; Mendocino Ridge; Cordell Bank; Monterey Canyon; specific areas in the Federal waters of the Channel Island National Marine Sanctuary; specific areas of the Cowcod Conservation Area.

Defining Characteristics

As noted above, the shoreward boundary of the Washington State waters HAPC is defined by MHHW while the seaward boundary is the extent of the three-mile territorial sea. The remaining area-based HAPCs are defined by their mapped boundaries in the EFH assessment Environmental Impact Statement (EIS) (NMFS 2005). The coordinates defining these boundaries may be found in Appendix B to the FMP.

2.1.2 Ecologically Important Habitat Areas

Amendment 19 identified discrete areas that are closed to fishing with specified gear types, or are only open to fishing with specified gear types; however, these areas were not designated as HAPCs. These ecologically important habitat closed areas are intended tominimize the adverse effects of fishing on groundfish EFH. They may be categorized as bottom trawl closed areas (BTCAs) and bottom contact closed areas (BCCAs) (Figure 3). For the purpose of regulation each type of closed area should be treated differently. For the purposes of BTCAs, the definition of bottom trawl gear in Federal regulations applies (PFMC 2011a). For the purposes of BCCAs, the definition of bottom contact gear in the FMP (PFMC 2011a) and in Federal regulations applies.

The extent and configuration of these areas do not vary seasonally and they are not usually modified through in season or biennial management actions. The location and extent of these areas are described by a series of latitude-longitude coordinates enclosing a polygon published in permanent Federal regulations (May 11, 2006, 71 FR 27408). There are 51 such closures, described in Chapter 4 Minimizing Effects.

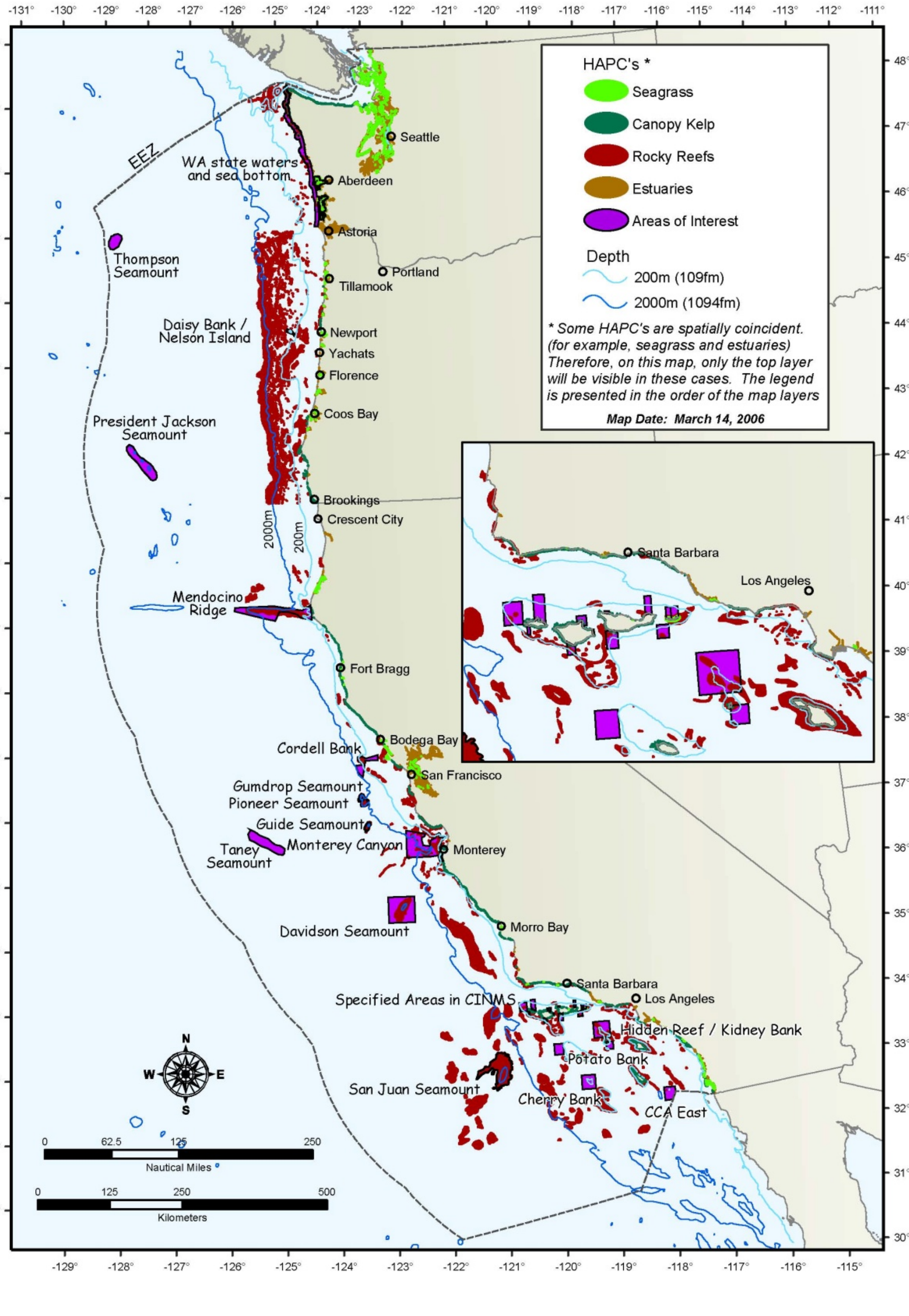
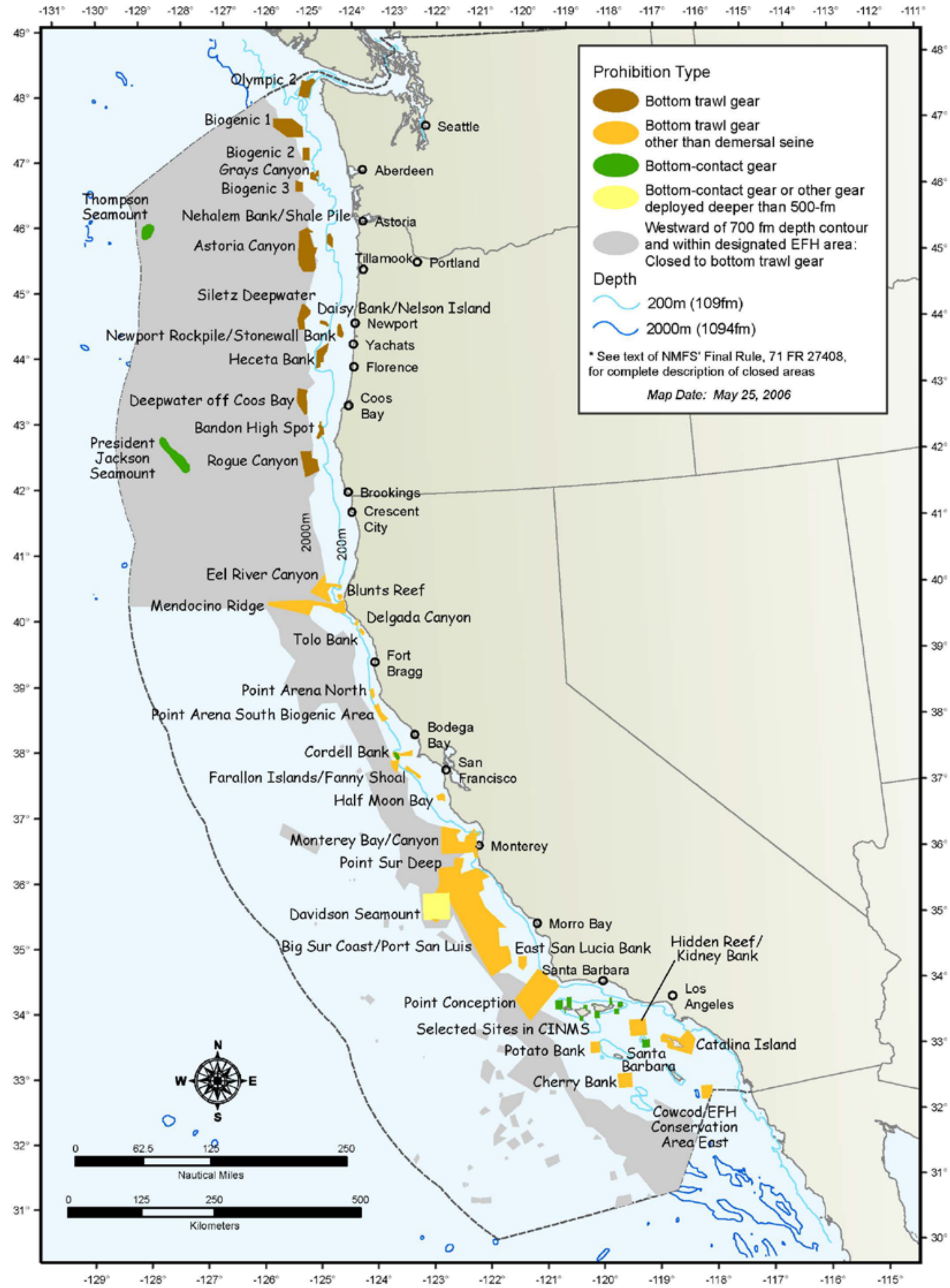


Figure 2. Groundfish HAPC.



EFH area closures to protect Pacific Coast groundfish habitat - Coastwide.

Figure 3. Ecologically important habitat closed areas.

3.0 REVIEW OF NEW INFORMATION ON GROUNDFISH ESSENTIAL FISH HABITAT

The primary purpose of an EFH review is to examine new or newly-available information, especially as it relates to the information that was used as the basis for the original EFH designation. A means to organize and report on this information is provided in the EFH regulatory guidance, which suggests describing EFH for each species based on the highest of four levels of data (50 CFR 600.815(a)(1)(B)). These levels are:

Level 1: *Distribution data are available for some or all portions of the geographic range of the species.* At this level, only distribution data are available to describe the geographic range of a species (or life stage).

Level 2: *Habitat-related densities of the species are available.* At this level, quantitative data (i.e., density or relative abundance) are available for the habitats occupied by a species or life stage.

Level 3: *Growth, reproduction, or survival rates within habitats are available.* At this level, data are available on habitat-related growth, reproduction, and/or survival by life stage.

Level 4: *Production rates by habitat are available*. At this level, data are available that directly relate the production rates of a species or life stage to habitat type, quantity, quality, and location.

The available data on the habitat of Pacific Coast groundfishes includes data from all four levels. The 91 species in the Pacific Coast groundfish FMP are distributed over a wide geographic range, with populations adapted to local habitat conditions that can vary widely across this range. Current distribution data (Level 1) is generally available across the entire geographic range. However, data on historical distribution are lacking in certain parts of the range for some species, and particularly in areas where populations have been extirpated. Information related to the other EFH levels, on the other hand, is usually limited to smaller geographic areas. Habitat-specific information from one location does not necessarily apply across the entire range. Therefore, it is appropriate to determine the geographic distribution of EFH for Pacific Coast groundfish using Level 1 information, and incorporate information from the other levels, when possible, in the species- and life-stage-specific descriptions of EFH.

Section 3 presents new information on habitats that has become available since the EFH designation in 2006 for the 91 species of Pacific coast groundfishes. There are five sub-sections, each accompanied by comprehensive Appendices. Section 3.1 summarizes an inventory of responses to the NMFS data call. Section 3.2 describes (in both text and maps) new information on the distribution of seafloor habitat types, including data on bathymetry, physical habitat interpretations, and biogenic components of habitat. Section 3.3 includes summaries, and associated citations, of recent information related to habitats for each life-history stage of the five species groups designated in the FMP for Pacific Coast groundfishes (i.e., flatfishes, other flatfishes, rockfishes, other rockfishes, and other groundfishes). Section 3.4 is a review of new modeling efforts relevant to the determination and designation of EHF for Pacific groundfishes, and Section 3.5 is an update on the Habitat Use Database (HUD).

3.1 Inventory of Responses to NMFS Data Call

To initiate Phase I of the Council's 5-year review of Pacific Coast groundfish EFH, NMFS Science Centers and Regions issued a data call to interested parties, soliciting habitat information that has become available since the EFH designation in 2006 for the FMU species. Information was requested on data type, source, time frame, spatial and temporal scale, metric, format, point of contact, and key references. This data call was posted on NMFS websites (NWFSC, SWFSC, NWR, and SWR) and in the Fishnews Digest, as well as distributed to researchers, managers, and conservation entities through email lists associated with the Western Groundfish Conference (over 60 people) and the West Coast Governors Agreement (over 850 people); the call was open from March through November 2011.

Thirty-nine sources of data relevant to groundfish EFH that had become available since 2006 were received through the NMFS data call (see Appendix B for details on each item). All of these data can be used to revise the descriptions of EFH and HAPC or to evaluate risk to EFH. Information associated with the NMFS data call comprised four general categories:

4. Four sources of new information on the distribution and extent of seafloor maps, seafloor data, and interpreted Pacific Coast groundfish habitat types were received.
5. Eight sources of new and updated fishery-independent data were received on groundfish species and associated components of habitat.
6. Twenty sources of new and updated information or data were received on the distribution of habitats, including two coast-wide oceanographic datasets, 12 surveys of deepwater, structure-forming invertebrates, two models of deep coral distributions, an assessment of 146 West Coast estuaries, an online data library and maps of California, and two visual surveys of fish and habitats.
7. Seven sources of new and updated information were received on existing and emerging threats to Pacific Coast groundfish EFH. These included five fishery-dependent datasets and two sources of information on non-fishery threats.

3.2 Bathymetry and Seafloor Habitat Maps

Pacific coast-wide comparative maps of bathymetry (i.e., seafloor imagery) and seafloor habitat types in 2005 and 2011 were compiled for the EEZ off Washington, Oregon and California from all available sources. Seafloor imagery consisted of gridded bathymetry data sets (Digital Elevation Models or DEMs), and backscatter imagery. Contour data, either interpolated or derived from DEMs, were not included. For reference purposes, any available sidescan sonar data were grouped with backscatter imagery. Seafloor habitat data consisted of automated habitat (i.e., substrate) classification data or geologic habitat interpretations, either represented in raster (i.e., grids) or vector (i.e., polygon shapefiles) format. Although the initial EFH map products were published in 2005, input data for those products was incorporated through mid-2002. Therefore, the current data search encompassed the years 2002-2011 and reference to 2005 maps implies that these maps contain data produced during or prior to 2002.

In addition to bathymetry, both sidescan sonar imagery and multibeam sonar backscatter imagery data types are included in the section 3.2 comparison maps. Sidescan sonar and multibeam backscatter are tools that measure the intensity of acoustic energy returned from an ensonified seafloor and are useful for understanding the distribution and abundance of seafloor habitats. Mapped variations in returned energy (backscatter images) may correlate to or result from variations in local seabed geology and are often used together with bathymetry imagery to determine seabed habitat type.

The map products displayed in this report were intended to provide a coast-wide overview of available data, and the methods chosen for display were designed to illustrate the range of values on that scale. There are other methods for displaying the same data that may provide alternative interpretations of temporal or spatial differences depending on such factors as geographic scale, value bins, or display algorithms. A data portal is available to allow access to maps and data from this report so that interested parties can manipulate data for specific purposes: http://efh-catalog.coas.oregonstate.edu/overview/.

3.2.1 Bathymetry and Substrate Maps

A set of 24 comparison map panels layouts (hereafter termed “plates”) were constructed at a scale of 1:500,000 and encompassed the EEZ of the southern U.S. Pacific Coast. Each plate presents a geographic comparison of project components (Imagery; Appendix C-1, and Habitat; Appendix C-2) over three time intervals: Pre 2005, 2005-2011, and Aggregate 2011 (combined overlay of Pre 2005 and 2005-2011 data).

Note that plates are meant to be printed at full size (44" wide by 60" tall). Shrinking a plate to fit on an 8.5" by 11" letter size page will change the map scale to approximately 1:2,588,235. It will also result in a loss of resolution due to resampling and printing limitations. See Appendices C-1 and C-2 for a compendium of the plates.

Two additional plates were constructed to depict regional and spatially contiguous (but lower resolution) bathymetry data that are currently available for the northwest region off Oregon and Washington, and for offshore California (Figures 4 and 5; Appendix C-3). These data were not included as part of the plates (above) because they do not include all sources of new bathymetry identified through this review. Instead, they represent the best available spatially continuous product. The maps are presented at 1:1,000,000 (Oregon and Washington) and 1:1,300,000 (California) to show the contrast between the official 2005 bathymetry contour map and a true regional grid file available now.

A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently in available online at: http://efh-catalog.coas.oregonstate.edu/overview/.

Seafloor imagery and habitat types were color-coded so that the composition of the available data associated with each survey region could be easily distinguished. Survey regions were divided into three categories, those that contained only bathymetry data (blue), those that contained bathymetry and backscatter data (green), and those that contained only backscatter data (grey) (e.g., Figure 6). Habitat types were distinguished as probable soft sediment (yellow), probable rock (red), or a mixture of soft sediment and rock (brown) (e.g., Figure 7). Given that this effort compiled habitat maps from a variety of sources, it is essential to understand that mapping methods varied widely among sources and that it was our task to display the sources under some common scheme.

A special habitat type case exists for Oregon and Washington. During the 2002 mapping effort, seafloor below 150m water depth and of 10 degrees slope or greater were mapped as rock outcrop (red). This mapping was made based upon expert observation that steep slopes in this region do not hold unconsolidated sediments well and are often rocky. To call attention to the facts that: 1) similar mapping was not done for California, 2) the mapping technique only infers rock outcrop through a simple >10 degrees of slope angle rule, and 3) the rule when applied classifies a large quantity of seafloor as rocky, this habitat type was mapped as "Inferred Rock" using a light red color. The extent of inferred rock in the current pre-2005 map plates is identical to that depicted in the 2002 West Coast Oregon and Washington substrate map; however, it is colored differently in the current pre-2005 map plates so that it may be distinguished from rock that was determined based on geologic interpretations or more rigorous automated classification techniques (Figure 7).

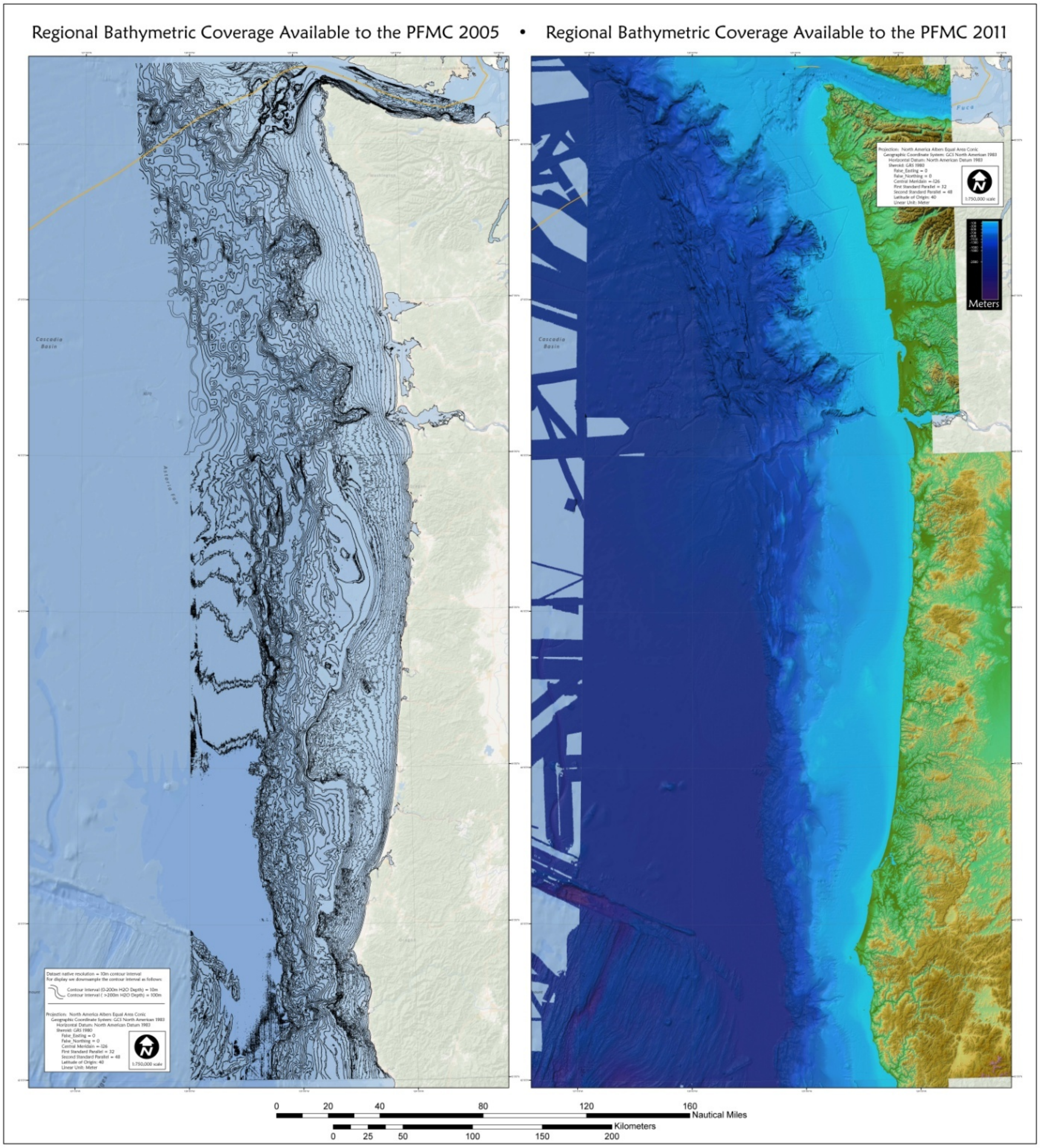


Figure 4. Washington and Oregon regional bathemetry pre-2005 and post 2005; from Appendix C-3.

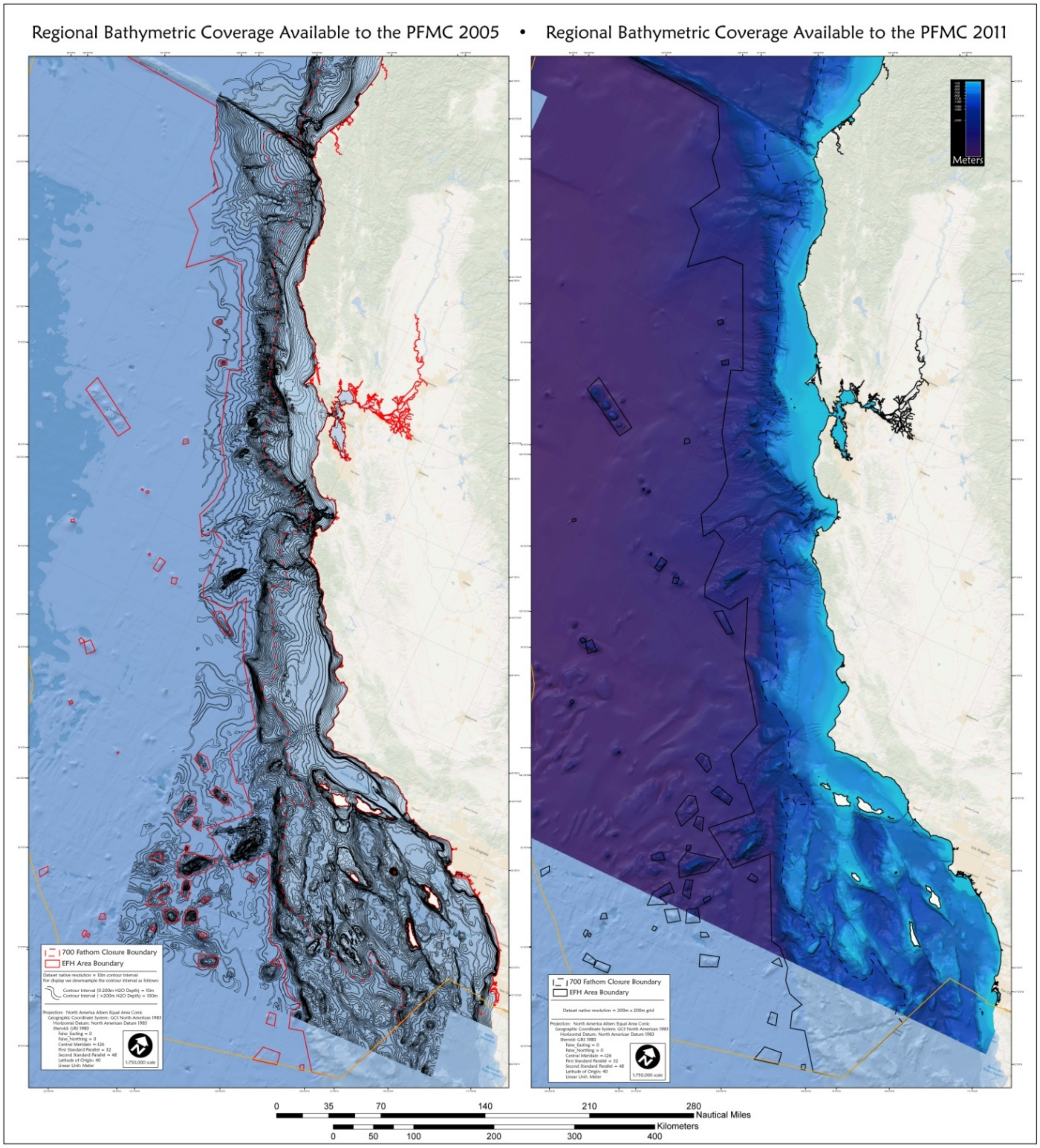


Figure 5. California regional bathemetry pre-2005 and post 2005; from Appendix C-3.

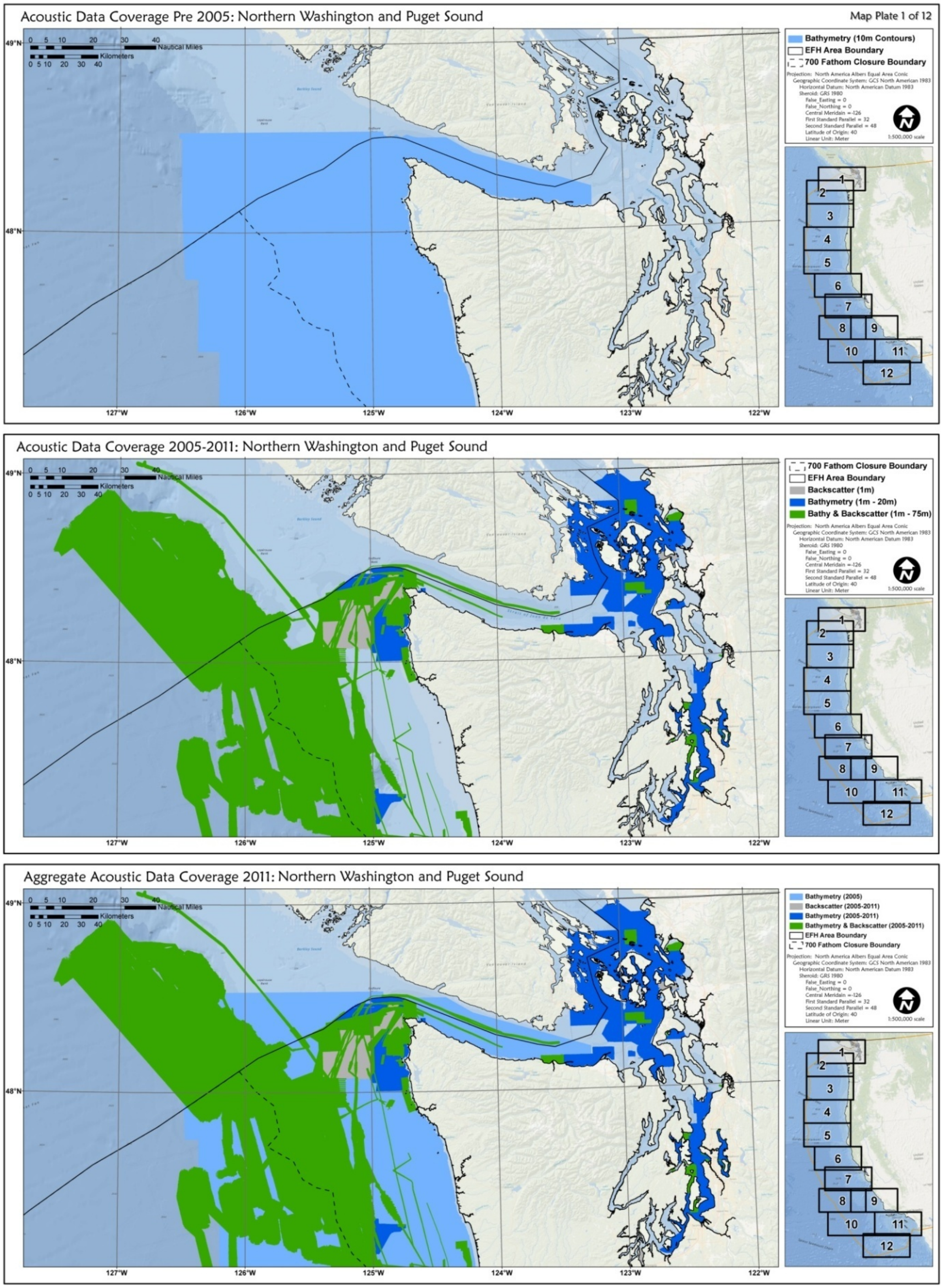


Figure 6. Example of imagry plate From Appendix C-1.

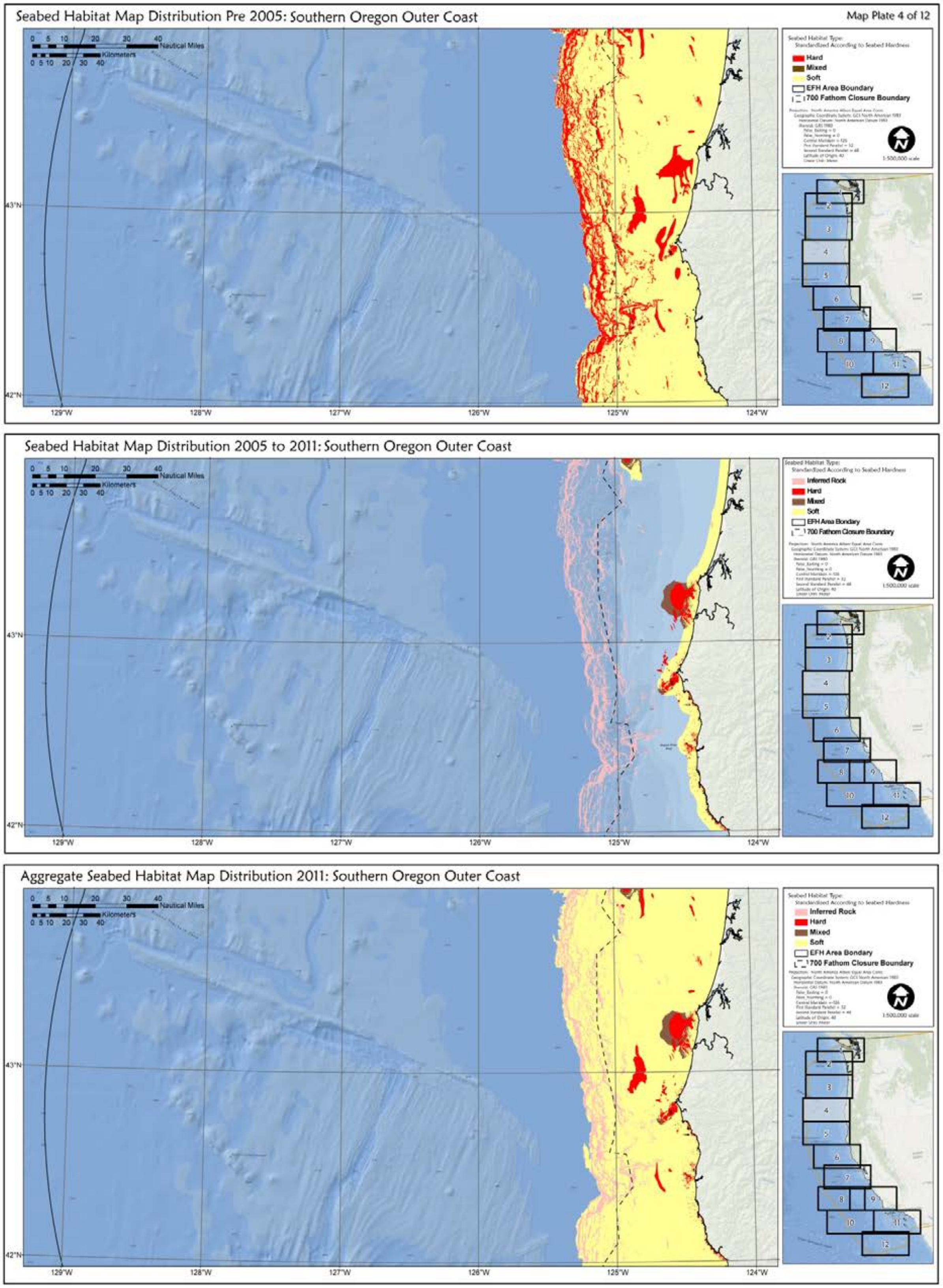


Figure 7. Example of bathymetry/substrate habitat plate from Appendix C-2.

3.2.1.1 Specific Notes by Region or Data Type

Oregon and Washington Surficial Geologic Habitat Maps
This product is an outgrowth and continuation of the original habitat maps created by the Active Tectonics & Seafloor Mapping Lab and The Center for Habitat Studies during the Amendment 19 (2006 EFH review) process. They are interpretive and regional, drawing input from any and all sources available. The coding scheme has changed little since 2005 and is considered a modification of Greene (1999).

Olympic Coast National Marine Sanctuary
Habitat Polygons were derived using a variety of automated image classification methods relying on seafloor samples and in-situ images for reference. Resultant image classifications were coded using Greene (1999).

Oregon State Waters
Habitat polygons were mapped using a hybrid of Supervised Image Classification techniques and geologic interpretation guided by sediment samples and seafloor imagery. Habitat codes explicitly discriminate rock outcrop from sedimentary habitats but do not follow Greene (1999) or any other standard coding scheme.

California State Waters
It should be noted that automated habitat classifications were based on comparative local depth values and therefore actually distinguish "smooth" and "rough" seafloor regions. These regions are predicted to consist of soft and hard substrate types, respectively. Interpreted habitat classifications were determined by geologists with appropriate expertise and based on a combination of the available seafloor imagery and any seafloor video or sediment samples.

3.2.1.2 Specific Notes By Comparison Plate

Plate 1: Northern Washington and Puget Sound
Plate 1 includes 118 new high-resolution seafloor imagery surveys published during or after 2002. Of these, 30 include bathymetry and backscatter data, 33 include only backscatter or sidescan data, and 55 include only bathymetry data (Figure 6; Appendix C-1, Plate 1). The primary source of seafloor imagery in this region is the NOAA National Ocean Service and the NOAA Olympic Coast National Marine Sanctuary (OCNMS) (Appendix C Table C-1). Plate one includes 39 new habitat maps (Appendix C-2 Plate 1).

The OCNMS has been actively mapping the northern portion of the sanctuary since 2000. Habitat map products became publically available in 2005, and are published periodically as new maps are completed. In total, 25 new habitat maps are now available in the northern OCNMS (Appendix C Table C-1) significantly modifying our regional understanding of the distribution and abundance of rocky habitats in the northern OCNMS. Taken as a complete set or individually, the OCNMS habitat maps show that the extent of rocky habitat in this area was greatly underrepresented by the Version 1 Surficial Geologic Habitat (SGH) map for Washington (Appendix C-2 Plate 1).

The Center for Habitat Studies, Tombolo Institute, and Geosciences Canada jointly produced an extensive habitat map of the Washington San Juan and Canadian Gulf Islands. This habitat map provides seafloor knowledge over an area previously unmapped by the Version 1 SGH Map for Washington (Figure 6; Appendix C-1 Plate 1, Appendix C-2, Plate 1). The USGS is currently engaged in a habitat mapping effort within the "inner" Puget Sound, though no habitat maps for this region have been officially published (Guy Cochrane, USGS, pers. comm., February 7th, 2012).

Regionally, significant updates have been made to the nearshore seafloor habitats of the Washington Outer Coast and within the Strait of Juan de Fuca in the Version 3.2 SGH map for Washington and Oregon. These regional habitat map edits modify the current state of knowledge of rocky outcrop distribution and abundance in nearshore state waters. New outcrops are identified and mapped along the outer coast from Cape Flattery south to Grays Harbor, Washington and with the Strait of Juan De Fuca from Cape Flattery, WA east to Dungeness Spit, Washington. The outcrops were identified using historic NOAA NOS hydrographic survey sheets and from air photo interpretations.

Plate 2: Washington Outer Coast

Plate 2 includes 22 new high-resolution seafloor imagery surveys. Of these, 18 include bathymetry and backscatter data, two include backscatter or sidescan data, and two include only bathymetry data (Appendix C Table C-1). The primary source of seafloor imagery in this region has been the National Science Foundation, including work completed under the Ocean Observing Initiative. Plate 2 includes six new habitat maps.

As in Plate 1 above, Plate 2 includes new nearshore mapping. Therefore, the abundance of nearshore rocky outcrops along the outer coast of Washington from Cape Flattery south to Grays Harbor has increased (Appendix C-2 Plate 2). Several large patches of mixed seafloor substrate have been mapped with multibeam sonar in the vicinity of Grays Harbor just outside of the nearshore zone and also in mid and outer shelf regions. Bathymetry surveys conducted during 2009, 2010, and 2011 show a large rocky reef along the southern border of the OCNMS and offshore of Grays Harbor in 60-100m of water. The Grays Harbor vicinity bathymetry surveys have not been mapped for seafloor habitat type.

For deepwater slope environments, the SGH map for Oregon and Washington has changed little since 2005. In May of 2011 the NSF sponsored a bathymetry mapping expedition for Washington, Oregon, and Northern California. A significantly improved map of Washington slope bathymetry resulted but has not been mapped for seafloor habitat.

Plate 3: Northern Oregon Outer Coast

Plate 3 includes 29 new sources of high-resolution seafloor imagery; 27 bathymetry and backscatter data surveys and two bathymetry data (only) surveys (Appendix C Table C-1). The primary source of new information in Plate 3 is the Oregon State Waters Mapping Program. Plate 3 includes 20 new habitat maps.

Locally, new multibeam mapping from the Oregon State Waters Mapping Project shows much greater abundance of rocky outcrop within the State Waters (0-3nm) of Oregon than was known in the Version 1 SGH map for Oregon. A new habitat map has been produced by NOAA NWFSC for Heceta Bank, Oregon providing greater information about the distribution of both rocky and mixed habitats than was previously available.

Regionally, a large rocky outcrop on mid continental shelf southeast (inshore) of Nehalem Bank is newly mapped. This feature was mapped as rock outcrop in the Version 1 SGH map for Oregon but at a more limited spatial extent. Submersible observations verified high relief outcrop as well as complex mixed seafloor habitats at the feature. Authegenic carbonate rocky ridgetop habitats are identified along upper continental slope ridges in northern Oregon. Similar habitat types were mapped in the Version 1 SGH map for Oregon in the vicinity of Hydrate Ridge and are now extended to include geologically similar ridge crests from Hydrate Ridge north to the Astoria Canyon. There has been no additional development of the “Predicted Rock Outcrop” data layer since the Version 1 SGH map for Oregon. The predicted rock outcrop map identifies local seafloor slopes (within a 300m by 300m analysis neighborhood) greater than 10 degrees. Any areas of 10 degrees or greater are classified as Inferred Rock.

Plate 4: Southern Oregon Outer Coast

Plate 4 includes 16 new sources of high-resolution seafloor imagery; 14 bathymetry and backscatter data surveys and two bathymetry data only surveys (Appendix C Table C-1). The primary source of new information in Plate 4 is the Oregon State Waters Mapping Program. Plate 4 includes 11 new habitat maps.

Re-mapping of the Bandon High Spot for habitat type was performed to address misclassifications identified in previous SGH map for Oregon versions. Although no new multibeam bathymetry was available for the re-mapping, existing seismic reflection profiles of the area were re-examined and re-interpreted yielding a more conservative rocky outcrop mapping and including a significant amount of mixed habitat type along the perimeter of the feature. The Version 3.6 SGH map for Oregon also includes updated rock outcrop mapping in Oregon neashore waters from NOAA NOS hydrographic survey sheets and from air photo interpretations.

New (2010) multibeam mapping of the adjacent Oregon State Waters at Cape Aragon and Bandon Reef reveals a large rocky reef, possibly an inshore extension of the Bandon High Spot. Habitat maps for Redfish Rocks and Island Rock provides updated rock outcrop mapping within the southern Oregon State Waters and nearshore zone while Oregon State Waters Mapping Program habitat maps are newly available for areas adjacent to Redfish Rocks and Island Rock.

Plate 5: Northern California and Mendocino Ridge

Plate 5 includes 20 new sources of high-resolution seafloor imagery coverages, encompassing 19 regions where bathymetry and backscatter data were collected and one region where only bathymetry data were collected (Appendix C Table C-1). In addition, habitat maps were constructed for 14 regions, including 13 that also had new bathymetry and backscatter coverages (Appendix C Table C-1). The northernmost coverage included in this plate (Pelican Bay) also extends to Plate 4 and is therefore not directly incorporated into this summary. The great majority of the regions in Plate 5 were surveyed and mapped by the Seafloor Mapping Lab at California State University, Monterey Bay (CSUMB-SML). NOAA-NOS additionally produced high-resolution imagery for three surveyed regions, and the Center for Habitat Studies (CHS) generated a habitat map for one region (Appendix C Table C-1).

New, high-resolution acoustic imagery in Plate 5 is restricted to nearshore and insular waters, with the great majority of new data collected and produced as part of the California Seafloor Mapping Project (CSMP). Sponsored by the California Ocean Protection Council, State Coastal Conservancy, Department of Fish and Game, and several branches of the NOAA, the CSMP is being conducted as a public/private partnership involving industry, resource management agencies and academia. In association with this project, the entire nearshore region of Northern California depicted in Plate 5 has been surveyed, and coupled bathymetry and backscatter coverages have been produced. In addition, a bathymetry coverage for Humboldt Bay was produced by CSUMB-SML in 2005, along with two higher-resolution, smaller bathymetry and backscatter coverages that detail portions of the northern and southern Bay. NOAA-NOS produced three small bathymetry and backscatter coverages in highly trafficked coastal regions off Northern California during 2008 and 2009 (Appendix C Table C-1).

The great majority of the seafloor habitat maps in Plate 5 were generated from the acoustic imagery collected as part of the CSMP project, and is therefore also restricted to nearshore waters. These maps were produced via automated habitat classification, conducted by personnel at CSUMB-SML. No CSMP habitat map products have been published for this or any region to date; geological map interpretations were used instead. CSUMB-SFL maps predict the occurrence of rocky regions mainly offshore of coastal points and promontories (e.g., Point St. George, Trinidad Head, Cape Mendocino, Punta Gorda, Point Delgado). A notably extensive region of unconsolidated sediments is predicted to occur from Trinidad Head to just north of Cape Mendocino. The new, higher-resolution (1:24,000 vs. 1:250:000) habitat maps in the nearshore region substantially refine the extent of hard and soft habitats along the Northern California coast. They greatly reduce and more precisely depict the extent of rocky habitats off Trinidad Head, whereas they substantially increase the amount of predicted habitat in other coastal regions. In addition to the automated habitat maps produced by CSUMB-SML, a single, interpreted coverage was produced offshore in the Eel River Basin region by H. Gary Greene and colleagues at Moss Landing Marine Laboratories' CHS. The mapped portion of Eel River Basin consists mainly of mixed habitat types, although a large amount of contiguous rock bottom is depicted in the central region.

Plate 6: Northern California Mendocino Coast

Plate 6 includes 101 new coverages, of which 35 represent bathymetry data, 34 represent backscatter data, and 32 are habitat maps. In total, these data are derived from 38 surveyed regions (Appendix C Table C-1). The primary source of seafloor imagery and habitat maps in this region CSUMB-SML. In addition, three regions were mapped for benthic habitats by CHS, and regional imagery products were additionally generated by NOAA-NOS (N=2) and USGS (N=1). The northernmost coverage included in this plate (Punta Delgada) also extends to Plate 5 and is therefore not directly incorporated into this summary.

New, high-resolution acoustic imagery in Plate 6 is largely restricted to nearshore and insular waters, with the great majority of new data collected and produced as part of CSMP efforts. The entire nearshore region depicted in Plate 6 has been surveyed, and coupled bathymetry and backscatter coverages were produced. In addition, bathymetry and backscatter coverages were created for Tomales Bay by USGS in 2008. A coverage that extends along the offshore region adjacent to Tomales Bay was generated by NOAA-NOS in 2007. NOAA-NOS also published a bathymetry layer that ranges along the coast from south of Point Reyes to north of San Francisco Bay. This region is obscured in Plate 6 because other bathymetry and backscatter data coverages overlap it. As part of NOAA's Ocean Exploration and Research Program, Active Tectonics and Seafloor Mapping Lab (ATSML) produced bathymetry and backscatter data coverages in 2010 that depict an offshore extension of San Andreas Fault between Point Arena and Cape Mendocino.

The great majority of the seafloor habitat maps in Plate 6 were generated by CSUMB-SFL from the acoustic imagery collected as part of the CSMP project. They are, therefore, largely restricted to nearshore waters. As previously described for Plate 5, new, higher-resolution maps greatly refine the amount and location of rocky habitats that are predicted to occur throughout the extent of their coverage. This refinement is particularly evident in the region between Point Reyes and Bodega Bay, where CHS has produced an expansive new coverage (Pt. Reyes) in addition to an older map (Bodega Basin (inshore). The original (2005) EFH substrate map depicted a large, contiguous rock bottom in this region, whereas the newer data displays a more punctuated, though extensive, distribution of rocky habitats. Locations of rocky habitats occur throughout the coastal region depicted in this plate, as opposed to their greater concentration in the northern region of Plate 5. In addition to nearshore regions, a sizeable portion of Bodega Basin (offshore) was also mapped by CHS. This map and its inshore complement were originally produced in 2001 but are included because they were not incorporated into the 2005 substrate map. The offshore region of Bodega Basin shows widespread, detailed areas of hard and mixed bottom where only coarse depictions of hard rock or soft bottom were previously evident.

Plate 7: San Francisco and Monterey Bay

Plate 7 includes 70 regions where high-resolution seafloor imagery was collected. Of these, 40 contain bathymetry and backscatter coverages, 27 consist solely of bathymetry layers, and one region includes only backscatter data (Appendix C Table C-1). In addition, habitat maps were constructed for 37 regions, including 33 that also had new bathymetry and backscatter coverages (Appendix C Table C-1). The majority of the regions in Plate 7 were surveyed and mapped by CSUMB-SML. However, NOAA-NOS and USGS produced acoustic imagery products for eight and seven regions, respectively (Appendix C Table C-1). Habitat maps were additionally produced for two regions each by CHS and USGS (Appendix

C Table C-1). Fifteen surveyed regions in the northern portion of Plate 7 were previously included in the description for Plate 6 and are not incorporated in this summary.

Much of the new, high-resolution acoustic imagery in Plate 7 was collected and produced as part of CSMP efforts. However, a great deal of additional data is available in this region and is especially concentrated in Monterey Bay, San Fransicso Bay and offshore regions located inside the 700 fathom boundary between Pacifica and Bodega Bay. The entire nearshore region displayed in Plate 7 has been surveyed, and coupled bathymetry and backscatter coverages were produced. There is one region just north of San Francisco Bay, however, where backscatter data only encompass a small portion of the available bathymetry coverage. Many bathymetry surveys were conducted in Monterey Bay since the last EFH review and a great deal of (often overlapping) coverages are therefore available (Appendix C Table C-1). One of the more interesting of these is a time series (2002-2008) of Monterey Canyon produced seasonally by CSUMB-SML. New USGS bathymetry and backscatter data covers a large portion of this region. Additional USGS bathymetry grids have recently been produced for Rittenburg Bank (2011) and Farallon Escarpment (2012), and corresponding backscatter data are currently being processed. NOAA-NOS data in Plate 7 largely consist of bathymetry coverages that are concentrated in the Gulf of the Farallons region and offshore of San Francisco Bay. Cordell Bank has been extensively surveyed (bathymetry and backscatter) by CSUMB-SML, and a backscatter coverage has been produced by USGS for a large region to the southeast of Rittenburg Bank.

New habitat maps have been produced throughout the nearshore regions encompassed by Plate 7, as well as in offshore regions between San Francisco and Bodega Bay. In nearshore regions, areas of rock are evident in association with the Monterey Peninsula and to the south, but much of Monterey Bay consists of soft bottom habitats. Between Monterey Bay and Pacifica, however, rocky habitats are prevalent in coastal regions. The region between Pacifica and Point Reyes is largely depicted as soft bottom, with the notable exception of a substantial hard bottom region off Stinson Beach. An extensive, detailed coverage was produced by CHS for the Golden Gate National Recreation Area and shows a great deal of hard and mixed seafloor. The new, higher-resolution maps greatly refine the amount and location of rocky habitats that are predicted to occur throughout the extent of their coverage in Plate 7. They generally reduce the amount of rock that was originally depicted, especially from Half Moon Bay to Pescadero, off Stinson Beach, and between Point Reyes and Tomales Bay. This trend is also evident in the northern offshore, region, where more precise habitat mapping has occurred on Rittenburg (USGS) and Cordell (CSUMB-SFL) Banks. A region southeast of Rittenburg Bank, however, was mapped by the USGS in 2005 and continues to show a large, contiguous area of rock bottom.

Plate 8: Central California Offshore

No new bathymetry, backscatter, or habitat coverages have been produced in the region encompassed by Plate 8 since the 2006 EFH review.

Plate 9: Central California

Plate 9 includes 189 new coverages, of which 64 represent bathymetry data, 60 represent backscatter data, and 65 are habitat maps. In total, these data are derived from 73 surveyed regions (Appendix C Table C-1). The primary source of seafloor imagery and habitat maps in this region CSUMB-SFL. However, USGS produced acoustic imagery products for seven regions and NOAA-NOS generated bathymetry and backscatter coverages in various regions Santa Barbara Channel (Appendix C Table C-1). Habitat maps were additionally produced for eight regions by CHS and two regions by USGS (Appendix C Table C-1). This summary does not incorporate four surveyed regions in the northern portion of Plate 9 that were previously included in the description for Plate 7.

New, high-resolution acoustic imagery in Plate 9 is restricted to nearshore waters, with the majority of new data collected and produced as part of CSMP efforts. The nearshore waters displayed in Plate 9 have been surveyed, and coupled bathymetry and backscatter coverages were produced for most regions. However, a notable exception is the region from Lopez Point to just north of San Simeon. CSUMB-SFL has collected bathymetry and backscatter data in this region but it has not yet been processed into grids and geotiffs for display. In addition, backscatter coverage is somewhat uneven in the coastal region south of Point Arguello. Many of the recently completed high-resolution surveys in the vicinity of the Santa Barbara Channel are-located in the southernmost portion of Plate 9. These include a small, coastal coverage off Ventura produced by NOAA-NOS, and several larger USGS coverages located throughout nearshore regions in northern Santa Barbara Channel. The northern extension of a large USGS data set in the northeastern Channel Islands regions also is depicted further offshore.

Most of the seafloor habitat maps in Plate 9 were generated by CSUMB-SFL from the acoustic imagery collected as part of the CSMP project. However, several interpreted habitat maps were produced (though not yet published) by CHS from a portion of the same data set, and these are overlaid where they occur in the Point Buchon and Santa Barbara Channel regions. Additional geologically interpreted coverages were created by USGS in the Northeastern Santa Barbara Channel and Southern Vandenberg Reserve. Habitat maps are absent in the north-central coastal portion of Plate 9 where seafloor imagery is not yet available, and in a small portion of the western Santa Barbara Channel. Rocky areas are abundant from Pismo Beach to San Simeon, and off Big Sur (to the north) and Point Sal (to the south). Diffuse rocky areas are also depicted off Point Conception, with mixed and rocky habitats located throughout the surveyed area in Santa Barbara Channels, mainly in deeper waters outside of coastal regions. The new, higher-resolution mapping efforts expand the known rocky areas throughout the coast, and more precisely depict their occurrences. For example, rocky areas are absent from the 2005 EFH map between Point Sal and Cape San Martin but present in the newer data. The extent of coastal rocky areas in the Santa Barbara Channel, however, has been reduced by newer mapping efforts, especially along the eastern and western margins depicted in Plate 9.

Plate 10: Southern California Offshore I

No new bathymetry, backscatter, or habitat coverages have been produced in the region encompassed by Plate 10 since the 2006 EFH review.

Plate 11: Southern California Borderland

Plate 11 includes 63 regions where high-resolution seafloor imagery was collected. Of these, 30 contain bathymetry and backscatter coverages, 26 consist solely of bathymetry layers, and 7 include only backscatter data (Appendix C Table C-1). In addition, habitat maps were constructed for 43 regions, including 21 that also had new bathymetry and backscatter coverages (Appendix C Table C-1). The majority of the regions in Plate 11 were surveyed and mapped by CSUMB-SFL. However, the following organizations also produced bathymetry and/or backscatter coverages in this region: USGS (N=12), Oregon State University's Active Tectonics and Seafloor Mapping Lab (ATSML) (N=6), and NOAA-NOS (N=4) (Appendix C Table C-1). Habitat maps were additionally produced for seven regions by USGS and six regions by ATSML (Appendix C Table C-1). This summary does not incorporate four surveyed regions in the northern portion of Plate 11 that were previously included in the description for Plate 9.

New, high-resolution acoustic imagery is abundant and widespread throughout the Southern California Bight region depicted in Plate 11. In this region, and evident throughout California waters, most of the new high-resolution acoustic data has been collected and imaged by CSUMB-SML. Coastal coverage in Southern California is, however, more sparse in terms of available new backscatter data than in other California regions. This situation is especially evident south of Newport Beach, where the only coastal backscatter available is located between Torrey Pines and La Jolla. In addition, the region between Dana Point and Torrey Pines is also largely devoid of new bathymetry imagery. However, expansive coastal bathymetry and backscatter coverages that extend far offshore have been produced by USGS in the southern border region and throughout the north-central Bight, and in the northeast Channel Islands region. In contrast to other California regions, offshore areas (especially those associated with islands and important fishing banks) have been well surveyed in Southern California. Much of the Channel Islands region contains bathymetry and backscatter coverages, produced by CSUMB, or backscatter data, produced by USGS. Extensive bathymetry and couple bathymetry and backscatter data, both collected by CSUMB-SML, surround Santa Barbara and Santa Catalina Islands, respectively. Bathymetry coverage, also produced by CSUMB-SML, is also evident along the west coast of San Clemente Island. Bathymetry data also have been collected and imaged by ATSML in several important offshore fishing regions, as contracted by NMFS SWFSC (Appendix C Table C-1). Additional offshore imagery was recently produced by CSUMB-SML for Cortes Banks (bathymetry and backscatter) and Tanner Bank (bathymetry). NOAA-NOS has produced four small, coupled bathymetry and backscatter coverages in highly trafficked coastal regions such as San Pedro Bay and Los Angeles Harbor.

New habitat map coverage in offshore areas of Southern California is more substantial and detailed than that of coastal regions, a condition that is unique to this region. The increased emphasis on mapping offshore regions in the Southern California Bight is a direct consequence of the importance of this area as EFH for commercially important rockfishes. Nearshore habitat coverages extend throughout the mainland coast with a notable absence in Santa Monica Bay and Long Beach Harbor. They depict primarily soft bottom, with rocky areas largely associated with promontories in the greater San Diego and border regions. These rocky areas are substantial, however, and were not previously depicted in the 2005 EFH substrate map. Santa Catalina Island is largely fringed by soft sediment, though some isolated rock is evident off the southern and western coasts. Extensive habitat coverage in the Channel Islands depicts a great deal of rocky habitat, especially off northern Santa Rosa Island (CSUMB-SML) and in association with Anacapa Island and the Anacapa Passage (USGS). In addition, mixed sediment is the dominant habitat type in Anacapa Passage and off eastern Anacapa Island (USGS). The USGS maps, especially, are quite detailed and consist of habitat interpretations based on acoustic imagery and geologic data. The offshore banks, surveyed by ATSML and, to a lesser extent, CSUMB-SML contain high concentrations of rocky and mixed habitats. This is to be expected, since these banks are known to provide important habitat for rockfishes. Among them, the more offshore banks (e.g., Tanner, Cherry, Potato) contain a much higher proportion of rocky and mixed habitats than their inshore counterparts. The contrast between the new, higher-resolution offshore habitat coverages and the same areas displayed on the 2005 EFH map is stark and highlights the greater utility of the newer data. For example, the 2005 EFH map shows contiguous rocky habitat around the totality of Santa Catalina Island, whereas soft sediment is dominant on the new coverages. Similarly, rocky regions have been defined in much greater detail and considerably reduced in association with Anacapa Island and Tanner Bank. By contrast, substantially rocky habitats on Cherry Bank are displayed as soft sediment in the 2005 EFH substrate map.

Plate 12: Southern California and International Border

No new bathymetry, backscatter, or habitat coverages have been produced in the region encompassed by Plate 12 since the 2006 EFH review.

3.2.2 Biogenic Habitat Maps

Biogenic habitat maps were developed from three sources of data:

- Selected Observations of Corals and Sponges, which are presented from various sources on regional plates (Appendix D).
- NMFS West Coast Groundfish Bottom Trawl Survey (WCGBTS), from which separate observations of corals (Appendix E1), sponges (Appendix E2), sea pens/whips (Appendix E3), and combined corals and sponges (Appendix E4) are presented on regional plates for pre-and post-Amendment 19 periods.

- West Coast Groundfish Observer Program (WCGOB) Commercial Bottom Trawl Bycatch, from which regional plates of similar taxa have been developed, and further stratified by lbs/km (Appendices F1-F4) and lbs/ton of groundfish (Appendices F5-F8).

3.2.2.1 Selected Observations of Corals and Sponges

Appendix D maps depict the spatial distribution of selected observations of corals and sponges from visual surveys conducted by a number of agencies and institutions (Table 3). Many of the locations of observations are included in a national database prepared under the auspices of NOAA's Deep-Sea Coral Research and Technology Program (NOAA 2011). Although there are a number of records of additional observations recorded at various research institutes, this database is currently the most comprehensive source of electronically available records of coral and, to a lesser extent, sponge observations in the region. Development of this database is ongoing and additional records of observations will be added as they become available. Appendix D plates also depict records from two other database query results: 1) selected observations of corals and sponges from submersible and remotely operated vehicle (ROV) surveys off southern California (NMFS SWFSC [M. Yoklavich]), and 2) a database maintained by Brian Tissot (Washington State University Vancouver) containing records of coral observations from submersibles and ROV surveys off Oregon and central and southern California (Bianchi, 2011; Bright, 2007; Pirtle, 2005). These additional records were added to the map figures because they were not yet included in the version of the national database. Compared to the 2006 groundfish EFH review, this database represents a major advancement in access and dissemination of records of coral and sponge presence in the region. Furthermore, this database was not available during the Amendment 19 process.

The Appendix D maps depict point locations of observations of corals and sponges recorded via a variety of collection methods (Table 3). Records with the label "in situ observation" were made using direct count methods utilizing submersible, ROV, or camera sled platforms. The precision of these point locations varies between data sets, ranging from very precise estimates of vehicle position at the location of the individual coral or sponge specimen observed in situ, to more general representations of a vehicle dive transect. Almost all records of corals and sponges collected via "trawls" or "dredges" originate from surveys conducted by NMFS during the past three decades; however, numerous records from museum collections within the "various" category also originate from very early NMFS trawl surveys conducted over the last century. Trawl and dredge records exhibit less locational precision, because trawls often operate over 100's of meters to 10's of kilometers. It is very difficult to estimate over the course of a trawl or dredge track when and where a particular specimen was collected. As mentioned above, records termed "various" most often are part of museum collections, for which the original collection method varies between the other four general categories or is not specified. The final category, "ROV collection" refers to specimens that were physically extracted from their benthic habitat by an ROV. Often times, these specimens are accessed in a museum collection. Consequently, this database of observations may contain duplicate records. Due to the varying and often unrecorded precision of the location information, particularly from trawl samples, users of these data should exercise caution when conducting any fine scale spatial analysis.

These records of selected coral and sponge observations are presented in map view to highlight the geographic scope of the observations (e.g., Figure 8; Appendix D). The spatial distribution of these locations of coral and sponge presence is largely driven by survey effort. The largest number of records originates from in situ observations (red) at discrete survey sites. Major areas of direct count *in situ* studies include sites in the Olympic Coast National Marine Sanctuary, numerous rocky banks off Oregon, central California (e.g., Cordell Bank National Marine Sanctuary) and in the southern California Bight, and submarine canyons off Oregon and central California, including a very large number of records from sites in and around Monterey Bay.

The second most numerous category of records comes from trawl surveys (blue), which were conducted mostly by the NMFS starting in the mid 1970's and continuing through 2010, at least for the current version of the database. These observations are limited to "trawlable" areas of the continental shelf and slope, while survey focus was often to make fishery-independent estimates of groundfish biomass. It is important to note that most trawl gear is not designed to sample sessile benthic invertebrates, nor is it designed to access the types of habitats in which these organisms typically reside. The exception is sea pens and sea whips, since they don't require hard substrate for attachment. For this reason, sea pens and sea whips are encountered much more frequently in the catch of trawl surveys than any other coral taxa (see Whitmire and Clarke, 2007).

Lastly, records in the "various" category (yellow) are less numerous and occur in areas off Washington and central and southern California. When they appear in dense clusters around a feature such as seamounts (e.g., Figure 8), they almost certainly originate from ROV or submersible surveys. Such records would have been members of the "*in situ* observation" had the data attributes indicated this. Often times, these records were provided as queries of museum specimen collections or online databases for which observations are compiled from a variety of sources.

In contrast to the existing databases of observations described above, the last review of groundfish EFH that concluded in 2006 utilized significantly fewer records of observations. A summary of data sources, total records reviews, and numbers of observations used during the last review is detailed in Appendix B of the Final Environmental Impact Statement (NMFS, 2005).

Table 3. Summary of records of coral and sponge observations depicted in map views (Figure 8; Appendix D) and categorized by collection method. Data sources include 1) a national database of deep-sea coral and sponge records maintained by NOAAs Deep-Sea Coral Research and Technology Program, 2) records from various submersible and ROV surveys conducted by the NMFS SWFSC (M. Yoklavich), 3) records from various submersible and ROV surveys conducted by OCNMS (C. E. Bowlby; Brancato et al. 2006; Brancato and Bowlby 2005) and 4) a database maintained by Brian Tissot (Washington State University Vancouver) containing records of coral observations from submersibles and ROV surveys off Oregon and central and southern California (Bianchi, 2011; Bright, 2007; Pirtle, 2005). Many specimens extracted from their benthic substrate via ROV are also included in the "various" category; however, the national database does not always include details about the collection method.

Collection Method	# Database Records *
in situ observation	304,069
research trawl	8,268
various	271
ROV collection	3
research dredge	1
Total	**312,612**

*Some database records may represent multiple observations of corals and/or sponges.

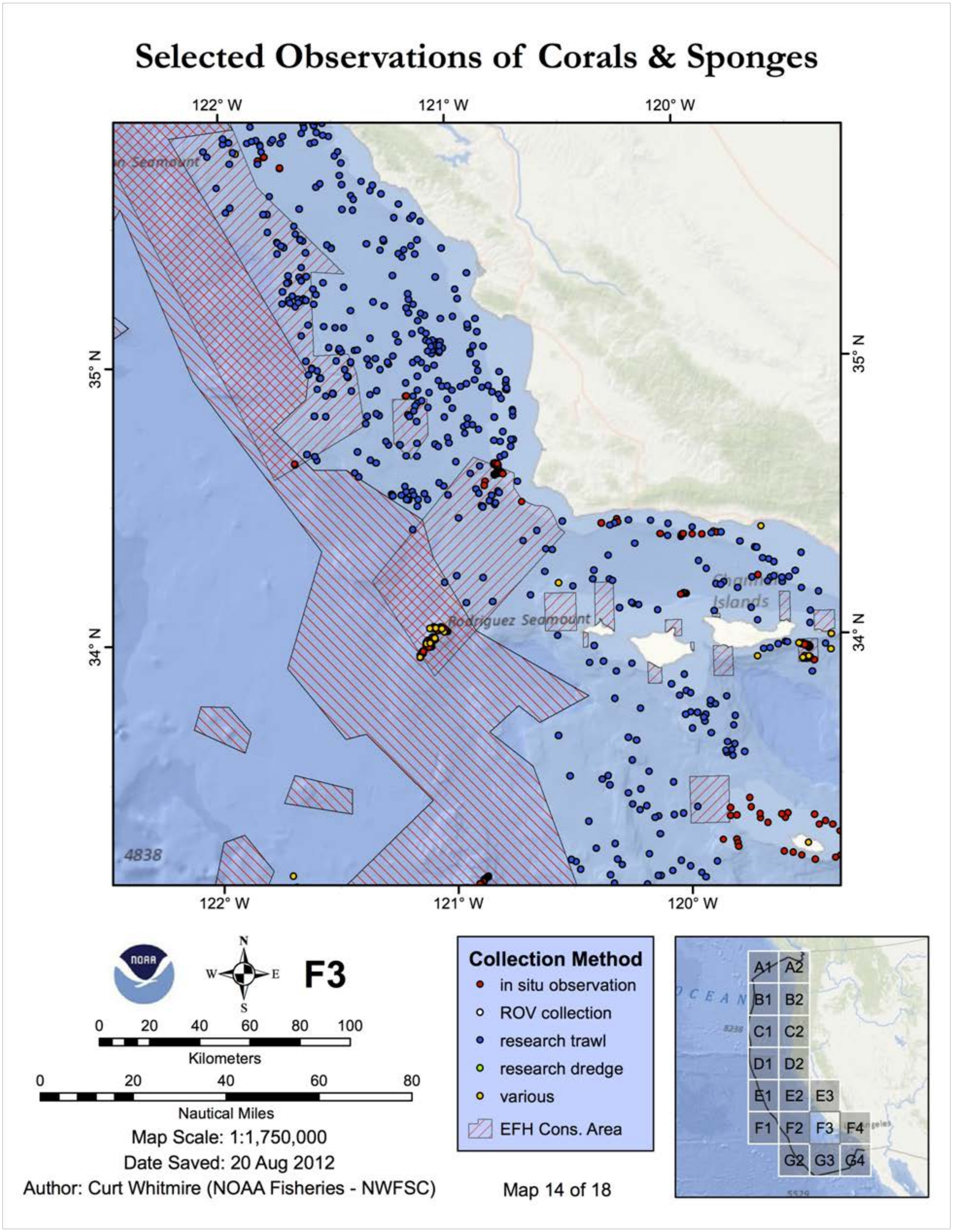


Figure 8. Example of map from Appendix D, selected observations of corals and sponges.

3.2.2.2 Distribution of Corals and Sponges from Standardized Catch in the NMFS West Coast Groundfish Bottom Trawl Survey Conducted Before and After the 2006 EFH Review

Appendix E plates depict the spatial distribution of standardized survey catch of corals and sponges within two time periods: "Before" (2003-05 survey cycles) and "After" (2006-10 survey cycles) implementation of Amendment 19 regulations. The sole data source for the map layers is catch records from the WCGBTS. Since 2003, the WCGBTS has been a combined survey of demersal species residing in both continental shelf (i.e., 30-100 fm) and slope (i.e., 100-700 fm) habitats. Each year, the WCBGTS sampled about 750 stations during two passes (May-July, August-October) operating north to south from the Canadian to Mexican maritime borders. Tow durations were targeted at 15 minutes, with a mean tow distance of 1.4 km. Invertebrates in the catch were sorted, weighed and identified down to the lowest possible taxonomic level. Consequently, taxonomic resolution was dependent upon the expertise of onboard biologists. A full description of the survey design and protocols can be found in past cruise reports at: http://www.nwfsc.noaa.gov/research/divisions/fram/index.cfm. A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online-at: http://efh-catalog.coas.oregonstate.edu/overview/.

Standardized catch was defined as the total weight of organisms (kg) per linear distance towed (km) witin a standard area and calculated for four taxonomic groupings of organisms: 1) corals (excluding sea pens and sea whips) and sponges, 2) corals (excluding sea pens and sea whips), 3) sponges, and 4) sea pens and seas whips (Appendix E-1 to E-4). The numerator (catch) was calculated using a kernel density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California). The kernel density algorithm distributes catch over a surface that is defined by a user-specified distance from the line, where the catch is highest on the line and dimishes proportionally with distance from the line (Figure 9). Each kernel surface encompasses the toal catch value for a given tow. The denominator (effort) was calculated using a line density algorithm that sums the total portions of lines intersecting a circular search area (Figure 10). Both density values are assigned to grid cells of user-specified dimensions. Cells with values greater than zero indicate areas of positive catch, while cells of zero value indicate areas where effort occurred but no corals and/or sponges were present in the catch. The density parameters used for calculating both catch and effort were a 6 km search radius and a 500x500 m cell size. By standardizing catch by effort, the resulting catch outputs were standardized over both space and time. Since density outputs are highly sensitive to the specified radius and cell size, the absolute values are less important than the relative nature of them. The benefit of this output over depicting towlines themselves is that the density output better identifies areas where catch is concentrated.

Sponges (Appendix E-3) were more common in the catch than corals (Appendix E-2), and accounted for the top six taxa by standardized weight (CPUE) in the period from 2003-10 (Table 4). Two pennatulid taxa were the next most abundant, with gorgonians and then black corals being the most frequently recorded of all non-pennatulid coral taxa. Any significant changes in the frequency or standardized catch of taxa between the two time periods should be interpreted with caution, as the ability of onboard biologists to identify corals in the catch has improved throughout time.

In order to evaluate how fishing effort has changed between the two time periods, the color ramps for the intensity layers are scaled to the same range of values in each panel (e.g., Figure 9). Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. The value in the map legends is the lowest "high" value between the time periods. It was necessary to set the color ramp to the lowest "high" value in order for the colors in each panel to perfectly match and therefore be comparative.

In the maps showing standardized catch of corals excluding sea pens/whips (Appendix E-2), areas of highest relative CPUE occurred off northern California (Figure 11) in both time periods. Two areas off northern Washington show moderate CPUE, one within the Olympic 2 EFH conservation area in the recent time period (Figure 12).

In the maps showing sponges only (Appendix E-3), the areas of highest relative CPUE occurred off southern California, two sites in the before period and one in the after (Plate F3). The one area of highest CPUE in the recent time period also showed relative moderate catches of sponges in the before period. Other areas of moderate catch of sponges occurred near the Eel River Canyon (Plate D2, before) and off central Oregon in both time periods (Plate B2).

Areas of highest CPUE for sea pens/whips (Appendix E-4) occurred off northern and central Oregon (Plate B-2) and central California (Plate F3). Other areas of moderate CPUE are apparent off San Francisco in the recent time period (Plate E2) and central (Plate F3) and southern California (Plates F4 and F5).

One important consideration when evaluating catch records of invertebrates from trawl surveys is the sampling gear itself. Bottom trawl gear used in the WCGBTS is not designed to sample sessile invertebrates, nor is it designed to access many of the preferred habitats for coral and sponge settlement or habitats known to support corals and sponges. Regardless of the limitations of the gear, corals or sponges were recorded in almost half of all survey tows (Table 4; Appendix E-1). The average length of survey tows is much shorter in duration than commercial tows, and vessel captains can often prosecute a tow in areas where they normally would not during commercial operations. This may in part account for the fact that corals and sponges are recorded more frequently in survey catches (see Section 3.2.2.3, Table 5 and Appendix F).

Table 4. Summary of coral and sponge taxa recorded during tows as part of the West Coast Groundfish Bottom Trawl Survey (WCGBTS), comparing two time periods: "Before" (2003-05) and "After" (2006-10). "#" denotes number of tows with recorded bycatch; "FREQ" denotes ratio of tows with catch to total tows recorded; "CPUE" denotes catch per unit of effort (units: kg/ha). Tow counts represent only those where corals or sponges were present in the catch. Taxa are listed in descending order of CPUE for combined time period.

	BEFORE			AFTER			BEFORE + AFTER		
	#	**FREQ**	**CPUE**	**#**	**FREQ**	**CPUE**	**#**	**FREQ**	**CPUE**
Porifera	359	21.7%	1,852.90	647	19.0%	2,297.41	1,006	19.9%	4,150.31
Hexactinosida	103	6.2%	810.13	295	8.7%	2,371.76	398	7.9%	3,181.89
Rossellinae	53	3.2%	154.01	91	2.7%	698.79	144	2.8%	852.80
***Suberites* spp.**	3	0.2%	425.77	9	0.3%	2.90	12	0.2%	428.67
***Hyalonema* spp.**	47	2.8%	49.17	95	2.8%	174.32	142	2.8%	223.49
Hexactinellida	17	1.0%	77.80	0	0.0%	0.00	17	0.3%	77.80
Pennatulacea	245	14.8%	16.18	417	12.3%	24.44	662	13.1%	40.62
Anthoptilum grandiflorum	98	5.9%	6.64	289	8.5%	30.58	387	7.7%	37.22
***Chrysopathes* spp.**	0	0.0%	0.00	31	0.9%	29.24	31	0.6%	29.24
Antipatharia	66	4.0%	23.85	25	0.7%	1.77	91	1.8%	25.61
***Halipteris* spp.**	0	0.0%	0.00	161	4.7%	13.11	161	3.2%	13.11
Gorgonacea	58	3.5%	2.56	82	2.4%	10.34	140	2.8%	12.90
Anthomastus ritteri	16	1.0%	3.09	69	2.0%	8.04	85	1.7%	11.13
Ptilosarcus gurneyi	28	1.7%	2.48	62	1.8%	5.64	90	1.8%	8.12
Alcyonacea	14	0.8%	0.89	15	0.4%	3.53	29	0.6%	4.42
***Anthomastus* spp.**	19	1.2%	3.00	11	0.3%	1.29	30	0.6%	4.29
Callogorgia kinoshitae	4	0.2%	0.06	22	0.6%	4.09	26	0.5%	4.15
***Umbellula* spp.**	23	1.4%	1.38	94	2.8%	2.47	117	2.3%	3.84
***Paragorgia* spp.**	6	0.4%	0.56	14	0.4%	2.68	20	0.4%	3.24
***Isidella* spp.**	1	0.1%	0.06	9	0.3%	3.05	10	0.2%	3.11
Scleractinia	4	0.2%	2.43	3	0.1%	0.14	7	0.1%	2.57
***Farrea* spp.**	5	0.3%	0.76	3	0.1%	0.85	8	0.2%	1.61
Anthoptilum murrayi	4	0.2%	0.06	29	0.9%	1.01	33	0.7%	1.07
Flabellidae	2	0.1%	0.03	9	0.3%	0.82	11	0.2%	0.84
Caryophylliidae	1	0.1%	0.09	5	0.1%	0.35	6	0.1%	0.45
***Bathypathes* spp.**	6	0.4%	0.05	25	0.7%	0.37	31	0.6%	0.42
***Keratoisis* spp.**	2	0.1%	0.41	0	0.0%	0.00	2	0.0%	0.41
Stylasteridae	1	0.1%	0.00	4	0.1%	0.37	5	0.1%	0.37
***Lillipathes* spp.**	3	0.2%	0.08	9	0.3%	0.20	12	0.2%	0.28
***Callogorgia* spp.**	1	0.1%	0.02	4	0.1%	0.17	5	0.1%	0.19
Pennatula phosphorea	1	0.1%	0.01	10	0.3%	0.10	11	0.2%	0.12
Acanthogorgiidae	0	0.0%	0.00	1	0.0%	0.01	1	0.0%	0.01
	749	**45.3%**	**3,434.45**	**1,554**	**45.7%**	**5,689.85**	**2,303**	**45.5%**	**9,124.30**
	1,652			**3,404**			**5,056**		

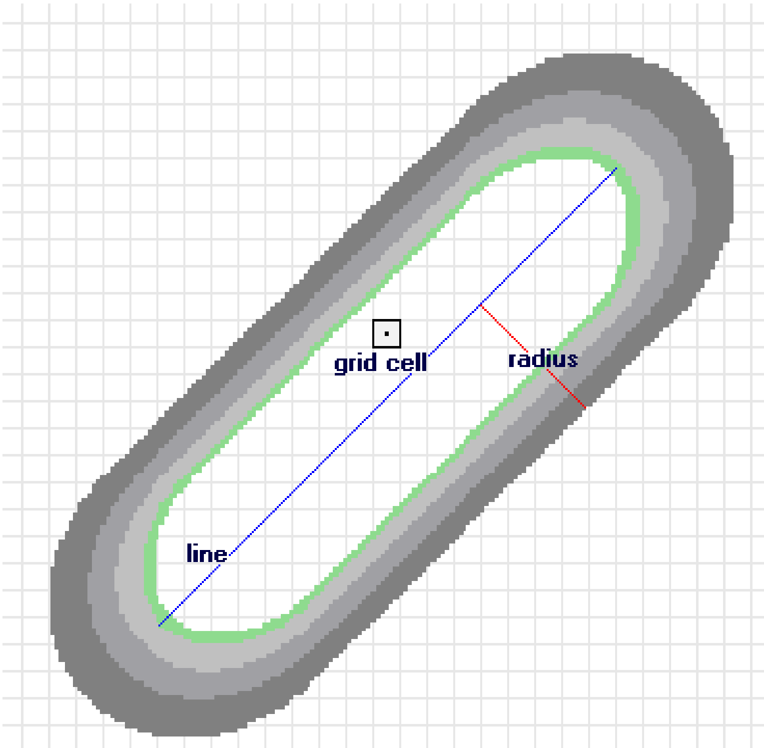


Figure 9. Conceptual drawing of how the ArcGIS kernel density algorithm works, showing application of the user specified parameter values: search radius and grid cell size. Image source: Environmental Systems Research Institute, Inc.

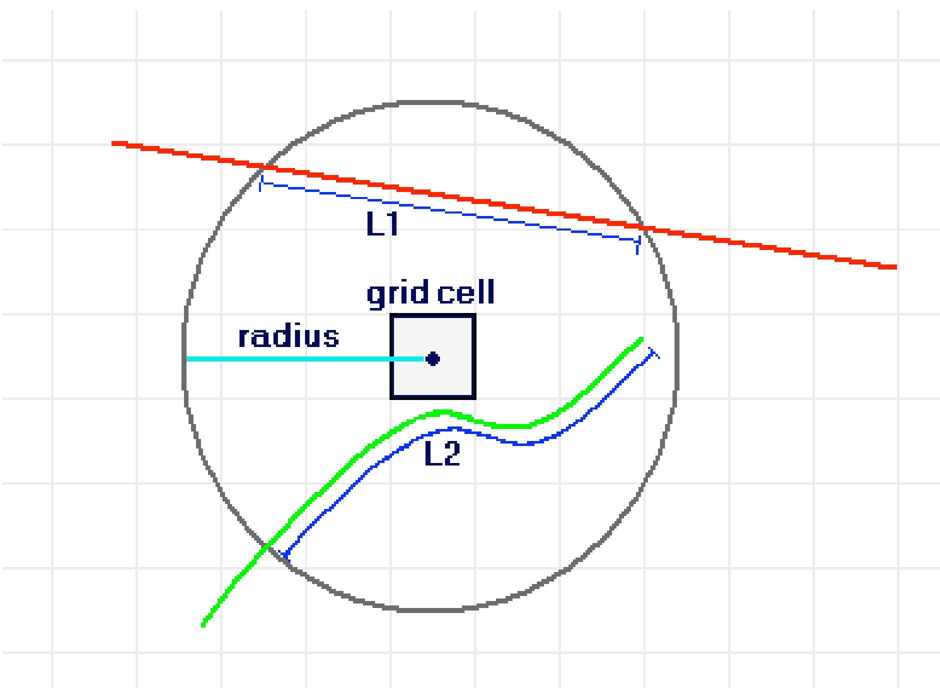


Figure 10. Conceptual drawing of how the ArcGIS line density algorithm works, showing application of the user specified parameter values: search radius and grid cell size. "L1" and "L2" represent hypothetical line inputs to the density algorithm. Image source: Environmental Systems Research Institute, Inc.

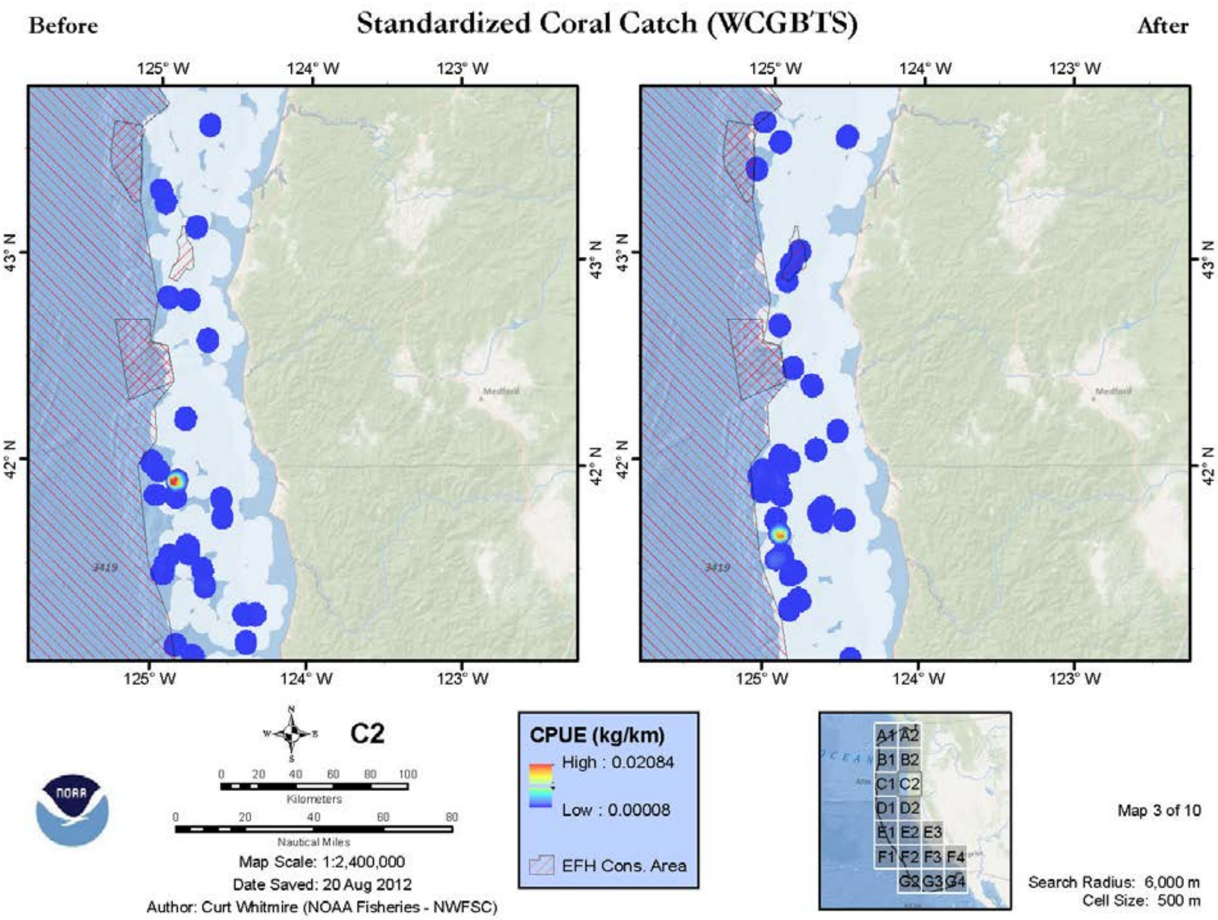


Figure 11. Example of plate from Appendix E-2 showing the distribution of coral CPUE (excluding sea pen/whips) off the Northern California Coast pre- and post- Amendment 19 from the West Coast Groundfish Bottom Trawl Survey.

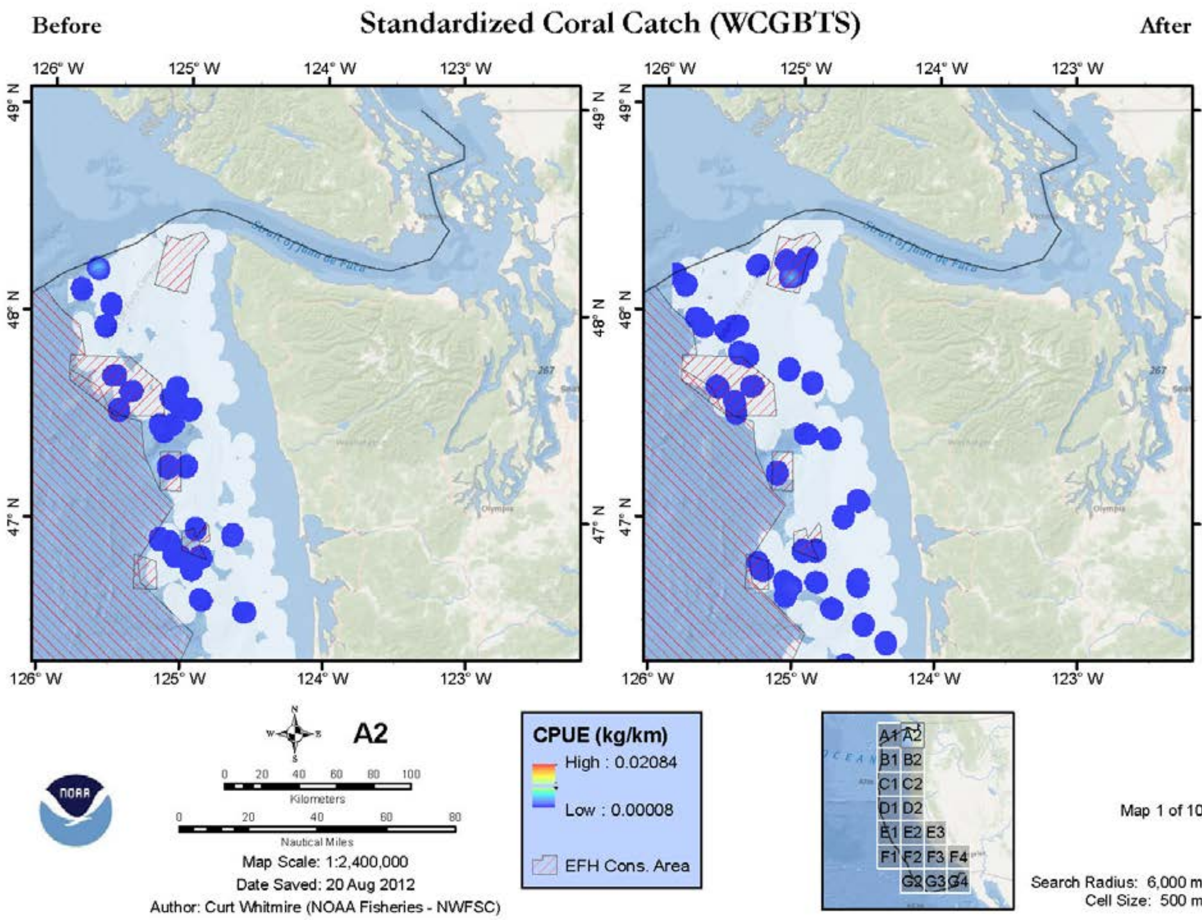


Figure 12. Example of plate from Appendix E-2 showing the distribution of coral CPUE (excluding sea pen/whips) off the Northern Washington Coast pre- and post- Amendment 19 from the West Coast Groundfish Bottom Trawl Survey.

3.2.2.3 Distribution of Corals and Sponges in Standardized Commercial Bycatch from West Coast Groundfish Observer Program Conducted Before and After the 2006 EFH Review

Appendix F Plates depict the spatial distribution of standardized commercial bycatch of corals and sponges within two time periods: "Before" (3 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of limited-entry trawl tows were compiled from one source: observer records from the WCGOP database. The WCGOP database includes records of trips for vessels using a variety of bottom trawl gear configurations, including small and large footrope groundfish trawl, set-back flatfish net, and double rigged shrimp trawl, to name a few. Records of tows using mid-water trawl gear were not included in this analysis, since observers recorded no bycatch of corals or sponges using this gear type. Furthermore, since all fishing operations are not observed, neither the maps nor the data can be used to characterize bycatch completely. We urge caution when utilizing these data due to the complexity of groundfish management and fleet harvest dynamics. Annual WCGOP coverage of the limited-entry trawl sector can be found online at:
http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm. A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and

to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.

Trawl events were represented by a straight line connecting the start and end points. Towlines intersecting land, outside the U.S. EEZ, deeper than 2,000 m, or with a calculated straight-line speed over 5 knots were removed from the spatial analysis. Bycatch was analyzed for four taxonomic groupings of organisms: 1) corals (excluding sea pens and sea whips) and sponges, 2) corals (excluding sea pens and sea whips), 3) sponges, and 4) sea pens and seas whips. For each of the four taxonomic groups, two standardized bycatch metrics were calculated: 1) standardized CPUE (units: lb/km; Appendix F-1 to F-4), and 2) catch-per-unit-of groundfish catch (i.e., CPUC, units: lb/ton of groundfish; Appendix F-5 to F-8).

The numerator for both bycatch metrics was catch density, calculated using a kernel density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California). Catch density was calculated for all tows with presence of one of the four taxonomic groups of corals and sponges.

The denominator for either the CPUE or CPUC was calculated using the same line density algorithm utilized in the two trawl effort intensity layers. For the CPUC metric, the line density algorithm weights each linear feature representing a tow by the weight of groundfish catch (tons). Effort density of density of groundfish catch was calculated for all tows, regardless of presence of corals or sponges in the catch.

By standardizing catch by either amount of effort (km/km^2; Appendix F-1 to F-4) or catch of groundfish (lb/km^2; Appendix F-5 to F-8), the resulting bycatch outputs were standardized over both space and time. In order to maintain the confidentiality of individual vessels, any cells with density values calculated from fewer than three vessels were removed from the final map layers. This did not significantly change how bycatch was represented since almost all bycatch occurred within areas where more than two vessels were operating. The density parameters used for calculating standardized bycatch were a 3 km search radius and a 500x500 m cell size.

Before interpreting the data and map figures, there are a few points about the methods used to create them that are important to consider. First, trawl tracks are only represented by straight lines connecting start and end points. Trawls rarely follow straight lines; therefore, the longer the line the higher the uncertainty as to its actual path. Second, since we are uncertain as to when bycatch occurred during the course of a trawl, bycatch was assumed to occur consistently and proportionally over the entire course of the straight trawl line. Third, only observed trips are represented. Fourth, different trawl gear configurations will access different types of habitats and topographic relief. Fifth, the boundaries of the trawl rockfish conservation areas have changed throughout both of these time periods, effectively changing access to trawlable (and biogenic) habitats within these areas. Lastly, implementation of the EFH conservation areas in June 2006 significantly curtailed access to some known biogenic habitats. The effects of these closures on protection of biogenic habitats are not fully understood.

Based on observer records of the limited-entry trawl sector, recorded bycatch of corals and sponges has changed significantly, both in frequency and standardized amount, since implementation of Amendment 19 regulations in June 2006 Table 5). Both the frequency (percent observed hauls) of bycatch and total weight (lb) of all three taxonomic groups combined have about doubled in the recent time period. Although this may seem alarming at first glance, this statistic is very likely influenced by a more concerted effort by observers to identify biogenic-structure forming invertebrates in commercial catches. Curiously, standardized bycatch (CPUE and CPUC) of corals has decreased over 5-fold since June 2006, while the frequency of occurrence has remained fairly consistent. What's even more perplexing is that the frequency of occurrence and standardized bycatch (CPUE and CPUC) of sea pens/whips have seen a

2-fold change, but in opposite directions (up for frequency and down for standardized bycatch). During the last decade of the observer program, sponges dominated the weight of bycatch for all three taxonomic groups, but this was not always the case. Sponge and corals were caught at relatively equal rates in the early time period, but in more recent times sponges are encountered four times more frequently and at much higher standardized catch rates compared to corals. Since observers in recent years have been trained to give equal attention to recording bycatch of both taxonomic groups, the large difference in magnitude may reflect either an increased level of impact by limited-entry trawlers on sponges compared to corals, or a greater relative abundance of sponges in “trawlable” habitats, or the more accurate records of sponge bycatch in recent years.

Eight (four taxonomic groups by two bycatch metrics) sets of map figures (Plates) were created to show temporal comparisons of standardized bycatch, (Appendix F). In order to evaluate how bycatch has changed between two time periods in any given map set, the color ramps for the density layers in each time period were scaled to the same range of values. Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. The upper value in the map legends is the lowest “high” value between the time periods. It was necessary to set the color ramp to the lowest “high” value in order for the colors in each panel to perfectly match and therefore be comparative.

One apparent feature of all map figures is that few areas of high relative bycatch are evident. This is a result of having to scale the color ramps for each panel to facilitate temporal comparison. Since the range of standardized bycatch values between each time period is significantly different and since many values are very low (near zero), most areas of the map layers appear dark blue (zero to low bycatch). The areas of the map that appear lighter blue (teal) or red represent areas where bycatch was higher in one time period versus the other.

For sponges (Appendices F-3 and F-7) and corals/sponges combined (Appendices F-1 and F-5), areas that show consistently higher relative amounts of bycatch are located on the northern Oregon slope (Figure 13; Plate B2) and a couple areas off southern Oregon (Figure 14; Plate C2). Areas of decreased bycatch for sponges (Appendix F-3) and corals/sponges combined (Apendix F-1 and F-5) occur at two small areas on the central Oregon slope (Plate B2) and near the Eel River Canyon (Plate D2). One area of increased bycatch of these taxonomic groups is evident off Cape Arago, Oregon (Plate C2). For corals (Appendicies F-2 and F-6), bycatch has decreased significantly in many areas, especially at one small area off the Columbia River mouth and a number of areas off northern Oregon (Plate B2), and two areas off southern Oregon (Plate C2). Bycatch has only increased in one area off Crescent City, California (Plate C2). And finally, bycatch of sea pens/whips (Appendices F-4 and F-8) has decreased significantly in three areas off northern Oregon (Plate B2) and one small area shoreward of the Bandon High Spot (Plate C2).

Table 5. Summary of coral and sponge bycatch metrics for observed tows using bottom trawls as part of the West Coast Groundfish Observer Program (WCGTOP), comparing two time periods: "Before" (3 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. "#" denotes number of hausl; "FREQ" denotes ratio of hauls with positive catch of taxon to total hauls observed; "Weight" denotes catch (lb); "CPUE" denotes catch per unit effort (units: lb/km); "CPUC" denotes catch per unit of groundfish catch (units: lb/ton GF). Haul counts represent only those hauls where corals or sponges were present in the catch. Annual WCGOP coverage of the limited-entry trawl sector can be found online at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm.

	Before					After					Before + After				
	#	**FREQ**	**Weight**	**CPUE**	**CPUC**	**#**	**FREQ**	**Weight**	**CPUE**	**CPUC**	**#**	**FREQ**	**Weight**	**CPUE**	**CPUC**
Coral	319	2.0%	9,309	4.9E-02	1.9E-04	335	1.8%	2,197	9.0E-03	3.7E-05	654	1.9%	11,507	2.7E-02	1.1E-04
sea pen/ whip	198	1.3%	232	1.2E-03	4.8E-06	474	2.5%	145	5.9E-04	2.5E-06	672	1.9%	377	8.7E-04	3.5E-06
sponge	469	3.0%	10,025	5.3E-02	2.1E-04	1,444	7.6%	45,383	1.9E-01	7.7E-04	1,913	5.5%	55,408	1.3E-01	5.1E-04
	903	5.7%	19,567	1.0E-01	4.0E-04	2,003	10.5%	47,725	2.0E-01	8.1E-04	2,906	8.4%	67,292	1.6E-01	6.2E-04

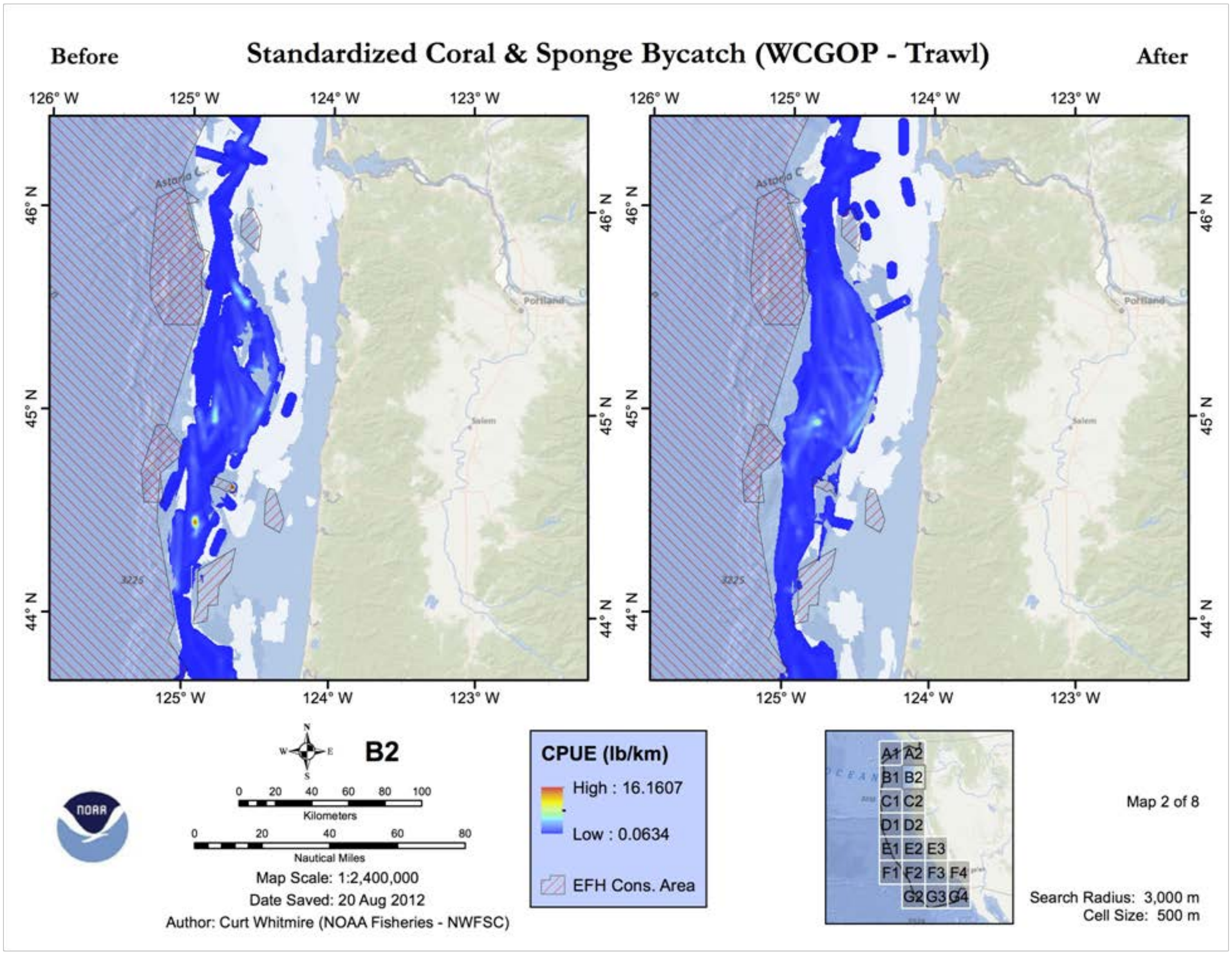


Figure 13. Example plate from Appendix F-1: the distribution of coral and sponge CPUE (lb/km) as bycatch from the West Coast Groundfish Trawl Observer Program before and after the implementation of Amendment 19 regulations.

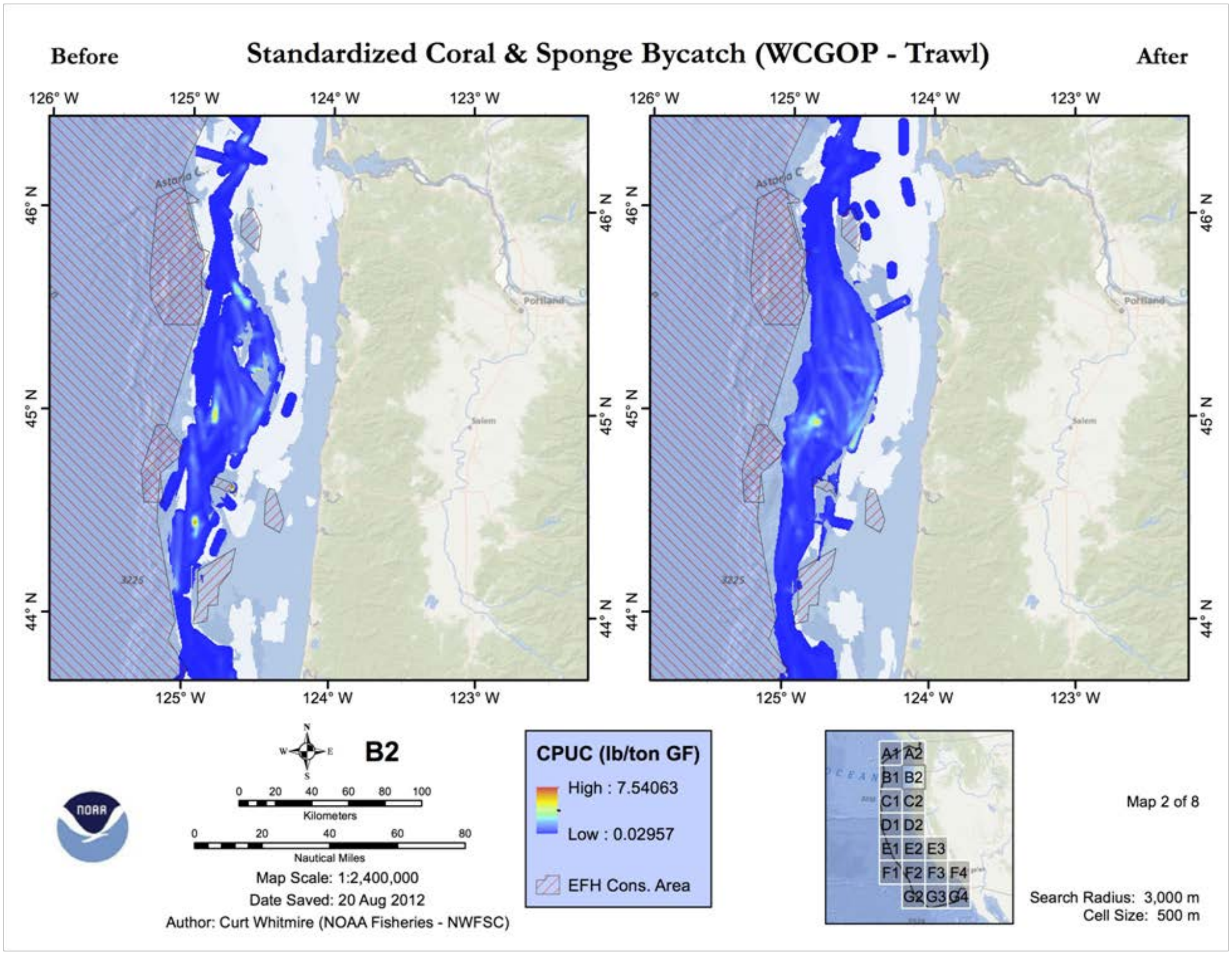


Figure 14. Example plate from Appendix F-5: the distribution of coral and spong CPUE (lb/ton groundfish) as bycatch from the West Coast Groundfish Trawl Observer Program before and after the implementation of Amendment 19 regulations.

3.2.2.4 Information on Commercial Bycatch of Corals and Sponges from West Coast Groundfish Observer Program Fixed Gear and At-sea Hake Sectors Before and After the 2006 EFH Review

Along with the limited-entry bottom trawl sector, the WCGOP observes vessels using fixed gears, including those participating in the following sectors: limited entry sablefish-endorsed primary season, limited entry non-sablefish endorsed, open access fixed gear, Oregon and California nearshore. Gear types where corals and sponges have been recorded as bycatch include longlines, set nets, fish pots and pole to name a few. Not all fixed gear trips are observed, so the data should not be used to characterize bycatch of corals and sponges completely. As with many observer data products, we urge caution when utilizing them due to the complexity of groundfish management and fleet harvest dynamics. Annual WCGOP coverage of the fixed gear sectors can be found online at:
http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm.

Because of the dearth and sparseness of bycatch records of corals and sponges during observed trips using fixed gears, bycatch records were unable to be summarized spatially. Since implementation of Amendment 19 regulations in June 2006, coastwide, combined bycatch of corals, sea pens/whips and sponges has decreased by at least 40 percent both in frequency and standardized amount (Table 6). For corals and sponges separately, both metrics of bycatch (frequency, standardized weight) have decreased. Since June 2006, only standardized weight (CPUC) of sea pens/whips has increased, that by 19 percent. Compared to observer records for the limited-entry trawl sector, the frequency of bycatch of corals and sponges in fixed gear sectors is markedly less.

Unlike the fixed gear and limited-entry trawl sectors, observer coverage in the at-sea hake fleet is very near 100 percent. Like the fixed gear sectors, bycatch of corals and sponges in the at-sea hake fleet, as recorded by observers of the At-Sea Hake Observer Program (ASHOP), is relatively rare (Table 7). This is most likely due to the fact that the at-sea hake fleet uses mid-water trawl gear, which typically does not contact the seafloor. Between 2000 and 2010, only 38 kg of combined bycatch of corals, bryozoans, sea pens/whips and sponges have been recorded for vessels in the at-sea sector. Bycatch was only recorded in 0.4 percent of all observed tows in that 11-year period. Although frequency and standardized catch (CPUE) have decreased in the last 5 years, the relatively low rate of bycatch makes it difficult to interpret any meaning from that change.

Table 6. Summary of coral and sponge bycatch metrics for observed sets using fixed gears as part of the West Coast Groundfish Observer Program (WCGOP), comparing two time periods: "Before" (3 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. "#" denotes number of sets with recorded bycatch; "FREQ" denotes ratio of sets with bycatch to total sets observed; "Weight" denotes bycatch (lb.); "CPUC" denotes bycatch per unit of groundfish catch (units: lb./ton GF). Set counts represent only those where corals or sponges were present in the catch.

	Before				**After**				**Before + After**			
	#	**FREQ**	**Weight**	**CPUC**	**#**	**FREQ**	**Weight**	**CPUC**	**#**	**FREQ**	**Weight**	**CPUC**
coral	49	1.0%	68	2.2E-02	39	0.6%	25	6.5E-03	88	0.7%	93	1.3E-02
sea pen/whip	18	0.4%	8	2.6E-03	7	0.1%	12	3.1E-03	25	0.2%	20	2.9E-03
sponge	36	0.7%	131	4.3E-02	41	0.6%	110	2.8E-02	77	0.7%	241	3.5E-02
	102	2.0%	207	6.8E-02	83	1.2%	147	3.8E-02	185	1.6%	354	5.1E-02

Table 7. Summary of coral and sponge bycatch metrics for observed tows using mid-water trawl gears as part of the At-Sea Hake Observer Program (ASHOP), comparing two time periods: 2000-05 and 2006-10. "#" denotes number of tows where bycatch was recorded; "FREQ" denotes ratio of tows with bycatch to total tows observed; "Weight" denotes bycatch (kg); "CPUE" denotes bycatch per unit of effort (units: kg/hr.). Tow counts represent only those where corals or sponges were present in the catch.

	2000-05				**2006-10**				**2000-10**			
	#	**FREQ**	**Weight**	**CPUE**	**#**	**FREQ**	**Weight**	**CPUE**	**#**	**FREQ**	**Weight**	**CPUE**
			9.8	3.6E-04			0.4	1.1E-05			10.2	1.7E-04
			17.3	6.4E-04			10.9	3.2E-04			28.1	4.6E-04
			0.1	1.9E-06			0.0	NA			0.1	8.2E-07
	67	0.5%	27.2	1.0E-03	33	0.2%	11.2	3.3E-04	100	0.4%	38.4	6.3E-04

3.3 Associations of Groundfish with Habitats

Appendix B.2 (McCain et al. 2005) of the Groundfish FMP (PFMC 2011a) includes composite life history, geographical distribution, and habitat association information for 82 FMU species. Appendix B2 was intended to be a “living” document, and includes information published prior to or during 2004 for 82 FMP species (McCain et al. 2005). Relevant new spatial and trophic information published during 2004-2011 was compiled and summarized for the 91 currently designated FMP species.

Knowledge of spatial associations (e.g., range and depth designations, distribution and abundance estimates, habitat associations, environmental correlates) and trophic interactions (e.g., diet composition, predators, foraging habitat, trophic position) is necessary for an accurate description of EFH. A thorough search was conducted for each of the 91 current FMP species in order to identify and compile all relevant new literature. Initially, a species’ synonmy was reviewed using the California Academy of Science’s Catalog of Fishes (Eschmeyer and Fricke 2011) to determine if any changes in the scientific name had occurred since the last review. If a recent name change was indicated, the prior scientific name was included in literature searches. The pertinent FishBase (Froese and Pauly 2011) species profile was then accessed and reviewed for information and literature relevant to EFH. Aquatic Science and Fisheries Abstracts, Biosis, Web of Science, and Zoological Record databases were used to locate any peer–reviewed publications, technical reports, student theses, book chapters, or other relevant literature that were produced during 2004–2011. All applicable new information, regardless of study region or publication language, was amassed from directed scientific research, fishery–independent surveys, and pertinent laboratory trials. Only field studies occurring in the eastern North Pacific were considered to restrict extraneous literature pertaining to species with amphi-Pacific or cosmopolitan distributions. A synthesis of new trophic and spatial information for each life stage (i.e., eggs, larvae, juveniles, adults) of the 91 designated groundfish species is included in Appendix G of this report. Results of predictive modeling efforts and literature restricted to these methods were not included and instead are covered in Section 3.4.1 of this report (“Description of Available Models”). A bibliography consisting of the totality of the identified literature is included as Appendix G.

3.3.1 Groundfish Species Group Summaries

The general structure of this Section and Appendix G is consistent with the composition and relative order of the species groups designated in the FMP for Pacific Coast groundfishes. These groups include: Flatfishes (N = 4 species), Other Flatfishes (N = 8), Rockfishes (N = 15), Other Rockfishes (N = 49), and Other Groundfishes (N = 15). However, the level of detail provided in this chapter is much more limited than that of McCain et al. 2005 by necessity and design. Thorough species accounts that incorporate all relevant information for each life stage (i.e., eggs, larvae, juveniles, adults) were constructed for the four flatfish species (Appendix G-1), Other Flatfish (Appendix G-2), Rockfishes (Appendix G-3), Other Rockfishes (Appendix G-4), and Other Groundfish (Appendix G-5). These are included as analogs to the species accounts provided by McCain et al. 2005 as a way to gauge the possible future utility of such an effort for all 91 species. The summaries below generally synthesize new information on spatial associations and trophic interactions that are pertinent to the designation of EFH for each of the five designated groundfish groups.

3.3.1.1 Flatfishes

New literature on spatial associations and trophic interactions of the Flatfishes group consisted of 64 publications, with several publications providing information for multiple species (Appendix G-1). Arrowtooth flounder was the most studied flatfish (39 publications), whereas petrale sole was the least studied (12 publications). Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al.

2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). However, directed studies provided more specific information that often built upon previous research and was of greater relevance for the description of EFH. Several such studies integrated contemporary and historic physical and biological data to provide detailed explanations for observed life–stage specific spatial patterns (e.g., Abookire et al. 2007; Bailey et al. 2008). More new spatial information was available when compared to trophic information, a situation that reflects the relative amount of scientific attention as well as the substantial contribution of newly published fishery-independent survey data.

A common element of contemporary spatial studies involving flatfishes is the integration of physical, environmental, and biological data. Integrated data sets were commonly used to explain distribution and abundance patterns, especially as they related to reproductive movements and environmental tolerances. Knowledge of seasonal and ontogenetic movements of arrowtooth flounder, Dover sole, and English sole was considerably enhanced, with research conducted in Alaskan (e.g., Logerwell et al. 2005; Blood et al. 2007) and West Coast (Chittaro et al 2009; Toole et al. 2011) regions. In addition, focused research greatly expanded knowledge regarding estuarine use of (primarily juvenile) English sole and emphasized the likely importance of these environments to population maintenance (Rooper et al. 2004; Brown et al. 2006a, b). Hypoxic conditions were found to be especially deleterious to petrale sole, but did not adversely affect English sole or Dover sole (Keller et al. 2010). Dover sole was also resilient to trawling disturbance (Hixon and Tissot 2007). Arrowtooth flounder populations in the eastern Bering Sea appear to be expanding as a result of ocean warming (Zador et al. 2011).

New information on trophic interactions was available for all members of the Flatfishes group to a variable degree (Appendix G-1). Arrowtooth flounder diet composition has been extensively studied in recent years throughout Alaskan (e.g., Yang et al. 2006; Knoth and Foy 2008) and Canadian (Pearsall and Fargo 2007) waters. These studies demonstrated the prevalence of piscivory, which increased with size, and a high proportion of pelagic prey. Dover sole in the Gulf of Alaska (Yang et al. 2006) and Hecate Strait (Pearsall and Fargo 2007) and English Sole in Hecate Strait (Pearsall and Fargo 2007) exhibited very similar diets consisting mainly of polychaetes and other benthic invertebrates and fed at a lower trophic level than Arrowtooth flounder. The prey composition of these species reflected foraging in unconsolidated habitats, especially those composed of mud. A single study indicated that petrale sole diet composition in Hecate Strait consisted primarily of fishes (especially Pacific herring) (Pearsall and Fargo 2007), in contrast to historic studies that showed a greater reliance on decapod crustaceans. Several new trophic linkages were established between the described flatfishes and their predators, which included seabirds (Iverson et al. 2007), pinnipeds (Reimer and Mikus 2006; McKenzie and Wynne 2008), and fishes (Trites et al. 2007; Pearsall and Fargo 2007). Food web modeling efforts in the Gulf of Alaska revealed the considerable importance of arrowtooth flounder to regional trophic dynamics, including a predator/prey feedback loop with walleye pollock (Aydin and Mueter 2007; Gaichas and Francis 2008; Gaichas et al. 2010).

Some biases and limitations were evident among relevant, recent publications and should be considered when interpreting results. Several studies distinguished juvenile and adult life stages based on size-at-maturity information rather than more cumbersome external inspection. Size may not be an accurate proxy for maturity, however, especially when reference information is derived from a different region. Trawl surveys were mainly conducted during spring and summer months on unconsolidated substrate, which restricts a comprehensive understanding of temporal or habitat-based variability. Tests of sample size sufficiency were limited to a single Steller Sea Lion diet composition study. These tests are especially important in diet composition research as most groundfishes are generalist predators with considerable intraspecific dietary variation. In addition, all diet studies used pooled rather than individual–specific prey data. This practice precludes the determination of intraspecific variability in diet composition and biases results to samples with high numerical or gravimetric contributions. Finally, only basic spatial information was provided for most diet studies, which prevented a detailed understanding of the relative use of foraging habitats.

3.3.1.2 Other Flatfishes

New literature on spatial associations and trophic interactions of the Other Flatfishes group consisted of 66 publications, with several publications providing information for multiple species (Appendix G-2). Most Other Flatfishes were well studied, with rex sole (41 publications), flathead sole (38 publications), and rock sole (31 publications) foremost among them. Curlfin sole (10 studies) and sand sole (12 publications) were referenced least among the accumulated literature, with most relevant information contained in survey reports. Data on Pacific and speckled sanddabs and southern and northern rock sole were occasionally pooled because of uncertain identification (e.g., Love and York 2005; McKenzie and Wynne 2008) or for convenience during multi–species analyses (e.g., Hoff 2006; Gaichas and Francis 2008). To avoid confusion, the current designation of “rock sole” should be changed to the proper common name of “southern rock sole” in accordance with American Fisheries Society guidelines. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). In addition, many directed studies provided information on a wide variety of topics related to EFH (e.g., habitat associations, physiological tolerances, trophic relationships), at various levels of detail. Much more new spatial information was available when compared to trophic information, and no new diet composition information was produced along the West Coast.

3.3.1.3 Rockfishes

From 2004–2011, 90 publications that contain information on spatial associations and/or trophic interactions were located for the Rockfishes group (Appendix G-3). Most publications reported information for multiple species and species were occasionally combined for convenience or because identification was uncertain (e.g., Lauth et al. 2004; Wilson et al. 2008; Marilave and Challenger 2009). Shortspine thornyhead (34 publications) and Pacific ocean perch (30 publications) were the most studied rockfishes, whereas blackgill (6 publication) and chilipepper (8 publications) were the least studied. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). However, the great majority of this information was derived from trawl surveys, which are limited in their capability to sample rocky substrates and therefore under–represent the distribution and abundance patterns of most rockfishes (PFMC 2011a). Results of these surveys should therefore be interpreted cautiously for the Rockfishes group. In addition, many directed studies focused on specific aspects of resource utilization (i.e., spatial associations, trophic relationships) and provided detailed information that was relevant for the description of EFH. Only 15 of the 89 contemporary publications contained trophic information, and there is a dearth of recent diet composition information for Rockfishes throughout the eastern North Pacific.

3.3.1.4 Other Rockfishes

New literature on spatial associations and trophic interactions of the Other Rockfishes group consists of 85 publications, with several publications providing information for multiple species (Appendix G-4). Species were sometimes combined for convenience or because identification was uncertain (e.g., Beaudreau and Essington 2007; Wilson et al. 2008; Frid and Marliave 2010). The most studied Other Rockfishes were rougheye (26 publications), copper (25 publications), greenstriped (25 publications), and redbanded (25 publications). Many species received sparse scientific attention, and no information was available for bronzespotted, California scorpionfish, chameleon, and semaphore rockfishes. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). In addition, many directed studies were published and provided information on a wide variety of topics related to EFH (e.g., habitat associations, genetics/distribution, and movement patterns). Although a substantial amount new spatial information was available, trophic information was comparatively sparse; a situation that reflects the relative amount of scientific attention as well as the substantial contribution of newly published fishery–independent survey data. Nine new species were added to the Other Rockfishes group since the last EFH review was conducted (chameleon, dwarf–red, freckled, halfbanded, pinkrose, Puget Sound, pygmy, and semaphore, and swordspine rockfishes). Literature reviews for these species were performed from 2002–2011 and references published during 2002–2003 (Bernardi et al. 2009; Johnson et al. 2009) are listed below. For historic information on these species, refer to Love et al. (2002). In addition, the species name of the dusky rockfish is listed incorrectly as Sebastes ciliatus in the current list of FMP groundfish species. Sebastes ciliatus refers to the more northernly distributed dark rockfish, whereas the dusky rockfish (*S. variabilis*) ranges throughout most of the U.S. West Coast (Orr and Blackburn 2004). The information and literature referenced here therefore refers to the dusky (S. variabilis), not dark (*S. ciliatus*), rockfish.

3.3.1.5 Other Groundfishes

The Other Groundfishes group contains 15 species that, unlike the other groups, are not monophyletic (i.e., derived from a single, common ancestral species). Therefore, for the purposes of this review, the following subcategories were established based on taxonomic relatedness: 1) chondrichthyan, or cartilaginous, fishes (big skate, California skate, leopard shark, longnose skate, spiny dogfish, spotted ratfish, tope), 2) gadiform fishes, or cods (Pacific cod, Pacific flatnose, Pacific grenadier, Pacific hake), and 3) scorpaeniform, or mail–cheeked, fishes (cabezon, kelp greenling, lingcod, sablefish). New literature on spatial associations and trophic interactions of Other Groundfishes consisted of 120 publications, with the designated subgroups receiving comparable scientific attention (Chondrichthyes, N = 58; Gadiformes, N = 64; Scorpaeniformes, N = 63) (Appendix G-5). Among species, lingcod (N = 42), Pacific cod (N = 42), and Pacific hake (N = 34) were most studied, whereas few publications contained relevant information about cabezon (N = 2), tope (N = 5), or California skate (N = 5). Most of the available information, and certainly the most comprehensive, was obtained from directed studies. However, fishery–independent surveys provided general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g., Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). The North Pacific spiny dogfish population was recently determined to be distinct from other global populations of spiny dogfish, *Squalus acanthias*, and renamed the spotted spiny dogfish, *S. suckleyi* (Ebert et al. 2010). This name change should be reflected in future documents. More new spatial information was available when compared to trophic information, a situation that reflects the relative amount of scientific attention as well as the substantial contribution of newly published fishery–independent survey data.

3.4 Modeling Distribution of Seafloor Habitat Types

Since 2005, a significant amount of research and modeling has been conducted regarding biogenic habitat. Habitat surveys have been conducted using sidescan and multibeam sonar, human-occupied submersibles, and remotely operated vehicles (ROVs). Several surveys have documented the interactions between groundfishes, other demersal fishes, invertebrates, and benthic habitats. Of particular importance in the future will be the determination of the distribution and abundance of biogenic species including deep water corals and their role and importance to the groundfish ecosystem.

Guinotte and Davies modeled significant areas of highly suitable deep-sea coral habitat both within and outside existing NMS and EFH area closure boundaries. Total summed model values highlight existing EFH area closures encompass the majority of predicted suitable habitat for Order Antipatharia and Suborders Alcyoniina, Calcaxonia and Scleraxonia. However, the majority of suitable habitat for Suborder Holaxonia and Order Scleractinia was predicted in areas outside of existing EFH area closure boundaries. This study is significant in the context of the EFH review, as no habitat suitability models for West Coast corals were available in 2005.

The EFHRC considered using new modeling applications that could be useful for assessing groundfish habitat suitability. Models can be used to infer distribution of habitats or species in areas that lack data and to increase the precision of distribution maps.

3.4.1 Description of Available Habitat Models

A model is a simplified, sometimes theoretical, representation of a real–world system. In any modeling effort, there is a trade–off between simplicity and complexity that is typically contingent on the question of interest and the amount and quality of the input data. A key to understanding the utility of a model, no matter the degree of complexity, is the acknowledgement that the model will not fully describe the study system completely or correctly, and acceptance of the possibility that many presumed interactions may not represent reality (Field 2004). Consequently, model results are best treated in a general sense to pinpoint major findings, key processes or drivers in study systems, and to direct future research. Three general categories of models (spatially explicit, trophodynamic, and integrated ecosystem), relevant to the determination and designation of EFH for Pacific groundfishes, are summarized in this section and comprehensively considered in Appendix H.

3.4.1.1 Habitat Suitability Probability Model

A habitat suitability probability (HSP) model, termed the “EFH Model” (PFMC 2011a), was developed in 2004 by NMFS and outside contractors, and used in the 2008 West Coast Groundfish FMP (MRAG Americas Inc. et al. 2004). The model incorporated three basic variables (seafloor substratum type, depth, and location) to describe and identify EFH for each life stage of federally managed groundfishes and presents this information graphically as an HSP profile (PFMC 2011a). Based on the observed distribution of a groundfish species/life–stage in relation to the input variables, locations along the West Coast were assigned a suitability value between 0 and 100 percent in the creation of the HSP profile. These scores and their differences among locations were used to develop a proxy for the areas that can be regarded as “essential.” The EFH Model provided spatially explicit HSP estimates for 160 of 328 groundfish species/life stage combinations, including the adults of all FMU species (PFMC 2011a). The remaining 168 species/life stages were not completed because of insufficient data. In 2005, when the HSPs of all species/life stages were combined, all waters and bottom areas at depths less than 3,500 m were determined to be groundfish EFH.

The data used to determine HSP values exhibited some biases and limitations, and have been subject to continued refinement. Among the primary concerns regarding the validity of model outputs are the use of disparate data sets and data of variable quality. The EFH Model has remained static and has not been used since its original construction. However, modification of the model is currently underway by personnel at Oregon State University’s Active Tectonics and Seafloor Mapping Laboratory and industry collaborators through support of the Bureau of Ocean Energy Management (C. Goldfinger, Oregon State University, pers. comm.). In addition, updates to the HUD (see Section 3.5.4 of this report) and significant amounts of new spatial and trophic information associated with Pacific groundfishes and life stages (see Section 3.3 of this report) also can be used to improve the predictive capabilities of the HSP Model.

Accurate estimates of groundfish distributions are critical for effective spatial management through improved stock assessments and the design of marine protected areas (MPAs) and EFH closed areas. Strong, consistent benthic habitat associations of many groundfishes, in conjunction with recent advances in acoustic seafloor mapping techniques, suggest that habitat determination may serve as a proxy for predicting groundfish distribution and abundance at broad regional scales (Anderson et al. 2009). Therefore, it should be possible to model and predict these spatial patterns using habitat maps and quantified habitat relationships. The previously described EFH Model represents one such effort to model groundfish distributions based on selected habitat variables. Four additional modeling efforts that attempt to explain or predict groundfish distributions off the West Coast recently have been published. Three of these were conducted in continental shelf waters off central California using presence/absence observation data (Iampietro et al. 2005, 2008; Young et al. 2010). In a more expansive study, Tolimieri and Levin (2006) examined composition and variation in West Coast groundfish assemblage structure on the upper continental slope in relation to temperature, year, depth, latitude, and longitude. Results of these fish–habitat modeling efforts were generally promising in their potential application to current management efforts and for the development of future studies. However, there are some caveats and limitations that should be considered (Appendix H, Section 2.2). For example, it is important to recognize that predictive distribution models estimate potential habitat suitability, rather than realized, habitat suitability, which represents a more limited spatial area.

Biogenic habitat modeling techniques have typically been developed for data–rich, terrestrial systems. However, recent increases in the quality and quantity of physical and biological seafloor data have supported development and application of these models in marine benthic systems. Off the West Coast, biogenic habitat modeling recently has been used to predict distribution and abundance patterns of structure–forming marine invertebrates (SFMI) (e.g., corals, sponges). SFMI have received considerable scientific attention because of their potential role as EFH for groundfishes and because they are generally vulnerable to human impacts.

Biogenic habitat modeling efforts relevant to the West Coast are less than 10 years old, but interest is growing and the field is rapidly advancing. At least six research efforts have utilized models to predict coral distributions on a coastwide or global scale, using coarse taxonomic categories and presence–only data (e.g., Clark et al. 2006; Bryan and Metaxas 2007; Tittensor et al. 2009). However, three regional studies incorporating presence–absence data and more specific taxonomic categories recently have been conducted (Graham et al. 2010; Etherington et al. 2011; Krisgman et al. 2012). Modeling techniques may provide the best available estimates of distribution, abundance, and habitat characteristics for SFMI, at least until more empirical data become available. However, many limitations and challenges exist that may impact the accuracy of model results, including: highly correlated and potentially incomplete environmental variables, the selection of appropriate spatial and temporal resolutions, and limited distribution and abundance data for SFMI (Appendix H, Section 2.3). Therefore, careful consideration should be taken when using modeling results for management and conservation purposes, especially those derived from presence–only models.

3.4.1.2 Ecopath/Ecosim Models

Ecopath, typically coupled with the dynamic companion model Ecosim, has become the standard for trophodynamic modeling not only off the West Coast but also throughout the world's marine and freshwater regions. Ecopath is a static (typically steady–state) mass balance model of trophic structure that integrates information from diet composition studies, bioenergetics models, fisheries statistics, biomass surveys, and stock–assessments (Field 2004). It represents the initial or reference state of a food web. Ecosim is a dynamic model in which biomass pools and vital rates change through time in response to simulated perturbations. Different species or functional groups are represented in Ecopath as biomass pools with their relative sizes regulated by gains (consumption, production, immigration) and losses (mortality, emigration). Biomass pools are typically linked by predation, though in some cases reproduction and maturation information is also included. Fisheries act as super–predators, removing biomass from the system. The Ecopath model framework allows investigators to evaluate how well conventional wisdom about a system of interest holds when basic bookkeeping tools are applied, to pool together species and into a coherent food web, and to evaluate trophic interactions (Field 2004). The combined model allows users to simulate ecological or management scenarios, such as the response of the system to changes in primary productivity, habitat availability, climate change, or fishing intensity (Harvey et al. 2010). Off the West Coast, the Ecopath model has been used to investigate the trophic role of large jellyfish in the Oregon inner–shelf ecosystem (Ruzicka et al. 2007), and the combined Ecopath/Ecosim model has been used to evaluate dynamic food web structure in the Northern California Current (NCC) (Field 2004) and Puget Sound (Harvey et al. 2010). These modeling efforts provided important information for an improved understanding of ecosystem dynamics. However, a lack of adequate data is the most pervasive limitation of food web models, which results in many unknown or generally estimated input parameters.

3.4.1.3 Atlantis Model

The primary tool used in integrated ecosystem modeling (especially in Australia and the United States) is the Atlantis Model (Fulton et al. 2004). Although it was originally focused on biophysical and fisheries aspects of an ecosystem, Atlantis has been further developed to consider all parts of marine ecosystems (i.e., biophysical, economic and social). All integrated ecosystem models require massive data inputs and must therefore strike a balance between simplicity and complexity, or tractability and realism. The systematic exploration of the optimum level of model complexity is one of the key strengths of the Atlantis Model. It can be used to identify which aspects of spatial and temporal resolution, functional group aggregation, and representation of ecological processes are vital to model performance. The Atlantis modeling approach primarily has been used to address fisheries management questions, but increasingly is being implemented to consider other facets of marine ecosystem use and function (CSIRO 2011). Off the West Coast, the Atlantis framework was recently used to construct a preliminary spatially explicit ecosystem model of the NCC (Horne et al. 2010), and is a fundamental tool in use by the Integrated Ecosystem Assessment Team to meet the goals of the Ecosystem Plan Development Team. Field's (2004) food web model (Ecopath) was incorporated as the foundation for model creation, building on prior results and parameterization. The NCC Atlantis Model is currently being refined and expanded by the Integrated Ecosystem Assessment Team. Once complete, it is expected to be a powerful management tool, providing a platform to address important hypotheses relating to the effects of perturbations (e.g., fisheries exploitation), characterize the potential trade–offs of management alternatives, and test the utility of ecosystem indicators for long–term monitoring programs (Horne et al. 2010). Ultimately, the model should have substantial utility in identifying which policies and methods have the most potential to inform ecosystem–based management on the U.S. West Coast.

3.4.1.4 Summary

Modeling efforts are being developed to meet NOAA's overall management goals and to specifically inform policy decisions regarding the determination and designation of EFH. These efforts have advanced substantially since the Amendment 19 process. Although the construction and application of spatially explicit, trophodynamic, and integrated ecosystem models mainly have been prompted by management needs, recent modeling studies have been facilitated by a considerable increase in the amount of available input data. Long–term NMFS surveys are an important source of biological data on species occurrence, biomass, and population changes. However, rapid advances in the collection and quality of seafloor acoustic data are the main drivers of contemporary modeling efforts in the marine demersal environment.

Recent advancements aside, the greatest limitation to the success of current and future modeling efforts remains the quantity and quality of input data for the West Coast marine region. The accuracy and consistency of model outputs are directly contingent on the input data that are used. When input data are sparse, generalized, or interpolated, model results should be viewed skeptically. Data limitation is an unfortunate consequence of modeling in marine environments, but its effects can be mitigated. A key element when dealing with limited data inputs is to formulate appropriate objectives and hypotheses. This practice will produce more reliable results even if the scope of the study must be limited. In addition, model construction can serve as a gap analysis to identify data limitations and inform future research needs and priorities. As data gaps are identified and filled, model results will become more robust and have increased utility for ecosystem understanding, management strategy evaluation, and policy formation.

3.5 Habitat Use Database

The Habitat Use Database (HUD) was developed byNMFS NWFSC scientists as part of the 2005 Pacific Coast Groundfish Essential Fish Habitat Environmental Impact Statement (EFH EIS) (NMFS 2005). Specifically, the HUD was designed to address the need for habitat-use analysis supporting groundfish EFH, HAPCs, and fishing and non-fishing impacts components of the EFH EIS. The 2005 database captured information on habitat use by Pacific Coast groundfishes covered under the FMP as documented in the updated life history descriptions found in Appendix B.2 of the EFH Final EIS, (NMFS 2005). The groundfish life history descriptions are the product of a literature review that collected and organized information on the range, habitat, migrations and movements, reproduction, growth and development, and trophic interactions for each of the FMU species by life stage.

Thus, the scope of the 2005 HUD was narrow and specific, well integrated with the EFH EIS, and provided a flexible and logically structured information base. The HUD was implemented during the Pacific Coast Groundfish EFH EIS by providing habitat preference and species distribution information to the HSP model (PFMC 2011a) for a subset of FMP species where catch or fishery independent data was insufficient for modeling. That is, fishery independent survey data (WCGBTS) was used preferentially for HSP modeling when possible.

After the 2005 EFH EIS was published, the NWFSC placed selected HUD tables and summary database “views” online through the Pacific Coast Ocean Observing System (PaCOOS) West Coast Habitat Server (deployed in Jan. 2006). The PaCOOS site provides OPeNDAP (a framework and software solution for scientific data networking) access to live database tables served from NWFSC. PaCOOS also provides a web map interface to the HUD through its spatial query tool. In addition to providing wide public access to the HUD through PaCOOS the NWFSC also made data updates and amendments, platform changes, and taxonomic additions to the database over the period from 2006 to present. The 2011 HUD now includes species other than FMP species, specifically species identified under Oregon’s Nearshore Strategy (Don et al., 2006). Additionally, a HUD workshop team at OSU identified important benthic invertebrate species that represented a key taxonomic gap in the HUD. This list of candidate benthic invertebrate species awaits further development of habitat associations, range, and distribution information before incorporation into the HUD.

Despite open and public access to the HUD it is not in wide use for research or management purposes outside of the PaCOOS implementation or the current EFH 5-Year Review. Although the HUD has undergone growth in taxonomic richness over the past five years, one potential reason the HUD has not seen much application in Integrated Ecosystem Management or Marine Spatial Planning yet is that the database remains FMP species centric and is summary in nature. Conventional deterministic modeling techniques use presence/absence, abundance, and density inputs, and are not well matched to this summary format. Renewed development of a probabilistic, Bayesian Network model for Pacific Coast groundfish habitat suitability by the Oregon State Active Tectonics and Seafloor Mapping Lab is helping to maintain the HUD (Chris Romsos, Oregon State University, pers. comm., Feb. 10, 2012).

3.5.1 Data Structure and Software Platform

The HUD was originally developed as a Microsoft Access® relational database application by MRAG Americas Inc. consultants to the 2005 EFH EIS. The 2005 Microsoft Access® HUD was a complete database package and included forms for data entry, stored procedures to check database and referential integrity, and a reference document. The MS Access database format also provided a Graphical User Interface to the database thus allowing fisheries research scientists to build and maintain the database. In 2006, the database was migrated to an Oracle® enterprise class database to better support public access and the internet application needs of the PaCOOS West Coast Habitat Server. This platform migration provided a more stable technology stack to build web applications upon, but also moved management and maintenance out of the hands of fisheries research staff and under the control of IT and Database Administrator staff at the NWFSC. Regrettably, this change has made it more difficult for fisheries scientists to interact with the database by including additional layers of management and technical complexity.

Despite the somewhat higher technical and administrative walls around the HUD, the underlying data structure of the 2005 HUD remains intact in the current installation (Bob Gref, NMFS NWFSC pers. comm., Aug. 29, 2011). Entity Attribute Relationship diagrams from both the 2005 and 2011 databases (Appendix I-1, Figures I-1.1 and I-1.2) show that the original structure of 24 tables and attributes have been maintained through the software platform migration. Appendix I-1 Table I-1.1 provides a listing and a short description of each HUD table.

3.5.2 Comparing the 2005 and 2011 HUD

The 2005 HUD was designed and constructed to keep data redundancy to a minimum. Information about habitat preference and use by species is broken down into tables (relations) of entities and unique attributes. Taken together these relations provide a platform for developing interrelated lines of analysis in the HUD (NMFS 2005). However, this computing structure can obfuscate, making it difficult to accurately describe what's inside the database. For example, a simple query of the species table yields total species counts (species richness), but no other information about the level of completeness for the habitat associations underlying each record. The query must be further specified by including additional tables to understand the extent of information in the HUD. Therefore, in contrasting the 2005 and 2011 HUD, we describe the HUD in terms of both its scope (number of taxa recorded) and its extent (completeness of related data).

3.5.2.1 The 2005 HUD: Scope and Extent

As previously stated, the 2005 HUD was developed from the Groundfish Life History Descriptions which was a revision of life history descriptions completed in 1998 (Casillas et al. 1998). The Pacific Coast groundfish taxonomic richness of the 2005 HUD included 87 species of groundfish, all 82 2005 FMU species plus five species soon to be included as Pacific Coast groundfish under the FMP (Appendix I-2 Table I-2.1). In addition to these 87 groundfish species, the 2005 HUD included 24 species identified as groundfish predators, 73 species identified as groundfish prey, two species identified as both groundfish predators and prey, and seven ungrouped species. Total species richness of the 2005 HUD was 193 species.

Only 81 of the 193 species in the 2005 HUD have corresponding habitat preference and distribution information (Table B.2). None of the non-groundfish species (i.e. predators, prey, predator and prey, or ungrouped species) have habitat preference or association information. This is, however, an expected level of completion, because the 2005 HUD was developed from the Updated Life History Documents covering only FMU species. It is therefore not surprising that any of the other species groups are incomplete in terms of habitat association or distribution information because there had not been any formal review of predator or prey life histories in Amendment 19.

In addition to providing an accounting of groundfish range and habitat preferences, the HUD was also designed to record information about groundfish prey items and about groundfish as prey. The source of prey information is the Groundfish Life History Descriptions found in Appendix B.2 of the EFH Final EIS (NMFS 2005) and the groundfish FMP (PFMC 2011a). HUD predator and prey tables were not intended to be comprehensive for West Coast marine communities at the time the HUD was created, but they provide a flexible database framework to build this knowledge upon now.

The HUD records any unique combination of Predator, Predator Gender, Predator Lifestage, Prey, Prey Gender, Prey Lifestage, and the Habitat Type where predation occurs as a row in the Prey (groundfish as predators) or Predators (groundfish as prey) tables. There are 1,348 records of groundfish as predators and 510 accounts of groundfish as prey in the 2005 HUD. Records occur in one of the two HUD predation tables and correspond to any account of predation noted from the literature during the review. It was not known if all accounts of predation were uniformly reported or if efforts were made to standardize the taxonomic reporting level across the body of work. For this reason it is important to understand that this accounting of groundfish predation in the HUD should be considered developmental and not comprehensive.

Appendix I-2, Table I-2.3 shows prey items for groundfish adults, juveniles, and larvae illustrating the application cautions noted above. Non-uniform taxonomic groupings were found throughout the Predator and Prey tables. For example, a dark grey color is used to highlight the mixed reporting level for fish in the Adult Groundfish Prey group. Despite this limitation, the prey tables in Appendix I-2 do reveal general and important prey item differences across groundifsh developmental stages. The top 10 prey items occurring most frequently in the literature have been shaded light grey showing that adult groundfish feed on higher trophic level prey while the earlier developmental stage groundfish are feed on lower trophic level planktonic prey. Further review of the predator and prey tables within the HUD is needed to determine their application for identifying EFH.

3.5.2.2 The 2011 HUD: Scope and Extent

The first additions to the HUD, post 2005 EFH EIS, were to increase the Pacific Coast groundfish species count from 82 to 91 by adding the additional four new FMP groundfish species: *Sebastes phillipsi* (chameleon rockfish), *Sebastes lentiginosus* (freckled rockfish), *Sebastes semicinctus* (halfbanded rockfish), *Sebastes simulator* (pinkrose rockfish), *Sebastes rufinanus* (dwarf-red rockfish), *Sebastes emphaesus* (Puget Sound rockfish), *Sebastes melanosema* (semaphore rockfish), *Sebastes wilsoni* (pygmy rockfish), *Sebastes melanosema* (semaphore rockfish), and *Sebastes ensifer* (swordspine rockfish). Subsequently, four other coastal pelagic species and their life history information (habitat, depth, and latitude associations) were added: *Clupea pallasii* (Pacific herring), *Engraulis mordax* (Northern anchovy), *Loligo opalescens* (market squid), and *Sardinops sagax* (Pacific sardine).

The ODFW *Oregon Nearshore Strategy* (ODFW, 2006) provided summary habitat associations with various species, but lacked distribution information or indexed references for the associations. In 2007, the PaCOOS West Coast Habitat Server development team (now informally overseeing the HUD) identified these species as important for diversifying the HUD. The addition of these species addressed obvious taxonomic gaps in the HUD and enhances the potential uses of the HUD, specifically as a tool suitable for applications in ecosystem assessment or marine spatial planning. The life history information for these species was formally reviewed by NWFSC staff before being added to the HUD. Distribution information was developed from the literature and references for habitat associations were collected during this review.

This update created three new levels within the "Plans" table of the HUD and provided 247 potential new species records to the HUD. However, many of the species from the *Oregon Nearshore Strategy* (Appendix I-3) were already accounted for in the HUD under the Pacific Coast Groundfish FMP, the Coastal Pelagic Species FMP, or Predator groupings, creating significant species overlap among plans in the HUD. Ultimately, 126 new species from the potential list of 247 species were added to the HUD as new species records (Appendix I-2). Therefore, in summary the taxonomic richness or "Scope" of the 2011 HUD grew from 193 to 323 with the addition of the four new FMP Groundfish, the four coastal pelagic species, and the 126 Oregon Nearshore Plan species (Appendix I-3; note the loss of four predator species in the 2011 HUD).

The species group by life stage summaries presented in Appendix I-2 Tables I-2.5a-d and I-2.6a-d provide glimpses into the "Extent" or level of life history completeness of the current 2011 HUD. The tables presented under I-2.5 describe the level of habitat association completeness while the I-2.6 tables describe the distribution (Latitude & Depth Range) completeness. In general, adult life stage has the highest level of HUD completeness; 213 of 323 adult life stage species have habitat distribution information and 148 of 323 adult life stage species have latitude and depth distribution information. Juvenile life stage species have 80 species with habitat associations and 80 species with distribution information. Larvae and egg life stages have 65 and 26 species with habitat associations and 65 and 26 species with distribution information respectively. Thus, level of completeness in the HUD increases with each successive level of development.

Findings for adult life stages (Appendix I-2 Tables I-2.5a and I-2.6a) show that FMP species have complete habitat association and distribution information. There remains no habitat association or distribution information for predator or prey species groups in the 2011 HUD (unchanged from 2005). *Oregon Nearshore Strategy* species (Appendix I-3) have a high level of completeness across Habitat Association and Distribution domains with the exception of Commonly Associated List species, which has no available distribution information (Appendix I-2 Table I-2.5a).

3.5.3 Using the HUD with Geographic Information Systems (GIS)

The HUD stores spatial information in the OCCURRENCE (Habitat Associations) and SPECIESLIFESTAGE (Depth, Latitude, Temperature, and Oxygen, requirements and preferences) tables. Latitude and depth preferences and requirements can be readily mapped over bathymetry within a GIS. Therefore, both latitude and depth may be used to define range envelopes for any species with complete distribution information in the database. Habitat Association information on the other hand is much more difficult to map because HUD habitat codes (PLACETIME IDs) are unique and do not conform to any geographic habitat mapping standard or scheme in use today.

A "crosswalk" table has been developed for the 2005 EFH EIS HSP modeling effort so that HUD PLACETIME habitat codes could be matched to codes from the Washington, Oregon, and California seafloor habitat maps (MRAG, 2005). This matching allows for a specific Habitat Association to be mapped spatially over a seafloor habitat map.

The nature of the relationships between HUD codes and the seafloor habitat codes is many-to-many. However, because the Access database does not support many-to-many relationships, a one-to-one crosswalk table is implemented (Appendix I-4). Note that despite the one-to-one table format, the crosswalk table maintains the many-to-many relationship. In 2005, 24 unique HUD PLACETIME codes were mapped to 36 unique seafloor habitat codes in 59 one-to-one relations.

The crosswalk table has undergone several updates since 2005. The first update was prompted when the PaCOOS West Coast Habitat Portal was published. The portal includes a tool to lookup species given a geographic map selection. To accommodate this lookup the crosswalk table had to be improved so that each seafloor habitat type from the Oregon and Washington Version 2 SGH map was accounted for in the crosswalk table. The crosswalk table has also been updated each time a new habitat map version was released. Currently the crosswalk has grown to include 108 unique seafloor habitat codes (from Oregon and Washington SGH Map Version 3.2 and the original California regional habitat map) and 116 unique HUD codes in 639 one-to-one relations (Appendix I-5).

3.5.4 Pending Updates

On May 6th, 2009 a HUD workshop was held at Oregon State University. The purpose of the workshop was to gather marine scientists from State, Federal, and Academic sectors and local Oregon fishermen, review the content of the HUD, identify possible taxonomic gaps, and examine the geographic lookup capabilities of the PaCOOS tool. The exercise was carried out in a "live" format by running spatial range and habitat queries against the HUD (over known habitats and familiar fishing grounds) and examining the species, life stage, and association level outputs against the experiential knowledge base gathered for the meeting. Comments were collected and summarized in the meeting report (Romsos 2009).

This meeting provided the first HUD review external to the EFH EIS process and was productive in terms of identifying taxonomic gaps and also for developing a set of improvement objectives. Alan Shanks and Brian Tissot noted the low diversity of plant and invertebrate species in the HUD. To remedy this, Alan and Brian provided a list of common invertebrates that should be included in the HUD (Shanks and Tissot, Appendix F). The invertebrate list is not comprehensive, but is meant to provide a minimum accounting of invertebrate species that could be used as indicator species. This list has yet to be added to the HUD; additional work to identify species distributions, habitat associations, preferences, and reference indexing remains to be completed before the species can be included in the HUD.

4.0 FISHING ACTIVITIES THAT MAY AFFECT EFH

The MSA requires FMCs for each FMP to identify fishing activities that may adversely affect EFH and to minimize adverse effects of those activities to the extent practicable. Fishing activities should include those regulated under the Pacific Coast Groundfish FMP that affect EFH identified under any FMPs, as well as those fishing activities regulated under other FMPs that affect EFH designated under the Pacific Coast Groundfish FMP.

The most common and direct effect of fishing on groundfish EFH results from fishing gear coming in contact with bottom habitats. Fishing gears can cause physical harm to corals, sponges, rocky reefs, sandy ocean floor, eelgrass beds, and other components of seafloor habitats.

A variety of fishing and other vessels can be found in estuaries, and the marine environment of the Pacific Coast. Vessel size ranges from small single-person vessels used in streams and estuaries, to mid-size commercial or recreational vessels, to large-scale vessels limited to deep-draft harbors and marine waters.

Fishing vessels can adversely affect EFH by affecting physical, chemical, or biological componentss. Physical effects can include physical contact with propeller wash in eelgrass beds (estuaries). Derelict, sunk, or abandoned vessels can cause physical damage to any bottom habitat.

Chemical effects from fishing activities could derive from anti-fouling paint, oil or gas spills, bilge waste, or other potential contaminants associated with commercial or recreational vessels operating in freshwater, estuaries, or the marine environment.

Biological effects include introducing invasive species from bilge waters in fishing vessels that can disrupt communities upon which managed fish species rely.

4.1 Fishing Effects on EFH by Gear Type

Fishing gear used in groundfish fisheries that have the potential to adversely affect EFH for Pacific Coast groundfish are shown in Table 8. These include fishing activities not managed under the MSA that may adversely affect groundfish EFH.

Table 8. Gear Types Used in the West Coast Groundfish Fisheries.[a/]

	Trawl and Other Net	Longline, Pot, Hook and Line	Other
Limited Entry Fishery (commercial)	Bottom trawl Mid-water trawl Whiting trawl Scottish seine	Pot Bottom Longline	
Open Access Fishery Directed Fishery (commercial)	Set gillnet Sculpin trawl	Pot Bottom Longline Vertical hook/line Rod/reel Troll/dinglebar Jig Drifted (fly gear) Stick	
Open Access Fishery Incidental Fishery (commercial)	Exempted trawl (pink shrimp, spot and ridgeback prawn, CA halibut, sea cucumber) Setnet Driftnet Purse seine (round haul net)	Pot (Dungeness crab, CA sheephead, spot prawn) Bottom Longline Rod/reel Troll	Dive (spear) Dive (with hook and line) Poke pole
Tribal	as above	As above	As above
Recreational	Dip net, Throw net (within 3 miles)	Hook and line methods Pots (within 3 milesfrom shore), private boat, commercial passenger vessel	Dive (spear)

Adapted from Goen and Hastie (2002). Most fishing gear used to target non-groundfish species (such as salmon, shrimp, prawns, scallops, crabs, sea urchins, sea cucumbers, California and Pacific Halibut, herring, market squid, tunas, and other coastal pelagic and highly migratory species) are similar to those used to target groundfish. These gears include trawls, trolls, traps or pots, longlines, hook and line, jig, set net, and trammel nets. Other gear that may be used includes seine nets, brush weirs, and mechanical collecting methods used to harvest kelp and sea urchins.

4.1.1 Bottom Trawling

Bottom trawling activity is conducted primarily by the West Coast groundfish fishery, harvesting over 90 species. Bottom trawling is managed under biennial specifications and includes a complicated matrix of sectors, seasons, and spatial limitations. There are many areas closed to bottom contact gear, including bottom trawling, many based on the designated HAPCs in the groundfish FMP EFH designations. (PFMC 2011a).

Appendix C to the Pacific Coast Groundfish FMP (PFMC 2011a) presents a risk assessment framework, including a sensitivity index and recovery rates for a variety of groundfish habitats. Impacts of bottom trawling to physical and biogenic habitats include removal of vegetation, corals, and sponges that may provide structure for prey species; disturbance of sediments; and possible alteration of physical formations such as boulders and rocky reef formations (PFMC 2011a).

4.1.2 Mid-Water Trawling

Mid-water trawls are used to harvest Pacific whiting, shrimp, and other species (PFMC 2011a). Like bottom trawling, it is managed under the Pacific groundfish FMP. Effects are generally limited to the effects of (1) removal of prey species, (2) direct removal of adult and juvenile groundfish, (3) occasional, usually unintentional, contact with the bottom (Devit 2011), and (4) effects resulting from loss of trawl gear, potentially resulting in impacts to bottom habitats and ghost fishing.

4.1.3 Bottom Long Line

Pelagic and bottom long-line fishing in the marine environment is prevalent on the Pacific Coast. Pelagic long-lining targets chiefly tuna and swordfish, while bottom long lining targets halibut, sablefish, and other species. Both types of long lining can incidentally harvest managed species as well as prey species. If long-line gear breaks loose and is lost, it can continue ghost fishing and potentially harm bottom habitat (see Derelict gear section).

4.1.4 Pot and Trap Gear

This gear type is dominated by commercial and recreational crab fisheries prevalent in estuaries and the marine environment along the entire West Coast. Lobster traps are used in California, but not typically north of the central California coast. To a lesser extent, pot gear is used in the sablefish fishery (NWFSC 2009).

Pot and trap gear can adversely affect EFH by smothering estuarine eelgrass beds and other marine/estuarine benthic habitats such as cobble and vegetated surfaces utilized by groundfish and can distrub biogenic habitat. Although typically placed in areas of sandy bottom, gear can also be deployed in areas of rocky habitat and may be dragged across the benthos by strong tidal or ocean currents. Lost trap and pot gear also can affect EFH and is discussed below under derelict gear.

4.1.5 Roundhaul Gear

Fisheries for coastal pelagic and highly migratory species use purse seines, lampara nets, dip nets, and drum seines to target Pacific sardine, northern anchovy, Pacific mackerel, jack mackerel, market squid, and tuna. Most tuna fishing occurs in the western and central Pacific, and tropical eastern Pacific. However, tuna are highly migratory and are present off the U.S. West Coast. They are therefore included in this consideration of habitat impacts from fishing activities.

Roundhaul gear can affect EFH through managed harvest of species that are prey for Pacific groundfish, as well as for other managed species. It can also affect squid EFH if nets are allowed to contact the benthos of squid spawning areas.

4.1.6 Derelict Commercial Gear

When gear associated with commercial or recreational fishing breaks free, is abandoned, or becomes otherwise lost in the aquatic environment, it becomes derelict gear. This phenomenon occurs in fishing activities managed under all four Pacific Coast FMPs, as well as recreational fishing and fishing activities not managed by the Council. In commercial fisheries, trawl nets, long lines, purse seines, crab and lobster pots, and other material, are occasionally lost to the aquatic environment. Recreational fisheries also contribute to the problem, mostly from lost crab pots and other fishing gear.

Derelict fishing gear, as with other types of marine debris, can directly affect groundfish habitat and can directly affect managed species via "ghost fishing." Ghost fishing is included here as an impact to EFH because the presence of marine debris affects the physical, chemical, or biological properties of EFH. For example, once plastics enter the water column, they contribute to the properties of the water. If debris is ingested by fish, it would likely cause harm to the individual. Another example is in the case of a lost net that becomes not only a potential barrier to fish passage, but also a more immediate entanglement threat to individual fish.

Along the Pacific Coast, Dungeness crab pots are especially prevalent as derelict gear (NWSI 2010). Commercial pots are required to use degradable cord that allows the trap lid to open after some time.

This is thought to significantly reduce the effects of ghost fishing. There was no reliable information regarding the numbers or impacts of lost recreational derelict crab pots.

Derelict gear can adversely affect groundfish EFH directly by such means as physical harm to eelgrass beds or other estuarine benthic habitats; harm to coral and sponge habitats or rocky reefs in the marine environment; and by simply occupying space that would otherwise be available to support managed species. Derelict gear also causes direct harm to groundfish (and potentially prey species) by entanglement. Once derelict gear becomes a part of the aquatic environment, it affects the utility of the habitat in terms of passive use and passage to adjacent habitats. More specifically, if a derelict net is in the path of a migrating fish, that net can entangle and kill the individual fish.

In Puget Sound, derelict fishing nets (primarily gillnets) as well as lost crab traps constitute a significant problem. And estimated 2,493 lost nets were removed recently during 18 months of a project funded under the American Recovery and Reinvestment Act. The Northwest Straits Initiative estimates that these nets were entangling 1.5 million animals annually. The nets are typically made from non-degradable nylon or plastic monofilament and persist in the aquatic environment for years (NWSI 2010). Hundreds of crab pots have also been removed (NWSI 2010).

4.2 Fishing Effects on EFH by Habitat Type

The degree of impact that affects a habitat is dependent upon several conditions including the inherent dynamics (dynamic vs. static), history of disturbances (disturbed vs. non-disturbed), and recovery of fished habitats and the relationships of adjoining habitats.

4.2.1 Dynamic Habitats

Dynamic seafloor conditions generally consist of soft, unconsolidated sediment that migrates across the seafloor and is mobilized by bottom currents. Submarine bedforms such as dunes, mobile sand sheets, sediment waves and ripples are the common habitat types that represent dynamic bottom conditions. These features may be foraging habitats for groundfish and long-term disturbances may disrupt habitation of prey species. Chronic or severe impacts may reduce the abundance of some prey species, such as Pacific Sand Lance (*Ammodytes hexapterus*), whereas they may make others more available to groundfishes through suspension (e.g., epifauna) or exposure (e.g., infauna). Some soft, unconsolidated habitats, especially those that have resulted from rising sea level during the early Holocene, may be relict (static) at deeper depths (>30 m). By contrast, others in shallow water (<30m) may seasonally cover or expose hard bedrock outcrops (dynamic). Hard gravel/pebble/cobble pavements, ridges, boulder fields, and pinnacles are generally considered to be static habitats that only typically vary as a result of punctuated, high energy events (e.g., geologic activity, tsunamis).

4.2.2 Disturbed Habitats

Historic and, to a lesser degree, contemporary fishing activities have been concentrated at specific areas on the continental shelf and slope. This repetitive fishing activity disturbs the seafloor to various degrees depending on gear types used. Most of the current trawling activities occur on soft, unconsolidated sand and mud seafloor and adjacent to hard bedrock outcrops, whereas longlines, fish traps (or pots) and other gear types are often also fished on hard-bottom regions.

4.2.3 Recovery of Habitats

Recovery of benthic habitats after disturbances occur is critical to the sustainability of a fishery. Many habitats such as soft, unconsolidated, dynamic, sedimentary bedforms can recover rapidly (within days or months) after disturbance, but it may take longer for the reoccupation of interstitial and other benthic organisms that make the seafloor a good foraging habitat. If a habitat is static then recovery after disturbance may be long-term (years to decades). Attached and sessile biogenic habitats associated with hard bedrock exposures may require considerable time to recover after fishing disturbance. Recovery times of these organisms depend upon the extent of removal and damage, as well as growth and recolonization rates.

4.2.4 Habitat Relationships

The degree of adverse impacts by fishing activities upon a benthic habitat is associated with the concentration and abundances of diverse habitats at fishing grounds. In regions where a fishing ground is homogenous and fairly extensive the impact may be low, while in regions of highly diverse benthic habitats consisting of foraging and various bottom fish life stage habitats disturbances may be acute, as it may interrupt feeding, predation avoidance, and reproduction activities of certain species.

4.3 Information on Habitat Effects of Fishing Gear

4.3.1 Information in the Groundfish FMP

As part of the Amendment 19 process, the Council issued an Impacts Model for Groundfish Essential Fish Habitat (PFMC 2011a) in 2005, which was adapted from the *Risk Assessment for the Pacific Groundfish FMP* (NMFS 2005). The Risk Assessment describes the EFH Model used to identify and describe EFH, an Impacts Model developed to evaluate anthropogenic impacts to EFH, and a data gaps analysis. Only two studies from the West Coast were found that had useful information for the analysis, therefore the review relied on studies from the global literature based on similar gear and habitat combinations as the West Coast. There was very little quantitative information describing the relationship between habitat type, structure, and function and the productivity of managed fish species. In particular, the level of information for most species-habitat associations remained at Level 1 as defined in the NMFS EFH Final Rule Guidance. Appendix J has additional detail on the results of the Amendment 19 analyses.

4.3.2 New Information on Habitat Effects

Since 2005, there have been several new publications, including peer-reviewed literature, white papers and technical memorandums, relevant to West Coast groundfish fisheries that have studied: 1) the effects of fishing gear on benthic habitats; 2) predictive modeling of biogenic habitats; and 3) the effects of fishing gear-related marine debris on habitats. An annotated bibliography of recent articles summarized below is presented in Appendix J.

The recent studies on the effects of fishing gear on benthic habitats are primarily focused on the effects of trawling. There have been several new studies off the West Coast of the contiguous U.S., Canada, and Alaska that have focused on otter trawls in unconsolidated substrate including sand and mud that contain biogenic habitat on the seafloor (Brown et al. 2005; De Marignac et al. 2008; Lindholm et al. 2008; Hixon and Tissot 2007; Hannah et al. 2010). Additionally, general effects of fishing with mobile, bottom-contact fishing gear (such as otter trawls) are increasingly well established through studies worldwide (Kaiser et al. 2006). There was also at least one publication that discussed the effects of bottom longlines Baer et al. 2010). Relative to the information available in 2005 the new studies, including those performed on the U.S. West Coast, found significant impacts of trawling on soft sediment habitats. Several of these pubilcations have noted that little has been written about recovery of seafloor habitat from the effects of fishing and that there is a lack of long-term studies, control sites, or research closures, which hinder the ability to fully evaluate impacts; however, some control sites are now available for monitoring recovery processes.

Fujioka (2006) documented the impacts model used in the Alaska EFH process. This model offered several advantages over the impacts model used in the Amendment 19 process. In particular the model addressed spatial heterogeneity in trawl effort and habitat types and trawl intensity, using empirical trawl effort data from the region.

Fujioka (2006) recommended using longer estimates of recovery time for hard corals, on the order of 100 years, and developmed a Long-term Effect Index (LEI), which calculated an estimate of the proportion of each habitat type in each cell impacted over the long-term under current levels of effort. Tthe LEI results for hard corals were typically greater than 50 percent even under low levels of trawl effort and that substantial long-term impacts could occur to soft sediment habitats depending on trawl intensity. While this approach employed a model with several underlying assumptions, it provided quantitative estimates of fishing impacts in a spatially explicit manner, which would be a significant improvement over the qualitative nature of the impacts model used in the Amendment 19 process.

Watters et al. (2010) provided the first quantitative assessment of marine debris and its impacts to the seafloor in deep submarine canyons and continental shelf locations off California and the U.S. They discerned only a few negative impacts to benthic organisms. Entanglement of fishes in other types of debris was not observed. Some debris caused physical disturbance to habitats (including common structure-forming macroinvertebrates) was observed. In another study Keller et al. (2010) documented the composition and abundance of man-made, benthic marine debris at 1,347 randomly selected stations along the U.S. West Coast during Groundfish Bottom Trawl Surveys in 2007 and 2008. Anthropogenic debris was observed in 469 of 469 stations at depths of 55 to 1,280 m. Plastic and metallic debris occurred in the greatest number of hauls followed by fabric and glass. Debris densities observed along the U.S. West Coast were comparable to those seen elsewhere and provide a valuable backdrop for future comparisons. Chiappone et al. (2005) found that less than 0.2 percent of the available invertebrates were affected by lost hook-and-line fishing gear, even though this gear caused 84 percent of the documented impacts (primarily tissue abrasion) to sponges and cnidarians. Debris was found to alter the seafloor by providing artificial habitat to demersal organisms; the majority of the debris was colonized by encrusting invertebrates.

4.4 Magnuson Act Fisheries Effects

4.4.1 Distribution of Commercial Fishing Effort

4.4.1.1 Bottom Trawl Effort

Figures in Appendix K-1 depict the spatial distribution of commercial bottom trawl effort within two time periods: “Before” (1 Jan 2002 – 11 Jun 2006) and “After” (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Each of the three coastal states administers a commercial logbook program, for which records are uploaded to the PacFIN regional database. Database records were utilized for commercial trips using bottom trawl gear types (e.g., “small” footrope, “large” footrope, flatfish, selective flatfish, and roller trawl) regardless of fishery sector (e.g., limited entry, open access). Records from the majority of state-managed trawl fisheries (e.g., pink shrimp, ridgeback prawn, sea urchin) are not included in PacFIN and thus are not represented in the figures. Tows targeting one state-managed trawl fishery – California halibut – are submitted to PacFIN and thus are included in the bottom trawl effort summaries.

In order to analyze the effort data spatially, a straight line connecting the start and end points was used to represent each tow event. Towlines intersecting land, outside the U.S. EEZ, deeper than 2,000 m, or with a calculated straight-line speed greater than five knots were removed from the spatial analysis. Two complimentary data products were created with these records: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than three vessels were operating, and 2) an extent polygon that shows the gross spatial extent of effort.

The first data product, intensity, was calculated as the total length of all towlines intersecting a standardized area. To calculate this metric, a line density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) was used. The line density algorithm calculates density within a circular search area (radius = 3 km) centered at a grid cell (size 500 m x 500 m). The value (units: km/km^2) for each grid cell is the quotient of total towline portions intersecting the circular area per grid cell area (Figure. 10). Since density outputs are highly sensitive to the specified radius and cell size, the absolute values are less important than the relative nature of them. The benefit of this output over depicting towlines themselves is that the density output better identifies areas where fishing effort is concentrated, while still ensuring confidentiality of individual fishing locations (e.g., Figure 15). The initial density output was more spatially extensive than the one shown in Appendix K-1, because it included cells with density values calculated from tows made by less than three vessels. Those "confidential" cells were removed for the final published data product. Density parameters were chosen in order to minimize data exclusion (due to confidentiality mandates) while still providing a fairly high spatial resolution (500 x 500 m). For the bottom trawl effort maps, only 1.1 and 1.8 percent of all effort (i.e., length of towlines) was excluded within a given time period, although the proportion varies considerably in certain areas along the coast (Table 9).

The second data product, the extent polygon, was created using an algorithm known as a convex hull. Convex hulls are a type of minimum extent polygon that forms an "envelope" around a group of points, or in this case, straight lines representing tows (Figure 16). The algorithm can be applied at various spatial scales. In this case, we grouped towlines into 0.5° latitude x 0.5° longitude blocks. The algorithm was then applied to each set of towlines within each block. Finally, all convex hull polygons were merged together for each time period. The resulting polygon encloses all towlines within each time period (e.g., Figure 15). The best way to interpret this data product is that no bottom trawling occurred outside of the extent polygon within a particular time period. In order to ensure that each extent polygon encompasses towlines from at least three vessels, the result is an overestimation of the areas of seafloor actually contacted by trawl gear. In fact, there are many areas within the extent polygon where no trawling occurred; hence this product is only intended to represent the gross "footprint" of trawling for each time period. However, there are several alternative approaches to determining the "footprint" of fishing effort resulting in very different spatial extents and interpretations, such as identifying the minimum area encompassing a certain percentage of all tows (e.g., Ban and Vincent 2009).

These spatial summaries of bottom trawl effort were developed from data represented only by start and end points of tows. It is recognized that tows rarely follow straight-line paths; however, this was the best information available on the spatial distribution of effort for vessels using bottom trawl gears. Because of this limitation and due to prohibitions of trawling within state waters, representatives of the states of Washington and California requested that any portions of the spatial summaries that intersect prohibited state waters be removed. In addition, Washington requested that effort occurring within both state and federal waters of the Salish Sea be removed since they felt that this information was incomplete and may not be representative of fishing effort within those areas. However, NMFS General Counsel has advised the EFHRC that there is not justification to limit access/display of these data from state waters so they are included in the map products.

In order to evaluate how fishing effort has changed between the two time periods, the color ramps for the intensity layers are scaled to the same range of values in each panel (e.g., Figure 15). Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. The upper value in the map legends is the lowest "high" value between the time periods. It was necessary to set the color ramp to the lowest "high" value in order for the colors in each panel to perfectly match and therefore be comparative.

Areas of high relative effort in the former time period are apparent off northern Washington (Appendix K-1, Plate A2), in Monterey Bay, CA (Appendix K-1, Plate E3) and south of Los Angeles, CA (Appendix K-1, Plate F4). In the recent time period, only one area in deeper waters off northern Washington (Appendix K-1, Plate A2) shows up with relatively high bottom trawl effort. There are a number of areas of medium to medium-high relative effort that show up in the map panels for both time periods. They are distributed throughout the region over both the shelf and slope, often showing some persistence between the two time periods.

A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/

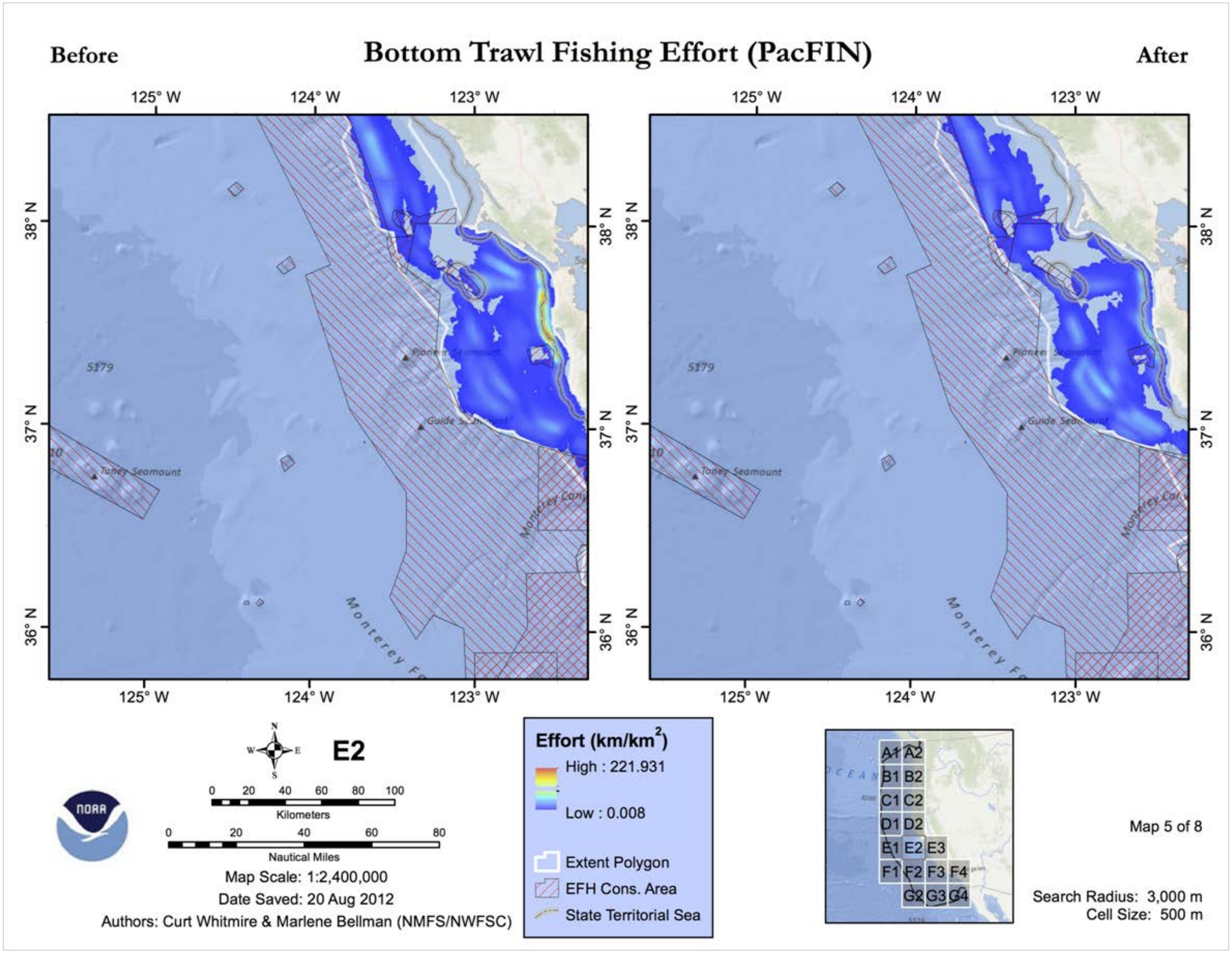


Figure 15. Example of Appendix K-1 bottom trawl effort from commercial logbook records in the PacFIN regional database.

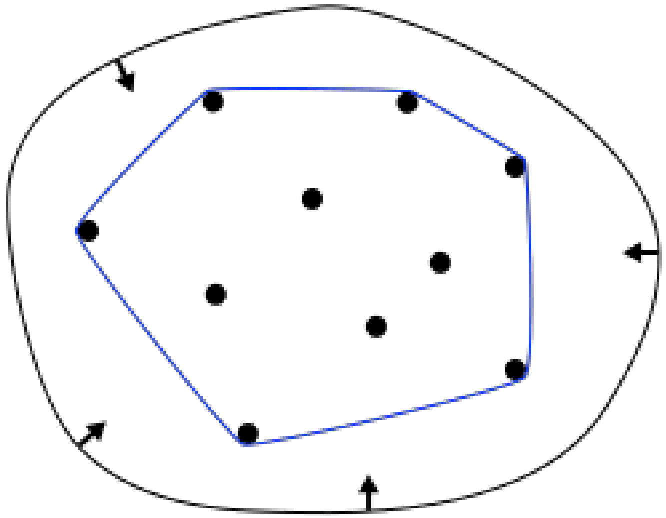


Figure 16. Conceptual drawing of a convex hull of a set of points. Imagine a rubber band being stretched around a set of points of lines. When the rubber band is released, the resulting shape is a convex hull. Image source: http://en.wikipedia.org/wiki/File:ConvexHull.svg (3 Jun 2008).

Table 9. Summary of commercial bottom trawl effort (i.e., length of towlines [km]) both inside and outside of density layer, summarized by degree of latitude and for two time periods: "before" (1 Jan 2002 – 11 Jun 2006) and "after" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulatory measures. The significance of this table is that it shows total recorded effort within the fishery (Inside+Outside), plus amount within each degree of latitude not represented in the fishing intensity layer (Outside), due to confidentiality considerations. Almost all recorded effort, however, is still represented in the extent polygon. "NA" means no records of bottom trawl trips exist for that latitude range and time period.

	Inside + Outside				Outside	
Latitude Range	BEFORE	% Coast	AFTER	% Coast	BEFORE	AFTER
48 - 49	83,719	8.3%	32,379	2.9%	1.0%	6.9%
47 - 48	87,351	8.7%	117,673	10.7%	0.5%	0.4%
46 - 47	106,758	10.6%	151,336	13.8%	0.1%	0.1%
45 - 46	87,864	8.7%	150,592	13.7%	0.8%	1.4%
44 - 45	57,119	5.7%	95,984	8.7%	1.1%	0.5%
43 - 44	58,631	5.8%	105,058	9.6%	1.7%	0.5%
42 - 43	57,289	5.7%	61,419	5.6%	2.1%	3.1%
41 - 42	93,191	9.2%	94,557	8.6%	0.1%	0.2%
40 - 41	72,037	7.1%	79,091	7.2%	0.2%	0.2%
39 - 40	50,802	5.0%	41,962	3.8%	0.4%	0.5%
38 - 39	38,028	3.8%	31,016	2.8%	1.4%	1.6%
37 - 38	90,268	8.9%	69,626	6.3%	0.4%	1.9%
36 - 37	46,183	4.6%	20,613	1.9%	0.5%	12.0%
35 - 36	19,774	2.0%	4,880	0.4%	4.5%	58.8%
34 - 35	52,194	5.2%	39,560	3.6%	6.7%	9.4%
33 - 34	8,434	0.8%	2,022	0.2%	2.2%	4.6%
32 - 33	0	NA	0	NA	NA	NA
Coastwide	1,009,642	100.0%	1,097,767	100.0%	1.1%	1.8%

4.4.1.2 Mid-Water Trawl Effort

Appendix K-2 Plates depict the spatial distribution of mid-water trawl effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of mid-water trawl tows were compiled from two data sources: 1) Logbook data originating from the state logbook programs and uploaded to the PacFIN regional database, and 2) observer records from the ASHOP. These two data sources represent the shoreside and at-sea hake fleets, respectively. Included in the ASHOP data are observations of tribal fishing in the at-sea hake sector.

In order to analyze the effort data spatially, a straight line connecting the start and end points was used to represent each tow event. Towlines intersecting land, outside the EEZ, deeper than 2,000 m, or with a calculated straight-line distance greater than 20 km were removed from the spatial analysis. Because of their patchy spatial distributions, towlines for mid-water trawls occurring south of Cape Mendocino were removed from the analysis at the request of the state of California. Similar to the bottom trawl effort maps, two complimentary data products were created with these towlines: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than three vessels were operating, and 2) an extent polygon that shows the gross extent of effort. Please refer to the description of methods used to create the bottom trawl effort Plates (Section 4.4.1.1), as they were very similar to the methods used for the mid-water trawl plates. The initial density output was more spatially extensive than the one shown in the Plates because it included cells with density values calculated from tows made by less than three vessels. For the published layer, grid cells were removed where tows from less than three vessels intersected the circular search area. These "confidential" cells only represent 1.6 and 3.1 percent of all towlines within a given time period, although the proportion varies considerably in certain areas along the coast (Table 10).

Similar to the bottom trawl effort figures, these spatial summaries of mid-water trawl effort were developed from data represented only by start and end points of tows. It is recognized that tows rarely follow straight-line paths; however, this was the best information available on the spatial distribution of effort for vessels using mid-water trawl gears. Because of their patchy spatial distributions, towlines for mid-water trawls occurring south of Cape Mendocino were removed from the analysis at the request of the state of California.

AppendixK-2 Plates show areas of high relative effort in the before time period are apparent off northern Washington and central and southern Oregon. In the after time period, areas of high relative effort show up again off northern Washington, off south-central Oregon, and near the Oregon-California maritime border (e.g., Figure 17, Plate A2). There are a number of areas of medium to medium-high relative effort that show up in the map panels for both time periods, but appear more widespread in the recent period. Those areas show little spatial consistency between the two time periods, possibly due to the migratory nature of the target species.

Table 10. Summary of commercial mid-water trawl effort (i.e., length of towlines [km]) both inside and outside of density layer, summarized by degree of latitude and for two time periods: “before” (1 Jan 2002 – 11 Jun 2006) and “after” (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulatory measures. The significance of this table is that it shows total recorded effort within the fishery, plus amount within each degree of latitude not represented in the fishing intensity layer, due to confidentiality considerations. Most recorded effort, however, is still represented in the extent polygon (see below for exception). “NA” means no records of mid-water trawl trips exist for that latitude range and time period.

	Inside + Outside				**Outside**	
Latitude Range	BEFORE	% Coast	AFTER	% Coast	BEFORE	AFTER
48 - 49	15,366	13.1%	11,160	6.7%	2.3%	5.4%
47 - 48	8,625	7.3%	32,584	19.4%	3.7%	1.6%
46 - 47	11,750	10.0%	30,904	18.4%	2.0%	0.7%
45 - 46	17,278	14.7%	25,151	15.0%	5.3%	1.1%
44 - 45	30,189	25.7%	25,320	15.1%	0.6%	0.9%
43 - 44	18,504	15.7%	25,006	14.9%	1.0%	0.7%
42 - 43	12,143	10.3%	13,081	7.8%	3.9%	0.9%
41 - 42	1,240	1.1%	3,014	1.8%	9.4%	1.3%
40 - 41	1,767	1.5%	872	0.5%	5.3%	7.9%
39 - 40	8	0.0%	126	0.1%	100.0%*	100.0%*
38 – 39	70	0.1%	NA	NA	100.0%*	NA
37 - 38	466	0.4%	NA	NA	100.0%*	NA
36 - 37	32	0.0%	NA	NA	100.0%*	NA
35 - 36	74	0.1%	NA	NA	100.0%*	NA
34 - 35	87	0.1%	366	0.2%	100.0%*	100.0%*
33 - 34	NA	NA	NA	NA	NA	NA
32 - 33	NA	NA	NA	NA	NA	NA
Coastwide	**117,598**	**100.0%**	**167,585**	**100.0%**	**3.1%**	**1.6%**

* Denotes areas south of Cape Mendocino, CA (~40.5 deg. lat.) where effort data were removed from the analysis at the request of the state of California.

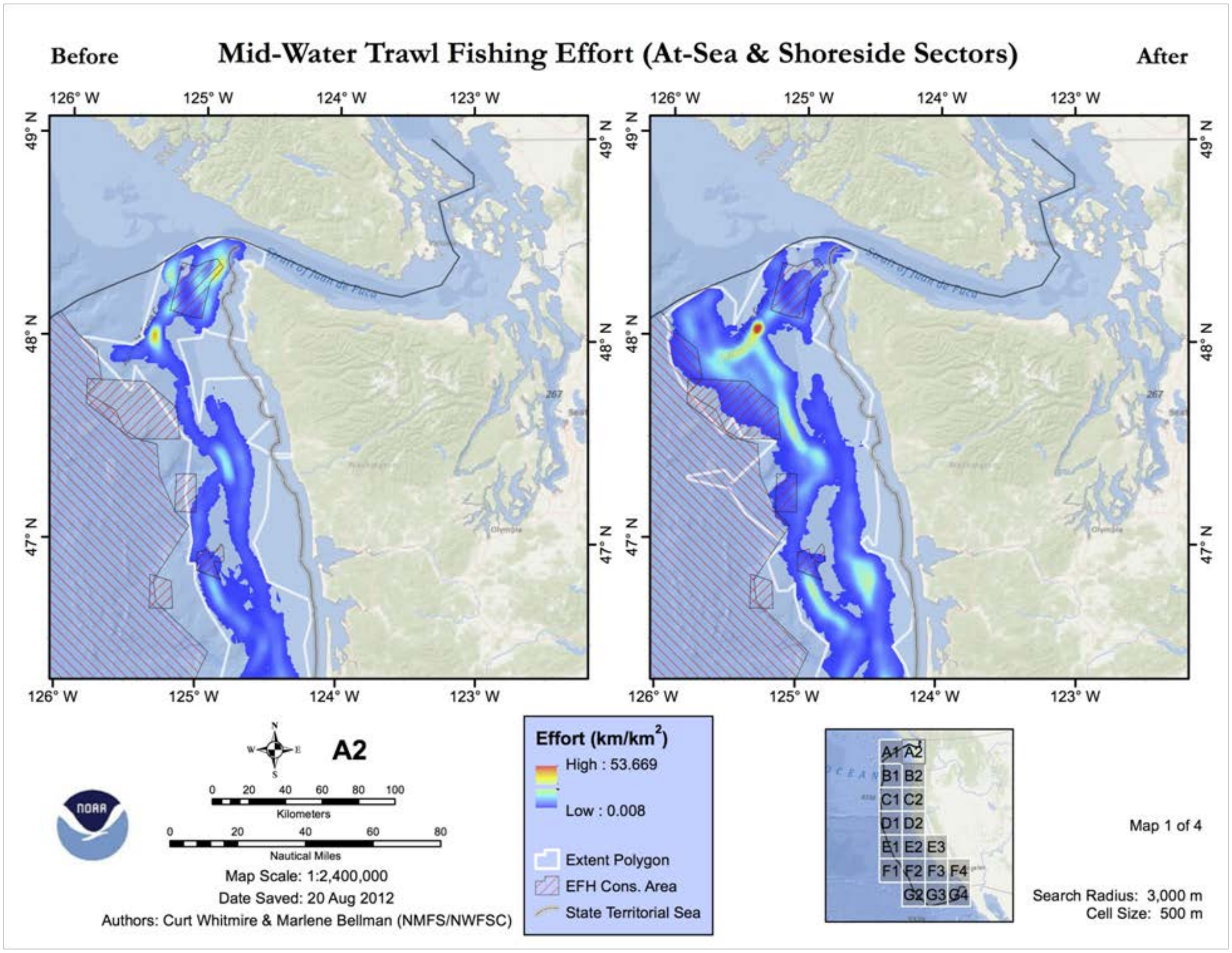


Figure 17. Example of Appendix K-2 mid-water trawl effort from commercial logbook records in the PacFIN regional database.

A GIS project was constructed in ArcCatalog and ArcMap in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/

4.4.1.3 Fixed Gear Effort

Appendix K-3 figures depict the spatial distribution of observed fixed gear effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of fixed gear fishing locations were compiled from one source: observer records from the West Coast Groundfish Observer Program (WCGOP database. The WCGOP database includes records of trips for vessels participating in the following sectors: limited entry sablefish-endorsed primary season, limited entry non-sablefish endorsed, open access fixed gear, Oregon and California nearshore. Annual WCGOP coverage of fixed gear sectors can be found online at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely. We urge caution when utilizing these data due to the complexity of groundfish management and fleet harvest dynamics.

Since fishing does not occur continuously between set and haul points for fixed gears, the WCGOP fixed gear data products are based on spatial locations of both set and haul coordinates (referred to as "fishing locations"). This is in contrast to the trawl effort data products, where a straight line connecting the start and end points was used to represent each tow event. Fishing locations where either set or haul points were either on land, outside the EEZ, or deeper than 2,000 m were removed from the spatial analysis. Similar to the bottom trawl effort maps, two complimentary data products were created with these fishing locations: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than 3 vessels were operating, and 2) an extent polygon that shows the gross extent of effort. Please refer to the description of methods used to create the bottom trawl effort maps, as they were very similar to the methods used for the bottom trawl and mid-water trawl figures. The main difference for the fixed gear data is that a point density, rather than a line density, algorithm was used to quantify density of effort (units: locations/km2; Figure 18). The density parameters used for calculating standardized effort for observed fixed gear fishing locations was a 5 km search radius and a 1,000x1,000 m cell size. As with the two trawl data products, the initial density output was more spatially extensive than the one shown in the figures, because it included cells with density values calculated from fishing locations of less than three vessels. For the published layer, we removed those grid cells where fishing locations from less than 3 vessels intersected the circular search area. These “confidential” cells represent 15.3 and 22.4 percent of all fishing locations within a given time period, although the proportion varies considerably in certain areas along the coast (Table 11).

As with the two trawl effort maps, the color ramps for the intensity layers are scaled to the same range of values in each panel

AppendixK-3 map plates show areas of high relative effort in the before time period are apparent off northern Washington, Cape Blanco, OR, and Crescent City, CA. In the after time period, areas of high relative effort show up again off northern Washington, off the Columbia River mouth, and off Cape Blanco, OR (e.g., Figure 14). There are a number of areas of medium to medium-high relative effort that show up in the map plates for both time periods; however, compared to the two sets of trawl figures, there appear to be little spatial consistency between the two periods.

Another stark contrast between the fixed gear figures and the two trawl figures is the characteristic of the extent polygons. The extent polygons for fixed gear effort (Figure 18) extend greater distances from the intensity layers than trawl effort (Figures 15 and 17). There are a couple probable explanations for this phenomenon. First, the fixed gear data comes from observers who are present only on a subset of all fixed gear trips, in contrast to the bottom trawl and mid-water trawl data sources which are a mostly complete record of all trips using those gear types (see exceptions detailed in methods). Second, due to a more patchy nature of the spatial distribution of effort, the fixed gear intensity layer represents a smaller portion of locations within the extent polygon. In other words, a higher proportion of density cells were considered confidential because the values for those cells were calculated from only one or two vessels (Table 11). The overall objective of the fixed gear intensity layer development was to ensure adequate coastwide representation (in which over 80 percent or more of the data are represented). Compared to the bottom and mid-water trawl summaries, the extent polygon for observed fixed gear effort encompasses a large majority of observed fishing locations; however, some points were excluded due to confidentiality considerations.

Table 11. Summary of observed fixed gear effort (i.e., number of fishing locations) both inside and outside of density layer, summarized by degree of latitude and for two time periods: "before" (1 Jan 2002 – 11 Jun 2006) and "after" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulatory measures. The significance of this table is that it shows total observed effort within the fishery, plus amount within each degree of latitude not represented in the fishing intensity layer, due to confidentiality considerations. Most observed effort, however, is still represented in the extent polygon.

	Inside + Outside				Outside	
Latitude Range	BEFORE	% Coast	AFTER	% Coast	BEFORE	AFTER
48 - 49	1,079	10.0%	1,488	10.3%	4.9%	0.9%
47 - 48	1,033	9.6%	785	5.5%	7.9%	8.4%
46 - 47	508	4.7%	1,512	10.5%	10.8%	5.4%
45 - 46	867	8.0%	1,094	7.6%	46.1%	25.2%
44 - 45	1,205	11.2%	1,539	10.7%	23.3%	17.0%
43 - 44	689	6.4%	751	5.2%	20.5%	7.7%
42 - 43	845	7.8%	1,912	13.3%	6.5%	1.3%
41 - 42	1,028	9.5%	837	5.8%	31.0%	16.6%
40 - 41	259	2.4%	224	1.6%	35.1%	48.7%
39 - 40	366	3.4%	218	1.5%	12.3%	8.3%
38 - 39	173	1.6%	228	1.6%	26.0%	93.0%
37 - 38	220	2.0%	428	3.0%	65.0%	37.4%
36 - 37	302	2.8%	300	2.1%	7.6%	13.0%
35 - 36	360	3.3%	333	2.3%	18.1%	53.8%
34 - 35	196	1.8%	125	0.9%	28.6%	63.2%
33 - 34	956	8.9%	1,984	13.8%	43.1%	17.9%
32 - 33	704	6.5%	640	4.4%	21.3%	19.4%
Coastwide	**10,790**	**100.0%**	**14,398**	**100.0%**	**22.4%**	**15.3%**

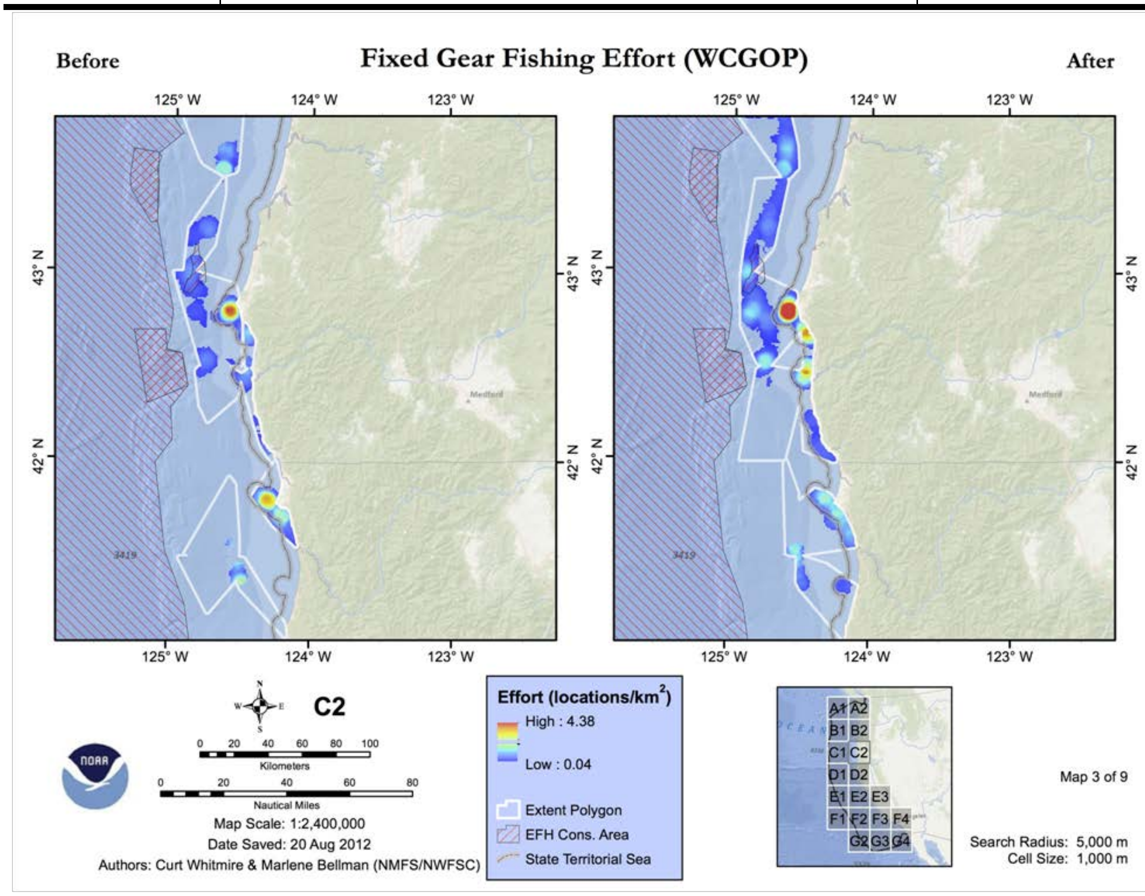


Figure 18. Example of Appendix K-3 fixed gear effort from commercial logbook records in the PacFIN regional database.

A GIS project was constructed in ArcCatalog and ArcMap in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/

4.4.2 Recreational Fishing

Hook and line gear and pots are the most widely used and most likely sources of potential recreational fishing gear impacts to EFH. Hook and line gear often involves use of large (usually lead) weights when trolling for salmon or fishing groundfish such as halibut, lingcod, and rockfish species. Metal recreational weights can impact biogenic habitat and soft and hard substrate when lost or when making contact with the bottom. Hooks, lines, and smaller weights can be lost and become entangled in rocky and biogenic habitat. Recreational pot gear can damage habitat when making initial bottom contact while fishing or drag across the bottom causing more widespread damage when lost.

Biogenic habitats are most at-risk from recreational fishing gear impacts followed by hard substrate and lastly, soft sediments. Impacts would proportionally be larger in areas of high recreational activity. Many areas of vulnerable biogenic habitat are located far offshore lessening chance of recreational gear and vessel impacts such as anchoring.

Lost gear may remain in-place and adversely affect organism growth while continuing to fish. Ghost fishing can occur but is limited for hook and line gear by number of hooks. Recreational pots can continue to fish until required biodegradable cord opens escape hatches disabling the fishing ability of the gear.

Cumulative impacts from recreational fishing gear will be most pronounced in heavily fished areas but little is known since minimal visual monitoring or inspections have been conducted; research is needed in this area. Due to the relatively small gear and spatial footprint of recreational fisheries overall, impacts are minimal compared to commercial fisheries. Though dive fishing with spears and spear-guns are addtional forms of recreational gear their impacts are minimal to EFH.

4.4.3 Minimizing Effects

Fishery Management Plans are required to minimize adverse affects to EFH to the extent practicable. Minimization measures can include, but are not limited to, time/area closures, fishing equipment restrictions, harvest limits, and effort control. Adverse impacts to benthic habitats associated with bottom fishing activities have been considerably reduced during the last two decades. These reduction were achieved primarily in three areas; fleet reduction, gear modifications and area closures.

4.4.3.1 Fleet Reduction

Prior to 1994, the Pacific Coast groundfish trawl fleet numbered over 500 vessels. Through a number of capacity reduction measures, which included limited entry, the groundfish buyback program, and the rationalization of the trawl fleet (individual quota shares), has reduced the trawl groundfish fleet by nearly 80 percent (Table 12). In this same time period, the limited entry fixed gear fleet was also reduced by almost 30 percent.

Table 12. Counts of vessels participating in groundfish fishery sectors: 2005-2011.[a/]

Groundfish Sector	2005	2006	2007	2008	2009	2010	2011
Catcher-Processors	6	9	9	8	6	7	9
Mothership whiting CVs	17	20	20	19	19	22	18
Shoreside whiting trawl CVs	29	37	39	37	34	36	26
Nonwhiting trawl CVs[b/]	123	122	121	120	117	105	129
Sub total trawl vessels	175	188	189	184	176	170	182
Limited Entry fixed gear	126	132	136	135	139	140	166
Open Access fixed gear	670	764	696	650	660	578	682
Sub total fixed gearl vessels	796	896	832	785	799	718	848
Incidental Open Access	537	462	449	274	280	294	284
Total Groundfish Vessels [c/]	**1,232**	**1,219**	**1,178**	**1,011**	**1,025**	**965**	**1,041**
Vessels participating in both shoreside whiting and nonwhiting fisheries	20	27	27	28	26	24	14
Vessels participating in both shoreside and at-sea whiting fisheries	7	12	15	13	13	15	13

a/ Source: PacFIN. Vessel counts for 2011 are preliminary.
b/ The increase in the number of nonwhiting trawl CVs in 2011was due to fixed gear vessels with trawl permits utilizing gear switching provisions.
c/ Vessels may participate in more than one fishery sector, so this total exceeds the number of West Coast groundfish vessels.

4.4.3.2 Gear Modification

In the early 2000's, the need to constrain the catch of overfished rockfish species brought about regulatory changes to limit the footrope size to less than 8 inches inside of 100 fathoms. This gear regulation not only helped restrict catches of overfished rockfish species, it dramatically changed the spatial footprint of the trawl fishery, out of rocky habitat areas. Additional regulations as a result of Amendment 19 further restricted gear types to footropes less than19 inches outside of 100 fathoms, and banned use of dredges and beam trawls. The actual trawl footprint has been further reduced by the trawl rationalization program, which allows gear switching (i.e., trawl-permitted vessel can use fixed gear to capture groundfish). Improved electronics and technology have also allowed the fishing fleet to better position themselves and avoid sensitive habitats.

4.4.3.3 Area Closures

Bottom Contact Closed Areas

In 2006, the Council and NMFS took action to close the following areas to specific bottom contact gear (trawl gear only or all bottom contact gear), based on the outcome of the Amendment 19 process.

Off of Washington:

1. Olympic_2
2. Biogenic_1
3. Biogenic_2
4. Grays Canyon
5. Biogenic_3

Off of Oregon:

1. Nehalem Bank / Shale Pile
2. Astoria Canyon
3. Siletz Deepwater
4. Daisy Bank / Nelson Island
5. Newport Rockpile / Stonewall Bank
6. Heceta Bank
7. Deepwater off Coos Bay
8. Bandon High Spot
9. Rogue Canyon

Off of California:

1. Eel River Canyon
2. Blunts Reef
3. Mendocino Ridge
4. Delgada Canyon
5. Tolo Bank
6. Point Arena Offshore
7. Cordell Bank
8. Biogenic Area 12
9. Farallon Islands / Fanny Shoal
10. Half Moon Bay
11. Monterey Bay / Canyon
12. Point Sur Deep
13. TNC/ED Area 2
14. TNC/ED Area 1
15. TNC/ED Area 3
16. Potato Bank
17. Cherry Bank
18. Hidden Reef / Kidney Bank
19. Catalina Island
20. Cowcod Conservation Area East

Bottom Contact Closed Areas

Off of Oregon:

1. Thompson Seamount
2. President Jackson Seamount

Off of California:

1. Cordell Bank (within 50 fm isobath)
2. Davidson Seamount (fishing below 500 fathoms prohibited, see below)
3. Anacapa Island MCA
4. Anacapa Island MR
5. Carrington Point
6. Footprint
7. Gull Island
8. Harris Point
9. Judith Rock
10. Painted Cove
11. Richardson Rock
12. Santa Barbara
13. Scorpion
14. Skunk Point
15. South Point

These closed areas are summarized in Figure 3.

All of the BCCAs off of California occur within the Cordell Bank, Monterey, or Channel Islands National Marine Sanctuaries. Mitigation measures implemented under MSA authority are also intended to support the goals and objectives of these sanctuaries. In the case of Davidson Seamount, it is unlawful for any person to fish with bottom contact gear, or any other gear that is deployed deeper than 500 fathoms (~914m), within the area defined in Federal regulations. These gear restrictions address Sanctuary goals and objectives while practicably mitigating the adverse effects of fishing on groundfish EFH.

Bottom Trawl Footprint Closure

As a precautionary measure to mitigate the adverse effects of fishing on groundfish EFH, Amendment 19 closed the West Coast EEZ seaward of a line approximating the 700 fm (~1,280m) isobaths to bottom trawling (PFMC 2011a). However, NMFS disapproved the closing of areas within the EEZ that are not designated as EFH (i.e., deeper than 3,500 m), and closure was subsequently limited to designated EFH that is seaward of the line approximating the 700 fm isobath (May 2006, 71 FR 27408). This is referred to as the footprint closure because the 700 fm isobath is an approximation of the historic extent of bottom trawling in the management area. This closure is therefore intended to prevent the expansion of bottom trawling into areas where groundfish EFH has not historically been adversely affected by bottom trawling.

4.5 Non-Magnuson Act Fisheries Effects

The EFHRC requested spatial footprints of state-managed bottom contact gear fisheries, for use in the groundfish EFH review.

4.5.1 Fisheries Managed by the State of Washington

Logbook datat for state managed fisheries were aggregated into 10-minute blocks and indicate where fishing occurred by a minimum of three vessels (i.e., "rule of three"), consistent with other requests from non-fishery management agencies for commercial logbook data. As such, areas or blocks that are not shaded do not necessarily represent areas where fishing did not occur, but rather may not have met the "rule of three" standard.

For the Dungeness crab fishery, logbook data collection began in the 2009-2010 season and specific fishing location data prior then was unavailable. Data for each fishing season is presented separately (Figures 19a and 19b).

For the spot prawn fishery, prior to 2003, both trawl and pot gear could be used; however, beginning in 2003, trawl gear was prohibited. Therefore, trawl fishing location data were excluded because inclusion could give a false impression of where the fishery occurs. There are very few participants in this fishery, so applying the "rule of three" resulted in a display of only a few discrete areas; as such, data were aggregated across all years (2003-2011) to better display the extent of the spot prawn fishing footprint (Figure 20).

The Washington hagfish fishery has such few participants that it was difficult to meet the "rule of three" minimum standard to display any useful data, so no maps were included.

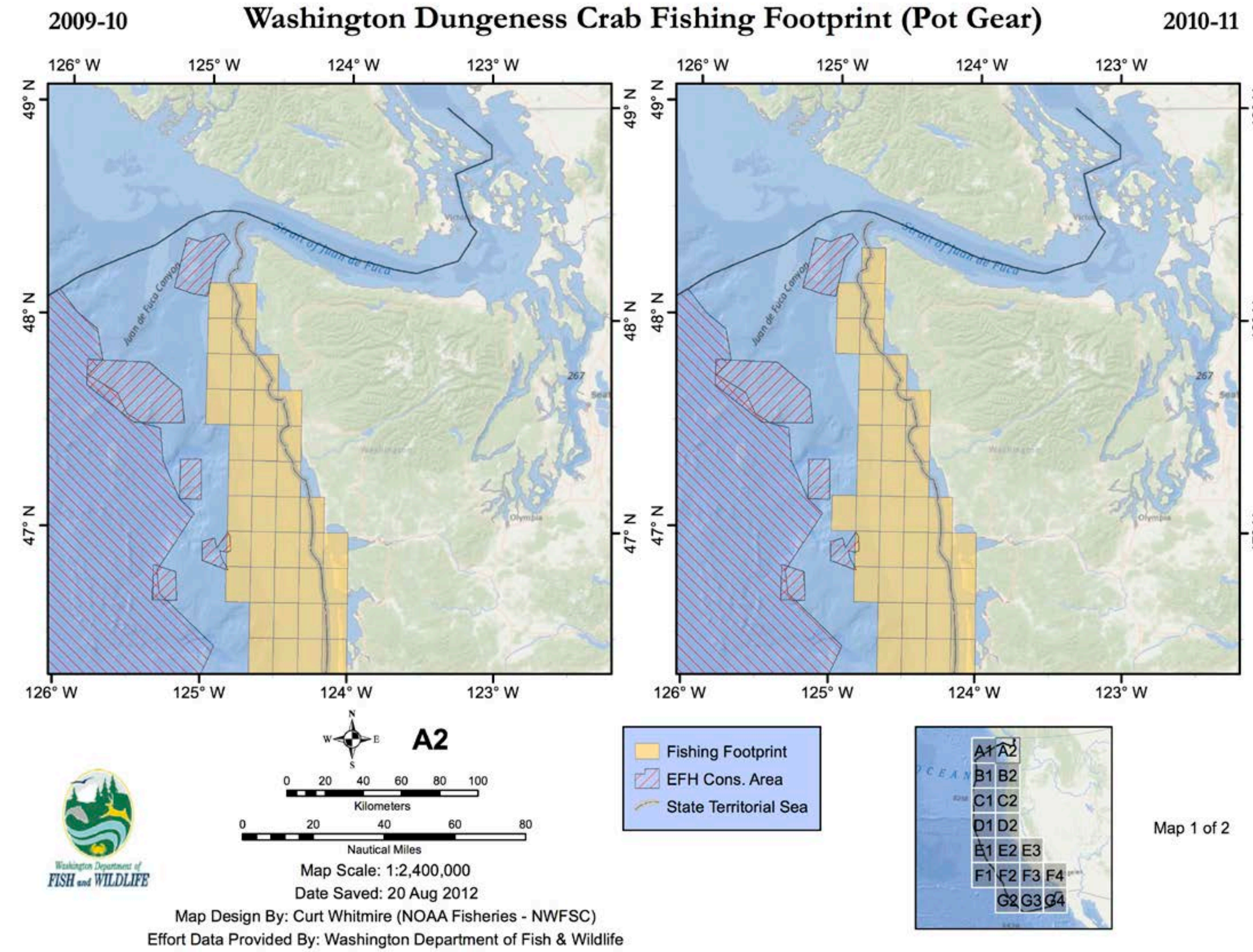


Figure 19a. Washington Dungeness crab fishery footprint during the 2009-2010 and 2010-2011 seasons.

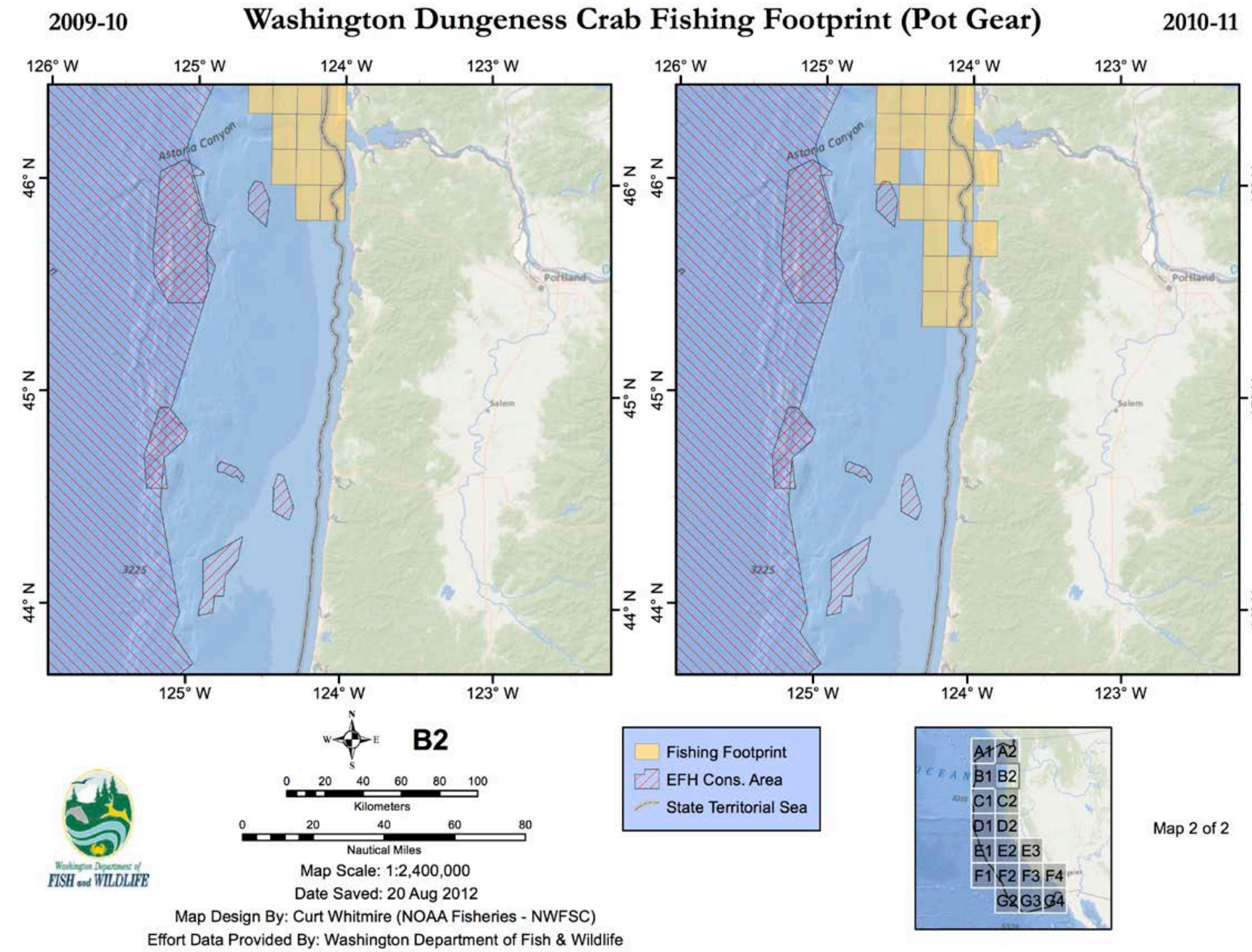


Figure 19b. Washington Dungeness crab fishery footprint during the 2009-2010 and 2010-2011 seasons.

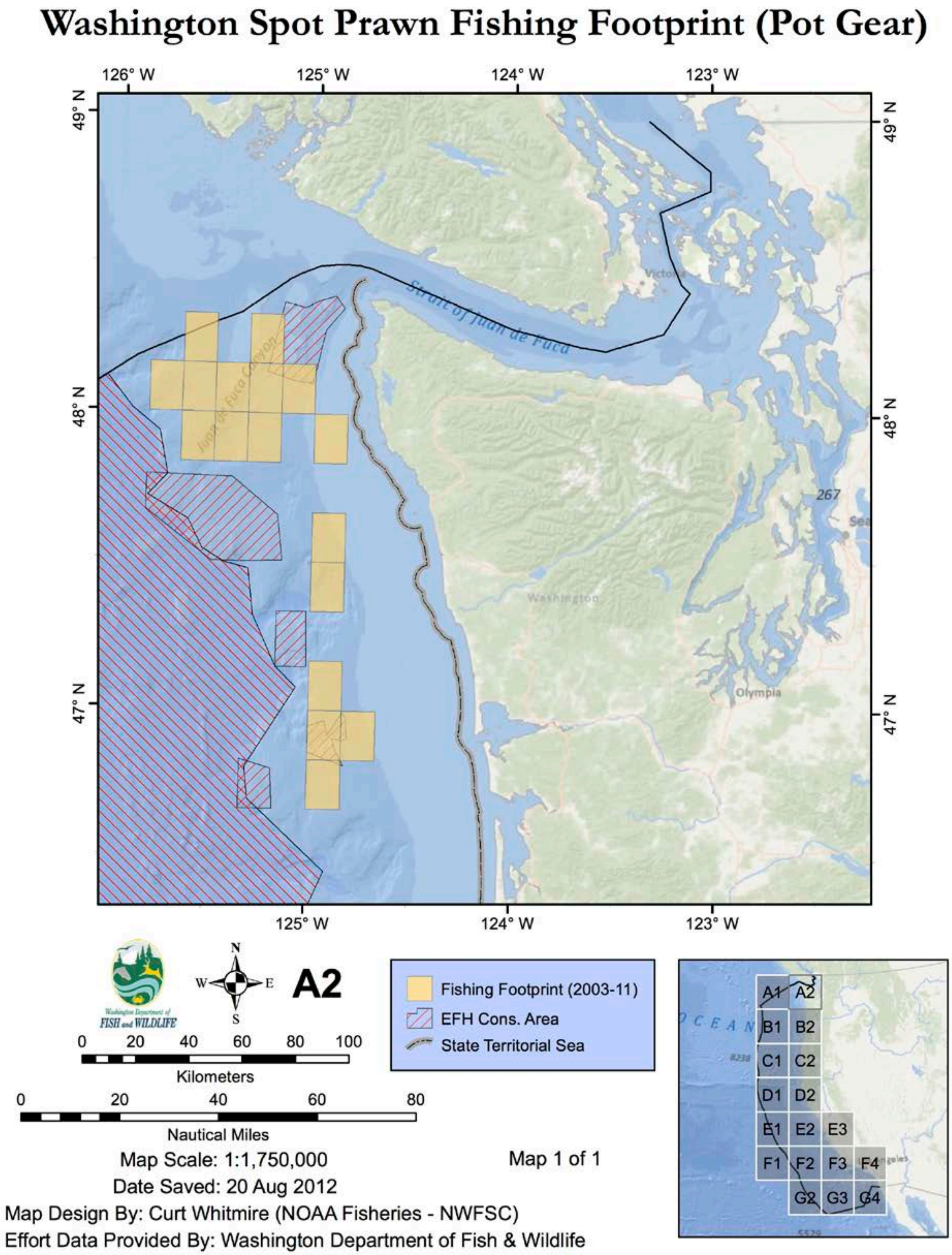


Figure 20. Washington spot prawn pot gear fishery footprint during the 2003-2011 seasons.

4.5.2 Fisheries Managed by the State of Oregon

Oregon Department of Fish and Wildlife provided fishery footprints created from state fishery logbook information for Dungeness crab (Figure 21), hagfish (Figure 22) and pink shrimp (Figures 23a-d) fisheries. Three crab seasons are represented in this footprint – 2007-08, 2009-10 and 2010-11. Catches from Oregon hagfish fisheries are presented for 1993-1998, 1999, part of 2001, 2002-2011 (limited catch reported in 2006). Prior to 2002 catch was reported sporadically, but reporting improved from 2002 onward. Pink shrimp bottom trawl footprint was based on logbook data from five large stock size years, 1987, 1989, 1992, 2005 and 2011.

Each data product represents a multiple year aggregate view of the extent of effort (or footprint) for each fishery. These were developed by taking a series of steps using ArcGIS, based on the methods used by NWFSC analysts to develop the trawl fishery footprint for the EFH process. Each fishery's logbook data was spatially joined to a 0.5° latitude X 0.5° longitude grid. Polygons were then created using the 'Minimum Bounding Geometry' tool with the convex hull bounding type selected for each grid cell. The polygons were then buffered by 1 nm for Dungeness crab and pink shrimp, and by 3 nm for hagfish, then the boundaries between each polygon were dissolved. The resulting polygons enclose >99% of all set string locations for each fishery. To maintain confidentiality, polygons with locations from fewer than three vessels were eliminated, as were arms on polygons that contained a single sample. These products are only intended to represent the general "footprint" of each fishery for the different time periods specified.

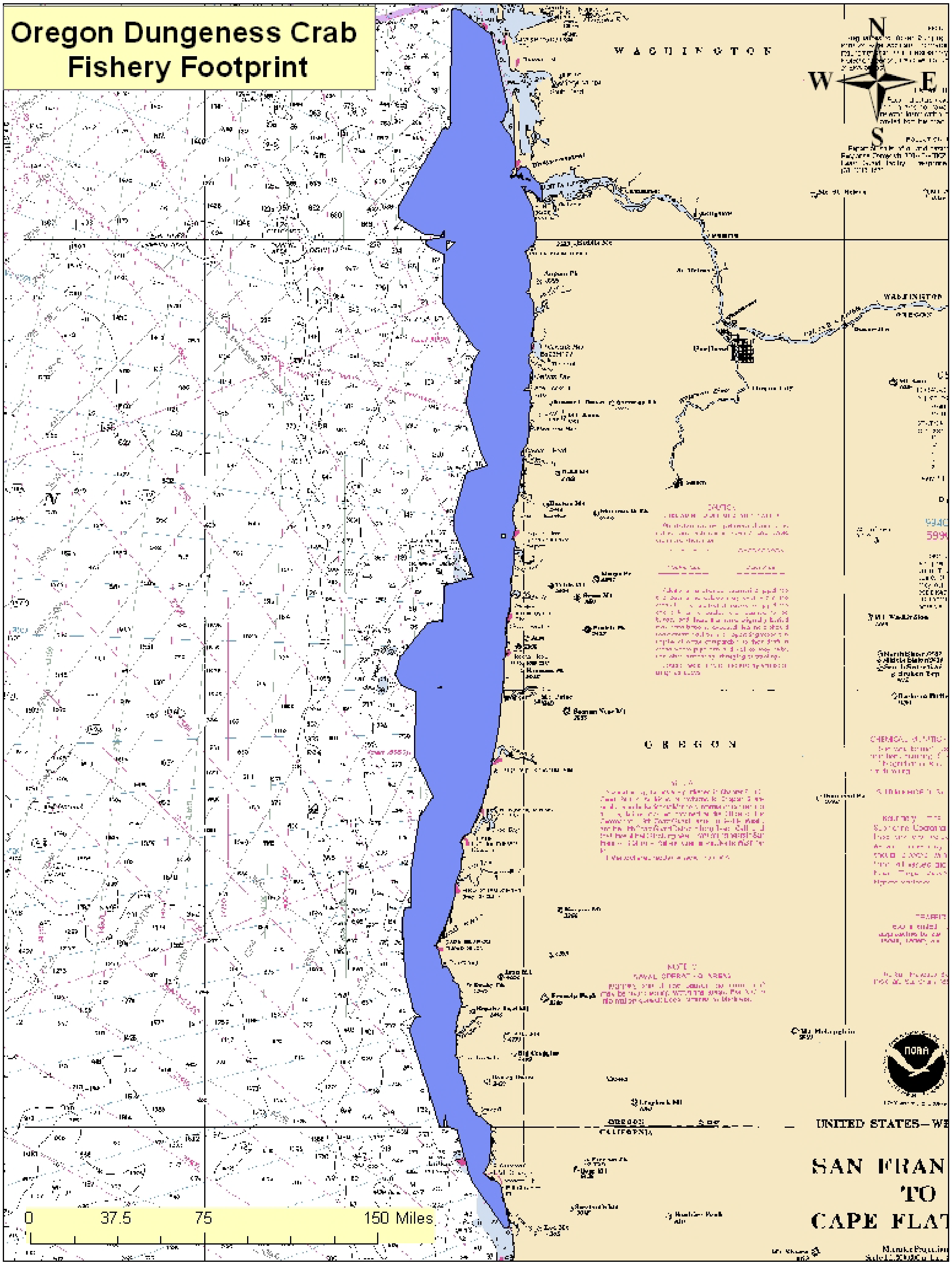


Figure 21. Oregon Dungeness crab pot fishery footprint for the 2007-08, 2009-10 and 2010-11 seasons.

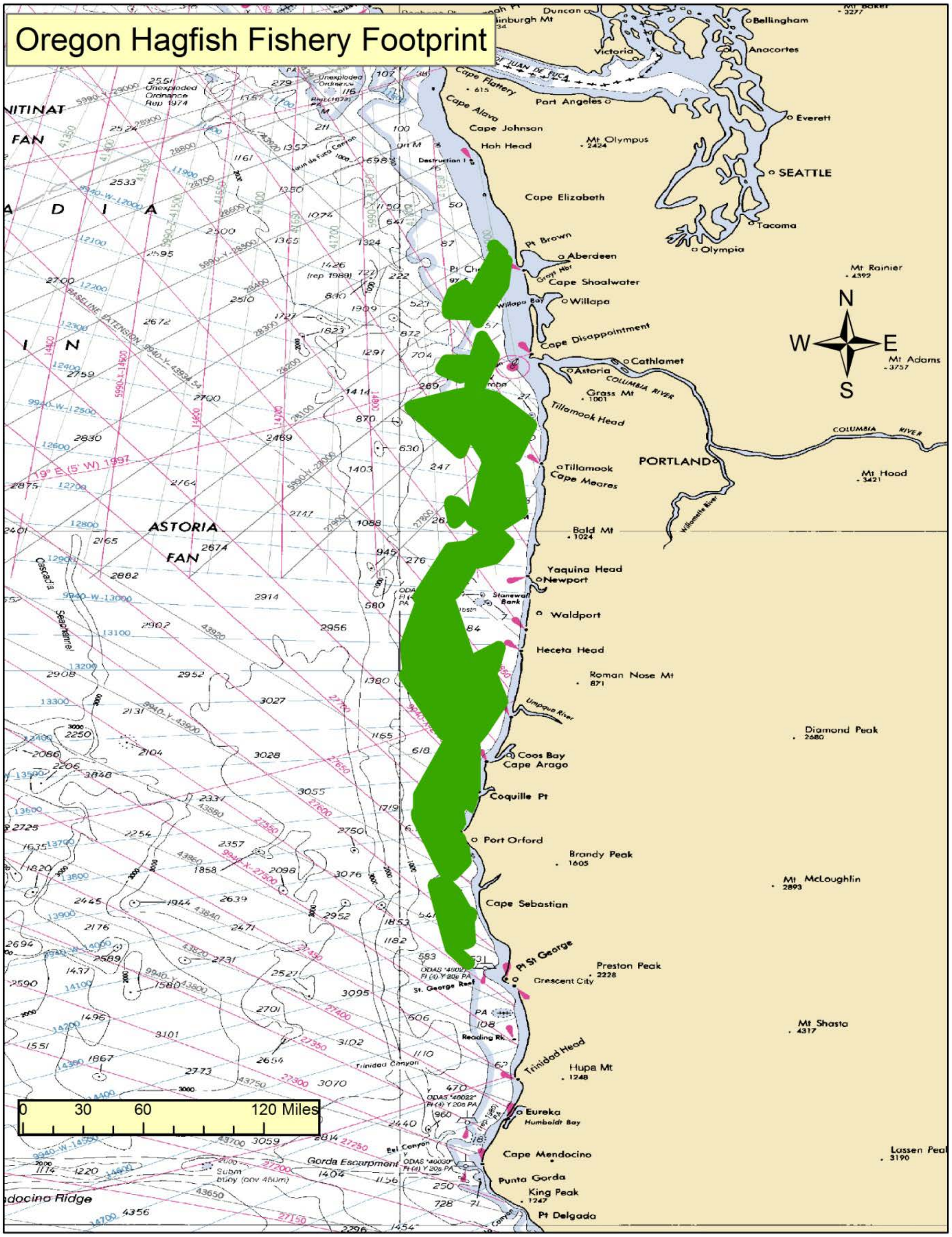


Figure 22. Oregon hagfish pot fishery footprint from 1998-1993, 1999, part of 2001, 2002-2011 (limited catch reported in 2006). Prior to 2002 catch reported sporadically, but reporting improves from 2002 onward.

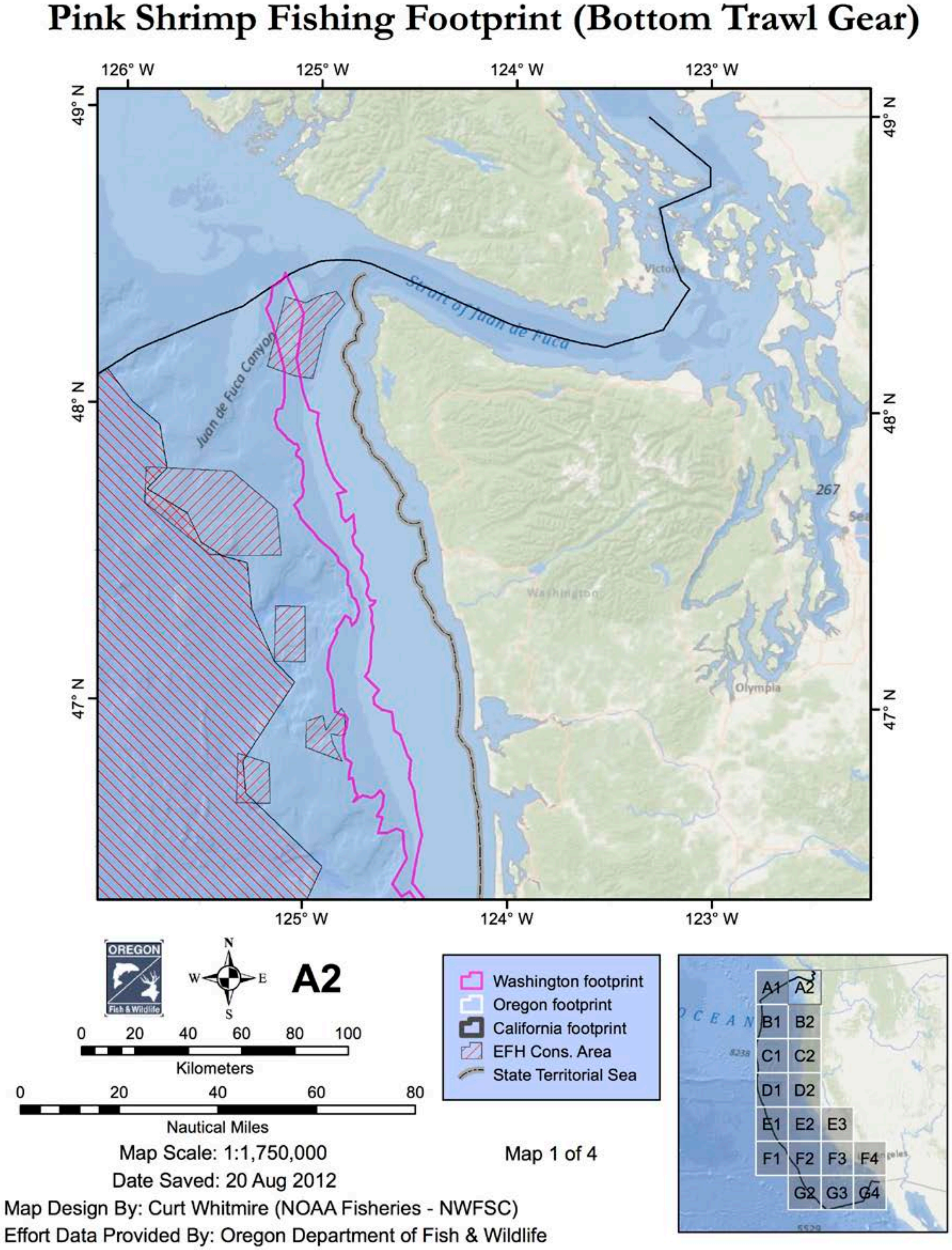


Figure 23a. Oregon pink shrimp bottom trawl fishery footprint from the 1987, 1989, 1992, 2005 and 2011 seasons.

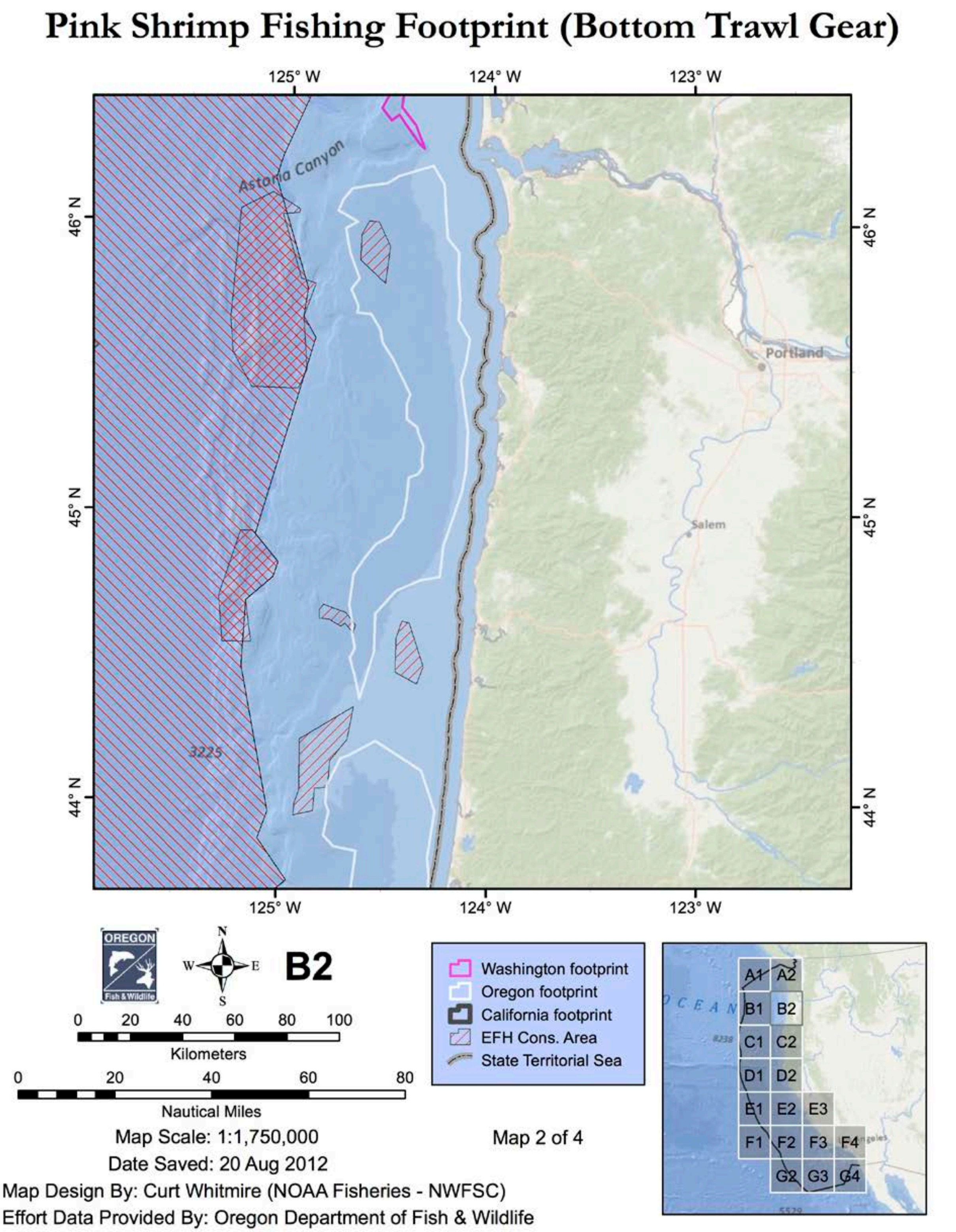


Figure 23b. Oregon pink shrimp bottom trawl fishery footprint from the 1987, 1989, 1992, 2005 and 2011 seasons.

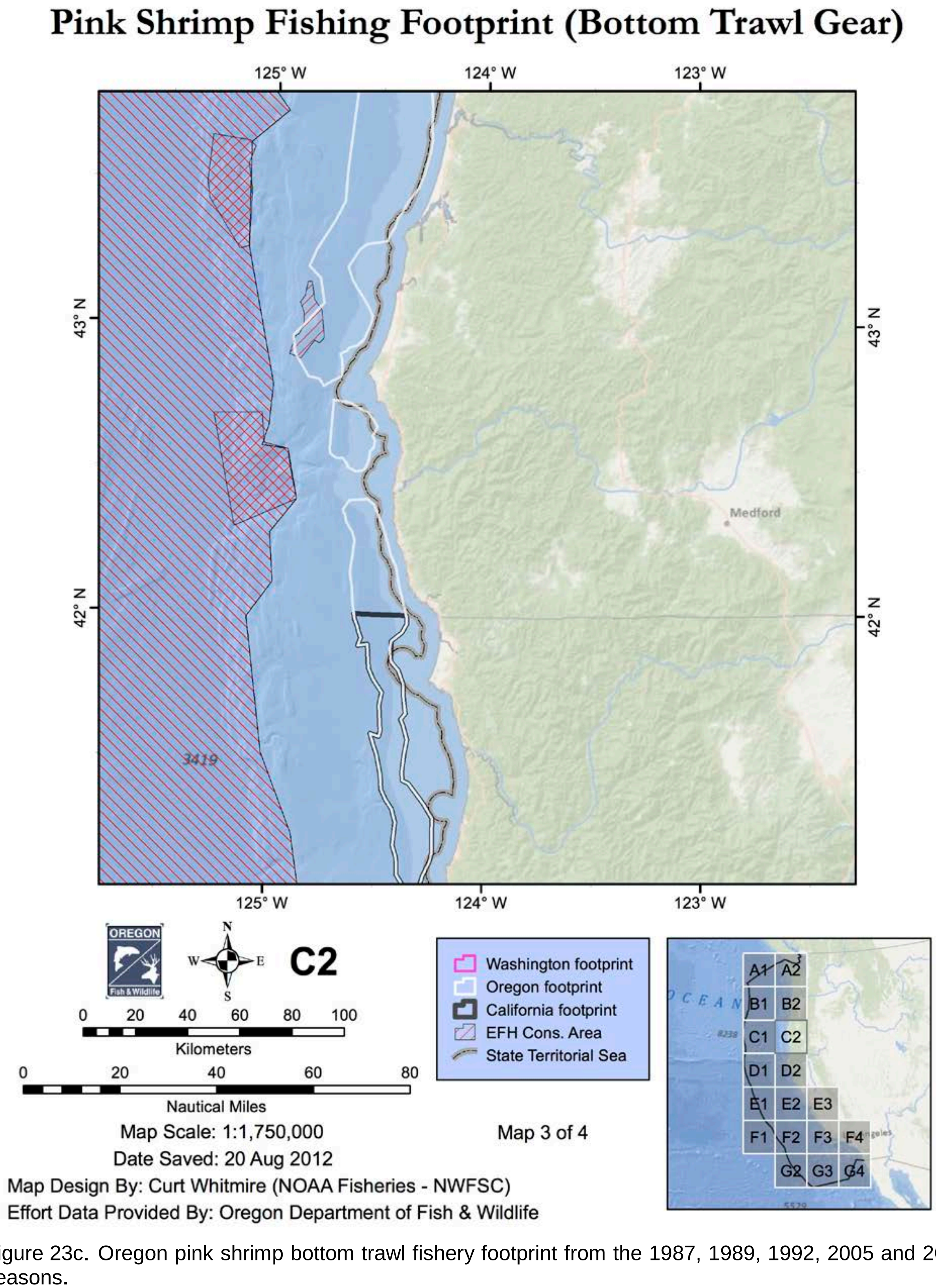


Figure 23c. Oregon pink shrimp bottom trawl fishery footprint from the 1987, 1989, 1992, 2005 and 2011 seasons.

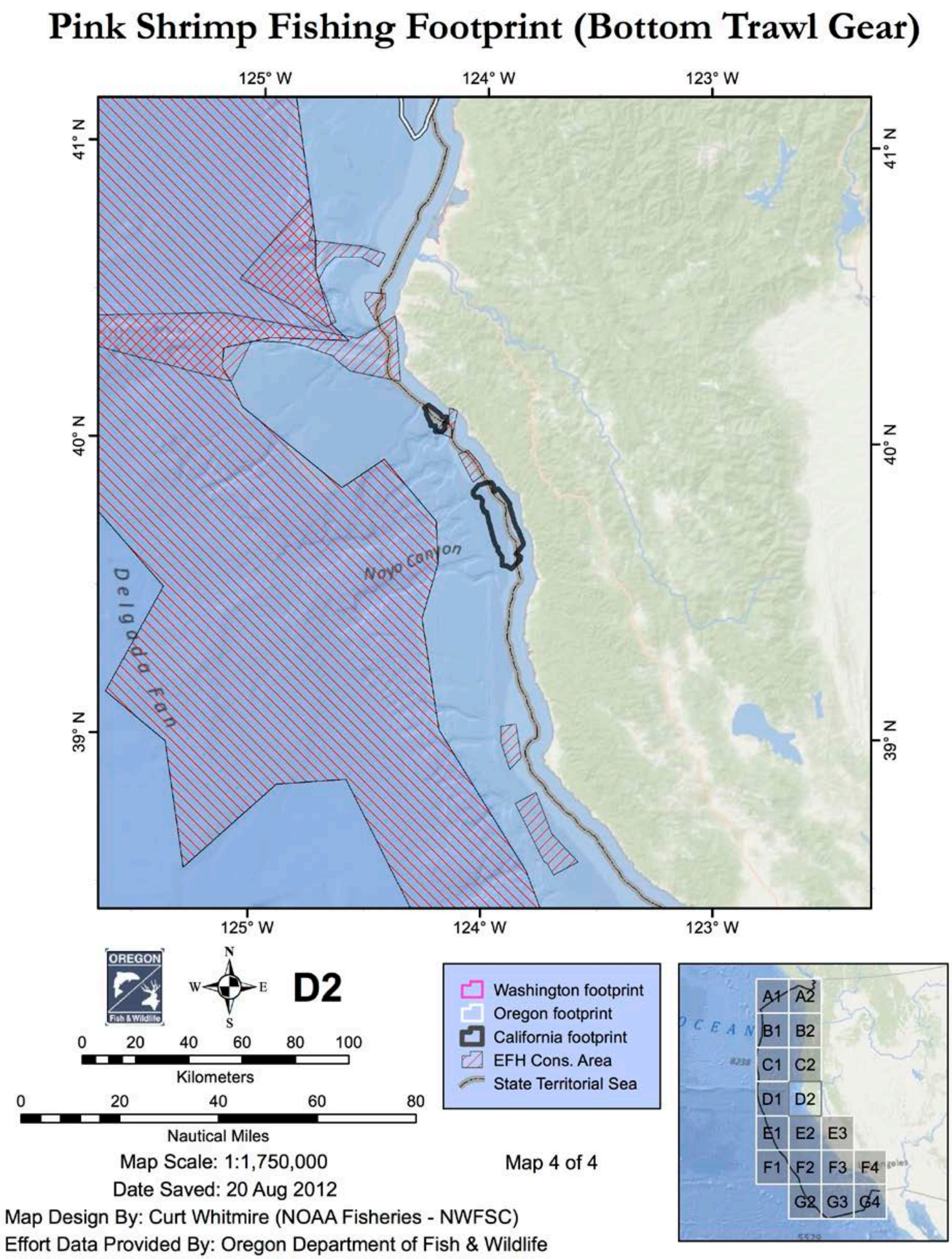


Figure 23d. Oregon pink shrimp bottom trawl fishery footprint from the 1987, 1989, 1992, 2005 and 2011 seasons.

4.5.3 Fisheries Managed by the State of California

The CDFG issued a report in 2008 that described the nature and extent of the California halibut fishery and to a lesser extent, then California sea cucumber trawl fishery (CDFG 2008). This was concurrent with the closure of California Halibut Trawl Grounds (CHTG), which have certain performance criteria associated with them, to be met prior to re-opening the CHTG. The criteria relate to bycatch, damage to seafloor habitat, ecosystem health, and restoration of biogenic habitats. While the report does not draw specific conclusions, it makes clear that there was a conservation concern

All citations in the report are from 2007 and before, and the EFHRC has not received any subsequent information in response to its request to the CDFG. While this report may not represent the most up to date information, it nonetheless provides an indicator of the location (Figure 24), nature, and intensity (Figure 25) of California halibut trawling; as well an insight into the potential adverse effects to marine habitat (Figure 26).

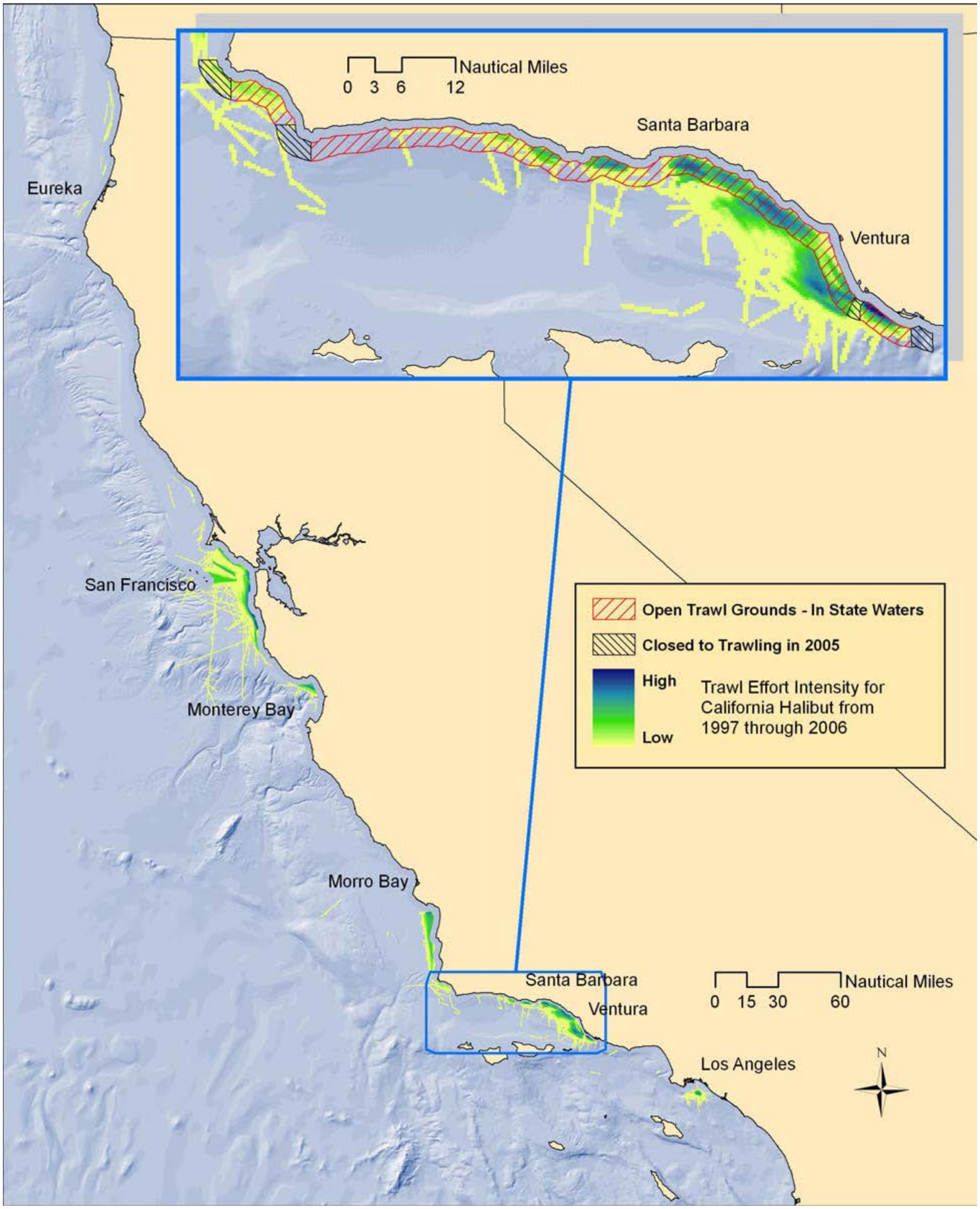


Figure 24. California historical statewide bottom trawl effort from 1997 to 2006.

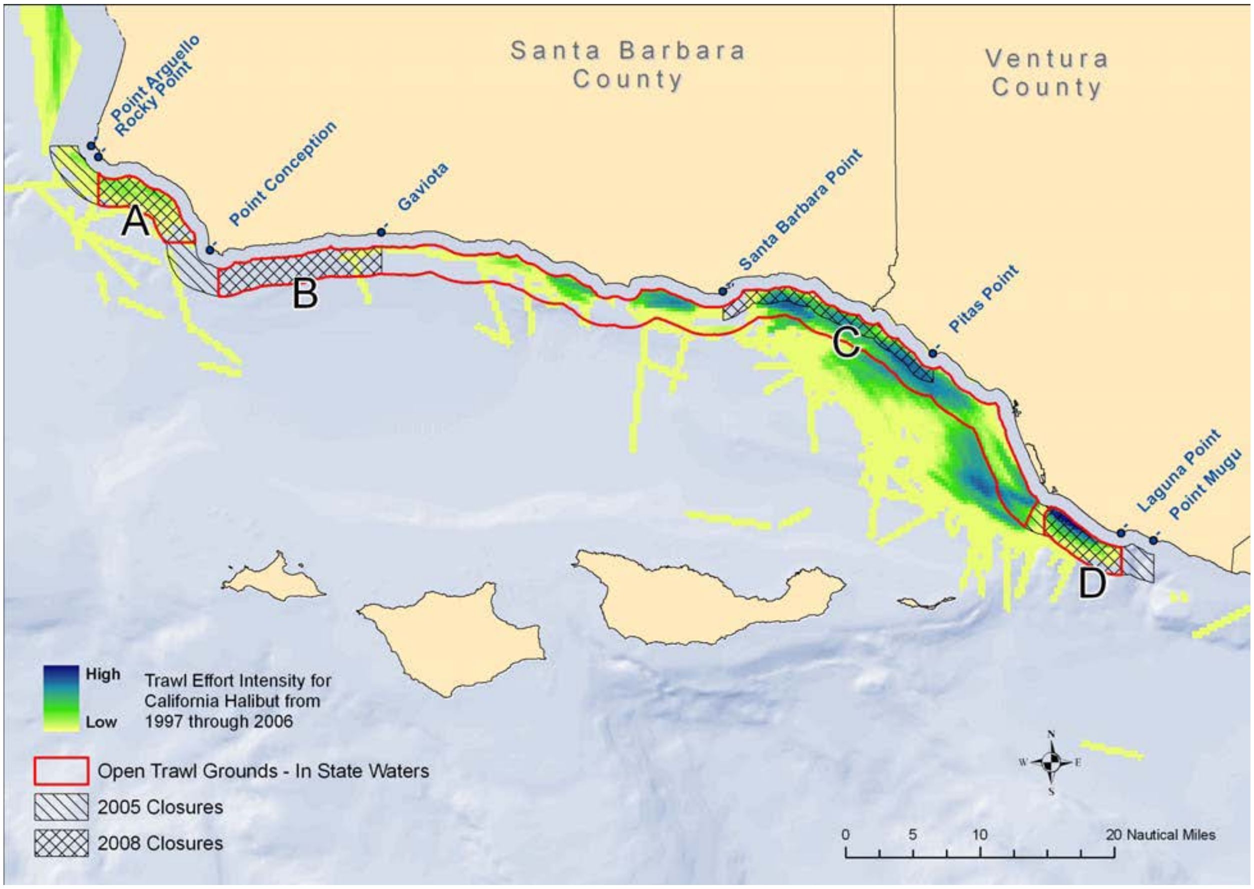


Figure 25. Bottom trawl intensity in the area of four California halibut trawl grounds proposed (as of 2008) for closure.

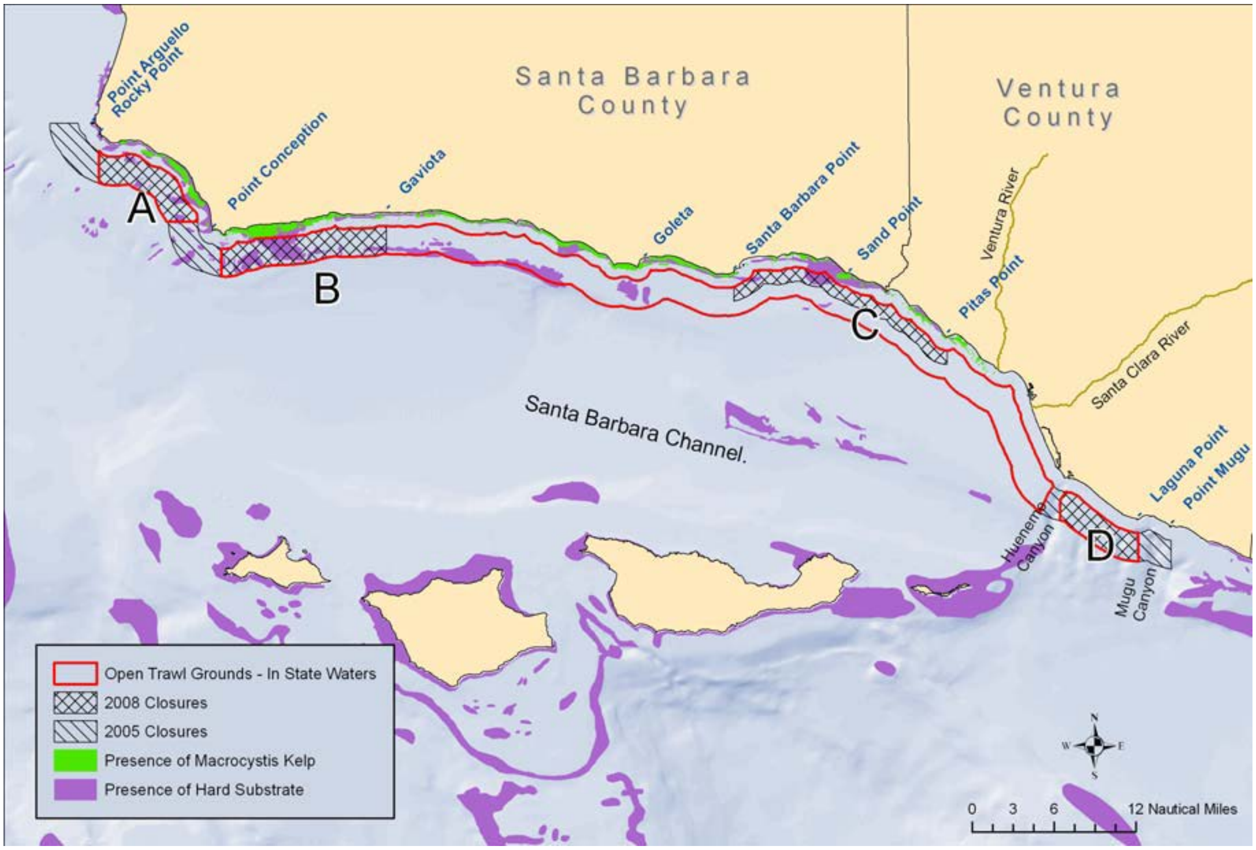


Figure 26. Depiction of hard or mixed substrate, kelp habitat, and two submarine canyons.

5.0 NON-FISHING ACTIVITIES THAT MAY AFFECT EFH

The MSA requires FMCs and NMFS to identify non-fishing activities that may adversely affect EFH, as well as actions to encourage the conservation and enhancement of EFH, including recommended options to avoid, minimize, mitigate, or otherwise offset the adverse effects. Appendix D to the FMP includes 31 such activities and associated conservation measures, and the EFHRC identified four additional non-fishing activities (Table 13). This section provides a description of the non-fishing activities to EFH that have gained attention since Appendix D was published. The threats posed by these activities include direct effects to managed species, such as impingemnt on intake screens, and indirect effects to these species, such as loss important habitat for prey species. Some activities are more developed than others, and some include preliminary conservation measures while others do not. However, each activity description contains the information necessary to, at a minimum, inform the Council on the potential severity of the adverse effects from these activities. See FMP Appendix D for a description of the 31 threats to EFH of Pacific Coast groundfish identified in 2006. It is important to note that many projects consist of more than one of these activities, and the aggregate effects of those activities should be considered when making EFH Conservation Recommendations.

The EFHRC anticipates that, should the Council amend the Pacific Coast Groundfish FMP, the descriptions of all activities, including those identifed in FMP Appendix D, will be expanded upon and refined, and that conservation measures will be developed for each activity. In addition, the Council may determine that activities in addition to those in Table 13 merit inclusion in the amendment.

Table 13. Non-fishing activities that may adversely affect Pacific Coast groundfish EFH . Detailed description of the threats identified in 2005 can be found in Appendix D to the FMP.

Activities Identified in Amendment 19 (2005)	**New Activities Identified During EFH Review**
Agriculture/Nursery Runoff	Alternative energy development
Silviculture/Timber Harvest	Liquefied natural gas projects
Pesticide Application	Desalination
Urban/Suburban Development	Activities that contribute to climate change and ocean acidification
Road Building and Maintenance	
Upland Mineral Mining	
Sand and Gravel Mining	
Debris Removal	
Dam Operation	
Commercial and Domestic Water Use	
Dredging and	
Dredged Spoil Disposal	
Landfills	
Vessel Operation/Transportation/Navigation	
Introduction of Exotic Species	
Pile driving	
Pile removal	
Over-water structures	
Flood control/shoreline protection	
Water control structures	
Log transfer facilities/In-water log storage	
Utility line/Cables/Pipeline installation	
Commercial utilization of habitat	
Artificial Propagation of Fish and Shellfish	
Bank Stabilization	
Point source discharge	
Fish processing waste – Shoreside and Vessel operation	
Water intake structures/discharge plumes	
Oil/Gas Exploration/development/production	
Habitat restoration/enhancement	
Marine mining	

5.1 Newly Identified Threats to EFH

5.1.1 Alternative Energy Development

Marine, estuarine, and freshwater hydrokinetic energy refers to electrical energy that comes from "waves, tides, and currents in oceans, estuaries, and tidal areas; free flowing water in rivers, lakes, and streams; free flowing water in man-made channels; and differentials in ocean temperatures (ocean thermal energy conversion)" (US DOE 2009). For the purpose of considering threats to designated groundfish EFH on the West Coast of the United States, this report focuses on nearshore wave energy and tidal turbine energy development because it is the most likely form of hydrokinetic technology to move forward within the next five years. Ocean thermal energy and offshore wind development are not considered in this discussion because they are not likely to be proposed off the West Coast of the United States in the near future.

Wave energy conversion devices can be grouped by the design features to capture wave energy, into six main types: point absorbers, attenuators, oscillating wave surge converters, oscillating water column, overtopping devices, and submerged pressure differential devices (U.S.DOE 2009). Tidal turbines are placed on the bottom and can have an exposed or closed blade. Although each design is unique, these devices are typically attached to the seafloor, channel bottom, or some type of structure and deployed at or near the water's surface or at depth.

In order to develop and operate wave or tidal hydrokinetic projects, there are four phases of activities that can potentially affect groundfish EFH. The potential effects of each phase of a hydrokinetic project (preconstruction, construction, operation and maintenance, and decommissioning) need to be considered (Boehlert and Gill 2010; Gill 2005; Kramer et al. 2010; Previsic 2010; U.S.DOE 2009). In addition to the design features and footprint of an individual device, the spatial and temporal scales of a project (single device /short-term; single device /long term; multiple devices /short term; multiple devices /long term) are important considerations when evaluating effects to groundfish EFH (Boehlert and Gill 2010). The potential cumulative effects of the spatial arrangement (vertical and horizontal) of multiple devices in the water column also need to be evaluated.

Construction activities typically include: horizontal directional drilling to land cables from the device to the shoreline; laying of subsea transmission cable; foundation/mooring installation; deployment and commissioning of device(s). Operation and maintenance include the mechanical functioning of the devices and appurtenances, as well as inspection and repair of equipment. Decommissioning at the end of the project (typically 5-30 years) involves removal of all equipment in the water column and transmission cables and restoration of the site, if needed.

Related activities that pertain to both the construction and operations phases include installation and maintenance of navigation buoys to mark the deployment area; and reliable port infrastructure to accommodate work vessels as well as delivery and retrieval of large hydrokinetic devices to pier-side for repair and maintenance, if necessary.

5.1.1.1 Potential Adverse Impacts

Because the majority of hydrokinetic renewable energy technologies remain at the conceptual stage and have not yet been developed as full-scale prototypes or tested in the field, there have been few studies of their environmental effects. Currently, identification of the potential environmental effects have been developed from: (1) predictive studies; (2) workshop reports from expert panels; and (3) report syntheses prepared from published literature related to other technologies, e.g., noise generated by similar marine construction activities, measurements of electromagnetic fields (EMFs) from existing submarine cables, environmental monitoring of active offshore wind farms in Europe, and turbine passage injury reduction mechanisms employed in conventional hydropower turbines.(Boehlert and Gill 2010; Kramer et al. 2010; Nelson et al. 2008; U.S. DOE 2009).

The majority of potential effects to groundfish EFH are from the presence and operation of a wave energy convertor device or turbine, although construction and installitaion of devices can also adversely affect EFH. Those effects are covered under the specific activity shch as pile driving.. Although all phases of an individual project will alter the physical marine environment, the types and duration of those changes are varied. Numerous reviews (Kramer et al. 2010; U.S.DOE 2009) have identified the following potential effects of the wave energy converter devices, all of which may affect the quality and quantity of groundfish EFH: (1) alteration of current and wave strengths and directions; (2) alteration of substrates and sediment transport and deposition; (3) interference with animal movements and migrations, including fish (prey and predators) and invertebrate attraction to subsurface components of device, concentration of displaced fishing gear; (4) presence of rotor blades or other moving parts; and attraction and concentration of predators on surface components of device; (5) alteration of habitats for benthic organisms; (6) sound and vibration in water column during construction and operation; (7) generation of EMFs by electrical equipment and transmission lines; (8) release into water column of toxic chemicals from paints, lubricants, antifouling coatings, as well as spills of petroleum products from service vessels. These potential effects to groundfish EFH apply to tidal turbines as well.

Presence of subsurface structures may affect water movements, as well as sediment transport, erosion, and deposition at a local scale. During construction and decommissioning, the installation and removal of the foundations, anchors, and transmission cables will disturb and suspend sediments, and may mobilize contaminants, if present. Disturbances to the benthic habitat will occur during temporary anchoring of construction vessels; clearing, digging and refilling trenches for power cables; and installation of permanent anchors, pilings, and other mooring devices. Prior to installation of a buried cable, any debris is typically cleared from the cable route using a ship-towed grapnel (Carter et al. 2009). Cables are buried using a ship mounted plow, whereas buried cables are usually exposed and reburied using a water-jetting technique when needing repair (Carter et al. 2009). Water quality will be temporarily affected by: (1) increased suspended sediments and resultant increased turbidity and decreased water clarity; (2) localized reduction of dissolved oxygen where anoxic sediments are suspended; and (3) mobilization of anoxic or buried contaminated sediments during cable route clearing and installation of cables.

The physical structures associated with ocean and tidal energy operations could potentially interfere with the migration, spawning, and rearing habitat functions for juveniles and adults from a variety of groundfish species (U.S.DOE 2009). The floating and submerged structures, mooring lines, and transmission cables may create complex structural habitat that could act as a fish aggregation/attraction device (FAD), as well as provide substrate for attachment of invertebrates (considered biofouling where unwanted). Groundfish may be attracted to the physical structure itself, and/or to forage fish attracted to the structure. Floating offshore wave energy facilities could potentially (1) create artificial haul-out sites for marine mammals (pinnipeds) and roosting of seabirds; and (2) trap floating vegetation (e.g., kelp, eelgrass, large wood), and lost fishing gear (e.g., nets, traps, and crab pots). Aggregation of predators (e.g., fish, marine mammals, sea birds) near FADs may reduce the safe passage attribute of a migration corridor by subjecting juvenile or adult groundfish or their prey to increased predation. Drifting nets and other fishing gear that may become entangled on mooring lines or the devices may decrease the mortality of groundfish due to capture from passive fishing of gear. Deposition of organic matter from biofouling on the structure can change the chemical properties and biological communities near the structures. There will be new lighted, fixed surface structures (devices and navigation buoys marking the project area) in the marine environment which may attract prey and predators of juvenile and adult groundfish.

Depending on the frequency and amplitude of the sound of the moving parts of the device, as well as how far the sound waves propagate, the operational sounds of the devices may affect spawning, rearing, and migration corridor habitat. There is limited information on sound levels produced during construction (e.g., offshore pile driving) and operation of ocean energy conversion devices, as well as the spatial extent of any altered acoustic environment. Turbines with exposed rotor blades may impede or entraine groundfish or their prey.

Migrating adult, juvenile, larval, and eggs of groundfish may be exposed to EMFs generated at a project site, which may affect movement and survival. The electric current in the cables will induce a magnetic field in the immediate vicinity (U.S.DOE 2009). During transmission of produced electricity, the matrix of vertical and horizontal cables will emit low-frequency EMFs. The source and effects of EMFs in the marine environment are limited and uncertain (Gill 2005).

Accidental, but acute, release of chemicals from leaks or spills (e.g., hydraulic fluids from a wave energy conversion device, drilling fluids during horizontal drilling) could have adverse effects to water quality. Anti-fouling coatings inhibit the settling and growth of marine organisms, and chronic releases of dissolved metals or organic compounds could occur from these compounds (U.S.DOE 2009). The rish of cumulative effects to groundfish and their prey from decreased water quality associated with the release of toxic chemicals could vary substantially depending upon the number of units deployed, type of antifouling coating used, and the maintenance frequency of the coating.

5.1.1.2 Recommended Conservation Measures

- Structural and operational mitigation options are often unique to the technology or issue of concern.
- Locate and operate devices at sites and times of the year, to avoid groundfish migration routes and spawning seasons, respectively. Structures should also be located to avoid sensitive habitats (e.g., rocky reef, kelp beds)
- Schedule the noisiest activities, i.e., pile driving, at times of the year to minimize exposure of juvenile and adult groundfish.
- Schedule transmission cable installation to minimize overlap with groundfish migration and spawning seasons. Structures should also be located to avoid sensitive habitats (e.g., rocky reef, kelp beds)
- Conduct pre-construction contaminant surveys of the sediment in excavation and scour areas.
- To avoid concentration of predators, above water structures could have design features to prevent or minimize pinniped haul-out and bird roosting.
- Sheath or armor the vertical transmission cable to reduce transmission of EMF into the water column.
- Bury transmission cables on the sea floor to minimize benthic and water column EMF exposure.
- Align transmission cables along the least environmentally damaging route. Avoid sensitive habitats (e.g., rocky reef, kelp beds) and critical life history pathways.
- Use horizontal drilling where cables cross nearshore and intertidal zones to avoid disturbance of benthic and water column habitat.
- Design the mooring systems to minimize the footprint by reducing anchor size, and cable/chain sweep.
- Develop and implement a device/array maintenance program to remove entangled derelect fishing gear and other materials that may increase mortality.
- Use non-toxic paints and lubricating fluids where feasible.
- Limit the number of devices and size of projects until effects are better understood and minimization measures tested.

5.1.2 Desalination

Global population growth continues to place high demand on available supplies of potable water, and areas with limited supplies of this essential resource are turning to desalination (Roberts et al. 2010). Recent estimates suggest that up to 24 million cubic meters of desalinated water are produced daily (Latterman and Hoepner 2008). Expansion of desalination capacity can be found in the U.S., Europe, China, and Australia. California is leading the way in the U.S., with projections indicating that up to 20 new desalination plants, with a capacity of 2 million cubic meters per day, will be constructed by 2030. Desalination plants have a strong potential to detrimentally impact the ecology of marine habitats through water extraction and discharge of effluent. The following discussion is taken, unless otherwise cited, from a recent critical review by Roberts et al. (2010) of the available, peer-reviewed literature on the effects of effluent discharge.

Desalination of seawater to produce potable water uses one of two basic processes: thermal distillation such as multi-stage flash (MSF) distillation, and reverse osmosis (RO). Both of these methods have a saltwater intake and an effluent discharge. The effluent is water remaining after desalination and the concentrated salts from the seawater, commonly referred to as "brine." The brine also may contain various chemicals used in the desalination process, heavy metals from the machinery, and concentrated contaminants that were in the seawater. Reverse osmosis plants are increasingly common compared to the MSF plants.

5.1.2.1 Potential Adverse Effects

The potential effects are largely concerned with intake of seawater, which can entrain and impinge marine organisms, and discharge of the brine, which can affect the physiochemistry and, therefore, the ecology at the discharge site and beyond. The effects from intake water would be similar to those expected from Water Intake Structures (Table 13).

The discharge of brine can affect the salinity, temperature, and contaminant loading of the receiving body. Changes to salinity have been the most studied of these potential effects. Depending on the desalination method used, the design of the plant, and the salinity of the intake water, the salinity of the brine can range from as low as 37.3 parts per thousand (ppt) to as high as 75 ppt. In general, for an RO plant, the salinity of the brine will be roughly double that of the intake water. Published research shows that the extent of the brine plume (the area where the salinity is elevated) varies greatly, from 10s of meters, to 100s of meters, or in extreme cases, to several kilometers from the discharge point. The extent of the plume depends on a variety of factors, including the capacity of the plant, the salinity of the brine, the location of the discharge, the design of the diffuser, and local hydrologic conditions. However, in most cases studied, the intensity of the plume diminishes rapidly with distance from the outfall and is usually no greater than 2 ppt above background salinity within 20 m of the outlet.

Brine is usually denser than seawater and will, therefore, sink to the bottom and extend farther along the seafloor than at the surface. Where prevailing currents carry the plume further alongshore than offshore, the coastal fringe may be especially susceptible to impacts. During times of high tide, the brine may be concentrated around outfalls. Thus, the area impacted by the plume is likely to be both spatially and temporally variable.

A number of studies have shown that discharge of brine can lead to detectable ecological impacts to seagrass habitats, as well as phytoplankton, invertebrate and fish communities. The effects to seagrasses are the most widely studied. However, the results of these studies are highly variable. Several studies on the Mediterranean seagrass, *Posidonia oceana,* showed clear adverse effects, with significant increases in mortality and leaf necrosis at increases of only 1-2 ppt. Others found no significant effects, even six years after plant operations began. A study on eelgrass (*Zoster marina*) from marine and estuarine waters of the Netherlands found increased mortality at salinities 30 ppt and 25 ppt respectively, which are at the upper end of the salinity range in these habitats (van Katwijk et al. 1999). This suggests that eelgrass, a species of particular importance to Pacific Coast fisheries, is sensitive to salinity changes and could be at risk if exposed to a brine plume.

Infaunal and epifaunal invertebrate communities were found to be impacted by the brine plume in several studies. Close to the outfall, nematodes dominated the community and reduced diversity of other taxa up to 400 meters from the outfall. The diversity and abundance of benthic diatoms may also be reduced near the outfall. These communities are an important part of the food web upon which juvenile and adult groundfish depend, and could be at risk from exposure to brine plumes. In contrast, other studies found no change in the macrobenthic organisms where the brine dissipated within 10 m from the outfall. Some of the studies that showed changes to the benthic community were associated with older plants that discharged excessive levels of copper, an issue that is largely avoidable.

Salinities of 55 ppt or higher were found to be acutely toxic to juvenile sea bream and larval flounder. The implications of this for Pacific Coast groundfish are not clear, but brine discharge could affect their survival, depending on the location of the outfall.

Depending on the design of the plant, the brine may be warmer than the receiving waters. This is primarily limited to MSF plants, while RO plants tend to result in plumes that are near ambient temperature. Because RO plants are becoming more common, relative to the MSF plants, this is a lesser problem than in the past. MSF plants can produce brines that are 10-15° C warmer than the receiving waters. However, most studies have found that the thermal impacts dissipate quickly, typically diminishing to background levels within tens of meters of the outfalls. The extent and severity of the thermal plume is dependent upon a variety of factors, such as the temperature of the discharge and receiving waters, the plant capacity, and local hydrologic conditions. Given the potentially high water temperatures in the immediate vicinity of the plume, there is a potential for groundfish, particularly juveniles, to be affected.

Desalination can clearly impact the ecology of the receiving waters, but the extent of those effects depend on a variety of factors, such as plant capacity, discharge location and design, temperature and salinity differences between effluent and receiving water, and hydrologic conditions at the discharge site. Such variables should be considered when assessing the effects of these plants.

5.1.3 Activities that Contribute to Climate Change and Ocean Acidification

Human activities that emit greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases contribute to a changing climate. Global climate change is correlated to the residence time of these compounds in the atmosphere and their ability to warm the planet. Examples of human activities that contribute to GHG emissions include burning fossil fuels, deforestation, and land development.

Pacific Northwest temperatures have increased by about 0.8° C, and models project warming of 2.0° C by the 2040s and 3.3° C by the 2080s (Mote and Salathé 2009). Precipitation is also projected to increase with a more intense seasonal cycle - autumns and winters may become wetter and summers may become drier. Regional climate models indicate that overall extreme precipitation in western Washington will increase and the snowpack in the Cascades will decrease (Mote and Salathé 2009).

In the marine environment, increased water temperatures would promote stratification between warmer surface waters and cooler, nutrient rich deep waters. The resulting thermocline could prevent nutrient cycling between regions diminishing growth of phytoplankton that form the base of marine food webs (Climate Impacts Group 2004; Scheuerell and Williams 2005).

The ocean is a major sink for atmospheric CO_2, and changes in atmospheric concentrations will affect oceanic conditions. Specifically, as the level of CO_2 in the atmosphere increases, it will dissolve more readily in the ocean, increasing the concentration of carbonic acid and lowering the pH of seawater. Whether or not this change will directly harm groundfish is not known, but their ecosystem may be far less productive. Planktonic organisms that form the base of many marine food webs secrete $CaCO_3$ shells necessary for survival. Lower pH will dissolve or prevent the formation of these shells causing mortality (Orr et al. 2005). Groundfish juveniles and prey species rely on plankton as a food source and decreased plankton abundance could affect growth and survival. Changing ocean temperatures may alter groundfish behavior, distribution, and migrations.

5.1.4 Liquefied Natural Gas Projects

Liquefied natural gas (LNG) is expected to provide a large proportion of the future energy needs in the United States. In recent years there has been an increase in proposals for new LNG facilities along the West Coast including a number of onshore and offshore facilities in Oregon and California. The LNG process cools natural gas to its liquid form at approximately -162°C. This reduces the volume of natural gas to approximately 1/600th of its gaseous state volume, making it possible for economical transportation with tankers. Upon arrival at the destination the LNG is either vaporized onshore or offshore and sent out into an existing pipeline infrastructure or transported onshore for storage and future vaporization. The process of vaporization occurs when LNG is heated and converted back to its gaseous state. LNG facilities can utilize open loop, closed loop, combined loop, or ambient air systems for vaporization. Open loop systems utilize warm water for vaporization, and closed loop systems generally utilize a recirculating mixture of ethylene glycol for vaporization. Another type of closed-loop system is submerged combustion vaporization (SCV), which provides a water bath with submerged pipe coils. Combined loop systems utilize a combination of these systems.

Onshore LNG facilities generally include a deepwater access channel, land-based facilities for vaporization and distribution, storage facilities, and a pipeline to move the natural gas. Offshore facilities generally include some type of a deepwater port with a vaporization facility and pipelines to transport natural gas into existing gas distribution pipelines or onshore storage facilities. Deepwater ports and onshore terminals require specific water depths and include an exclusion zone for LNG vessel and/or port facility security.

5.1.4.1 Potential adverse effects to EFH

Construction and operation of LNG facilities can affect the habitat of groundfish in a variety of ways. Direct conversion and loss of habitat can occur through dredging and filling, construction of overwater structures, placement of pipelines, and shoreline armoring. Construction-related effects to habitat include generation of underwater noise from pile driving and vessel operations, turbidity, and discharge of contaminants. Long-term degradation of habitat can result from impingement and entrainment at water intakes for vaporization water and ballast and engine cooling water for LNG vessels, discharge of contaminants, and discharge of cooled water from open-loop systems. Short- and long-term habitat degradation can result from accidental spills of LNG and other contaminants. With the exception of the discharge of contaminated water, discharge of vaporization water, and accidental spills of LNG, these effects are covered under other threats described in either this document or the Groundfish FMP.

Contaminants can enter aquatic habitats through accidental releases associated with onshore and offshore operations, discharge of water containing biocides used to control fouling of piping systems, and discharges of the condensates from heat exchangers. A rapid phase transition can occur when a portion of LNG spilled onto water changes from a liquid to a gas virtually instantaneously. The rapid change from a liquid to vapor state can cause locally large overpressures ranging from a small pop to a blast large enough to potentially damage structures (Luketa et al. 2008). Because rapid phase transition would occur at the surface of the water it would be unlikely to affect fishes that are several feet under the surface. However, any fish present at or near the surface of the water would likely be killed. Effects on the aquatic environment from an LNG spill include thermal shock from the initial release (cold shock from the cryogenic liquid) and thermal shock from ignition of the vapor (Hightower et al. 2004). Condensates from heat exchanger such as SCV systems are generally acidic and require buffering with alkaline chemicals (FERC 2010). The condensate can include a wide range of metals and other contaminants. These contaminants may include copper, a known disruptor of olfactory function in fishes (e.g., Baldwin et al. 2003). Dissolved copper is also toxic to many invertebrate species, which may affect the prey base for groundfishes. The concentration of these chemicals will vary depending on the water source and facility design.

The operation of LNG facilities can result in the alteration of temperature regimes. Water utilized for the purposes of vaporization could be discharged at temperatures that differ significantly from the receiving waters and can be 5-10°C below ambient temperature. Changes in water temperatures can alter physiological functions of marine organisms including respiration, metabolism, reproduction, and growth; alter migration pathways; and increase susceptibility to disease and predation. Thermal effluent in inshore habitat can cause severe problems by directly altering the benthic community or adversely affecting marine organisms, especially egg and larval life stages (Pilati 1976, cited in NMFS 2008; Rogers 1976, cited in NMFS 2008).

5.1.4.2 Potential Conservation Measures

- Site LNG facilities in areas that minimize the loss of habitat such as naturally deep waters adjacent to uplands that are not in the floodplain.
- Recommend the vaporization systems that do not rely on surface waters as a heat source, such as an ambient air system. This will avoid impingement and entrainment of living resources. If a water-sourced system must be used, recommend closed loop systems over open loop systems. This will minimize water withdrawals and the associated impingement and entrainment of living marine resources.
- Locate facilities that use surface waters for vaporization and engine cooling purposes away from areas of high biological productivity, such as estuaries.
- Design intake structures to minimize entrainment or impingement.
- Regulate discharge temperatures (both heated and cooled effluent) such that they do not appreciably alter the temperature regimes of the receiving waters. Strategies should be implemented to diffuse this effluent.
- Avoid the use of biocides (e.g., aluminum, copper, chlorine compounds) to prevent fouling where possible. The least damaging antifouling alternatives should be implemented.

6.0 PREY SPECIES

The EFH regulatory guidance (50 CFR §600.815) states that loss of prey species may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat. Both fishing and non-fishing actions that reduce the availability of a major prey species may be considered as adverse effects on EFH, if they reduce the quality or quantity of EFH. Chapters 4 (Fishing Activities that May Affect EFH) and 5 (Non-fishing Activities that May Affect EFH) describe human-caused activities that may adversely affect EFH, including prey species.

The regulatory guidance also states that FMPs should list the major prey species and discuss the location of prey species' habitat. Appendix B3 of the groundfish FMP (PFMC 2011) lists prey species for each managed groundfish species. However, it does not discuss the location of the habitat, or identify fishing and non-fishing activities that may adversely affect groundfish prey and/or its habitat, as called for in the EFH regulatory guidance.

A guidance memorandum from NMFS (Montanio 2006) sought to clarify the question of prey as EFH. The regulatory guidance states that, as part of "associated biological communities", prey may be considered a component of EFH. However, the guidance memorandum further states that "prey species alone should not be described as EFH." This subtle distinction is important, and does not preclude the requirement of FMPs to identify adverse impacts to prey species.

The EFH guidance does not explicitly specify criteria for identifying "major" prey species. However, even with clear guidance, identifying which prey items constitute major prey for Pacific Coast groundfishes is highly dependent on the quality and availability of data on diet composition. While some groundfish species have diet composition samples taken over a broad geographic and temporal range, diet analysis for many species has been limited to a single time of year at a single location with a small sample size, and for some groundfish there is no diet data available. This makes broader generalizations about the diet across the range of the species uncertain, even when the studies are aggregated across species. Therefore, even where quantitative data do exist, the EFHRC did not attempt to identify "major" prey or distinguish "major" prey from other prey. For this report, the EFHRC took a general approach and identified prey at broader taxonomic levels, based on a pre-existing literature reviews conducted by Dufault et al. 2009, which was compiled for a different purpose. More detailed information and a comprehensive literature review, particularly the identification of prey at the species level, will be required to adequately describe and identify the major prey for Pacific Coast groundfishes.

6.1 Prey Species Listed in the Groundfish FMP

Appendix B3 of the groundfish FMP (PFMC 2011a) provides prey items associated with each FMP groundfish species and each life stage, but does not distinguish between "major" prey items and general prey. Table 14 below lists the entire suite of prey items included in the FMP.

Table 14. List of prey species from the Gourndfish FMP (PFMC 2011a).

Fish	Arthropods	Others
Fish	Crustaceans	Algae
Fish larvae	Invertebrate nauplii	Gelatinous plankton
Small fishes	Crustacean zoea	Diatoms
Hydrologus colliei	Cladocerans	Dinoflagellates
Clupeids	Ostracods	Tintinnids
Gadids	Copepods	Invertebrate eggs
Theragra chalcograma	Barnacle Cypriots	Hydroids
Merluccius productus	Amphipods	Jellyfish
Cottids	Isopods	Sea urchin
Juvenile rockfish	Shrimp	Seastars
	Krill	Brittle stars
	Euphausiids	Salps
	Mysids	Tunicates
	Crabs	Annelids
		Polychaetes
		Mollusks
		Nudibranchs
		opisthobranchs
		Snails
		Cephalopods
		Squids
		Octopi

6.2 New Information on Prey Species

There is not a large body of literature on Pacific groundfish diets since 2006; however significant details on diet composition from the literature were not included in the Amendment 19 documentation. In addition, several groundfish stock assessments were completed in 2009 and 2011, some of which included information on groundfish diet composition. Selected stock assessments are referenced in Table 15 below. Aside from those cited in Table 15, the 2009 and 2011 stock assessments generally corroborate the information contained in Dufault et al. (2009), as well as prior stock assessments on the same species.

This section summarizes the major prey items for the species managed under the groundfish FMP, based on a 2009 review by Dufault et al (2009) that described the diets of selected California Current species. By reviewing over 75 publications on diet studies, Dufault et al. were able to describe predator/prey relationships in a more refined way than in Amendment 19. They used a hierarchical cluster analysis to identify distinct feeding guilds of the California Current and present quantitative relative abundance of various prey categories for each species. While not comprehensive of all species managed under the Groundfish FMP, it represents newly available synthesis of information that was not included in Amendment 19. Table 15 summarizes the Dufault et al. synthesis for relevant FMP groundfish species.

Appendix G (Species Summaries) includes several relevant publications since 2006. However, while many diet composition studies break out individual species of prey, the Dufault et al. (2009) analysis groups prey into categories (as the primary purpose was the establishment of feeding guilds to inform the Atlantis model), so obtaining information on specific species of prey requires examination of the original literature used in Dufault et al. (2009). Recently published diet studies for Pacific Coast groundfish generally corroborate the synthesis by Dufault et al (2009).

Species comprising the groundfish FMP exhibit a wide range of prey preferences, ranging from phyto- and zoo-plankton, to small crustaceans, cephlapods, and other finfish. Some species are characterized by a preference for a very few prey items (e.g., canary rockfish) while others show a much wider range of prey items (e.g., longspine thornyhead, yelloweye rockfish).

In some cases, FMP groundfish species show preference for categories of prey (fish, benthic invertebrates, etc), but appear to be opportunistic within those groups. For example, arrowtooth flounder is primarily piscivorous, but preys on different fish species depending on geographic location and (presumably) prey availability (Pearsall and Fargo 2007).

Pacific sardine has a large volume of data on population and biomass. Emmett et al. (2001) found one Pacific sardine and seven northern anchovy in 2,200 hake stomach samples, although 1,627 stomachs were empty. Emmett et al. (2005) found that nine of 12 hake stomach samples contained Pacific sardine. The extent to which Pacific sardines serve as prey for hake and other groundfish has not been thoroughly assessed. Pacific sardine is managed in the Coastal Pelagic Species FMP, and the stock is also fished in Mexico and Canada; there is no international management agreement.

Table 15. Major prey components from selected species groups, based on Dufault et al. (2009).

Guild (from Dufault et al. 2009)	**Species**	**Prey species (approx % of diet; includes prey comprising ~>15% of diet)* from Dufault et al. 2009**	**Additional Sources/Notes**
Define Guilds/Legend	Canary rockfish	Large zooplankton (95%)	
A	Darkblotched rockfish	Large zooplankton (78%)	
A	Greenstriped rockfish	Large zooplankton (72%)	Hicks et al. (2009) state that greenstripe diet includes fish, krill, shrimps, copepods, amphipods, and squid, but does not distinguish “major” prey items.
A	Pacific hake	Large zooplankton (78%) Small planktivores (19%)	Hamel and Stewart (2009) state that for larger hake, other fish (especially Pacific herring) become a more significant portion of their diet. Pacific hake feed on euphausiids, pandalid shrimp, and pelagic schooling fish (such as eulachon and Pacific herring) (Livingston and Bailey 1985).
A	Pacific ocean perch	Large zooplankton (65%)	
A	Pygmy rockfish	Large zooplankton (92%)	
A	Redstripe rockfish	Large zooplankton (100%)	
A	Sharpchin rockfish	Large zooplankton (45%) Deep vertical migrators (36%)	
A	Spiny dogfish	Large zooplankton (53%)	
A	Splitnose rockfish	Large zooplankton (94%)	
B	Black rockfish	Small planktivores (51%)	
B	Blue rockfish	Gelatinous zooplankton (55%) Small planktivores (35%)	
D	Dover sole	Benthic carnivores (43%) Deep macrozoobenthos (36%)	
D	English sole	Deposit feeders (70%) Benthic carnivores (16%)	
D	Rex sole	Benthic carnivores (67%) Deposit feeders (32%)	
E	Big skate	Shrimp (59%) Megazoobenthos (22%)	
E	Longnose skate	Shrimp (21%)	
E	Pacific sanddab	Shrimp (42%) Benthic herbivorous grazers (25%) Deposit feeders (24%)	
E	Petrale sole	Small flatfish (62%) Shrimp (25%)	Pearsall and Fargo (2007) found the composition in Hecate Strait consisted primarily of fishes, esp. Pacific herring. This contrasts with other studies showing greater reliance on decapods crustaceans. Allen et al. (2006) noted that petrale become increasingly piscivorous at larger sizes.

Guild (from Dufault et al. 2009)	Species	Prey species (approx % of diet; includes prey comprising ~>15% of diet)* from Dufault et al. 2009	Additional Sources/Notes
F	Pacific grenadier (Pacific rattail)	Cephalopods (35%) Deposit feeders (24%) Deep misc. fishes (23%)	
G	Rosethorn rockfish	Deposit feeders (46%) Benthic herbivorous grazers (35%)	
G	Rougheye rockfish	Benthic herbivorous grazers (49%)	
G	Widow rockfish	Gelatinous zooplankton (48%) Large zooplankton (34%)	
G	Yellowtail rockfish	Large zooplankton (40%) Gelatinous zooplankton (22%)	
H	Arrowtooth flounder	Pacific hake (46%) Small planktivores (16%)	Various studies suggest that arrowtooth flounder adults are preferably piscivores, feeding opportunistically on available fishes. Juveniles ingest a greater proportion of macrobenthos, euphausiids, and shrimp. (See Appendix G, Species Summaries)
H	Lingcod	Shallow small rockfish (21%) Miscellaneous nearshore fish (20%)	
H	Longspine thornyhead	Deposit feeders (24%) Megazoobenthos (20%) Small planktivores (14%)	
H	Sablefish	Deep small rockfish (34%)	
H	Shortspine thornyhead	Megazoobenthos (32%)	
H	Yelloweye rockfish	Small planktivores (33%) Deposit feeders (19%)	
	Other FMP Groundfish Species	**Diet**	**Notes/Source**
	Aurora rockfish		
	Bank rockfish		
	Black-and-yellow rockfish		
	Blackgill rockfish		
	Bocaccio	Primarily piscivorous	Field, John C., E.J. Dick, D. Pearson, A MacCall. Status of bocaccio, *Sebastes paucispinis*, in the Conception, Monetery and Eureka INPFC areas for 2009.
	Bronzespotted rockfish		N/A
	Brown rockfish		FMP includes prey information
	Butter sole		FMP includes prey information
	Cabezon		FMP includes prey information
	Calico rockfish		FMP includes prey information
	California scorpionfish		FMP includes prey information
	California skate		FMP includes prey information

Guild (from Dufault et al. 2009)	Species	Prey species (approx % of diet; includes prey comprising ~>15% of diet)* from Dufault et al. 2009	Additional Sources/Notes
	Chameleon rockfish		N/A
	Chilipepper		FMP includes prey information
	China rockfish		FMP includes prey information
	Cowcod		FMP includes prey information
	Curlfin sole		FMP includes prey information
	Dusky rockfish		N/A
	Dwarf-red rockfish		N/A
	Flag rockfish		FMP includes prey information
	Flathead sole		FMP includes prey information
	Freckled rockfish		N/A
	Gopher rockfish		FMP includes prey information
	Grass rockfish		FMP includes prey information
	Greenblotched rockfish		FMP includes prey information
	Greenspotted rockfish		FMP includes prey information
	Halfbanded rockfish		N/A
	Harlequin rockfish		N/A
	Honeycomb rockfish		N/A
	Kelp greenling		FMP includes prey information
	Kelp rockfish		FMP includes prey information
	Leopard shark		FMP includes prey information
	Mexican rockfish		N/A
	Olive rockfish		FMP includes prey information
	Pacific cod		FMP includes prey information
	Pacific flatnose		N/A
	Pink rockfish		N/A
	Pinkrose rockfish		N/A
	Puget Sound rockfish		N/A
	Quillback rockfish		FMP includes prey information
	Redbanded rockfish		N/A
	Rock sole		FMP includes prey information
	Rosy rockfish		FMP includes prey information
	Sand sole		FMP includes prey information
	Semaphore rockfish		N/A
	Shortbelly rockfish		FMP includes prey information
	Shortraker rockfish		FMP includes prey information
	Silvergray rockfish		N/A
	Speckled rockfish		FMP includes prey information

Guild (from Dufault et al. 2009)	Species	Prey species (approx % of diet; includes prey comprising ~>15% of diet)* from Dufault et al. 2009	Additional Sources/Notes
	Spotted ratfish		FMP includes prey information
	Squarespot rockfish		FMP includes prey information
	Starry flounder		FMP includes prey information
	Starry rockfish		FMP includes prey information
	Stripetail rockfish		FMP includes prey information
	Swordspine rockfish		N/A
	Tiger rockfish		FMP includes prey information
	Tope		N/A
	Treefish		FMP includes prey information
	Vermilion rockfish		FMP includes prey information
	Yellowmouth rockfish		N/A

*Prey component groups:

Large zooplankton: euphausiids, chaetognaths, pelagic shrimp, pelagic polychaetes, etc.
Small planktivores: northern anchovy, Pacific sardine, Pacific herring
Large planktivores: Pacific mackerel, jack mackerel
Deposit feeders: small crustacean (isopods, amphipods, etc)
Benthic carnivores: polychaetes, burrowing crustacean, peanut worms, and flatworms
Benthic herbivorous grazers: gastropods, sea urchins, and herbivorous decapods shrimps
Gelatinous zooplankton: salps, jellyfish, ctenophores, and comb jellies
Megazoobenthos: *Cancer* and tanner crabs, and lobsters
Miscellaneous nearshore fish: croakers, wrymouths, sculpins

An objective threshold for the proportion of a diet warranting identification of a “major” prey species does not exist in the EFH guidance or scientific literature; however, as an initial attempt to distinguish “major prey” for groundfish species with quantitative data on diet composition, a threshold of 13% was chosen for illustrative purposes, as that seemed to represent a relevant break in the data across species. Howeever, there may be cases where different threshold could arguably be more appropriate. Based on this threshold, the following Groundfish FMP species consume >14% of other FMP or state-managed species in their adult life stages:

- Arrowtooth flounder: Pacific hake (46%) and small planktivores (16%)
- Black rockfish: small planktivores (51%)
- Blue rockfish: small planktivores (35%)
- Big skate: shrimp (59%), small flatfish (15%)
- Lingcod: shallow small rockfish (21%), miscellaneous nearshore fish (20%)
- Longnose skate: shrimp (21%), miscellaneous nearshore fish (20%)
- Longspine thornyhead: small planktivores (14%)
- Pacific hake: small planktivores (19%)
- Pacific sanddab: shrimp (42%)
- Petrale sole: small flatfish (62%), shrimp (25%)
- Sablefish: deep small rockfish (34%), Pacific hake (13%)
- Yelloweye rockfish: small planktivores (32%)
- Yellow tail rockfish: juvenile. Pacific hake (15%)

6.3 Potential Fishing Activity Impacts to Groundfish Prey Species

While it can be challenging to quantify impacts to prey species from fishing or non-fishing activities, the EFH regulatory guidance states that FMPs “must describe each fishing activity, review and discuss all available relevant information” regarding intensity, extent, and frequency of any adverse effects in EFH. Each FMP must also minimize to the extent practicable adverse effects on EFH from Magnuson Act fishing activities (600.815(a)(2)(ii)).

The diets of several groundfish FMP species consist of significant percentages of Federal or state-managed species. This warrants consideration because targeted fishing could potentially adversely affect EFH if it reduces the availability of major prey species. In the case of state-managed stocks that are subject to directed fisheries and are also prey items for FMP species, the Council and NMFS may make conservation recommendations to minimize adverse affects.

Periodic reviews of EFH should describe new information that may inform determinations regarding adverse effects, but new minimization measures would be considered only after the Council and NMFS determine that sufficient new information exists to warrant revisions to EFH elements.

The groundfish FMP (PFMC 2011a) includes management measures intended to minimize effects on EFH, bycatch, and other purposes. Some non-EFH related minimization measures collaterally provide protections to EFH. The three general categories of management measures implemented to protect EFH are gear modification, area closures, and reduction of fishing effort. Areas closed to bottom trawling (or other bottom contact gear, in some cases) include all areas deeper than the 700 fathom line, as well as many reefs, seamounts, and other areas of high habitat value that the Council and NMFS determined should be closed to certain types of bottom contact gear. These management measures were aimed at protecting physical and biogenic habitats, and not at preventing harm to EFH via harvest of prey species.

6.3.1 Assessing Adverse Impacts due to Fishing Effects

The EFH regulatory guidance states that "actions that reduce the availability of a major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH." For managed prey species that have stock assessments, it is possible to examine population trends. A low or biomass or decreasing population trend could indicate decreased availability of prey items for groundfish species. However, inferring whether a depleted stock results in reduced prey availability is more difficult to determine, particularly for generalist groundfish species that have the ability to switch among alternative prey sources. As described above, many piscivores are opportunistic feeders. Knowing that many small prey items (e.g., zooplankton and small planktivores) are subject to natural major population and biomass fluctuations, it is challenging to determine whether fishing activities have a significant effect against the backdrop of natural population fluctuation. A further challenge is that for some prey categories, the literature does not generally distinguish prey items down to the species level.

Nonetheless, it makes sense to examine possible methods for assessing fishing impacts to prey populations. One way to do that would be to explore the relative impacts of fishing pressure on prey populations and biomass. Small planktivores (i.e., anchovy, herring, and sardine) could provide a case study because they are subject to direct fishing, and one (Pacific sardine) has a large volume of data on population and biomass. The Dufault et al. (2009) prey categories include several functional groups containing multiple species rather than individual species. Therefore, identifying the major prey species is difficult, which in turn makes it difficult to assess the effects of fishing on groundfish prey, as fisheries information and management (e.g., landings, ACLs, etc.) are species-specific.

The bullet list above highlights several groundfish species for which a single species group comprises the majority of its diet. These include arrowtooth flounder (Pacific hake); black, blue, and yelloweye rockfish (small planktivores); big skate and Pacific sanddab (shrimp); petrale sole (small flatfish); and sablefish (deep small rockfish).

The following summaries provide information on specific groundfish prey species that are fished and/or federally managed on the U.S. Pacific Coast. These summaries are intended to provide an objective reporting of relevant recent information and statistics that might be part of a process for assessing potential adverse impacts to groundfish prey species caused by fishing. However, these summaries are not intended to provide recommendations or conclusions regarding whether adverse impacts are occurring. In particular, the status of one particular prey item in isolation may not be indicative of overall prey depletion, as many groundfish may switch prey as the relative availability. For example, it may be more appropriate to look at overall prey guilds as a whole rather than trends in individual species. Furthermore, trends in biomass may not be indicative of fishing impacts, as other factors such as recruitment or oceanic conditions also affect biomass trends. Therefore the challenges in reviewing this information include assessing whether overall prey abundance for each groundfish is depleted, and the extent to which fishing pressure has contributed to such depletion.

6.3.1.1 Krill (Euphausiids)

Large zooplankton comprise a significant portion of the diet of many groundfish species (e.g., yellowtail rockfish, widow rockfish, canary rockfish, darkblotched rockfish, greednstripe rockfish, Pacific ocean perch, redstripe rockfish, Pygmy rockfish, sharpchin rockfish, Pacific hake, splitnose rockfish, spiny dogfish). This category includes euphausiids, chaetognaths, pelagic shrimps, pelagic polychaetes, and pasiphaeids (Dufault et al. 2009). Krill has received significant attention in the management context as there is a significant global market for krill and there are major fisheries on krill globally, in particular in Antarctic waters. Two species of krill, *Euphausia pacifica* and *Thysanoessa spinifera*, form large aggregations near the surface, while *Nematocelis difficilis* is highly abundant in deeper waters. Other krill species off the Pacific Coast include *T. gregaria*, *E. recurva*, *E. gibboides*, and *E. eximia*. Recognizing the importance of krill in the Pacific Coast marine ecosystem, NMFS adopted a prohibition on krill harvest throughout the West Coast EEZ in July 2009 through Amendment 12 to the Coastal Pelagic Species FMP (PFMC 2011b), containing no provisions for future fisheries. In addition, state laws prohibit krill landings by state-licensed fishing vessels into California, Oregon, and Washington. Therefore, there are no directed fisheries in Council-managed waters.

6.3.1.2 Pacific Herring (*Clupea pallasi*)

Pacific herring are schooling pelagic fish serving as prey for at least 14 groundfish species (McCain et al. 2005), including Pacific hake (Livingston and Bailey 1985) and Petrale sole. They are part of the "small planktivore" functional group in Dufault et al. 2009 and are part of the Clupeid group identified in the FMP. While managed primarily by the three West Coast states, Pacific herring was added to the Coastal Pelagic Species FMP in Amendment 13 as an "Ecosystem Component" species due to incidental take in CPS fisheries. Less than half (47%) of Washington herring stocks are considered healthy or moderately healthy (Stick and Lindquist 2009). The Northwest San Juan Island herring population is considered to have disappeared and the Strait of Juan de Fuca herring population is in critical condition. The only current commercial herring fishery in Washington is in Puget Sound, landing an average of 387 mt in recent years (Stick and Lindquist 2009). Pacific herring is not heavily targeted in Oregon, as the only major commercial roe-herring fishery in Yaquina Bay has opened twice since 1999 due to low herring returns, and the other fisheries are small-scale for recreation and bait. Historically, Pacific herring was targeted in ocean waters off California, however, the only remaining major fishery takes place in San Francisco Bay, with an average biomass since 1978 of 49,327 short tons (2011 biomass estimated at 57,082 short tons) (Figure 27). Fishing rates have declined in recent years and the fishery was closed in 2009 as the population fell to a historic low. Since then, the population appears to be recovering and recent harvest rates remain below 5 percent; however, there remain concerns that there are relatively few older herring in the population (CDFG 2011).

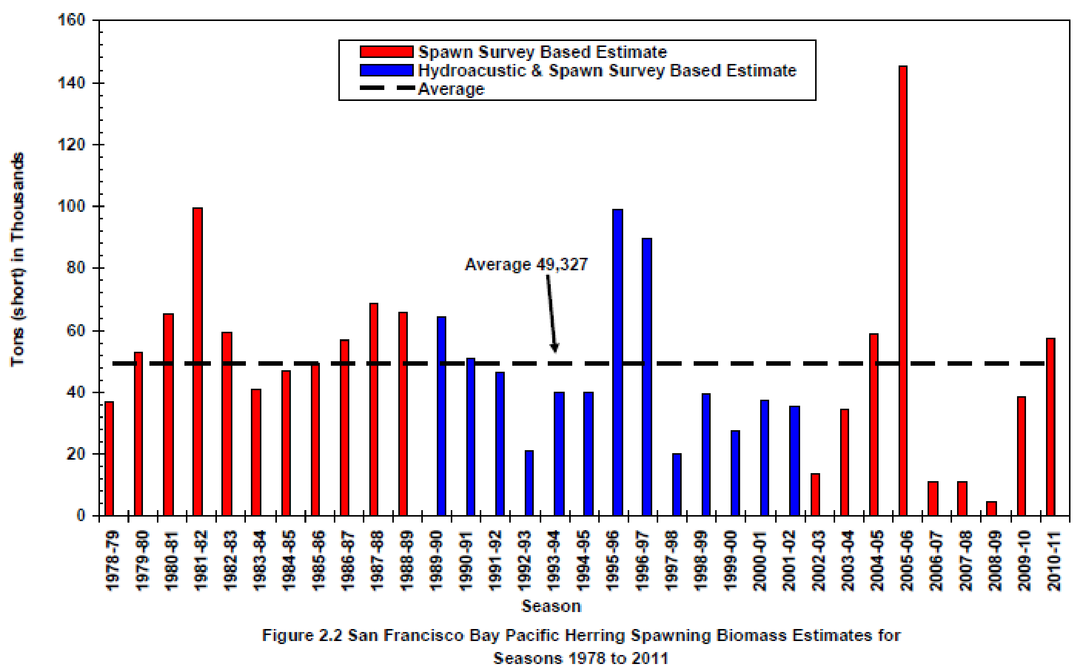


Figure 27. San Francisco Bay Pacific herring spawning biomass estimates for season 1978-2011. From CDFG (2011), p. 2-8

6.3.1.3 Northern Anchovy (*Engraulis mordax*)

Northern anchovy abundance is highly variable; they have been identified in the diets of 18 groundfish species (McCain et al. 2005). The most recent complete assessment for northern anchovy was described in Jacobsen et al. (1995). Historically, northern anchovy was the subject of a major commercial fishery in the 1960s and 1970s, with peak landings of 143,799 mt in 1975. From 1983 to 1999, landings did not exceed 6,000 mt per year. Since 2000, U.S. landings have been variable, but have remained below 20,000 mt. The overfishing limit (OFL) values are based on past estimates of biomass and the ABC is reduced by 75 percent to account for uncertainty in the estimate of the OFL. An annual catch target for the northern subpopulation of northern anchovy was established at 1,500 mt.

6.3.1.4 Market Squid (*Doryteuthis opalescens*)

Market squid have been identified as a prey item for several groundfish species, including Pacific hake, lingcod, dogfish, scorpionfish, and many species of rockfish (California Market Squid FMP 2005; Table 2-1). The "Cephalopods" functional group from Dufault et al. (2009) includes market squid. Market squid have short lifespans (less than 10 months) and abundance is thought to fluctuate widely, as evidenced by high variance in catch levels (Figure 28). However, there are no estimates of the population size, as stock assessments are not conducted on this species. This species is the subject of a major commercial fishery, which in recent years has been the largest and most valuable commercial fishery in California. The market squid fishery has a catch limit of 118,000 short tons established by the State of California, and is managed through a suite of effort controls including a weekend closure to allow for uninterrupted spawning. Market squid adults and eggs serve as groundfish prey.

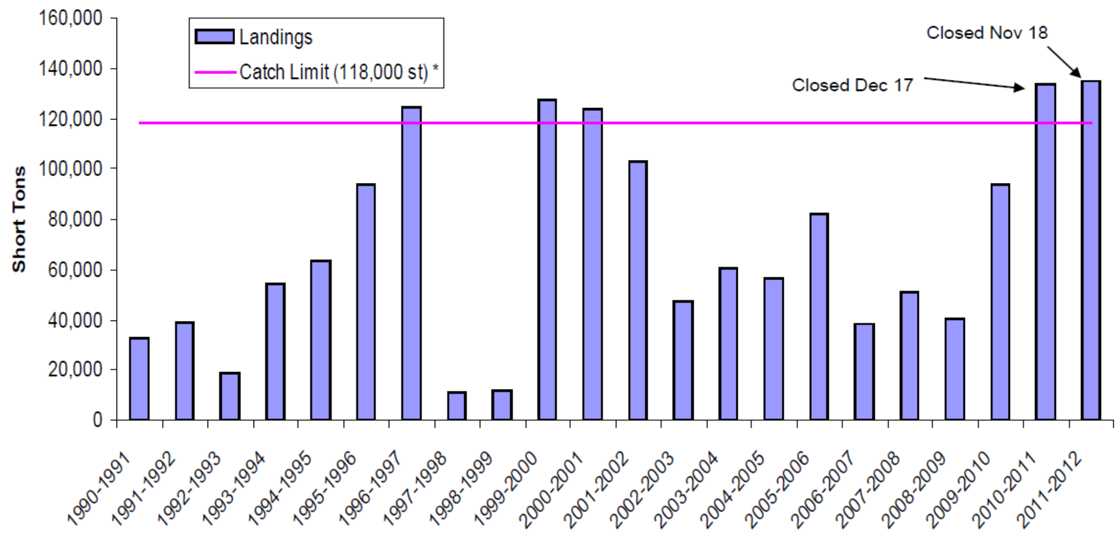


Figure 28. Market squid landings in California by season. The State of California estiblishedCatch limit was implemented beginning in the 2005-2006 season. Source: CDFG.

6.3.1.5 Pacific Hake (*Merluccius productus*)

Pacific hake is a semi-pelagic schooling species that serves as a prey item for multiple groundfish species including lingcod (Stewart et al. 2011), and in particular, represents the largest single component in the diet of arrowtooth flounder (Dufault et al. 2009). The coastal stock of Pacific hake ranges from the waters off southern California to Queen Charlotte Sound, British Columbia. Pacific hake is managed under the Pacific Coast Groundfish FMP and through an international treaty with Canada. The combined catches from the U.S. and Canada have ranged from 177,000 mt to 363,000 mt, making it the largest fishery by volume in the California Current System (Figure 30). Pacific hake is currently the most abundant groundfish population in the California Current System. The most recent stock assessment used two models, both indicating that the Pacific hake stock is increasing. Spawning biomass estimates (with 95% confidence intervals) produced by the two models are 91% (35%-203%) and 175% (75%-409%) of unfished levels respectively (Figure 29).

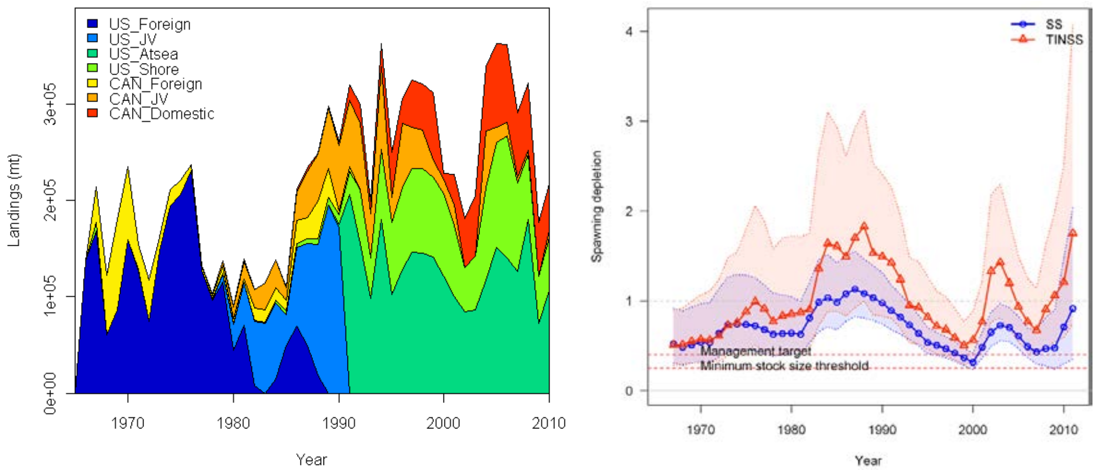


Figure 29. Left: Total Pacific hake landings by sector (including tribal catches). Right: Time series of estimated relative Pacific hake spawning depletion through 2011 using two models with 95% posterior credibility intervals. From Stewart et al. 2011.

6.3.1.6 Deposit Feeders and Benthic Carnivores

This group of prey species (including epibenthic and burrowing polychaetes, crustacea, mollusks, peanut worms, flatworms,and brittlestars) is consumed in the diets of several species in the Groundfish FMP, and are of mojor importance in the diet of a number of flatfishes. These prey species are not the subject of directed fisheries, however, may be impacted by mobile bottom tending gear managed under the groundfish FMP. Further exploration of this group should include a more detailed identification of the key prey species for groundfish and documented impacts to those species from trawl fishing.

6.3.1.7 Other Unmanaged Prey Species

Several groundfish prey items (e.g., myctophids or “deep vertical migrators”) are not currently the subject of directed fisheries, and are currently not managed by the Council or individual states, but could potentially be targeted by fisheries in the future (PFMC 2011c). The Council has established a management objective “to prohibit the development of new directed fisheries on forage species that are not currently managed by our Council, or the States, until we have an adequate opportunity to assess the science relating to the fishery and any potential impacts to our existing fisheries and communities”. The Council is currently considering modifications to its list of allowable fisheries and adding these prey species into a Federal FMP.

6.4 Potential Non-Fishing Activity Impacts to Groundfish Prey Species

Generally, groundfish prey species would be suceptable to the same non-fishing impacts as those affecting groundfish. Section 5 summarizes non-fishing activities that may affect groundfish EFH.

Pollution and oil spills from petroleum development can have catastrophic effects on prey species, through developmental effects and acute toxicity (Peterson et al. 2003). The *Exxon Valdez* oil spill caused the collapse of Prince William Sound herring populations, which has still not recovered over twenty years later and this has also likely affected the recovery of seabirds that feed on herring (Paine et al. 1996; EVOSTC 2009). In 2007, the container ship Cosco Busan released 54,000 gallons of bunker fuel oil into San Francisco Bay, causing unexpectedly high mortality in Pacific herring embryos and contributing to recent population declines (Incardona 2012).

7.0 INFORMATION AND RESEARCH NEEDS

The following information and research are recommended in order to improve the designation, monitoring, and effectiveness of groundfish EFH:

1. Recommendations to analyze the new information gathered in the EFHRC groundfish EFH Phase 1 Report, in order to inform decisions to modify the 2006 groundfish EFH regulations.

   a. Evaluate the boundaries of the 2005 EFH closures, relevant to the distribution of seafloor habitats in the newly developed 2011 maps.
   b. Evaluate associations of vulnerable groundfish species and benthic habitats, relevant to the 2011 maps of distribution of seafloor habitats, to identify new areas where additional habitat protection should be considered.
   c. Evaluate changes in the distribution of fishing effort, using the new 2005 and 2011 maps of effort for the bottom-contact fisheries, and determine if changes to current area management measures and gear restrictions from 2006 groundfish EFH regulations may be warranted.
   d. Evaluate the 2005 mobile-fishing-gear risk assessment model relevant to new data.
   e. Run the habitat suitability probability models for all west coast groundfish species, using the new maps of habitat distributions and other relevant data.
   f. Evaluate corals and sponges as essential habitat for groundfishes, especially relevant to 2006 groundfish EFH regulations.
   g. Evaluate new information on non-fishing-gear impacts to EFH (including environmental/oceanographic trends), especially relevant to 2006 groundfish EFH regulations.
   h. Evaluate new information on EFH relative to Level 1-4 and compare to information level available in establishing the 2006 groundfish EFH regulations.

2. Recommendation to conduct visual, no-take surveys of fishes and habitats inside and outside current EFH closures in order to evaluate the effectiveness of these conservations areas.

3. Recommendation to conduct high-resolution seafloor mapping (bathymetry, back-scatter, and associated interpreted substrata types), particularly on the shelf and slope associated with groundfish EFH conservation areas. Numerous studies and workshops have documented large gaps in the availability of spatial data for coastal and marine habitats, and information on the dynamic nature of benthic habitats is almost non-existent (e.g., recent seafloor mapping workshops conducted separately for the states of California, Oregon and Washington and a 2010 Pacific coast-wide report by the West Coast Govenors Alliance Seafloor Mapping Action Coordination Team). Detailed characterization of the seafloor is particularly needed in untrawlable rocky habitats of high relief. Such mapping efforts are needed to improve the scientific basis for designating and monitoring EFH conservation areas (for future EFH reviews), as well as to improve some groundfish stock assessments and habitat assessments for a diverse array of other spatial management issues.

4. Recommendation to improve the Habitat Use Database (HUD):

   a. implement a maintenance plan, including an oversight committee of HUD users (NOAA, EHFRC, OSU) and a schedule for regular HUD updates

b. develop tools and protocols to aid in data entry and to address specific architectural problems
c. address potential biases associated with inclusion of species from the Oregon Nearshore Strategy
d. update associations and distribution of groundfish habitat (including prey), using new information reported in the EFHRC report. Add descriptions for other species groups similar to those provided for Flatfish group.
e. develop crosswalk with other seafloor habitat classification schemes (i.e., Greene et al., 1999, FGDC CMECS, 2012)
f. update HUD definitions, documentation, and standards (e.g. clarify 'preferred depth'; consider young of year (YOY); verify species range and habitat preference using fishery dependent and independent survey data; develop standards for recording database amendments and expert opinion).

5. Recommendation to improve our understanding of habitat condition, including adverse effects of fishing gear to EFH, across the geographic range of groundfish,

6. Recommendation to advance our understanding of the affects of a changing climate on West Coast groundfishes.

7. Recommendation to evaluate potential adverse effects from fishing and non-fishing activities on the major prey species in the diets of west coast groundfish.
   a. develop criteria for defining major prey species for groundfish species and lifestages
   b. compile lists of major prey species for the all stocks and lifestages in the groundfish FMP.

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9.0 APPENDICES

APPENDIX A PERSONS CONSULTED AND CHRONOLOGY FOR THE PERIODIC REVIEW OF PACIFIC COAST GROUNDFISH ESSENTIAL FISH HABITAT

Table A-1 Members of the EFHRC[a/].

Name	Affiliation	Subcommittee	Alternate
Brad Pettinger, Chair	Oregon Trawl Commission	Data	Scott McMullen
Megan Mackey, Vice-Chair	Ecotrust	Data	
Ed Bowlby	NOAA Olympic Coast National Marine Sanctuary	Data	Karen Reyna
Bob Eder	Fixed gear fisheries		Bernie Bjork
Chris Goldfinger	Oregon State University		
Gary Greene	Moss Landing Marine Laboratories		
Dayna Matthews	NMFS Northwest Region, Office of Law enforcement		
Joe Schumacker	Quinault Indian Nation	Data	Jennifer Hagen
Geoff Shester	Oceana	Data	Ben Enticknap
John Stadler	NMFS Northwest Region, Habitat Conservation Division		
Waldo Wakefield	NMFS Northwest Fisheries Science Center	Data	
Mary Yoklavich	NMFS Southwest Fisheries Science Center	Data	

a/ Kerry Griffin and Chuck Tracy staffed the EFHRC for the Council.

Others who contributed:
Curt Whitmire, Marlene Bellman - NMFS NWFSC
Joe Bizzarro, Chris Romsos - NMFS Contractors
Kelly Corbett, Niels Leuthold, Bob Hannah, Maggie Sommer – ODFW
Lorna Wargo, Corey Niles - WDFW

Chronology

Table A-2. Meeting chronology and results of the EFHRC.

Timing/Due Date	Action
April 2011	Council approves the process, and solicits for information and data (deadline: July 1, 2011)
Summer 2011	NMFS Science Center (or contractor) compiles and synthesizes data and information, initiates review. EFHRC starts reviewing interim products
Dec 31, 2011	NMFS Science Center (or contractor) product due
April, 2012	EFHRC provides progress update to Council
Jan-August 2012	EFHRC drafts report summarizing new data and information; including how it compares with existing information, maps, etc.
September 2012	Council adopts interim report and consideres revised RFP
Sept 2012-Mar 2013	NMFS NWFSC synthesizes information in Phase 1 Report
April 2013	NMFS NWFSC presents synthesis report to Council; Council decides whether or not to issue an RFP for any changes to existing GF EFH, HAPCs, etc. (END PHASE I)

APPENDIX B RESULTS FROM THE NMFS 2011 GROUNDFISH ESSENTIAL FISH HABITAT DATA CALL

Thirty-nine sources of data relevant to groundfish EFH that had become available since 2006 were received through the NMFS data call (see Appendix B for details on each item). All of these data can be used to revise the descriptions of EFH and HAPC or to evaluate risk to EFH. Information associated with the NMFS data call comprised four general categories:

1. Four sources of new information on the distribution and extent of seafloor maps, seafloor data, and interpreted Pacific Coast groundfish habitat types were received. In addition to these responses to the NMFS data call, several other new and updated datasets related to seafloor bathymetry and interpreted habitats were identified and used in this EFH review (see section 3.2 of this report).
2. Eight sources of new and updated fishery-independent data were received on groundfish species and associated components of habitat. These datasets comprised: four trawl surveys, an integrated acoustic and trawl survey for hake (2005-present), two direct observation surveys (southern California SCUBA survey, 1974-present; central California submersible survey, 2007-2008), and the California Cooperative Oceanic Fisheries Investigations (CalCOFI) ichthyoplankton survey (2005-present). Associated habitat components that were collected during several of these surveys included water temperature, salinity, depth, dissolved oxygen, and specific habitat types (e.g., rocky banks, soft-bottom), among others.
3. Twenty sources of new and updated information or data were received on the distribution of habitats, including two coast-wide oceanographic datasets, 12 surveys of deepwater, structure-forming invertebrates (including corals and sponges) as biogenic components of habitat (i.e., visual surveys conducted with ROVs, manned submersibles, and AUV at various locations along the West Coast, and the NMFS West Coast bottom trawl survey), two models of deep coral distributions, an assessment of 146 West Coast estuaries conducted by The Nature Conservancy, an online data library and maps of California, and two visual surveys of fish and habitats off central California. Several of the visual surveys also included associations of fishes with corals and sponges. In addition to the two responses on modeling deep coral distributions, several other new modeling efforts related to biogenic habitats, trophodynamics, and habitat associations with groundfishes were reviewed in section 3.2 of this report.
4. Seven sources of new and updated information were received on existing and emerging threats to Pacific Coast groundfish EFH. These included five fishery-dependent datasets (i.e., NMFS bottom trawl logbook effort summaries in 10 x10 km and 500 x 500 m grid cells, 2002-2010; NMFS West Coast observed groundfish fixed-gear effort summaries, 2002-2010; NMFS observed hake commercial effort, 2002-2010; and NMFS groundfish trawl effort and coral/sponge locations). Much of these data have been analyzed, and the associated coastwide maps of the distribution of biogenic bycatch and fishing effort are presented in sections 3.2 and 3.3.1, respectively. and two sources of information on non-fishery threats were identified as responses to the NMFS data call: water sampling on Cordell Bank, central California (2010) and on Piggy Bank seamount, southern California (2010). Both studies were funded by the NOAA Deepsea Coral Program as baseline monitoring of ocean acidification.

1. SEAFLOOR MAPPING DATA

1.0.1 Item: SEAFLOOR MAPPING FOR CORAL SURVEYS

Source: NOAA Olympic Coast National Marine Sanctuary; NOAA Deepsea Coral Program

Time Frame: 2011

Spatial and Temporal Scale: inside Olympic Coast National Marine Sanctuary

Metric: side scan and multibeam (including backscatter) sonar data

Available Format: DVD; data; maps

URL: http://olympiccoast.noaa.gov/

Point(s) of Contact: N. Wright and C.E. Bowlby (NOAA Olympic Coast National Marine Sanctuary, Port Angeles, WA)

Key Reference(s):
Wright, N. 2011. Multibeam mapping of potential deep-sea coral habitats around Olympic II EFH. Report to NOAA Coral Reef Conservation Program. Olympic Coast National Marine Sanctuary Survey HMPR-128-2011-02. pp. 15.

Wright, N. 2011. Seafloor mapping in Olympic Coast National Marine Sanctuary: 2000-2011. A preliminary report to Pacific Fishery Management Council Essential Fish Habitat Review Committee, 7 p.

Comments: seafloor mapping in support of visual surveys of deep corals and sponges

1.0.2 Item: SEAFLOOR MAPPING FOR SPONGE REEF SURVEYS

Source: NOAA NMFS NWFSC; NOAA Deepsea Coral Program

Time Frame: 2010

Spatial and Temporal Scale: glass sponge reef area off Grays Harbor, WA

Metric: multibeam sonar data

Available Format: data; maps

URL: n/a

Point(s) of Contact: E. Clarke (NMFS NWFSC); C. Goldfinger (OSU)

Key Reference(s): n/a

Comments: seafloor mapping in support of visual surveys of deep sponge reefs

1.0.3 Item: SEAFLOOR MAPPING FOR CORAL AND SPONGE SURVEYS

Source: NOAA Cordell Bank National Marine Sanctuary; NOAA Deepsea Coral Program

Time Frame: 2011

Spatial and Temporal Scale: canyons and banks in vicinity of Cordell Bank National Marine Sanctuaries

Metric: multibeam sonar data; depth; slope; rugosity;aspect; substrate type

Available Format: data; maps

URL: n/a

Point(s) of Contact: D.F Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA); G. Cochrane (USGS)

Key Reference(s): n/a

Comments: seafloor mapping in support of visual surveys of deep sponge reefs; data in Cordell Bank collected from NOAA vessel *Okeanos Explorer*

1.0.4 Item: SEAFLOOR MAPPING OF RITTENBURG BANK, FARALLON ESCARPMENT AND AREA WEST OF FANNY SHOAL

Source: USGS

Time Frame: 2011

Spatial and Temporal Scale: canyons and banks within the boundaries of Gulf of Farallones National Marine Sanctuary

Metric: multibeam sonar data

Available Format: data; maps

URL: n/a

Point(s) of Contact: G. Cochrane (USGS) and

Key Reference(s): n/a

Comments: n/a

2. FISHERY-INDEPENDENT FISH DATA

2.1 *Trawl Surveys*

2.1.1 Item: NWFSC WEST COAST BOTTOM TRAWL SURVEY

Source: NOAA NMFS NWFSC

Time Frame: 2003 - present

Spatial and Temporal Scale: depths 55-1,280 m (30-700 fathoms), off Cape Flattery, Washington (lat 48° 10′ N) to the U.S.-Mexico border (lat 32° 30′ N)

Metric: size, age, abundance, biomass of benthic fishes and invertebrates

Available Format: database

URL: http://www.nwfsc.noaa.gov/research/divisions/fram/index.cfm

Point(s) of Contact: A.A. Keller (NOAA NWFSC, Seattle, WA)

Key Reference(s):

Keller, A.A., B.H. Horness, E.L. Fruh, V.H. Simon, V.J. Tuttle, K.L. Bosley, J.C. Buchanan, D.J. Kamikawa, J.R. Wallace. 2008. The 2005 U.S. West Coast bottom trawl survey of groundfish resources off Washington, Oregon, and California: Estimates of distribution, abundance, and length composition. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-93, 136 p. (http://www.nwfsc.noaa.gov/assets/25/6802_08122008_165005_GroundfishSurveyTM93Final.pdf)

Comments: Additional west coast bottom trawl surveys were conducted from 1977-2002

2.1.2 Item: CITY OF LOS ANGELES TRAWL SURVEYS

Source: City of Los Angeles Environmental Monitoring Division

Time Frame: 1987-2011

Spatial and Temporal Scale: inner, middle, and outer shelf soft bottom in southern CA

Metric: size, abundance, biomass of benthic fishes and invertebrates

Availabile Format: *Access* database

URL: n/a

Point(s) of Contact: Curtis Cash (City of Los Angeles, Environmental Monitoring Division, Los Angeles, CA)

Key Reference(s): n/a

Comments: n/a

2.1.3 Item: CALIFORNIA HALIBUT TRAWL SURVEYS

Source: California Department of Fish and Game

Time Frame: 2007-2010

Spatial and Temporal Scale: annual data; southern and central California

Metric: length, weight, sex; species composition; tag-release

Available Format: reports and possible database

URL: http://www.dfg.ca.gov/marine/sfmp/halibut-studies.asp

Point(s) of Contact: Paul Reilly and Travis Tanaka (California Department of Fish and Game)

Key Reference(s): n/a

Comments: n/a

2.1.4 Item: TRAWL SURVEYS FOR JUVENILE ROCKFISHES AND PACIFIC HAKE

Source: NOAA NMFS SWFSC and NWFSC

Time Frame: annual surveys, ongoing

Spatial and Temporal Scale: California and Oregon

Metric: densities; associations with environmental factors

Available Format: database; reports

URL(S): n/a

Point(s) of Contact: John Field (NMFS SWFSC, Santa Cruz, CA); R. Brodeur (NMFS NWFSC Newport, OR)

Key Reference(s): n/a

Comments: mid-water trawls; CTD

2.2 ***Acoustic Surveys***

2.2.1 Item: NWFSC WEST COAST INTEGRATED ACOUSTIC AND TRAWL SURVEY OF PACIFIC HAKE

Source: NOAA NMFS NWFSC

Time Frame: 2005, 2007, 2009, 2011, and ongoing

Spatial and Temporal Scale: biannual; surveying a series of parallel line transects oriented east-west, spaced at a 10-nmi interval, and traversed sequentially in alternating directions; the survey typically begins just north of Point Piedras Blancas, California and extends north to the U.S/Canada border, continuing into Canada

Metric: acoustic estimates of hake biomass estimates, which are verified by trawl catches; data are recorded with a number of discrete narrow-band, split-beam acoustic echo sounders, typically at 18, 38, 120, and 200 kHz; CTD casts

Available format: database

URL: http://www.nwfsc.noaa.gov/research/divisions/fram/acoustics.cfm

Point(s) of Contact: Lawrence C. Hufnagle (NOAA NWFSC, Seattle, WA)

Key Reference(s):
Fleischer, G. W., K. D. Cooke, P. H. Ressler, R. E. Thomas, S. de Blois, L. C. Hufnagle Jr. 2008. The 2005 integrated acoustic and trawl survey of Pacific hake, Merluccius productus, in U.S. and Canadian waters off the Pacific coast. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWFSC-94, 41 p.

Comments: Additional acoustic surveys were conducted from 1977 to 2003

2.3 *Direct Observation Surveys*

2.3.1 Item: Vantuna Research Group visual SCUBA surveys

Source: Vantuna Research Group, Occidental College

Time Frame: Variable depending on project, with maximum duration for a single project from1974 - present

Spatial and Temporal Scale: Various rocky reef areas in Southern California Bight from ~2-30 m depth:

- Santa Monica Bay
- Rocky Point, Palos Verdes, and King Harbor, Redondo Beach (1974-present)
- Cabrillo Jetty and Breakwater, Angel's Gate (seaward side), Angel's Gate East (harbor side), the rocky perimeter of the shallow water habitat, Pier 400 Port of Los Angeles
- Southern California Bight (2008-2009) Regional Monitoring Project (Santa Barbara, Malibu coast, Palos Verdes Peninsula, King Harbor, Horseshoe Kelp near the Port of Los Angeles, inside Port of Los Angeles, Santa Barbara Island, San Nicolas Island [including Begg Rock], Santa Catalina Island, and San Clemente Island)
- Cooperative Research and Assessment of Nearshore Ecosystems (CRANE) Program (88 reefs from Santa Cruz to the Mexico Border including southern California islands)

Metric: fish size/abundance, invertebrate abundance, biotic and abiotic habitat characteristics

Available Format: database

URL: http://college.oxy.edu/vrg/; http://www.dfg.ca.gov/marine/fir/crane.asp

Point(s) of Contact: Jeremy Claisse (claisse@oxy.edu)

Key Reference(s): n/a

Comments: similar protocol to PISCO surveys

2.3.2 Item: CALIFORNIA MARINE LIFE PROTECTION ACT VISUAL SURVEYS

Source: California Department of Fish and Game

Time Frame: 2007-2008

Spatial and Temporal Scale: inside/out of eight MPAs off central California; 20-365 m depth; 700 quantitative transects conducted from manned submersible

Metric: size, abundance, biomass of benthic fishes and invertebrates, habitat types

Available Format: *Access* database

URL: http://www.dfg.ca.gov/mlpa/

Point(s) of Contact: M.M. Yoklavich (NOAA SWFSC Santa Cruz, CA)

Key Reference(s):
Starr, R. and M. Yoklavich. 2008. Monitoring MPAs in deep water off central California: 2007 IMPACT submersible baseline survey. CA Sea Grant College Program Publ. No. T-067: 1-22.

Yoklavich, M. *et al*. (2010) Monitoring MPAs in Deep Water off Central California: 2007-2008 IMPACT Submersible Baseline Survey. Final report to CA Ocean Protection Council.

Comments: baseline monitoring of MPAs off south-central California coast, as associated with Marine Life Protection Act

2.4 *Ichthyoplankton Surveys*

2.4.1 Item: CalCOFI SURVEYS

Source: California Cooperative Oceanic Fisheries Investigations

Time Frame: 2005 – 2011, and ongoing; time series extending back to 1949

Spatial and Temporal Scale: standard survey: 4-5 cruises per year (winter, spring, summer, fall); 75-station pattern from San Diego to Pt. Conception, CA along 6 sampling lines

Metric: temperature, salinity, oxygen, phosphate, silicate, nitrate and nitrite, chlorophyll, transmissometer, PAR, C14 primary productivity, phytoplankton biodiversity, zooplankton biomass, and zooplankton biodiversity; ancillary data collected include continuous underway sea surface & meterological measurements; Acoustic Doppler Current Profiler data; the Continuous Underway Fish Egg Sampler (winter & spring); trace metals; sediments; MOCNESS net sampling; bio-optics; PCO2 air-sea interface, and atmospheric measurements; marine mammal and sea bird visual surveys

Available Format: database

URL(S): http://calcofi.org/

Point(s) of Contact: Tony Koslow (Scripps Institution of Oceanography, La Jolla, CA)

Key Reference(s): http://calcofi.org/pubs.html

Comment: CalCOFI is a partnership of the California Department of Fish and Game, NOAA Fisheries, and Scripps Institution of Oceanography

3. HABITAT INFORMATION

3.1 *Oceanographic*

3.1.1 Item: OCEANOGRAPHIC DATASETS FOR THE WASHINGTON AND OREGON COASTS

Source: Oregon State University, College of Earth, Ocean, and Atmospheric Sciences

Time Frame: The climatologies are formed from the earliest time available (depending on the variable and time of the year) to the year 2004

Spatial and Temporal Scale: Monthly climatologies from northern California Current System from the Strait of Juan de Fuca in northern Washington (49 degrees N) to northern California (41 degrees N) and extended from the coastline to 127 degrees W. The oceanographic data products were computed at depths of 0, 50, 100, 500, 1000 m and near the bottom.

Metric: temperature, salinity, chlorophyll-a and current velocity

Available Format: MS Thesis; database

URL(S): http://ir.library.oregonstate.edu/xmlui/handle/1957/1693

Point(s) of Contact: John Barth (College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, Corvallis, OR)

Key Reference(s):
Juan-Jorda´, M.J. (2006) Integration of oceanographic information off the Washington and Oregon coasts into the ecology of groundfish and their management. MS thesis, Oregon
State University, Corvallis, Oregon, pp. 290.

Juan Jordá, M.J., J.A. Barth, M.E. Clarke and W.W. Wakefield. 2009. Groundfish species associations with distinct oceanographic habitats off the Pacific Northwest Coast. Fisheries Oceanography 8:1-19.

Comment: main sources of data used in this study were remotely sensed from satellites and high-frequency land-based coastal radars, and from in situ instruments, such as conductivity-temperature-depth, bottle samples, and data from an acoustic Doppler current profiler.

3.1.2 Item: OCEANOGRAPHIC DATA of the PACIFIC COAST

Source: International Pacific Halibut Commission

Time Frame: 2007-2010

Spatial and Temporal Scale: surface to depth (50-500 m) along part or all of the Pacific Coast

Metric: temperature/salinity/depth profiles

Available Format: database

URL(S): http://www.nodc.noaa.gov/; http://www.iphc.int/; http://www.ecofoci.noaa.gov/efoci_sitemap.shtml

Point(s) of Contact: Lauri Sadorus (International Pacific Halibut Commission, Seattle, WA)

Key Reference(s): n/a

Comments: ongoing surveys

3.2 *Structure-Forming Invertebrates*

3.2.1 Item: BENTHIC INVERTEBRATES AS HABITAT IN SUBMARINE CANYONS

Source: Washington State University Vancouver

Time Frame: 1994, 2001

Spatial and Temporal Scale: 1 year each at Ascension, Carmel, Astoria Canyons

Metric: quantitative visual surveys; nearest neighbor analyses; distance of fish to deep corals

Available Format: MS Thesis; *Access* database

URL(S): n/a

Point(s) of Contact: B.N. Tissot (Washington State University Vancouver)

Key Reference(s):

Bianchi, C. 2011. Abundance and distribution of megafaunal invertebrates in NE Pacific submarine canyons and their ecological associations with demersal fishes. MS Thesis, Washington State University Vancouver.

Comments: includes fish associations with corals and sponges, 90-1400 m depth

3.2.2 Item: BENTHIC INVERTEBRATES AS HABITAT ON FOOTPRINT BANK, SOUTHERN CALIFORNIA BORDERLANDS

Source: Washington State University, Vanvouver

Time Frame: 1995-2004

Spatial and Temporal Scale: 28 dives on top of bank

Metric: quantitative visual surveys; nearest neighbor analyses; distance of fish to deep corals

Available Format: MS Thesis; database

URL(S):
https://research.vancouver.wsu.edu/sites/research.vancouver.wsu.edu/files/Bright_Thesis_2007.pdf

Point(s) of Contact: M.S. Love (University of California Santa Barbara), B.N. Tissot (Washington State University Vanvouver)

Key Reference(s):
Bright, J.L. 2007. Abundance and distribution of structure-forming invertebrates and their association with fishes at the Channel Islands “Footprint” off the southern coast of California. MS Thesis Washington State University Vancouver.

Comments: includes fish associations with corals and sponges at 97-314 m depth

3.2.3 Item: BENTHIC INVERTEBRATES AS HABITAT ON CORDELL BANK, CALIFORNIA

Source: Cordell Bank National Marine Sanctuary

Time Frame: 2002

Spatial and Temporal Scale: 27 quantitative dives

Metric: quantitative visual surveys; nearest neighbor analyses; distance of fish to deep corals

Available Format: MS Thesis; database

URL(S): http://cordellbank.noaa.gov/science/pirtle_invertfishhab_ms_thesis.pdf

Point(s) of Contact: D.F Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA); B.N. Tissot (Washington State University Vanvouver)

Key Reference(s):
Pirtle, J.L. 2005. Habitat-based assessment of structure-forming megafaunal invertebrates and fishes on Cordell Bank, California. MS Thesis Washington State University Vancouver.

Comments: includes fish associations with corals and sponges at 55 – 250 m depth

3.2.4 Item: DEEP CORAL AND SPONGE VISUAL SURVEYS IN SOUTHERN CALIFORNIA (ROV AND HUMAN-OCCUPIED SUBMERSIBLE)

Source: NOAA NMFS SWFSC; NOAA Deepsea Coral Program

Time Frame: 2010

Spatial and Temporal Scale: cruise 1 (6 ROV dives from 280 to 900 m at Piggy Bank); cruise 2 (several dives with human-occupied submersible in 200-300 m depth on rocky banks in Southern California Borderlands)

Metric: quantitative visual surveys of corals, sponges, fishes, habitats; association of fish to deep corals and sponges

Available Format: database and report

URL(S): n/a

Point(s) of Contact: M.M. Yoklavich (NMFS SWFSC Santa Cruz, CA)

Key Reference(s):
Yoklavich, M., et al. 2011. A characterization of the coral and sponge community on Piggy Bank seamount in southern California from a survey using a remotely operated vehicle. Final report to NOAA Deepsea Coral Research and Technology Program. 63 p.

Comments: n/a

3.2.5 Item: QUANTITATIVE VISUAL SURVEYS of DENSITIES OF CORALS, SPONGES, AND FISHES, and ASSOCIATION OF FISH TO DEEP CORALS – CORDELL BANK

Source: Cordell Bank National Marine Sanctuary; NOAA Deepsea Coral Program

Time Frame: 2010 (ROV); 2001-2005 (human-occupied submersible); 2004, 2007 (towed camera)

Spatial and Temporal Scale: Cordell Bank

Metric: quantitative visual surveys; densities of corals, sponges, fishes, association of fish to deep corals

Available Format: database, reports, published papers

URL(S): n/a

Point(s) of Contact: D.F Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA)

Key Reference(s):
Graiff, K., D. Roberts, D. Howard, P. Etnoyer, G. Cochrane, J. Hyland, and J. Roletto. 2011. A characterization of deep-sea coral and sponge communities on the continental slope west of Cordell Bank, northern California using a remotely operated vehicle. Final Report to NOAA Deep-sea Coral Research and Technology Program, 21 p.

Comments: n/a

3.2.6 Item: ROV SURVEYS of DEEP CORALS AND SPONGES OFF WASHINGTON

Source: NOAA Olympic Coast National Marine Sanctuary; NOAA Deepsea Coral Program

Time Frame: 2005, 2006; 2008; 2010; 2011

Spatial and Temporal Scale: Olympic Coast National Marine Sanctuary

Metric: quantitative visual surveys; densities of corals, sponges, fishes, habitats, association of fish to deep corals

Available Format: database and reports

URL(S): n/a

Point(s) of Contact: C.E. Bowlby (NOAA Olympic Coast National Marine Sanctuary, Port Angeles, WA)

Key Reference(s):
Bowlby, C.E, M.S. Brancato, J. Bright, K. Brenkman, and J. Hyland. 2011. A characterization of deep-sea coral and sponge communities on the continental shelf of northern Washington, Olympic Coast National Marine Sanctuary, using a remotely operated vehicle in 2006. A preliminary report to Pacific Fishery Management Council Essential Fish Habitat Review Committee, 76 p.

Bowlby, C.E, M.S. Brancato, J. Bright, K. Brenkman, and J. Boutillier. 2011. A characterization of deep-sea coral and sponge communities on the continental shelf of northern Washington, Olympic Coast National Marine Sanctuary, using a remotely operated vehicle in 2008. A preliminary report to Pacific Fishery Management Council Essential Fish Habitat Review Committee, 56 p.

Bowlby, C.E, J. Bright, K. Brenkman, P. Etnoyer, S. Rooney, and C. Brady. 2011. A characterization of deep-sea coral and sponge communities on the continental shelf of northern Washington, Olympic Coast National Marine Sanctuary, using a remotely operated vehicle in June 2010. A report to NOAA Deep-sea Coral Research and Technology Program, 21 p.

Brancato, M.S., C.E. Bowlby, J. Hyland, S.S. Intelmann, and K. Brenkman. 2007. Observations of Deep Coral and Sponge Assemblages in Olympic Coast National Marine Sanctuary, Washington. Cruise Report: NOAA Ship McArthur II Cruise AR06-06/07. Marine Sanctuaries Conservation Series NMSP-07-03. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 48 pp. http://sanctuaries.noaa.gov/science/conservation/bowlby.html

Brancato, M.S. and C.E. Bowlby. 2005. Survey of fishing gear and fiber optic cable impacts to benthic habitats in the Olympic Coast National Marine Sanctuary. Pages 629-630 in P.W. Barnes and J.P. Thomas, editors. Benthic habitats and the effects of fishing. American Fisheries Society, Symposium 41, Bethesda, Maryland.

Hyland, J., C. Cooksey, E. Bowlby, M.S. Brancato, and S. Intelmann. 2005. A Pilot Survey of Deepwater Coral/Sponge Assemblages and their Susceptibility to Fishing/Harvest Impacts at the Olympic Coast National Marine Sanctuary (OCNMS). Cruise Report for NOAA Ship McARTHUR II Cruise AR-04-04: Leg 2. NOAA Technical Memorandum NOS NCCOS 15. NOAA/NOS Center for Coastal Environmental Health and Biomolecular Research, Charleston, SC. 13 p. http://www.coastalscience.noaa.gov/documents/ar0404leg2.pdf

Comments: n/a

3.2.7 Item: AUV SURVEYS OF DEEP SPONGES and ASSOCIATION TO FISH

Source: NOAA NMFS NWFSC; NOAA Deepsea Coral Program

Time Frame: 2010

Spatial and Temporal Scale: 2 dives Olympic Coast National Marine Sanctuary [report/images not provided], WA; 6 dives Grays Harbor, WA glass sponge reef; 8 dives Piggy Bank southern California Borderlands

Metric: quantitative visual surveys; densities of sponges, corals, and association with fishes

Available Format: digital still images

URL(S): n/a

Point(s) of Contact: M.E. Clarke (NOAA NMFS NWFSC Seattle, WA)

Key Reference(s):
Clarke, M.E. and E. Fruh. 2011. A characterization of the sponge community in the region of Grays Canyon, WA from a survey using an autonomus underwater vehicle October 2010. A Report to NOAA Deep-Sea Coral Research and Technology Program, 62p.

Comments: n/a

3.2.8 Item: CLOUD SPONGES AS NURSERY HABITAT FOR FISHES IN BRITISH COLUMBIA

Source: Vancouver Aquarium

Time Frame: 2009

Spatial and Temporal Scale: Strait of Georgia, British Columbia; multiple years

Metric: scuba surveys of young-of-the-year yelloweye and quillback rockfishes

Available Format: poster presentation, dataset

URL(S): n/a

Point(s) of Contact: J.B. Marliave (Vancouver Aquarium, Vancouver, BC)

Key Reference(s): n/a

Comments: includes impacts from spot prawn traps

3.2.9 Item: ROV SURVEYS OF FISH, INVERTEBRATES AND HABITAT IN MONTEREY BAY AND SOUTHERN OREGON

Source: Oceana

Time Frame: 2010-2011

Spatial and Temporal Scale: ROV dives at 18 sites in Monterey Bay; 17 sites in southern Oregon

Metric: visual surveys

Available Format: raw video footage; summary

URL(S): n/a

Point(s) of Contact: G. Shester (gshester@oceana.org)

Key Reference(s): n/a

Comments: 24-188 m depth; former halibut trawl grounds; shale beds; in/out of EFH areas

3.2.10 Item: STRUCTURE-FORMING BENTHIC INVERTEBRATES ON THE CONTINENTAL MARGIN OF OREGON AND WASHINGTON

Source: Oregon State University

Time Frame: 1992-95

Spatial and Temporal Scale: nearshore and offshore regions at 66-370 m depth, from Cape Blanco, Oregon (ca. 43°50'N) to offshore of Gray's Harbor, Washington (ca. 47°05'N).

Metric: using a human-occupied submersible, quantitative inventory of structure-forming invertebrates; documentation of invertebrate associations with geological habitat types

Available Format: MS Thesis and database

URL(S):
http://oasis.oregonstate.edu/search~S13/?searchtype=a&searcharg=strom%2C+natalie&searchscope=13&SORT=D&extended=0&searchlimits=&searchorigarg=anatalie+reed;

Point(s) of Contact: C. Goldfinger (Oregon State University, Corvallis, OR)

Key Reference(s):
Strom, N.A. 2006. Structure-forming benthic invertebrates: habitat distributions on the continental margin of Oregon and Washington. MS Thesis, Oregon State University, Corvallis, OR.

Comments: n/a

3.2.11 Item: SURVEY OF CORAL AND SPONGE HABITATS OFF WEST COAST

Source: NOAA NMFS SWFSC; NOAA NOS NCCOS

Time Frame: November 1-5, 2010

Spatial and Temporal Scale: Five ROV transect surveys and CTD casts conducted between San Diego, CA and Seattle, WA at depths 110-400 m.

Metric: temperature, salinity, habitat type, relative abundance and density of corals, sponges, fishes

Available Format: Report

URL(S):

Point(s) of Contact: K. Stierhoff (kevin.stierhoff@noaa.gov); P. Etnoyer (peter.etnoyer@noaa.gov)

Key Reference(s):
Stierhoff, KL, PJ Etnoyer, DW Murfin, and JL Butler. 2011. A survey of deep-water coral and sponge habitats along the West Coast of the US using a remotely operated vehicle . NOAA Technical Memorandum NOS NCCOS, NOAA Center for Coastal Environmental Health and Biomolecular Research, Charleston, SC. 41 pp.

Comments: n/a

3.2.12 Item: DEEP CORAL MODELING

Source: Cordell Bank National Marine Sanctuary

Time Frame: n/a

Spatial and Temporal Scale: Cordell Bank

Metric: modeled habitat associations of deep corals

Available Format: data and report

URL(S): http://cordellbank.noaa.gov/science/research.html#coral

Point(s) of Contact: D.F Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA)

Key Reference(s):
Etherington, L.L., P. van der Leeden, K. Graiff, D. Roberts, and B. Nickel. 2011. Summary of deep sea coral patterns and habitat modeling results from Cordell Bank, CA. NOAA Cordell Bank National Marine Sanctuary, Olema, CA 94956.

Comments: n/a

3.2.13 Item: DEEP CORAL HABITAT SUITABILITY MODELING

Source: Marine Conservation Institute; NOAA Deepsea Coral Program

Time Frame: n/a

Spatial and Temporal Scale: U.S. West Coast

Metric: modeled habitat associations of deep corals

Available Format: data, model, and report

URL(S): n/a

Point(s) of Contact: J.M. Guinotte (John.Guinotte@marine-conservation.org)

Key Reference(s):
Guinotte, J.M. and A.J. Davies. 2012. Predicted deep-sea coral habitat suitability for the U.S. West Coast. Final Report to NOAA Deep-sea Coral Research and Technology Program, 85 pp.

Comments: n/a

3.2.14 Item: DEEP CORAL/SPONGE CPUE – NMFS NWFSC WEST COAST BOTTOM TRAWL SURVEY

Source: NOAA NMFS NWFSC

Time Frame: 2003-2010

Spatial and Temporal Scale: Pacific coast, 2003-05 and 2006-10 survey cycles

Metric: standardized CPUE

Available Format: data products via PaCOOS

Point(s) of Contact: Curt Whitmire (NOAA NMFS NWFSC, Newport, OR)

Comments: n/a

3.3 *Estuaries*

3.3.1 Item: CONSERVATION ASSESSMENT OF WEST COAST (USA) ESTUARIES

Source: The Nature Conservancy

Time Frame: n/a

Spatial and Temporal Scale: California, Oregon, Washington

Available Format: database and report

URL: http://conserveonline.org/workspaces/wcea/

Point(s) of Contact: Mary Gleason (The Nature Conservancy)

Key Reference(s):
Gleason MG, S Newkirk, MS Merrifield, J Howard, R Cox, M Webb, J Koepcke, B Stranko, B Taylor, MW Beck, R Fuller, P Dye, D Vander Schaaf, J. Carter. 2011. A Conservation Assessment of West Coast (USA) Estuaries. The Nature Conservancy, Arlington VA. 65pp.

Comments: Geographic information system (GIS) database containing spatial data for 146 estuaries and their associated catchments; includes 27 variables that characterize some key biophysical and human use parameters

3.4 *Other Habitat Information*

3.4.1 Item: HABITAT ASSOCIATIONS WITH FISHES

Source: Cordell Bank National Marine Sanctuary

Time Frame: n/a

Spatial and Temporal Scale: Cordell Bank

Metric: quantitative visual surveys of fishes and habitats

Available Format: data and published papers

URL(S): n/a

Point(s) of Contact: D.F Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA)

Key Reference(s):
Anderson, T.J., C. Syms, D.A. Roberts, D.F. Howard. 2009. Multi-scale fish-habitat associations and the use of habitat surrogates to predict the organization and abundance of deep-water fish assemblages. Journal of Experimental Marine Biology and Ecology 379:34-42.

Young, M.A., P. J. Iampietro, R.G. Kvitek, and C.D. Garza. 2010. Multivariate bathymetry-derived generalized linear model accurately predicts rockfish distribution on Cordell Bank, California, USA. Marine Ecology Progress Series 415:247-261.

Comments: n/a

3.4.2 Item: DATA LIBRARY and MARINE MAP - AN ONLINE MAPPING TOOL

Source: California Department of Fish and Game

Time Frame: n/a

Spatial and Temporal Scale: Coast of California

Metric: A geospatial data library viewable with MarineMap, which is an online mapping tool developed to assist in the design of marine protected areas (MPAs) in California.

Available Format: database and software

URL(S): http://marinemap.org/; http://northcoast.marinemap.org/; http://www.dfg.ca.gov/mlpa/northcoast.asp

Point(s) of Contact: Paulo Serpa (California Department Fish Game, Monterey, CA)

Key Reference(s): n/a

Comments: n/a

3.4.3 Item: VISUAL SURVEYS (ROV), SEDIMENT GRABS, MULTIBEAM MAPPING OF RIPPLED SCOUR DEPRESSIONS

Source: California State University Monterey Bay, Seafloor Mapping

Time Frame: 2009

Spatial and Temporal Scale: Monterey Bay; 15-50m depth

Metric: densities of scour depressions and associated fishes and invertebrates

Available Format: MS Thesis; database

URL(S): http://sep.csumb.edu/cwsp/theses/Hallenbeck_MSThesis_110327.pdf

Point(s) of Contact: R. Kvitek (California State University Monterey Bay, Seaside, CA)

Key Reference(s):
Hallenbeck, T.R. 2011. Rippled scour depressions add ecologically significant heterogeneity to soft sediment habitats on the continental shelf. MS Thesis, California State University Monterey Bay, Seaside, CA.

Comments: possible rockfish nursery habitat

4. EXISTING AND EMERGING THREATS

4.1 *Fishery-Dependent Threats*

4.1.1 Item: BOTTOM TRAWL LOGBOOK DATA SUMMARIES

Source: PacFIN (raw data); NMFS NWFSC (data products)

Time Frame: 2002-2010

Spatial and Temporal Scale: trawl towline model was used to allocate effort data in 10 x 10 km grid cells; annual representations

Metric: tow duration (h); groundfish catch (lbs); numbers of vessels and tows

Available Format: data products via PaCOOS

URL: http://pacoos.coas.oregonstate.edu/

Point(s) of Contact: Curt Whitmire (NOAA NMFS NWFSC, Newport, OR) and Marlene Bellman (NOAA NMFS NWFSC Seattle, WA)

Key Reference(s): n/a

Comments: To preserve confidentiality standards, data from grid cells with fewer than 3 vessels in any given year were excluded from that year's data product. In addition, bottom trawling is prohibited in Washington and California state waters, except within designated California Halibut Trawl Grounds; therefore data in cells that straddle the territorial sea boundaries of Washington and California were clipped to exclude those portions within state waters.

4.1.2 Item: BOTTOM TRAWL LOGBOOK DATA SUMMARIES

Source: PacFIN (raw data); NMFS NWFSC (data products)

Time Frame: 2002-2010

Spatial and Temporal Scale: 500 X 500 meter cells and composite convex hull of half degree latitude blocks; 5-year periods (2002–11 Jun 2006 and 12 Jun 2006 –2010)

Metric: distance fished (km) per km^2

Available Format: data products via PaCOOS

URL: http://pacoos.coas.oregonstate.edu/

Point(s) of Contact: Curt Whitmire (NOAA NMFS NWFSC, Newport, OR) and Marlene Bellman (NOAA NMFS NWFSC Seattle, WA)

Key Reference(s): n/a

Comments: To preserve confidentiality standards, data from grid cells with fewer than 3 vessels in any given time period were excluded from the data product. In addition, bottom trawling is prohibited in Washington and California state waters, except within designated California Halibut Trawl Grounds; therefore data in cells that straddle the territorial sea boundaries of Washington and California were clipped to exclude those portions within state waters.

4.1.3 Item: WEST COAST GROUNDFISH OBSERVER PROGRAM (WCGOP) FIXED GEAR DATA SUMMARIES

Source: NOAA NMFS NWFSC

Time Frame: 2002-2009

Spatial and Temporal Scale: fixed gear set and haul locations were used to allocate effort data to 20 x 20 km grid cells, combined 2002-2009 period; composite convex hull of half degree latitude blocks, 5-year periods (2002–11 Jun 2006 and 12 Jun 2006 –2010)
Metric: groundfish catch (lbs); number of hooks, pots, vessels, and sets or hauls

Available Format: data products via PaCOOS

URL: http://pacoos.coas.oregonstate.edu/

Point(s) of Contact: Marlene Bellman (NOAA NMFS NWFSC Seattle, WA)

Key Reference(s): n/a

Comments: To preserve confidentiality standards, data in grid cells with fewer than 3 vessels were excluded from the data product.

4.1.4 Item: OBSERVED PACIFIC HAKE COMMERCIAL EFFORT

Source: NOAA NMFS NWFSC

Time Frame: 2002-2010

Spatial and Temporal Scale: 500 X 500 meter cells and composite convex hull of half degree latitude blocks; 5-year periods (2002–11 Jun 2006 and 12 Jun 2006 –2010)

Metric: distance fished (km) per km^2

Available Format: data products via PaCOOS

Point(s) of Contact: Curt Whitmire (NOAA NMFS NWFSC, Newport, OR) and Marlene Bellman (NOAA NMFS NWFSC Seattle, WA)

Key Reference(s): n/a

Comments: Combined product from shore-side sector (PacFIN) and at-sea sector (At-Sea Hake Observer Program or A-SHOP). To preserve confidentiality standards, data in grid cells with fewer than 3 vessels were excluded from the data product.

4.1.5 Item: GROUNDFISH BOTTOM TRAWL FISHING EFFORT AND CORAL/SPONGE LOCATIONS

Source: NOAA NMFS SWFSC; NOAA Deepsea Coral Program

Time Frame: 1997 - 2009

Spatial and Temporal Scale: California coast; comparative maps of trawl effort between time periods 1997-1999 and 2006-2009; maps of coral/sponge presence 1980-2007

Metric: data from California trawl logbook data: hr towed per km^2 per year, aggregated over years and mapped in 1-minute latitude and longitude blocks; data from NMFS trawl surveys: presence of coral taxa

Available Format: maps and GIS layers

URL: n/a

Point(s) of Contact: J. Mason (NOAA NWFSC, Pacific Grove, CA)

Key Reference(s): n/a

Comments: To protect confidentiality, data were not used from 1-minute blocks with < 3 vessels for the aggregated years.

4.2 *Non-Fishing Threats*

4.2.1 Item: BASELINE WATER SAMPLING ON CORDELL BANK FOR STUDIES ON OCEAN ACIDIFICATION

Source: Cordell Bank National Marine Sanctuary

Time Frame: 2010

Spatial and Temporal Scale: Cordell Bank, California, shelf and slope

Metric: temperature, salinity, water chemistry

Available Format: dataset

URL(S): n/a

Point(s) of Contact: D. Howard (Cordell Bank National Marine Sanctuary, Point Reyes Station, CA)

Key Reference(s): n/a

Comments: baseline pilot study of ocean chemistry

4.2.2 Item: WATER SAMPLING ON PIGGY BANK SEAMOUNT IN SOUTHERN CALIFORNIA

Source: Channel Island National Marine Sanctuary; NOAA Deepsea Coral Program

Time Frame: June 27-1July 2010

Spatial and Temporal Scale: Piggy Bank, Southern California; surface to 815 m depth

Metric: temperature, salinity, pH, dissolved oxygen, phosphate, nitrite, nitrate, ammonium, dissolved inorganic carbon, total alkalinity, pCO2, aragonite

Available Format: dataset and report

URL(S): n/a

Point(s) of Contact: Danielle Lipski (danielle.lipski@noaa.gov)

Key Reference(s): n/a

Comments: baseline pilot study of ocean chemistry; 9 CTD casts and 68 water samples taken at surface, 50 m, 100 m, 150 m, 200 m, and near bottom (290-815 m)

APPENDIX C BATHYMETRY AND SEAFLOOR HABITAT MAPS

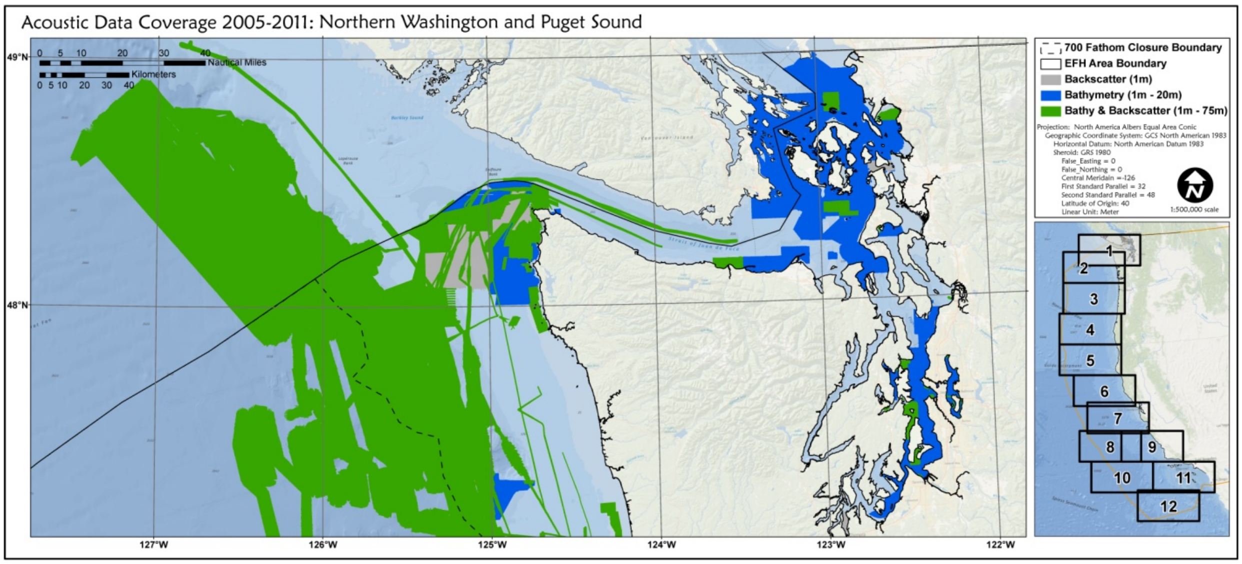
A set of 24 comparison map panel layouts were constructed at a scale of 1:500,000 and encompassed the EEZ of the southern U.S. Pacific Coast. Each comparison panel presents a geographic comparison of project components (Imagery; Appendix C-1, and Habitat; Appendix C-2) and over three time intervals: Pre 2005, 2005-2011, and Aggregate 2011 (combined overlay of pre-2005 and 2005-2011 data). Note that plates are meant to be printed at full size (44" wide by 60" tall). Shrinking a plate to fit on an 8.5" by 11" letter size page will change the map scale to approximately 1:2,588,235. . It will also result in a loss of resolution due to resampling and printing limitations.

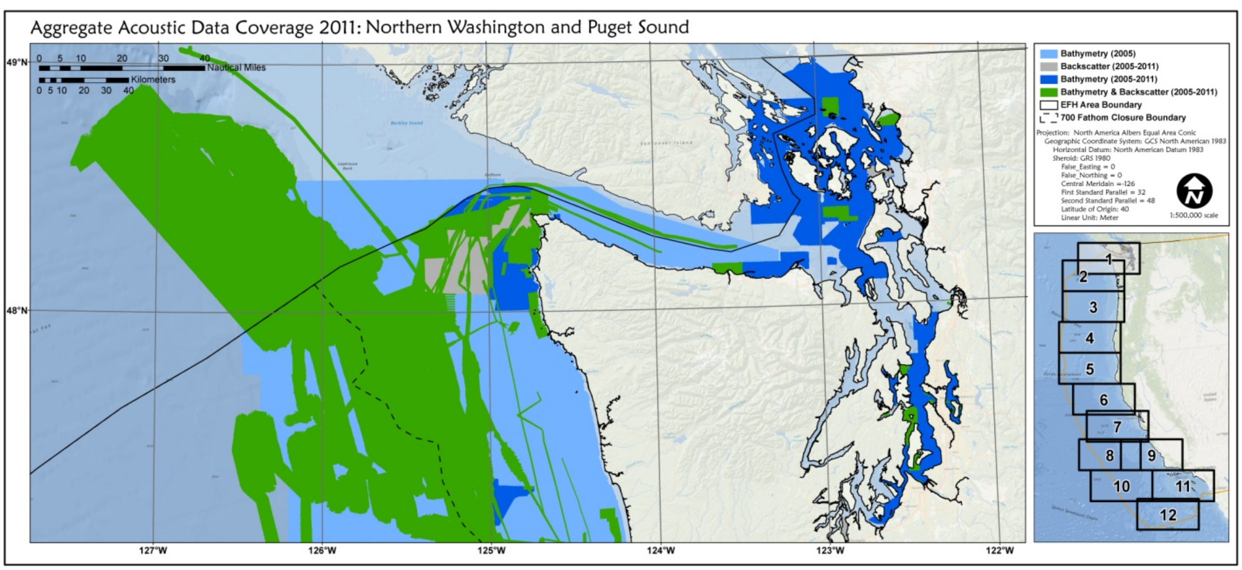
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.

Seafloor imagery and habitat types were color-coded so that the composition of the available data associated with each survey region could be easily distinguished. Survey regions were divided into three categories, those that contained only bathymetry data (blue), those that contained bathymetry and backscatter data (green), and those that contained only backscatter data (grey) (e.g., Figure 6). Habitat types were distinguished as probable soft sediment (yellow), probable rock (red), or a mixture of soft sediment and rock (brown) (e.g., Figure 7). Given that this effort compiled habitat maps from a variety of sources, it is essential to understand that mapping methods varied widely among sources and that it was our task to display the sources under some common scheme.

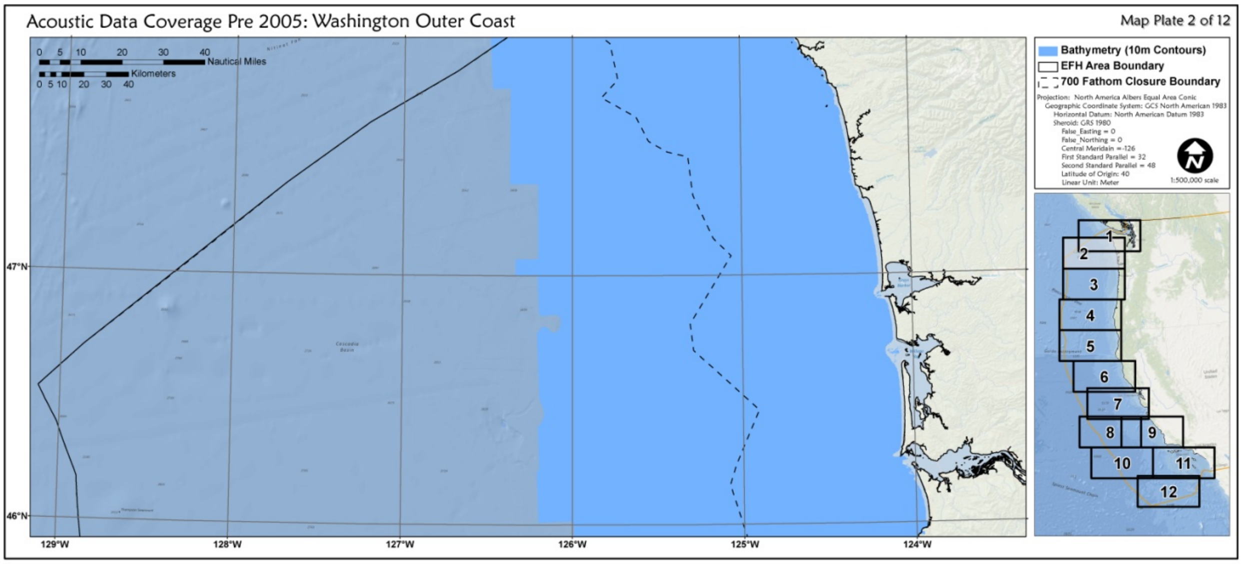
A special habitat type case exists for Oregon and Washington. During the 2002 mapping effort, seafloor below 150m water depth and of 10 degrees slope or greater were mapped as rock outcrop (red). This mapping was made based upon expert observation that steep slopes in this region do not hold unconsolidated sediments well and are often rocky. To call attention to the facts that: 1) similar mapping was not done for California, 2) the mapping technique only infers rock outcrop through a simple >10 degrees of slope angle rule, and 3) the rule when applied classifies a large quantity of seafloor as rocky, this habitat type was mapped as "Inferred Rock" using a light red color. The extent of inferred rock in the current pre-2005 map plates is identical to that depicted in the 2002 West Coast Oregon and Washington substrate map; however, it is colored differently in the current pre-2005 map plates so that it may be distinguished from rock that was determined based on geologic interpretations or more rigorous automated classification techniques (Figure 7).

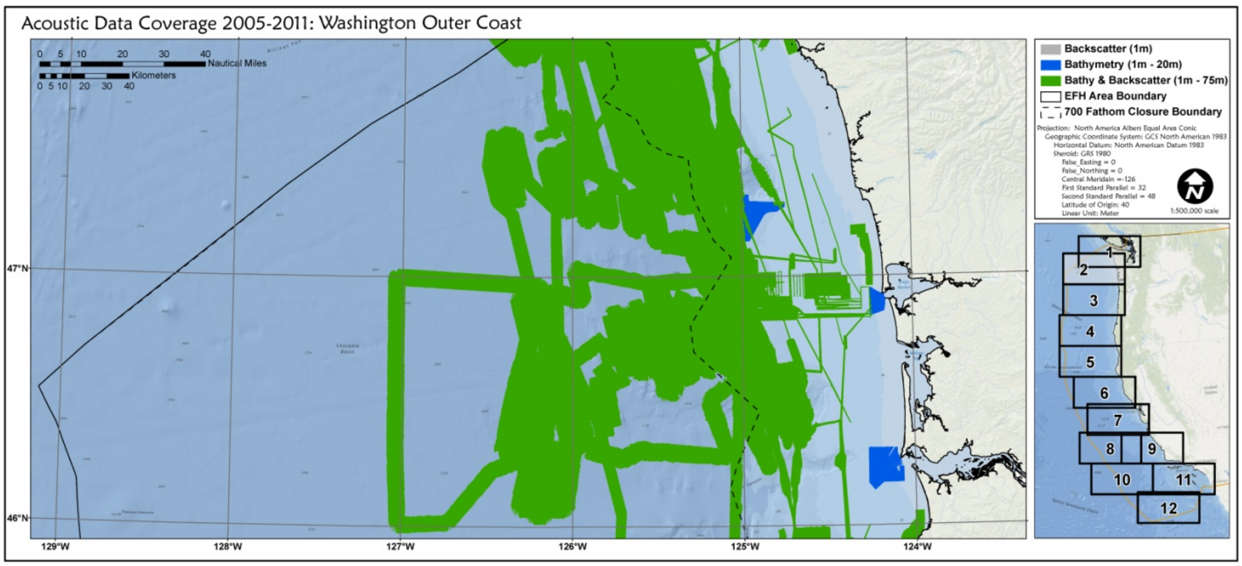
Appendix C-1: Imagery

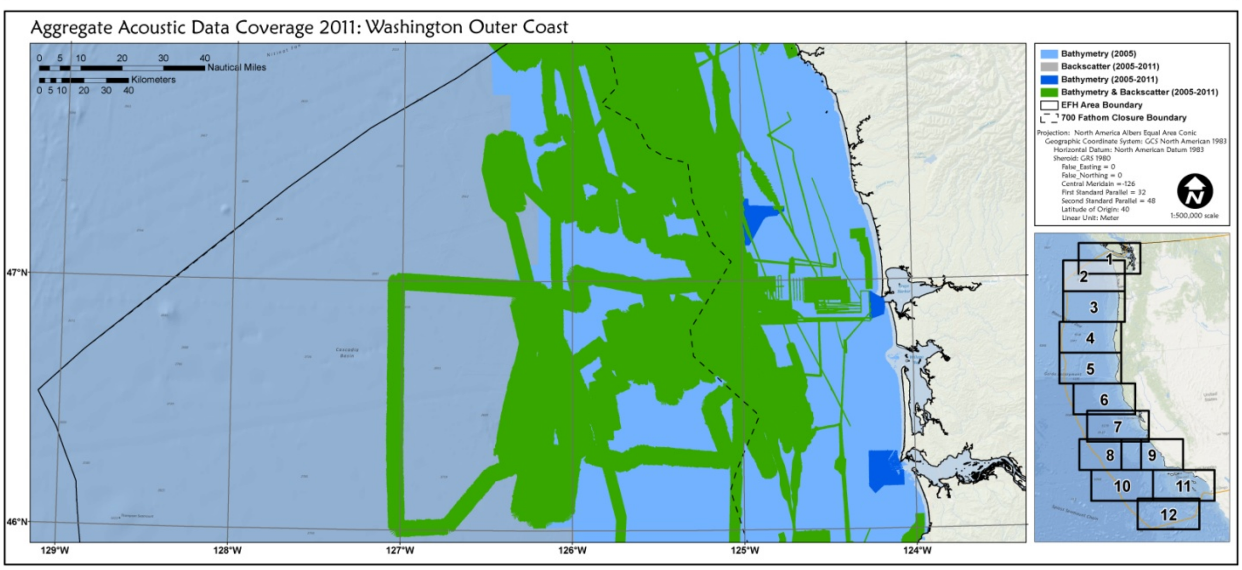




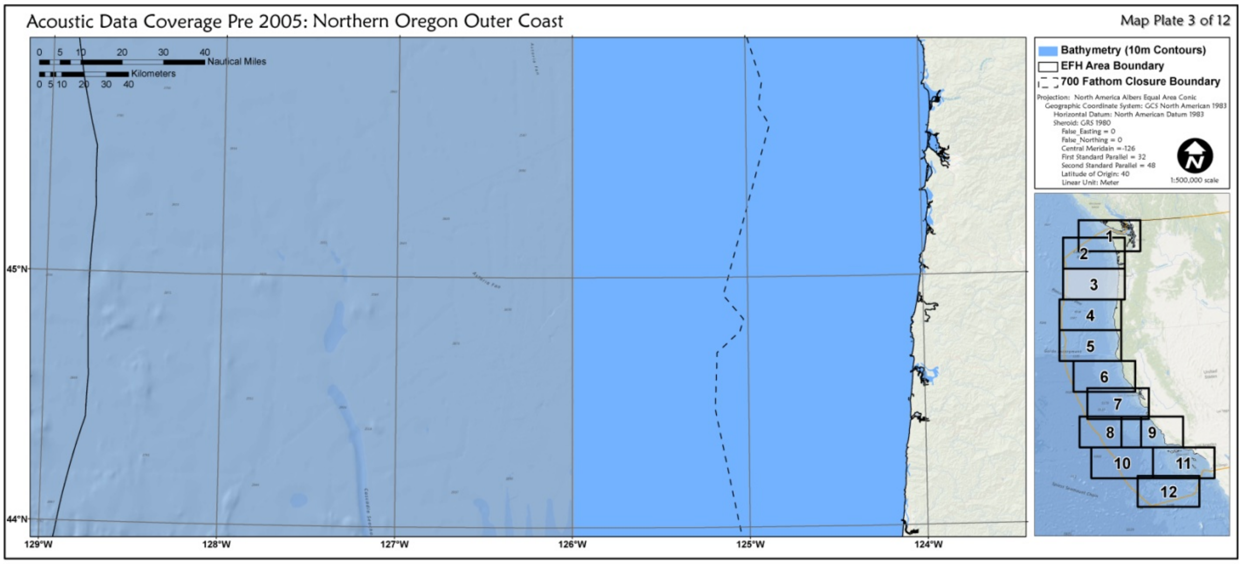
Appendix C-1: Imagery

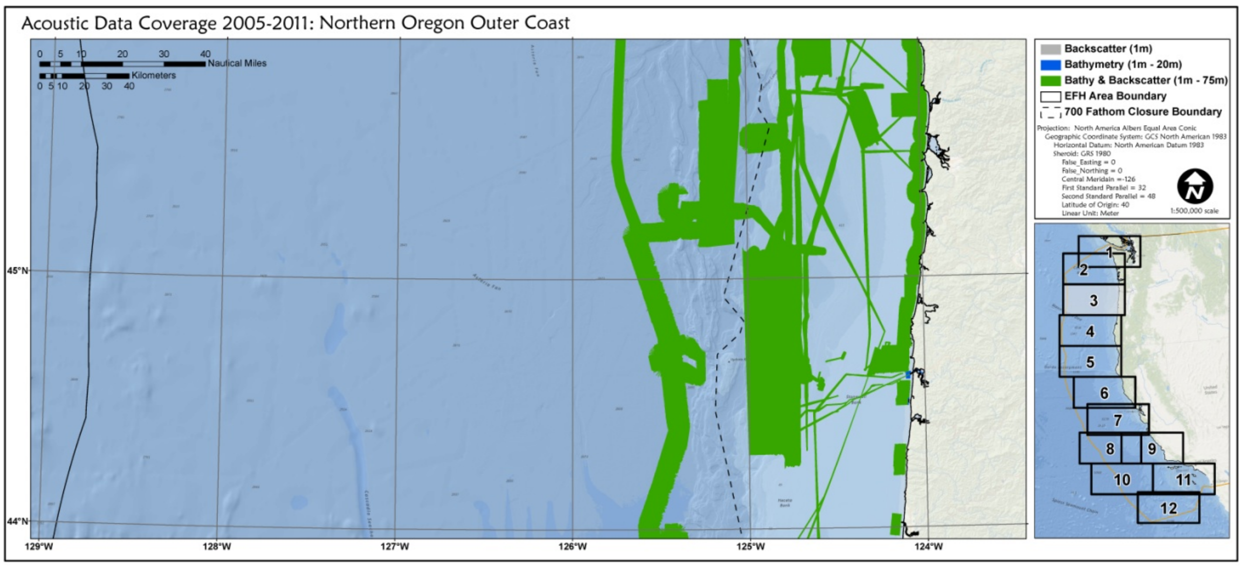


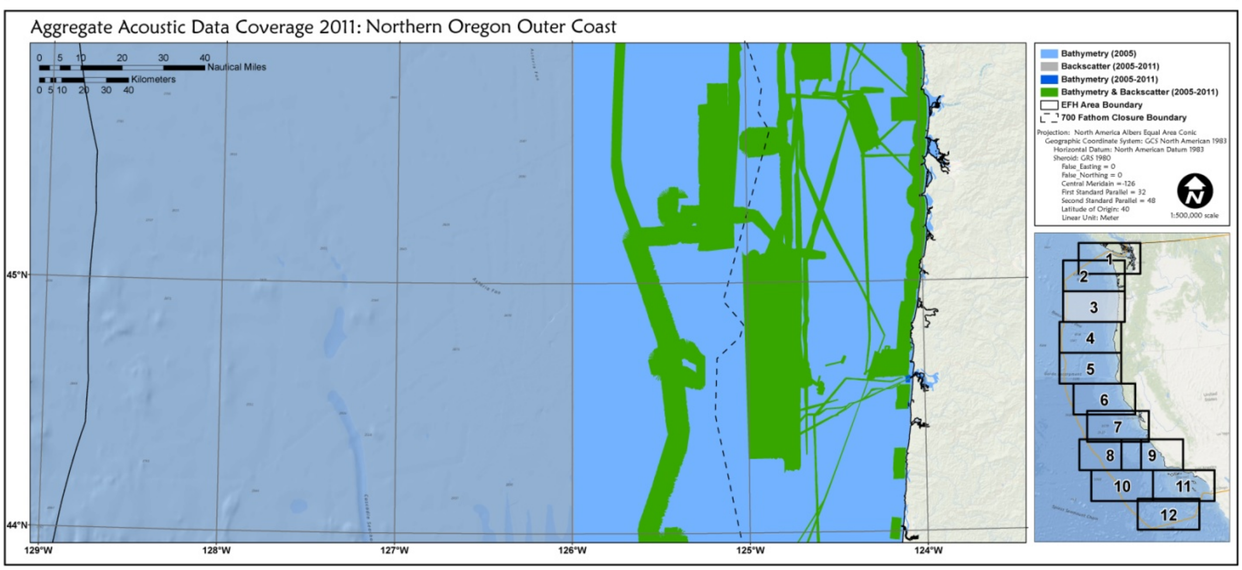




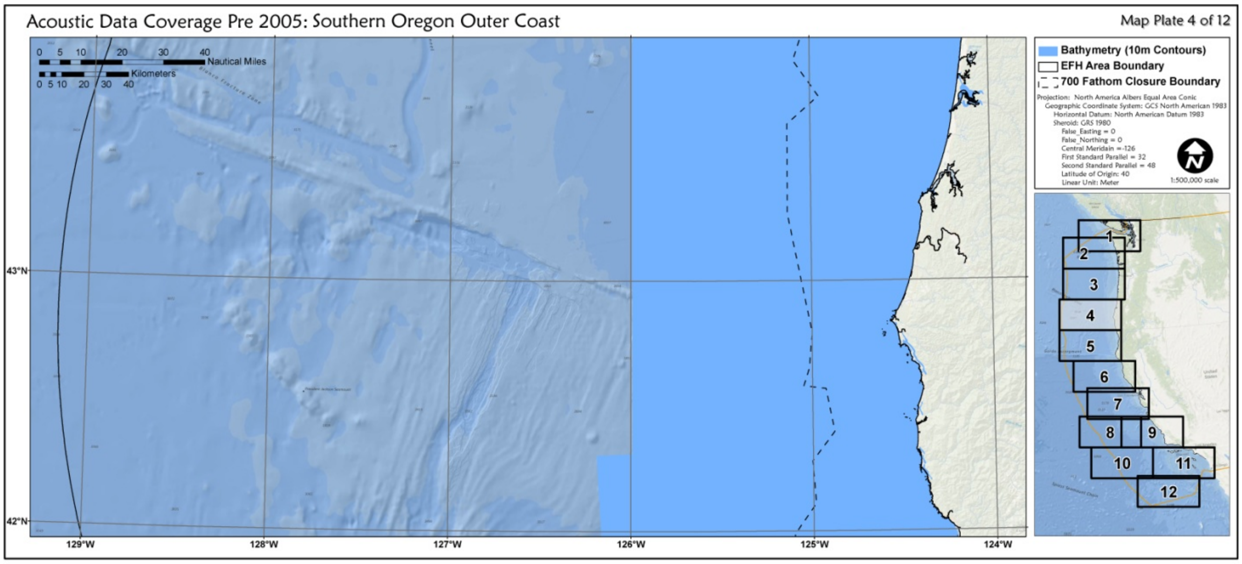
Appendix C-1: Imagery

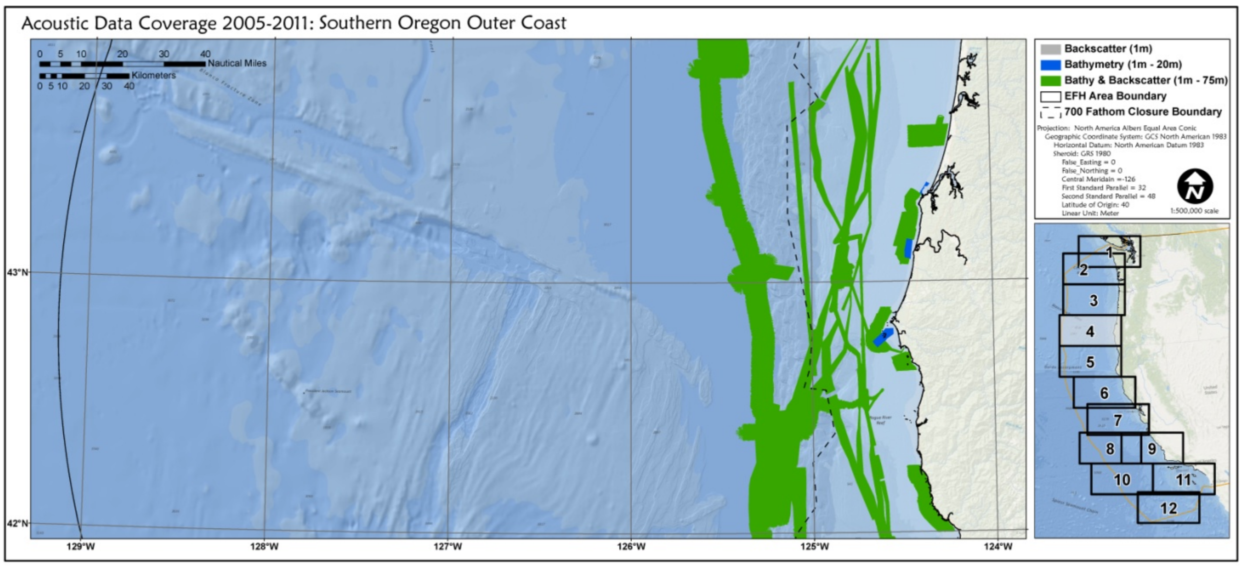


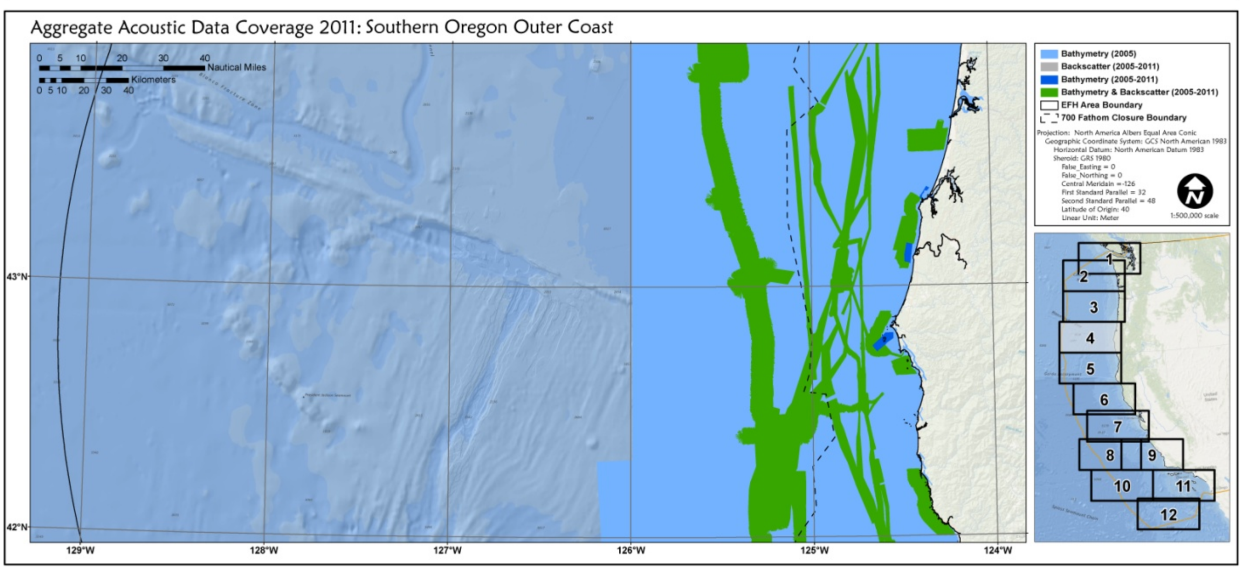




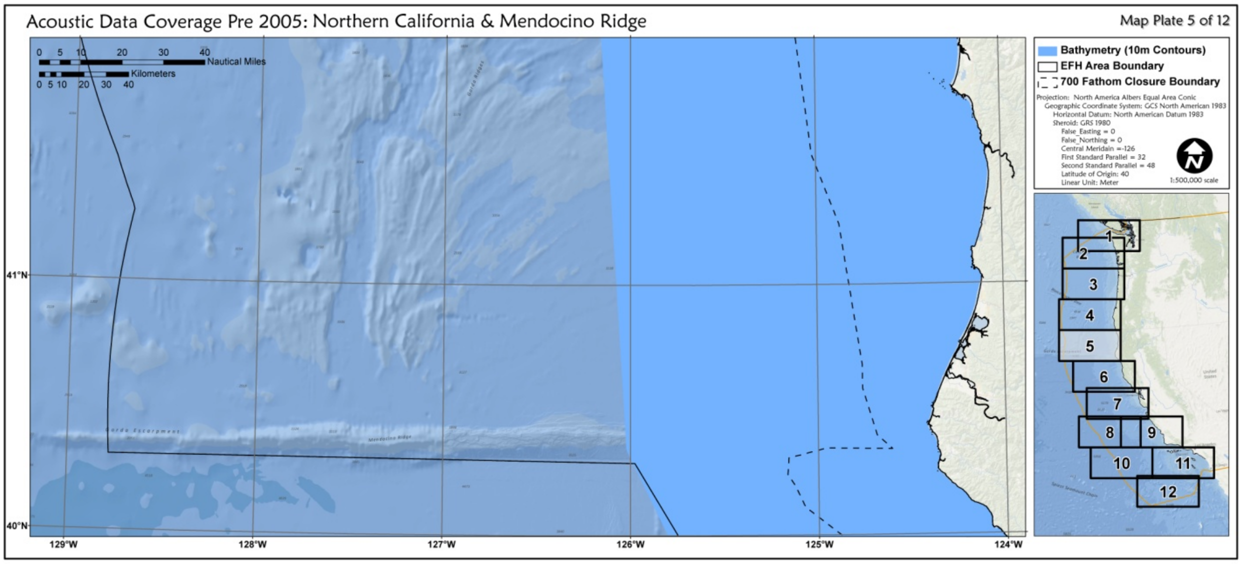
Appendix C-1: Imagery

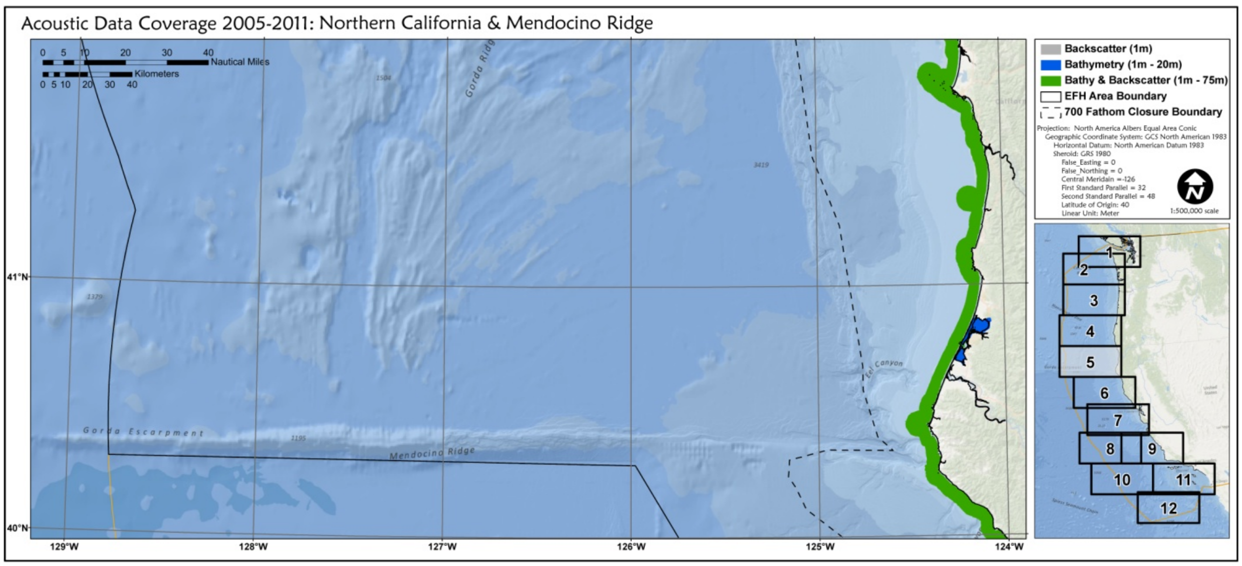


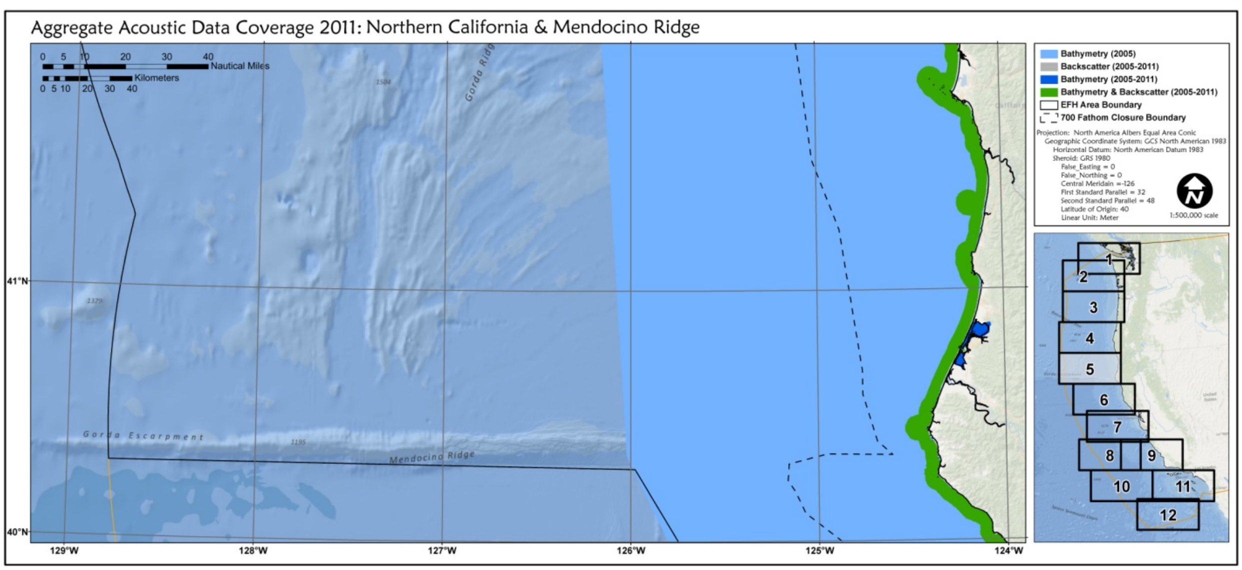




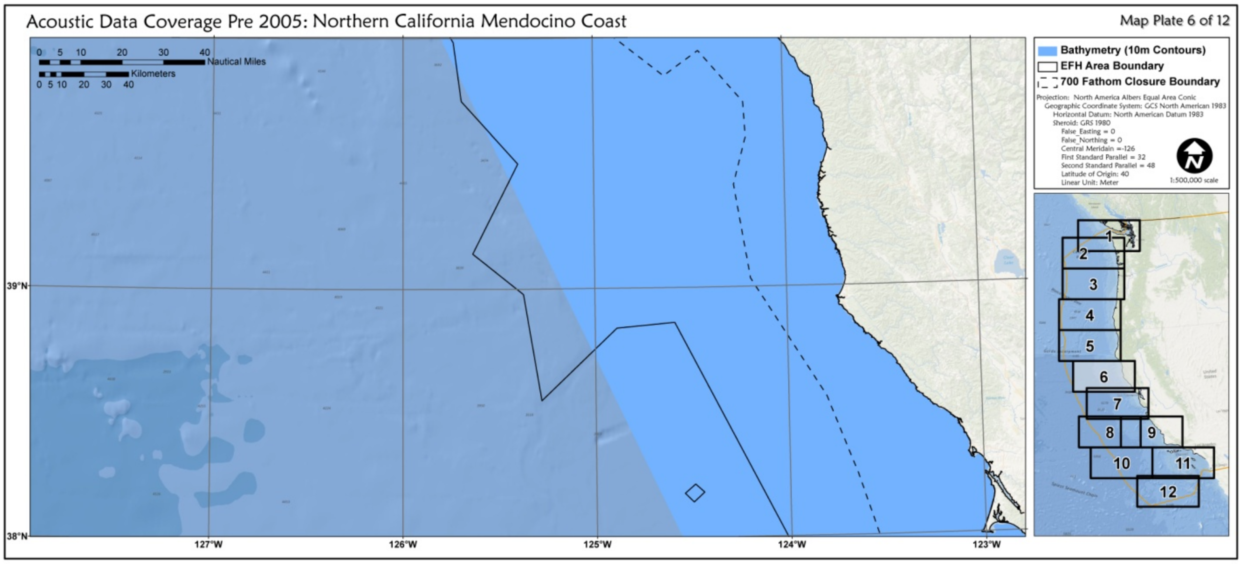
Appendix C-1: Imagery

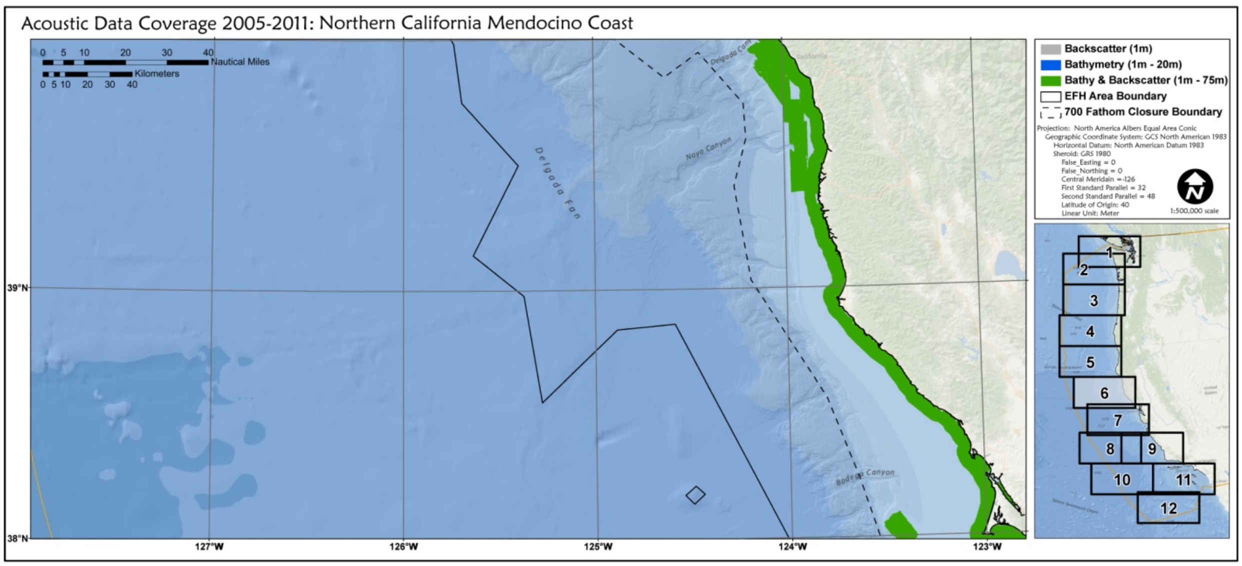


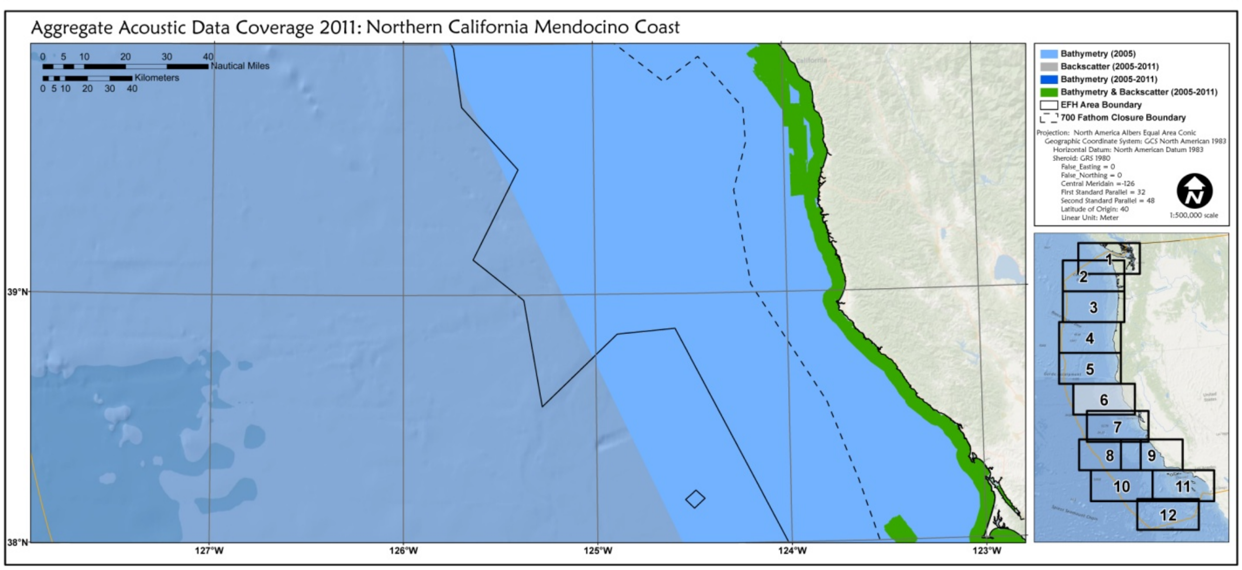




Appendix C-1: Imagery



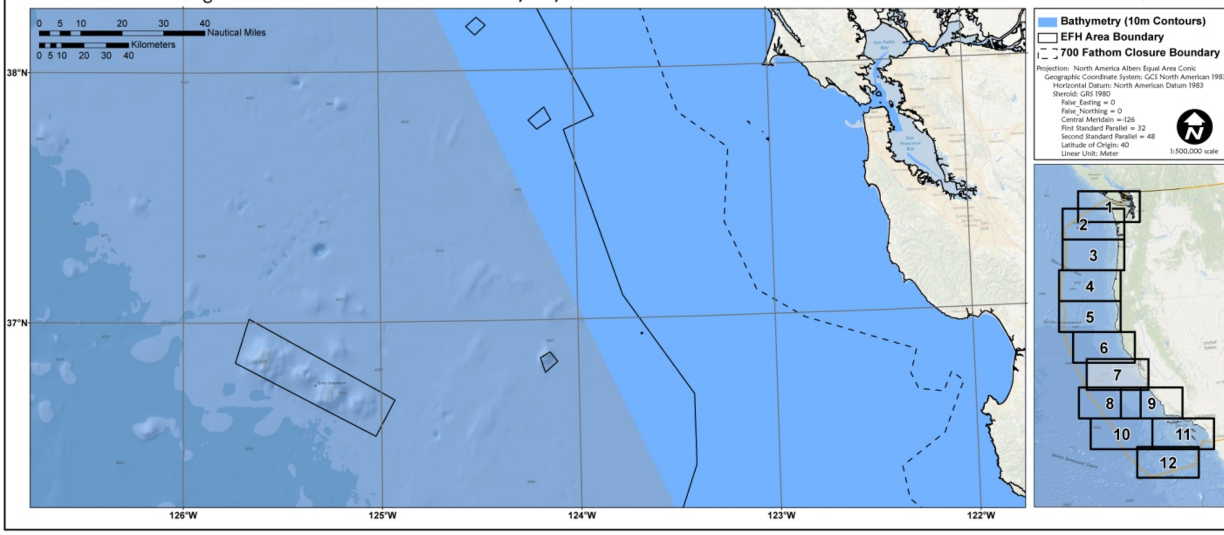




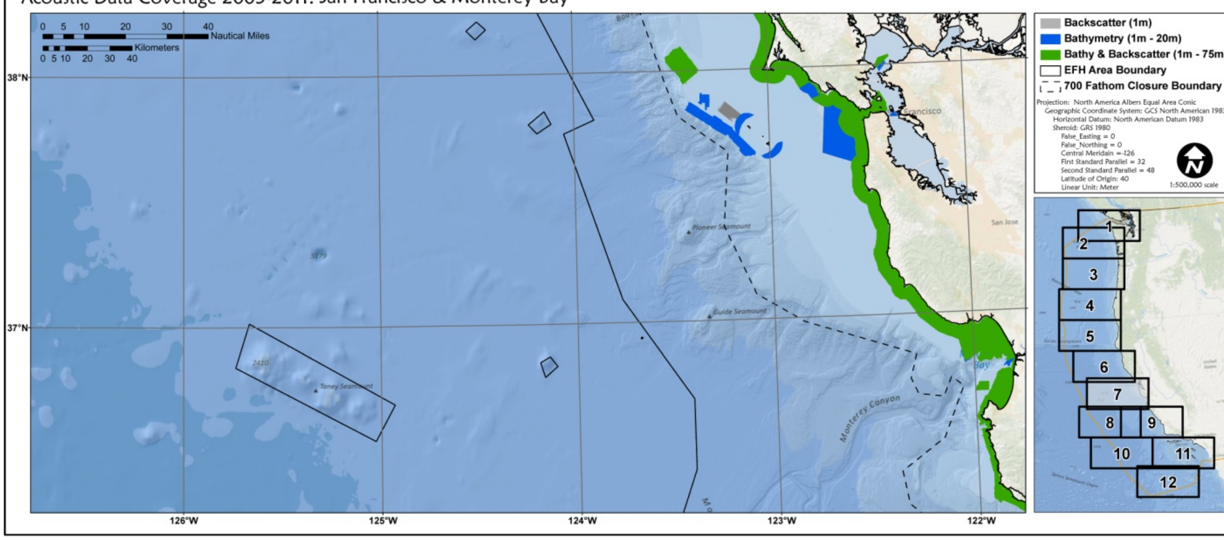
Appendix C-1: Imagery

Acoustic Data Coverage Pre 2005: San Francisco & Monterey Bay

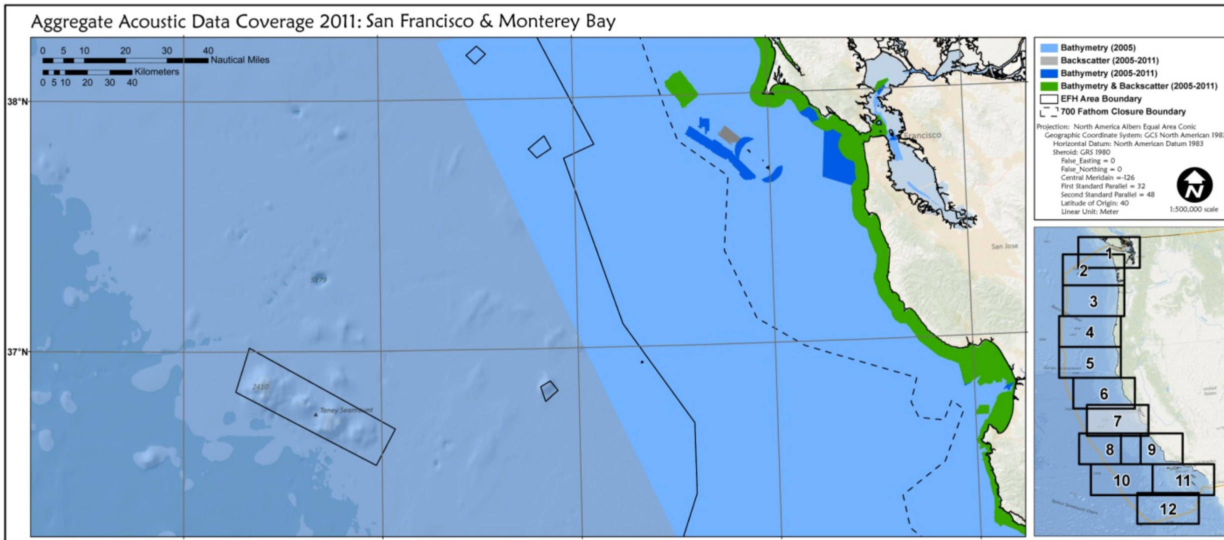
Map Plate 7 of 12



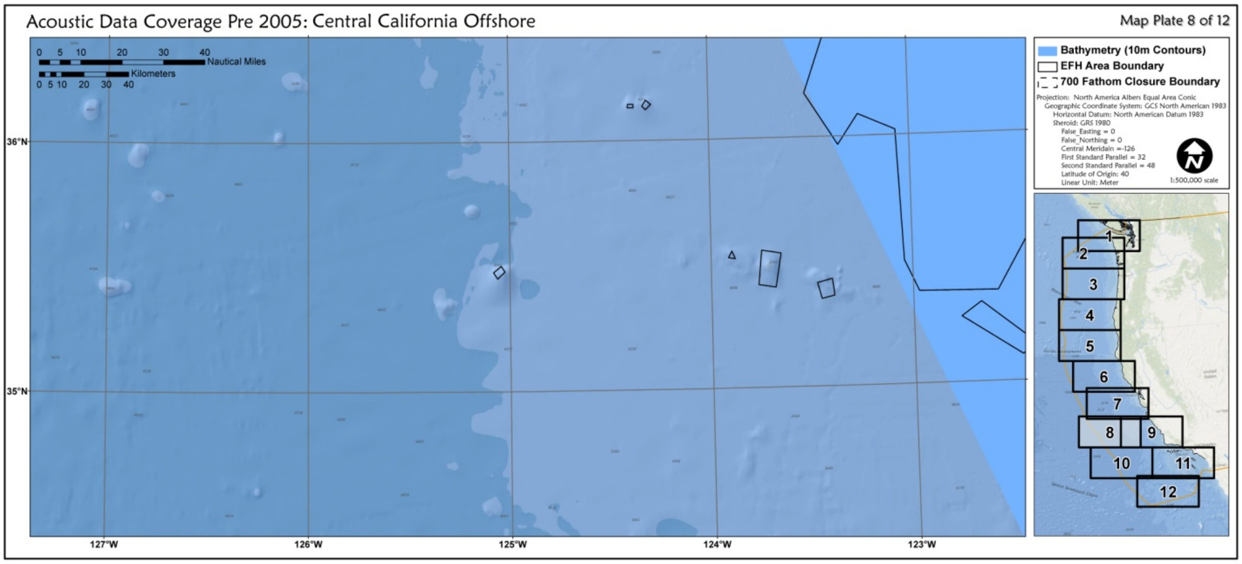
Acoustic Data Coverage 2005-2011: San Francisco & Monterey Bay

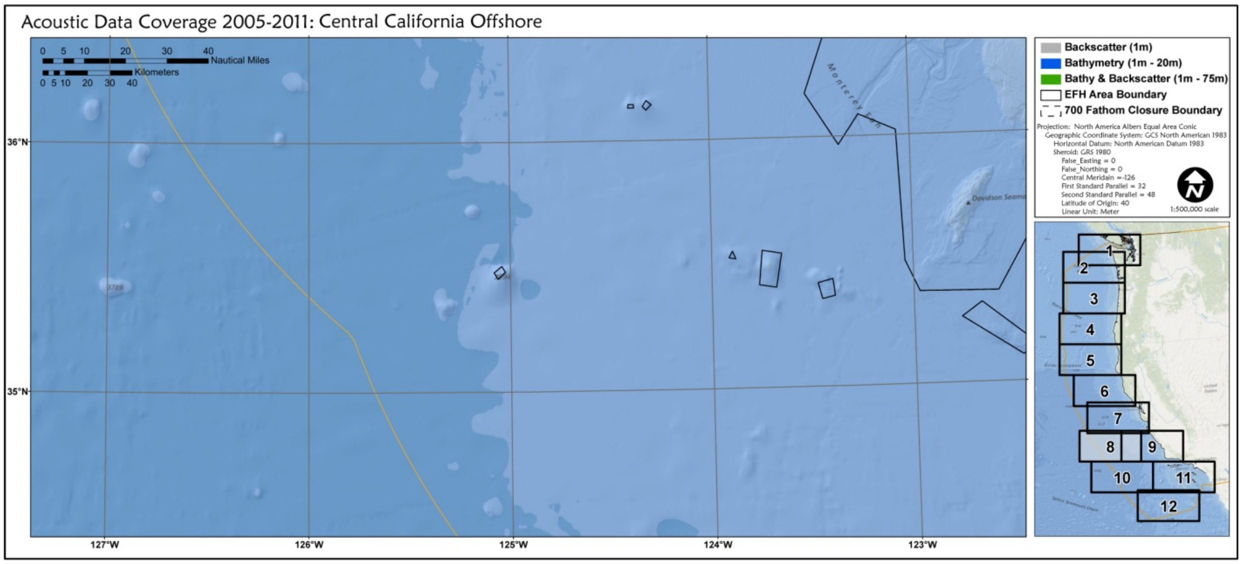


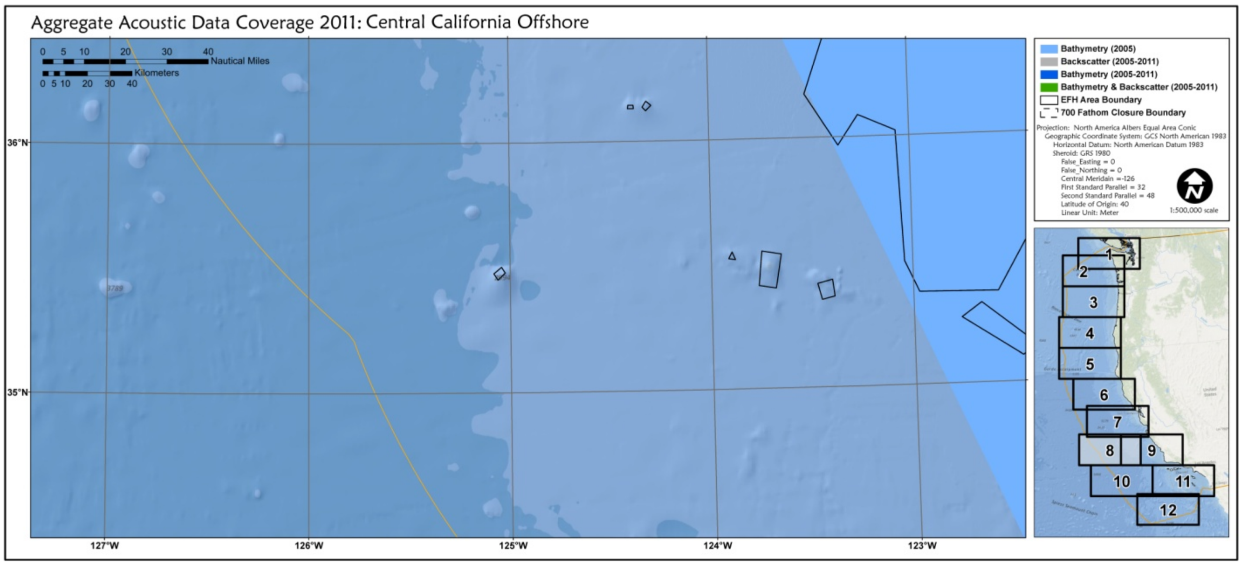
Aggregate Acoustic Data Coverage 2011: San Francisco & Monterey Bay



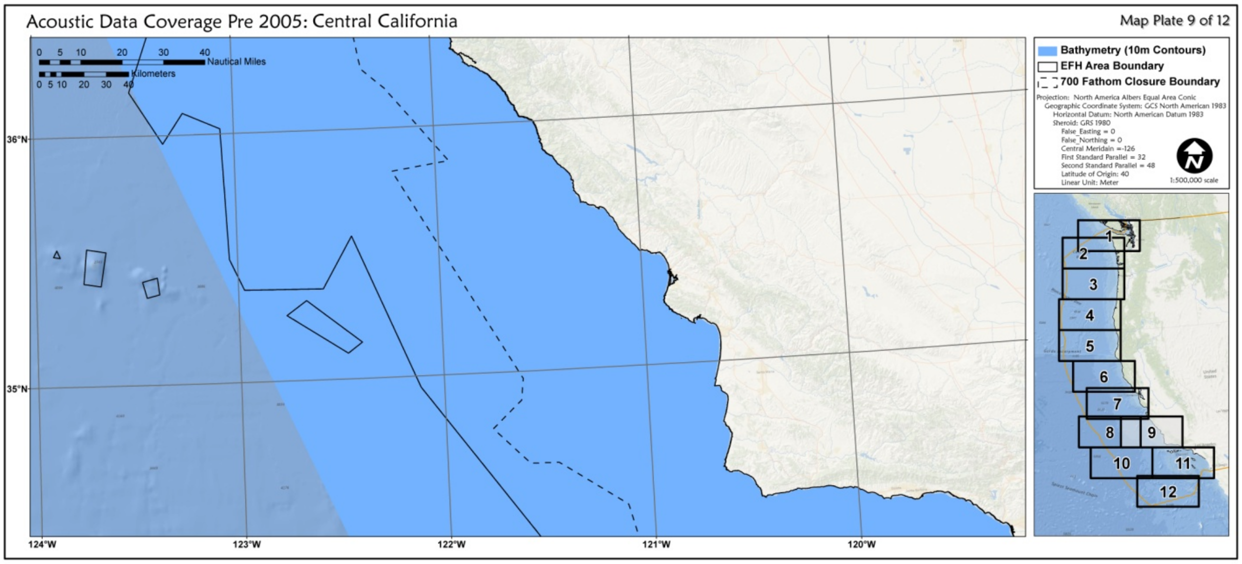
Appendix C-1: Imagery



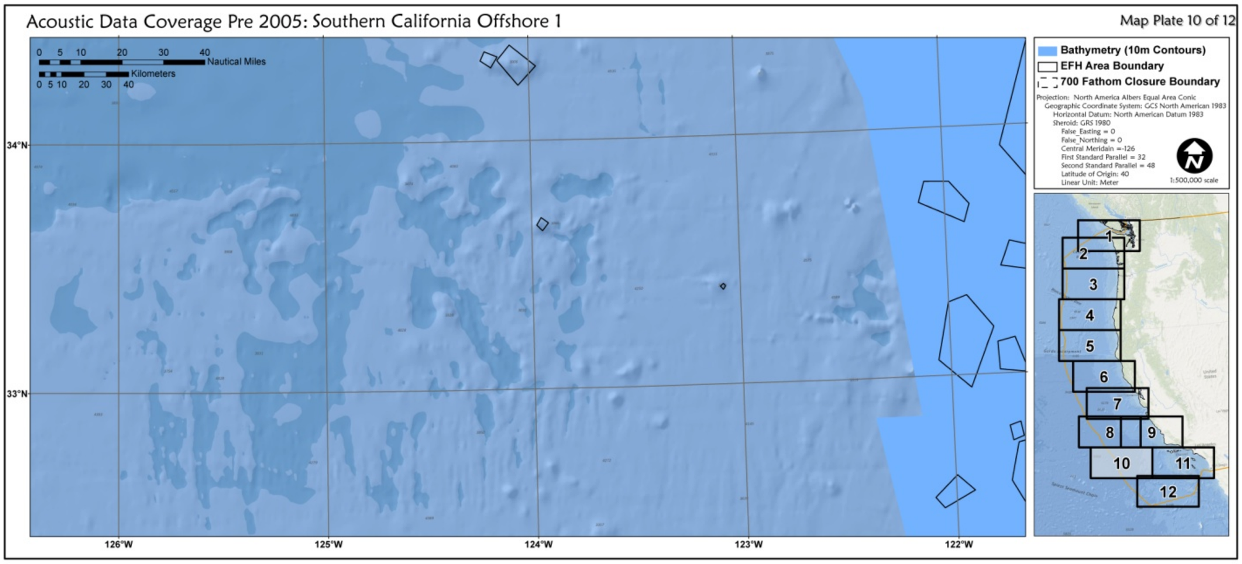


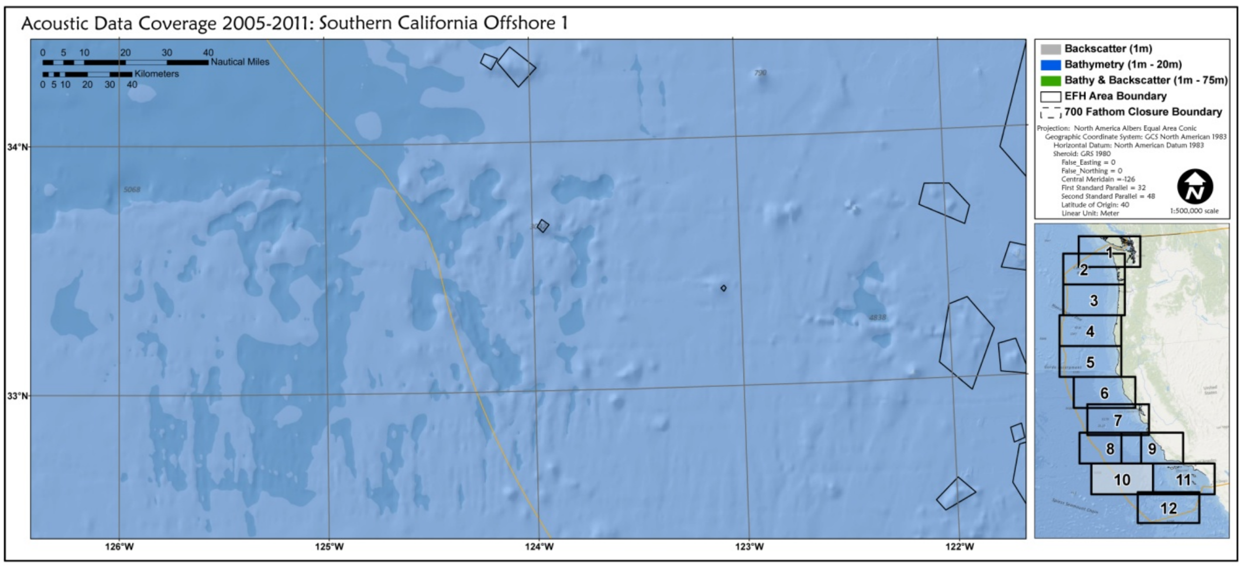


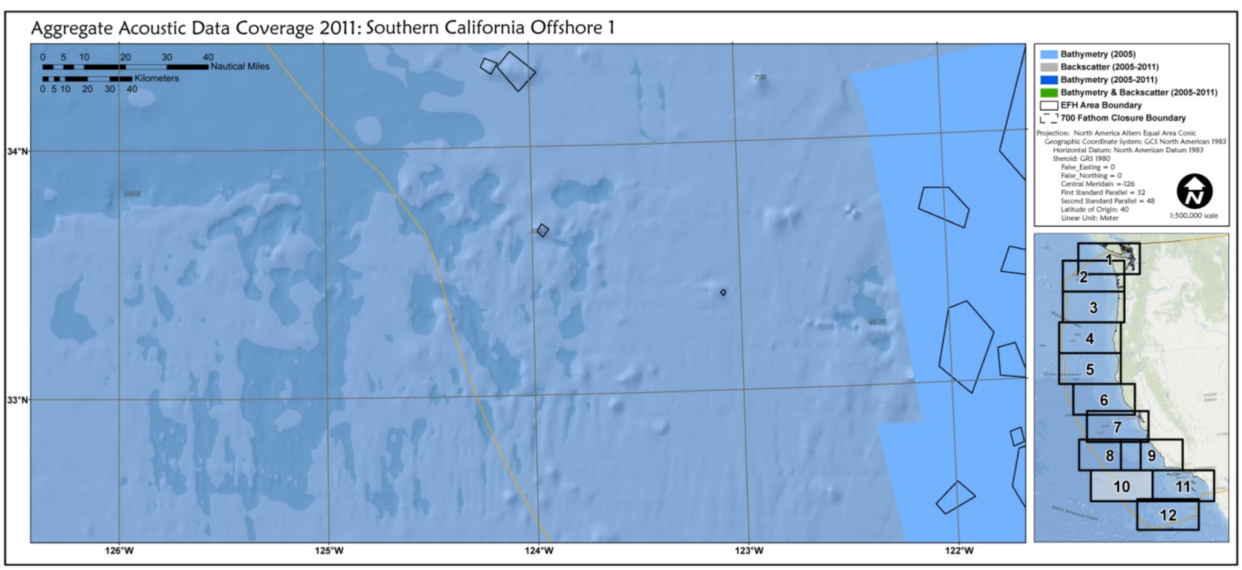
Appendix C-1: Imagery



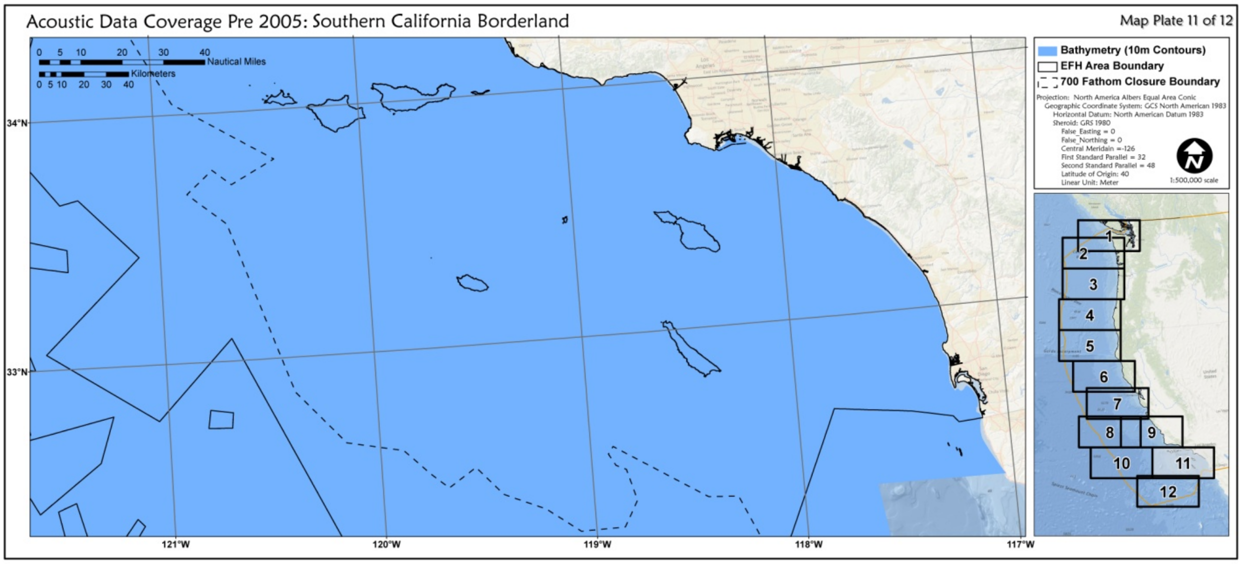
Appendix C-1: Imagery

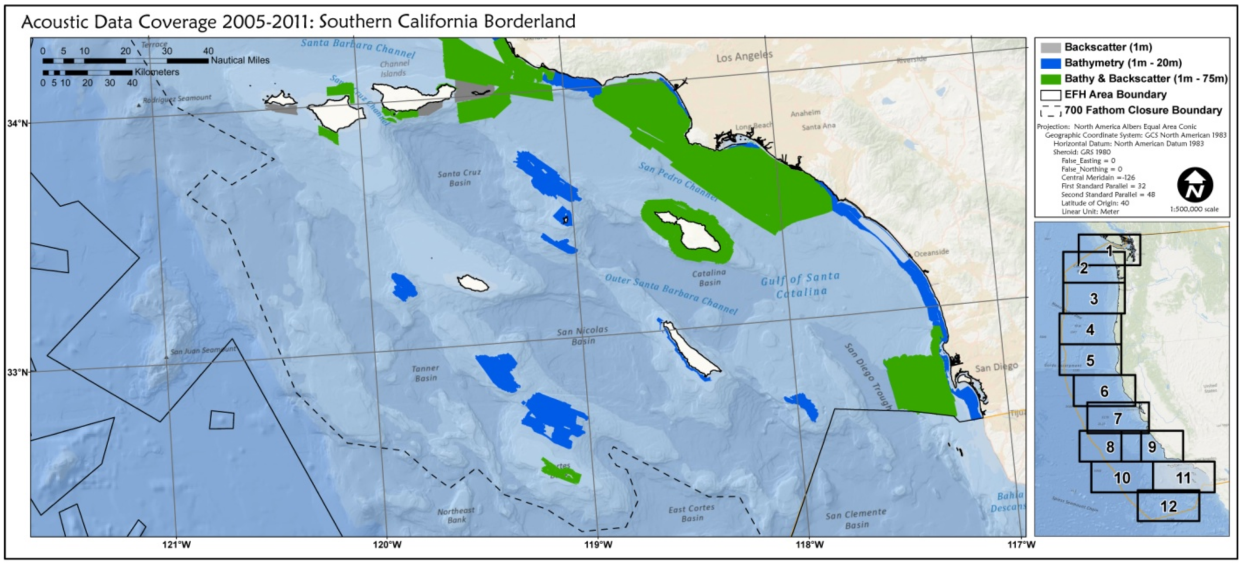


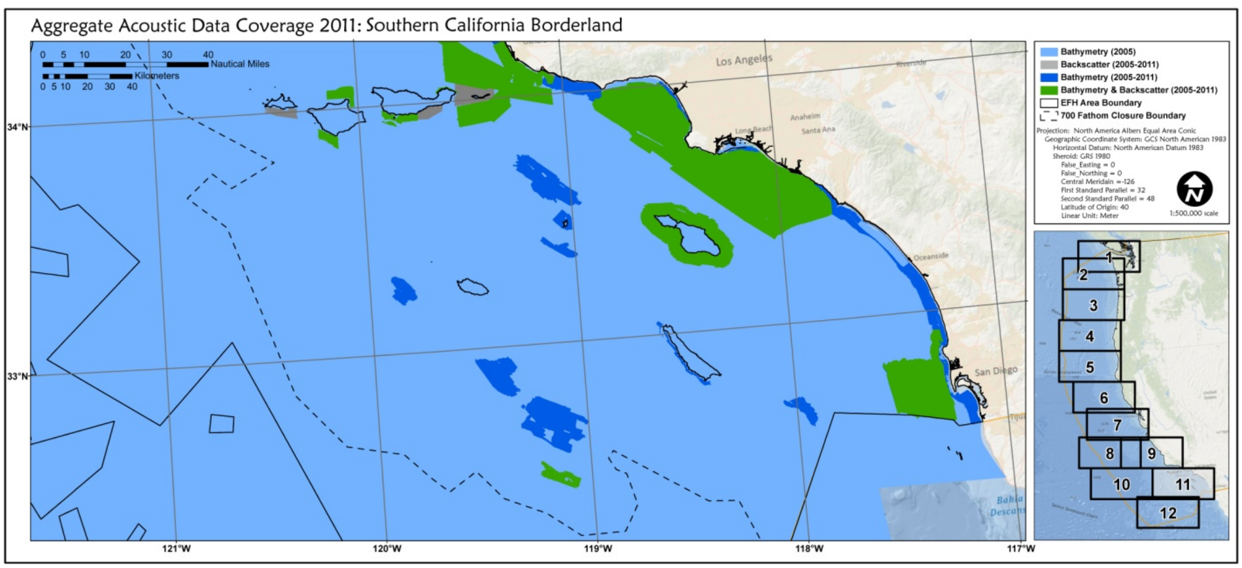




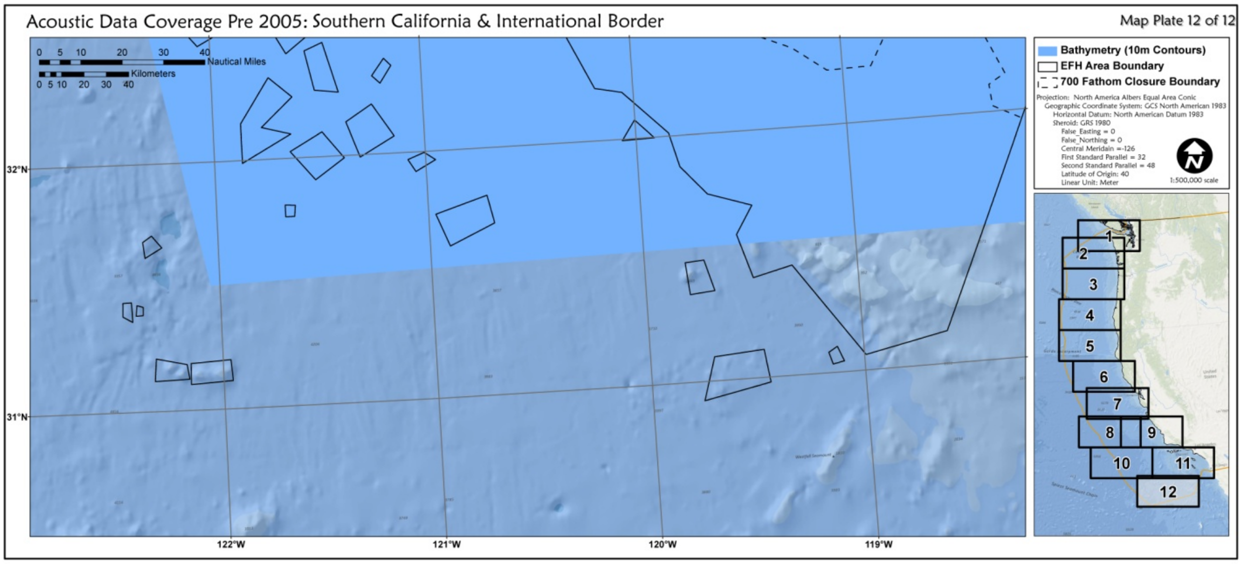
Appendix C-1: Imagery

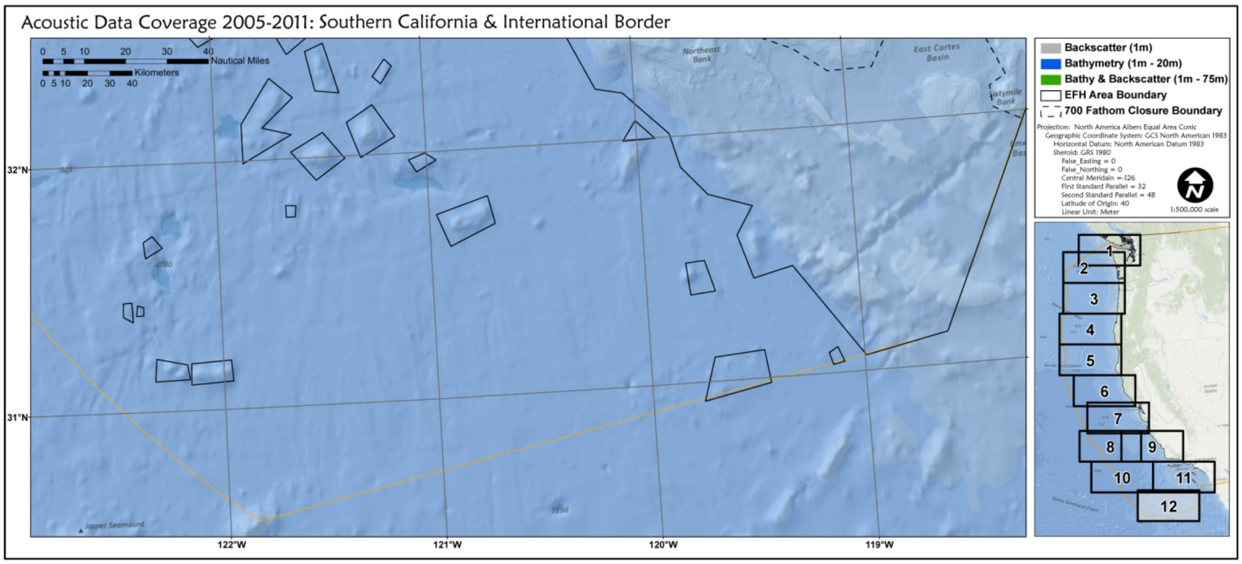


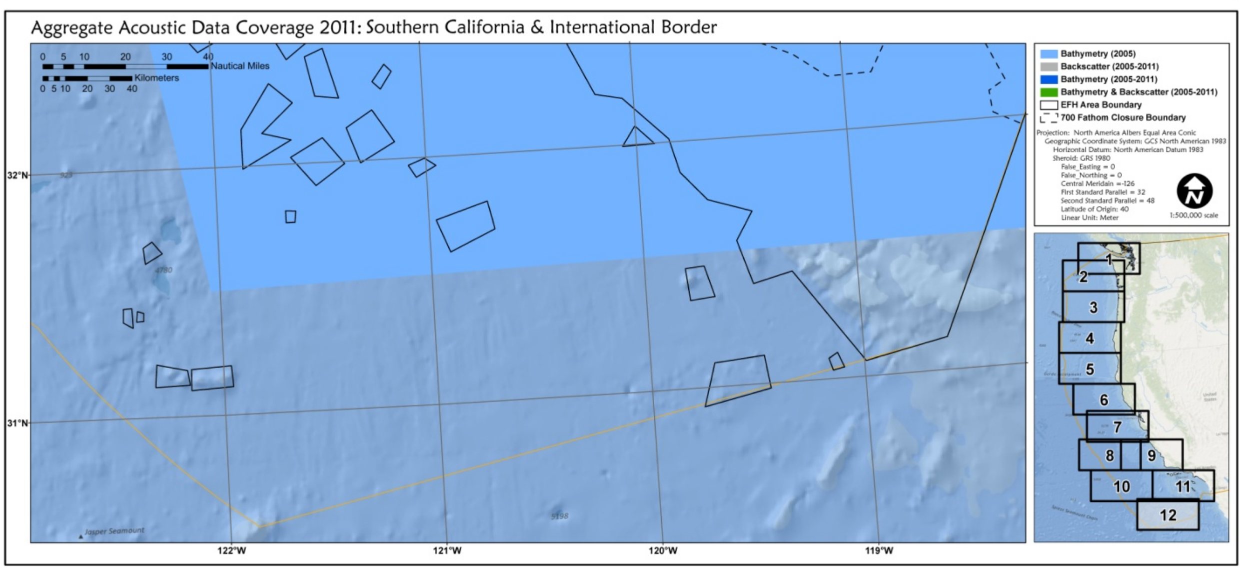




Appendix C-1: Imagery

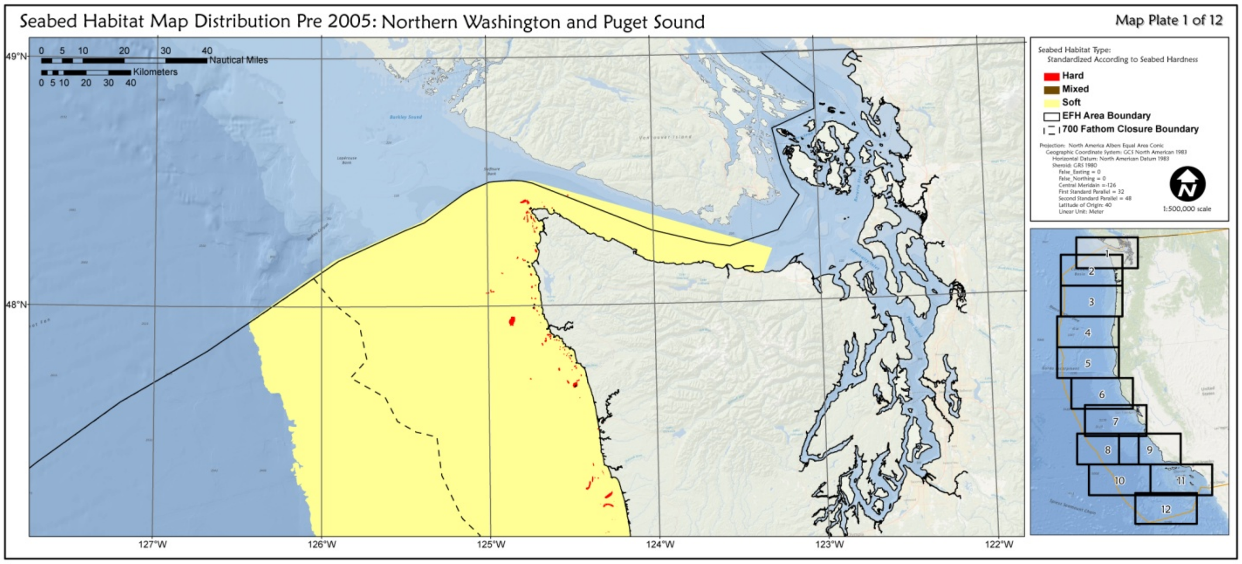


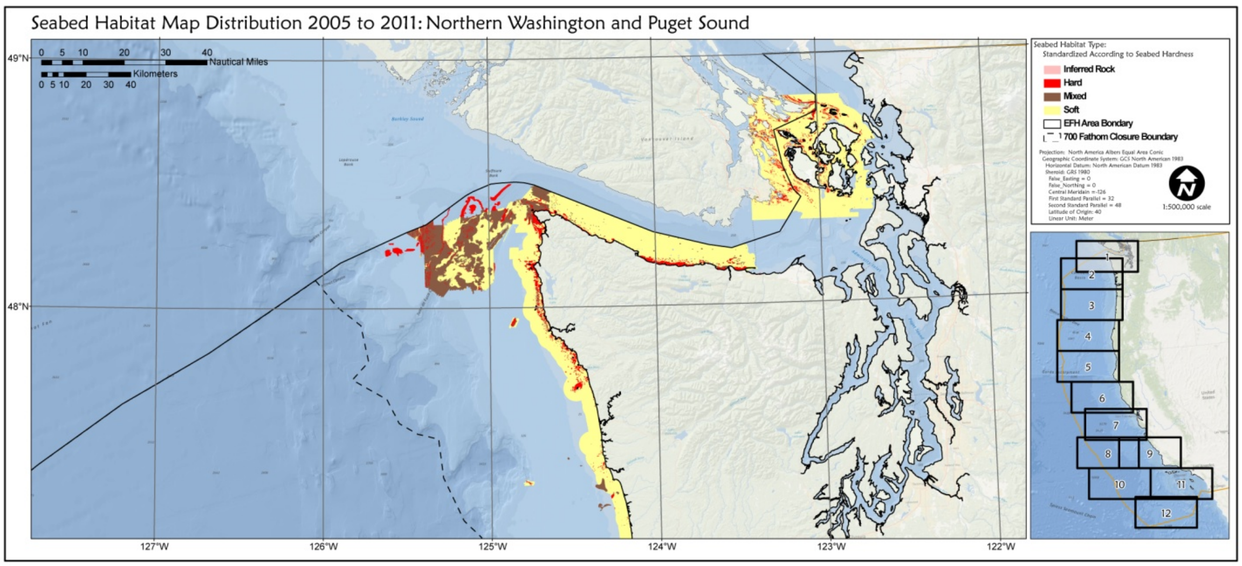


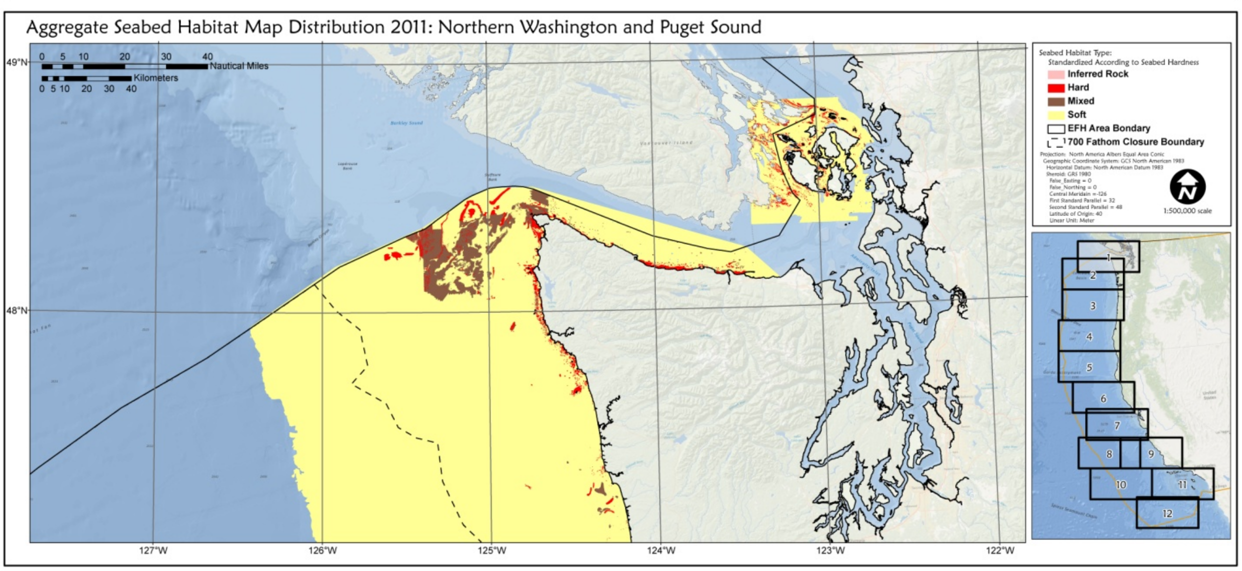


Apendix C-2: Substrate

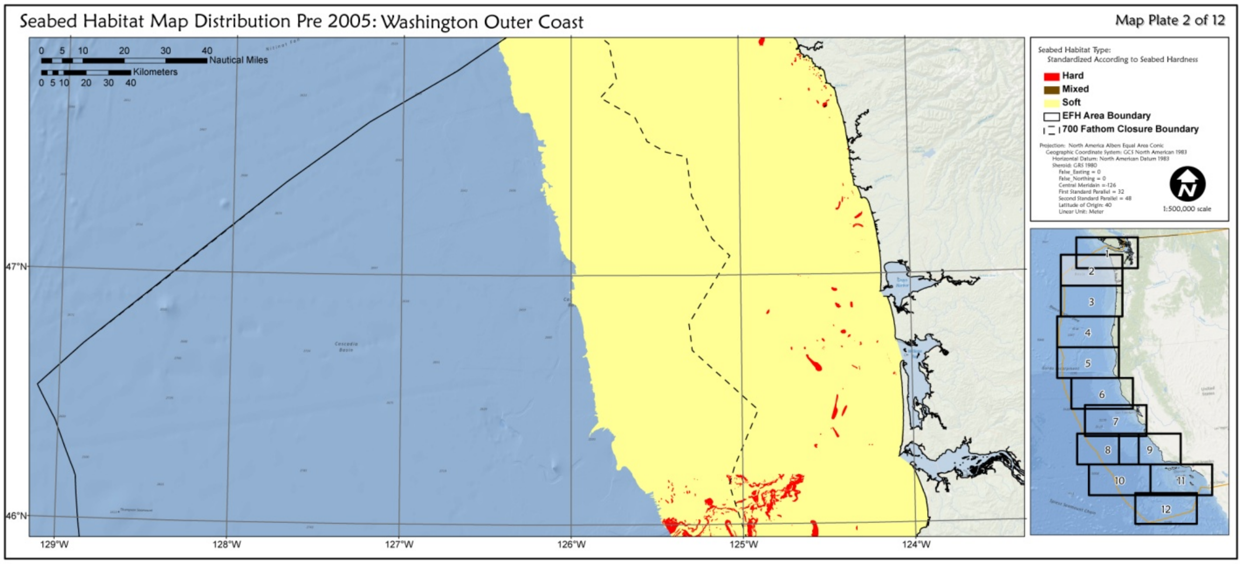
Apendix C-2: Substrate

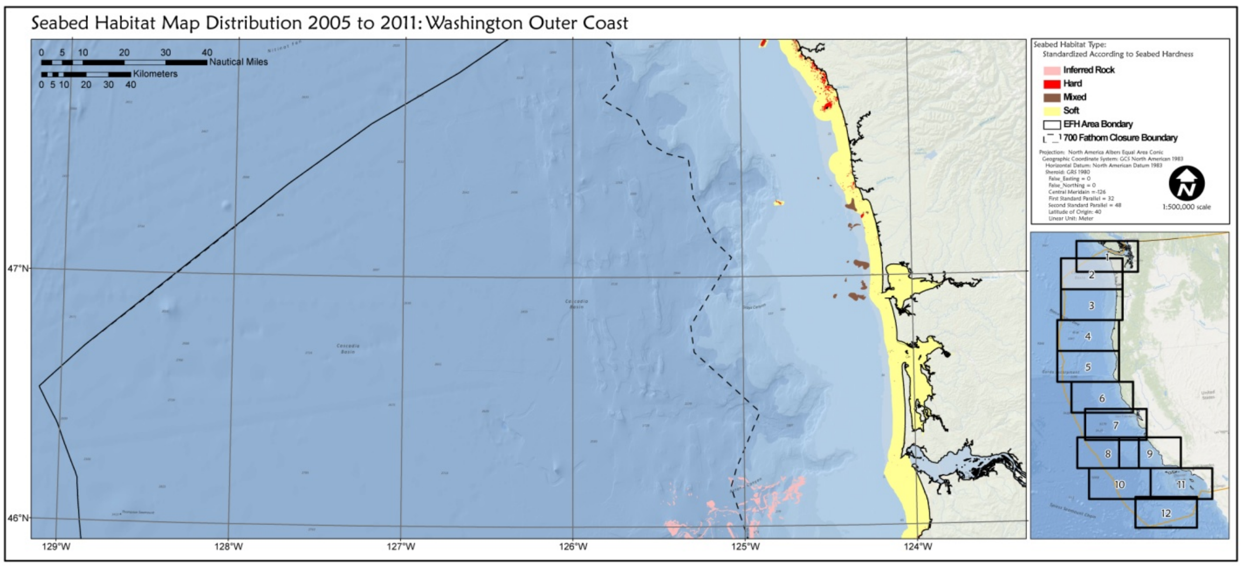


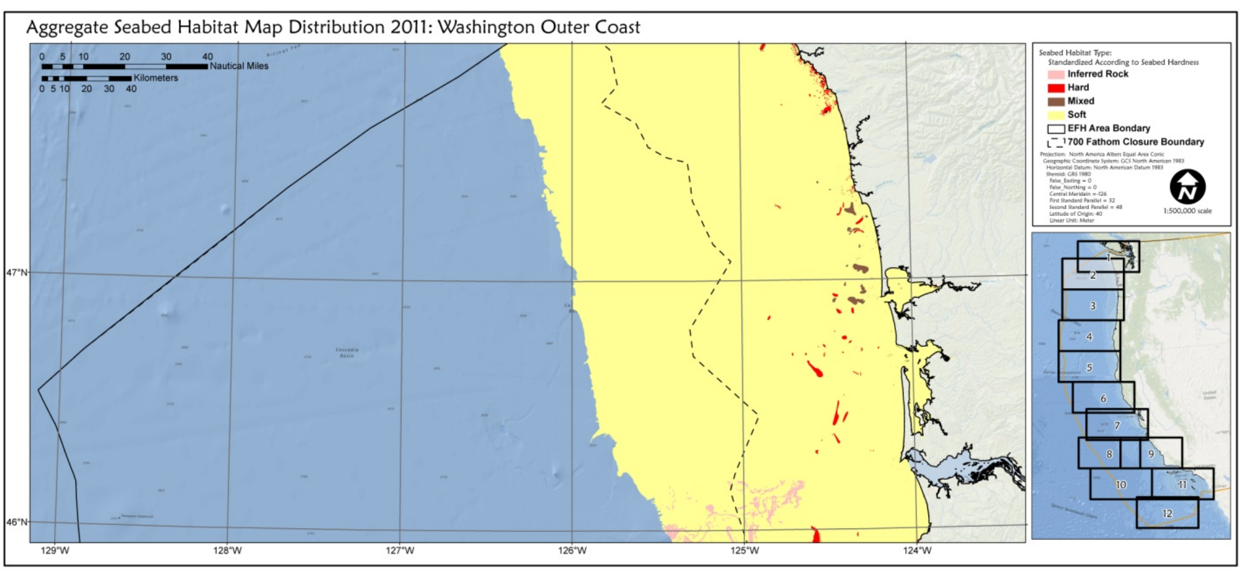




Apendix C-2: Substrate







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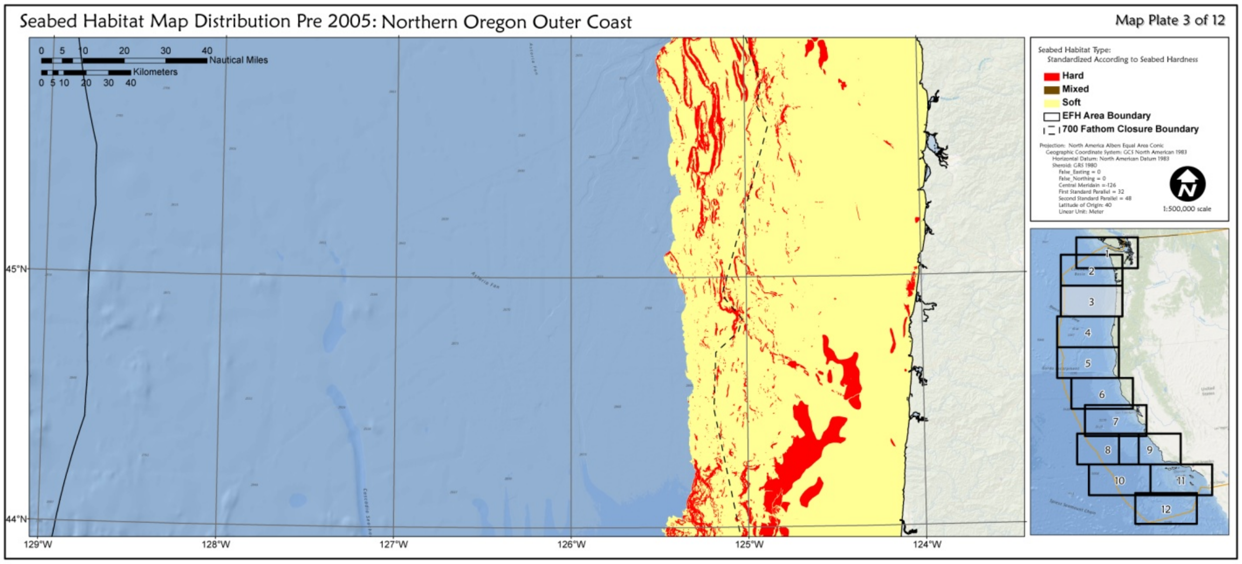
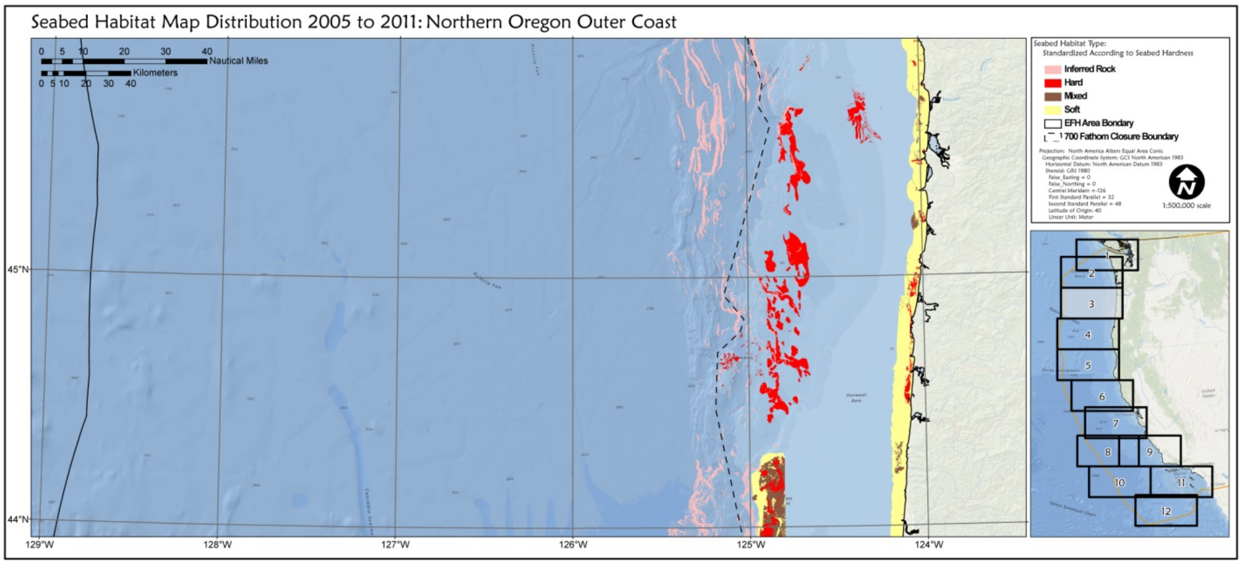
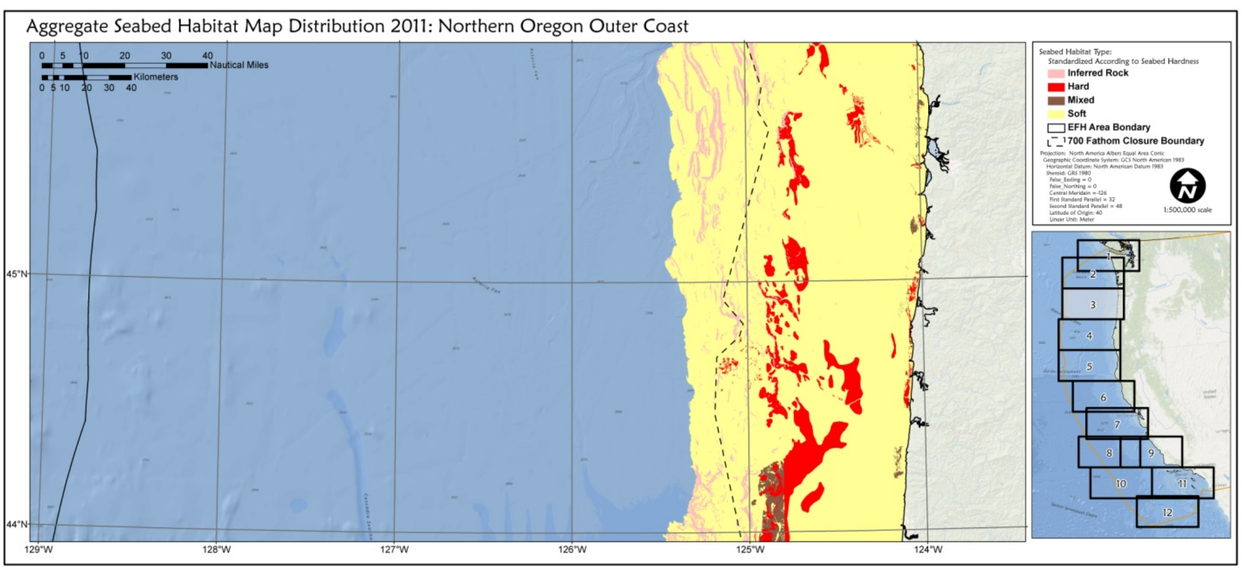
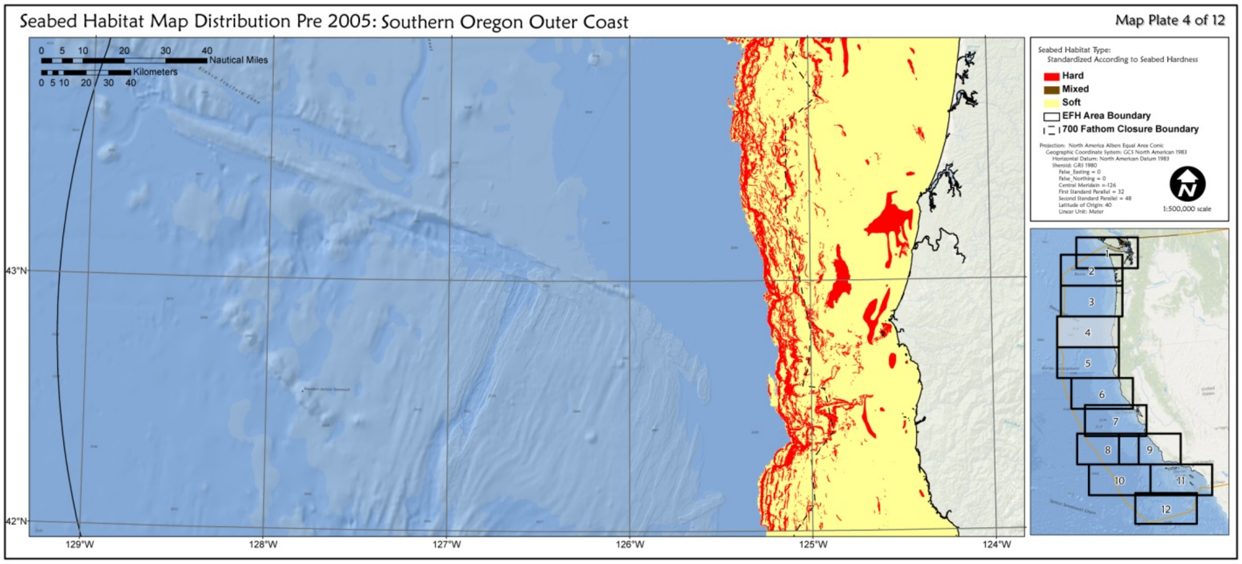
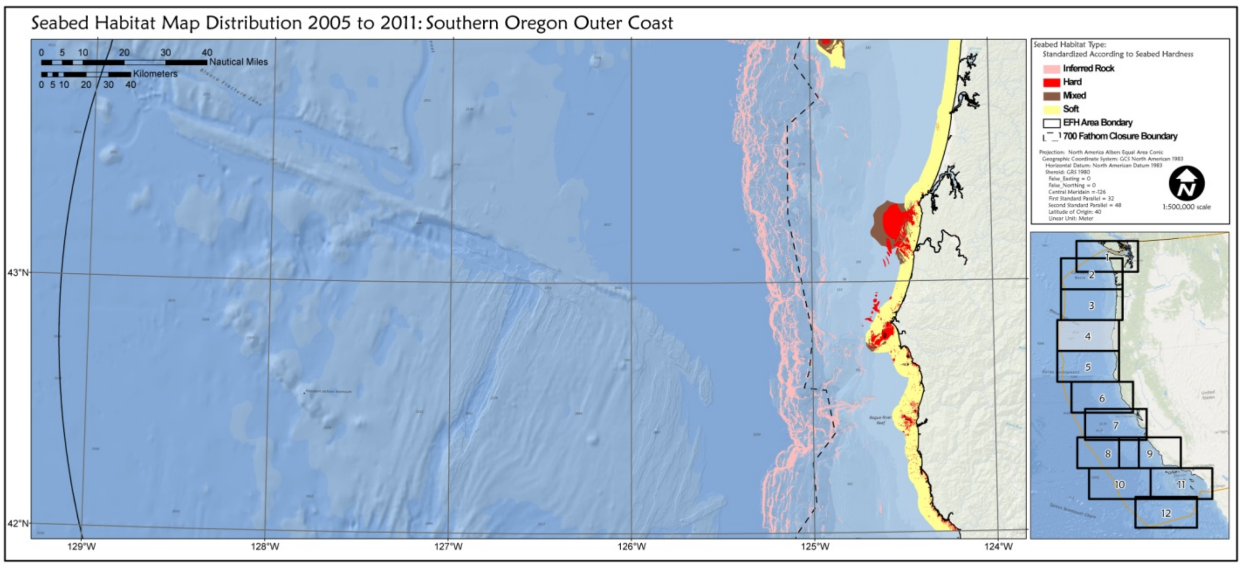


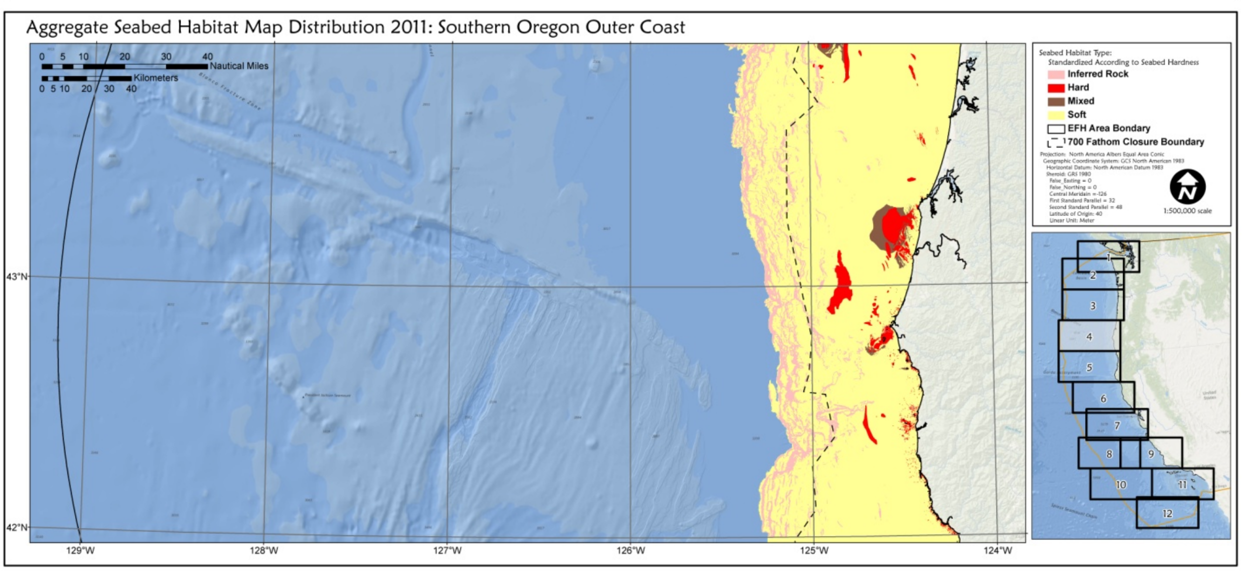




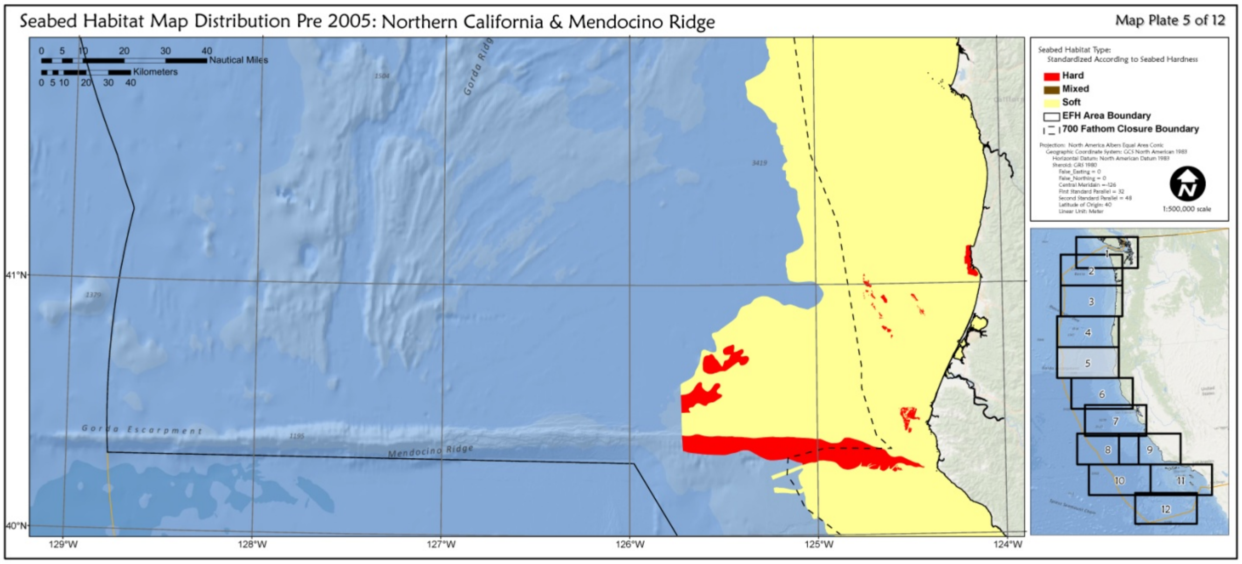
Apendix C-2: Substrate

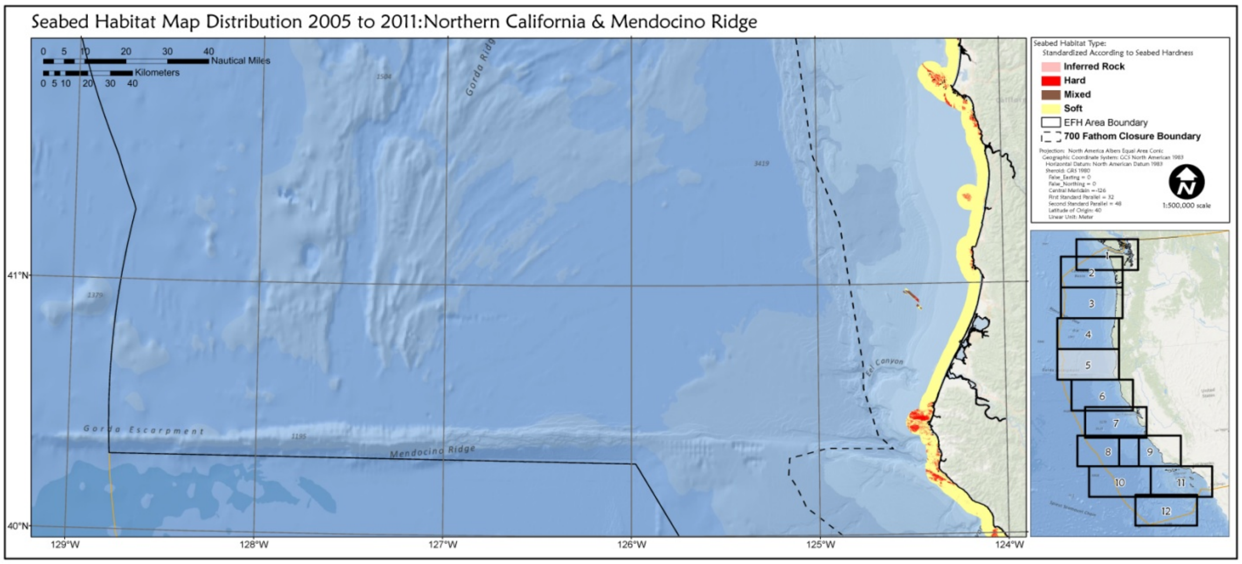


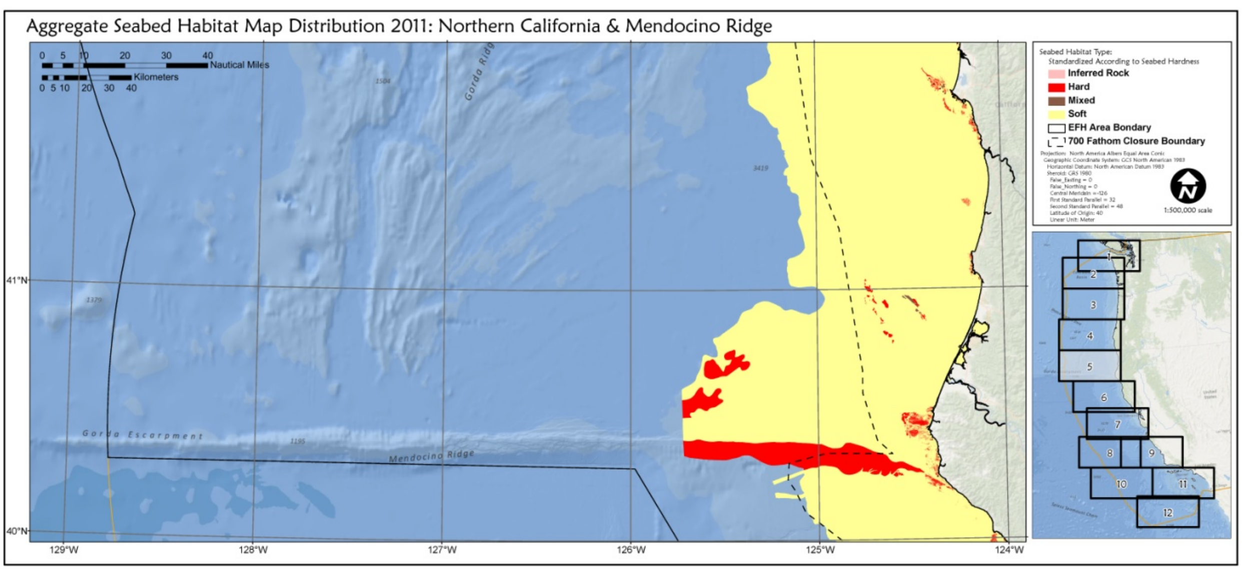




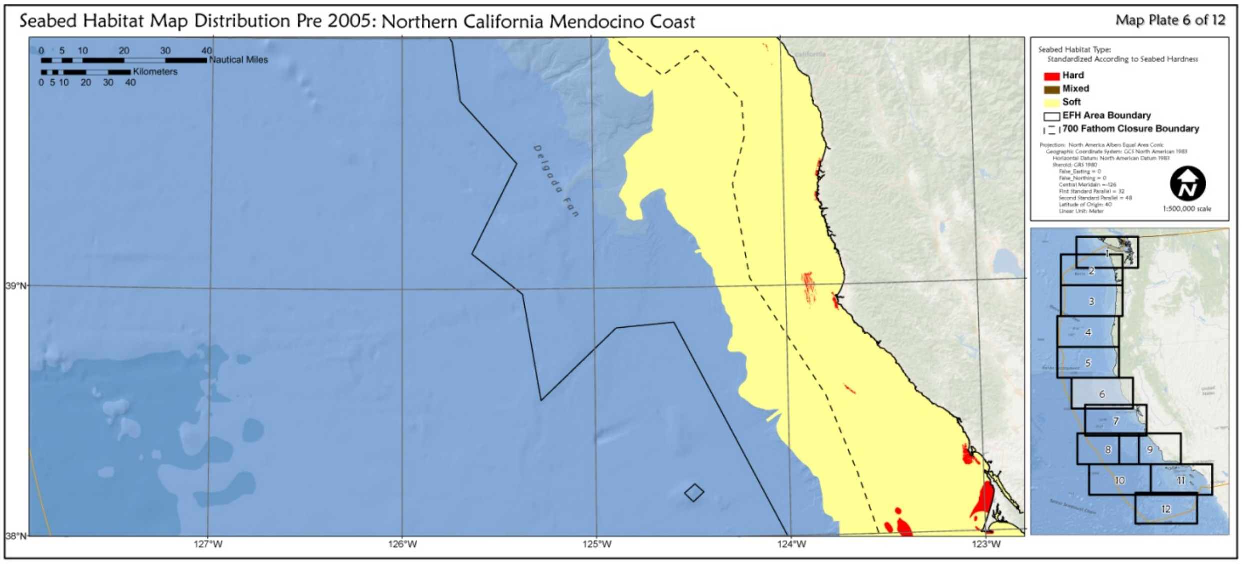
Apendix C-2: Substrate



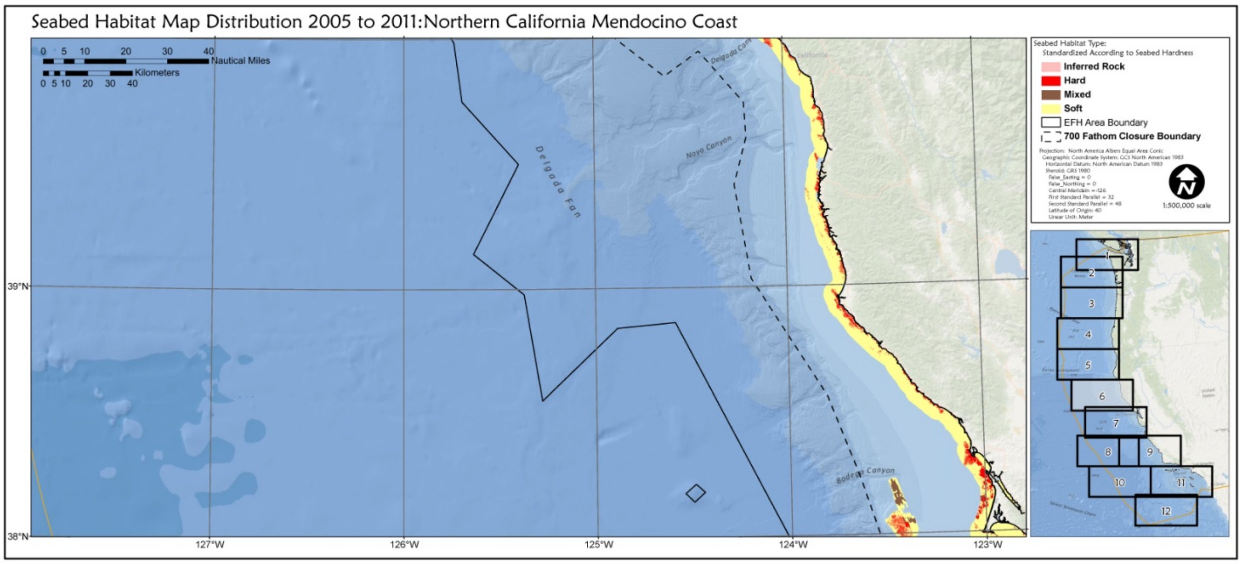




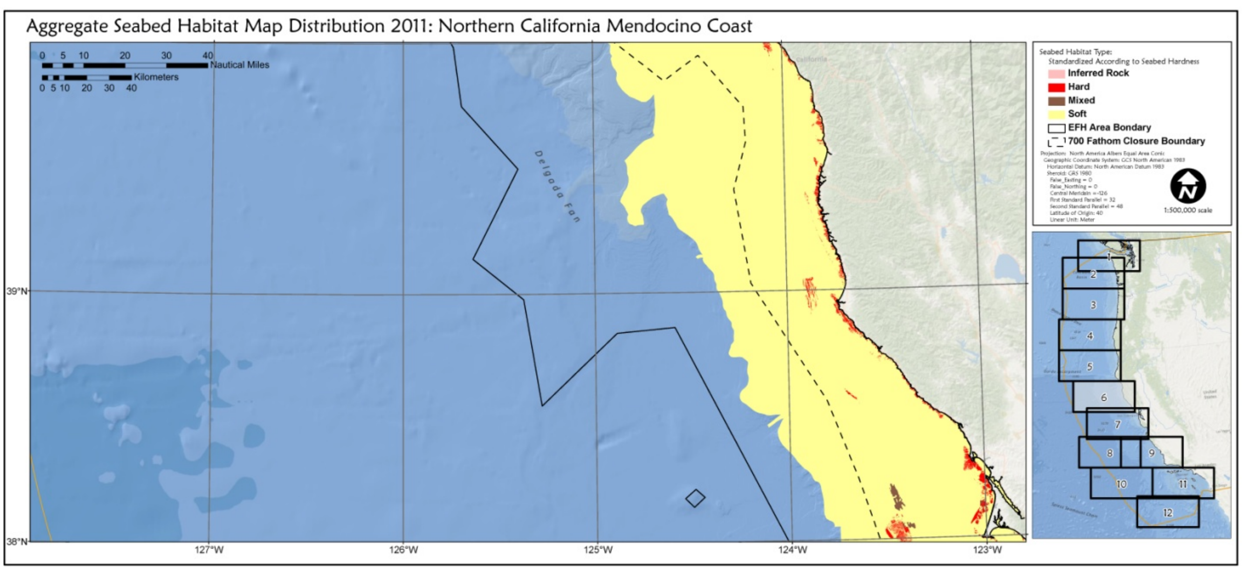
Apendix C-2: Substrate



Seabed Habitat Map Distribution Pre 2005: Northern California Mendocino Coast

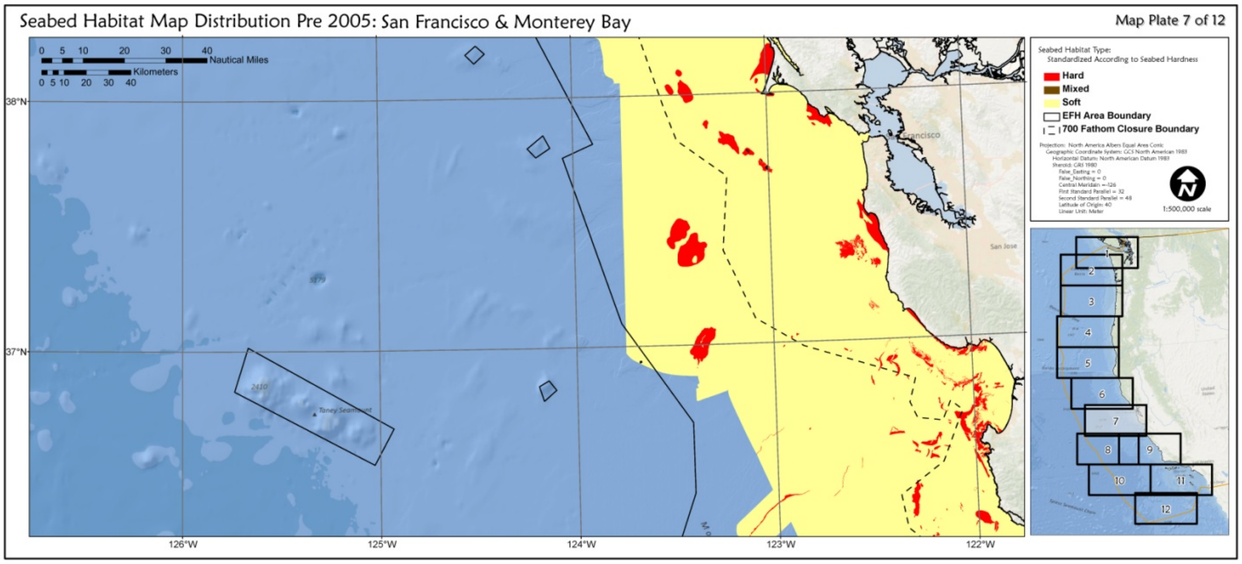


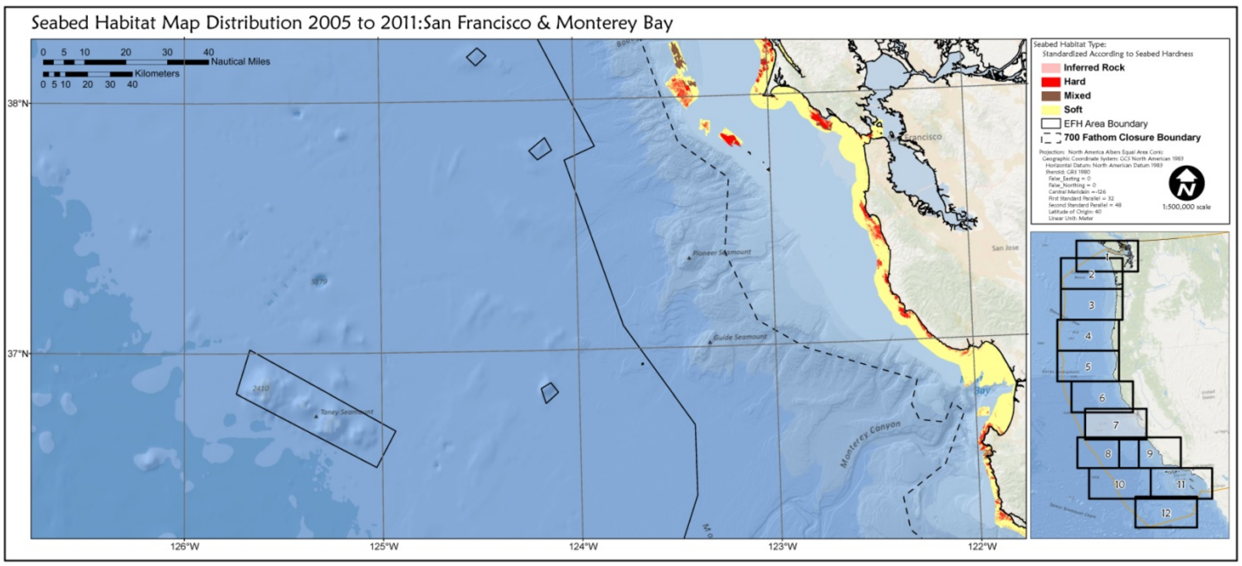
Seabed Habitat Map Distribution 2005 to 2011:Northern California Mendocino Coast

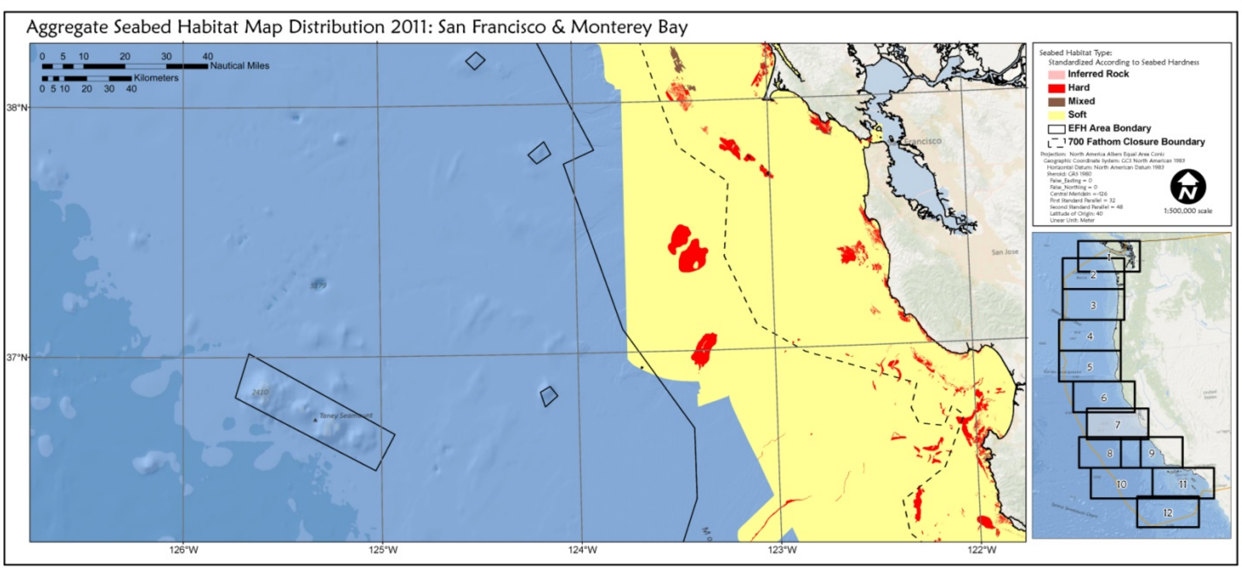


Aggregate Seabed Habitat Map Distribution 2011: Northern California Mendocino Coast

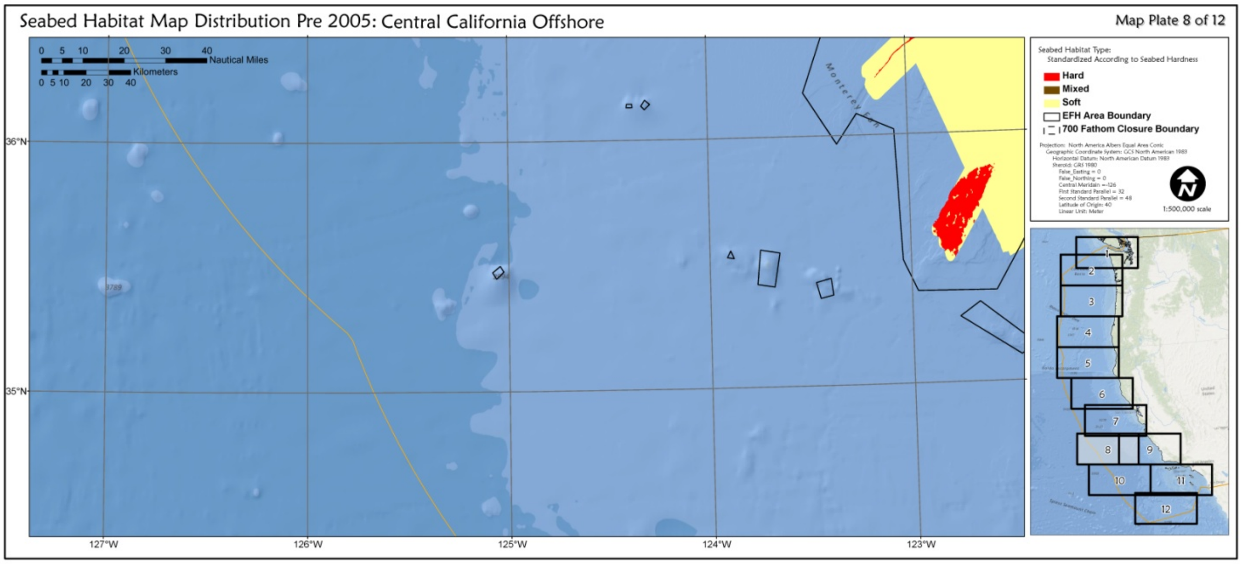
Apendix C-2: Substrate

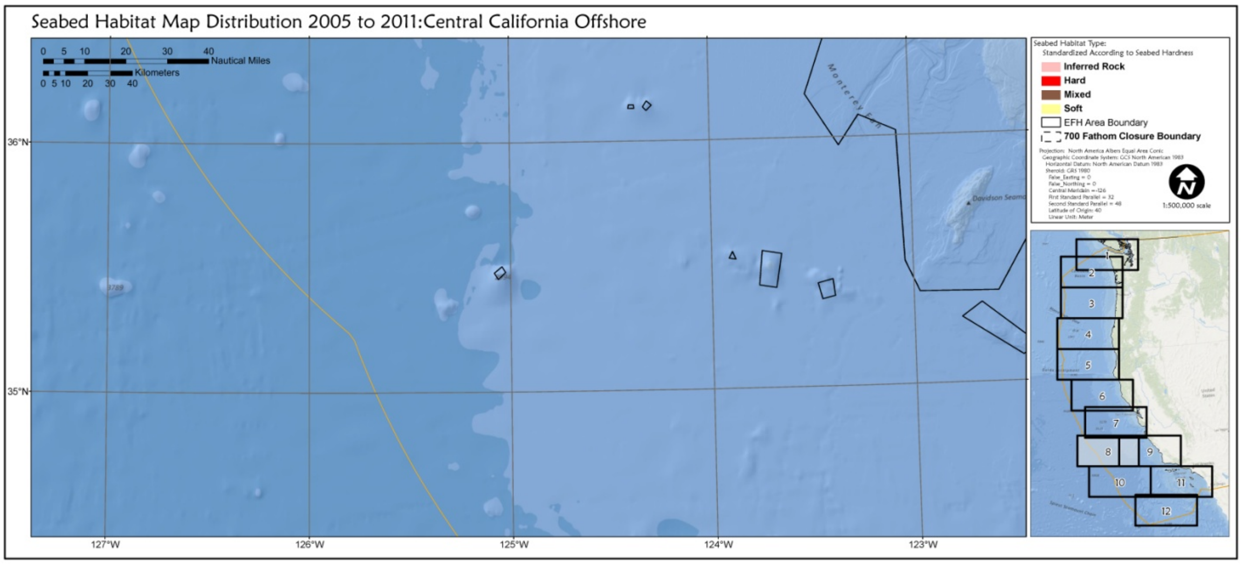


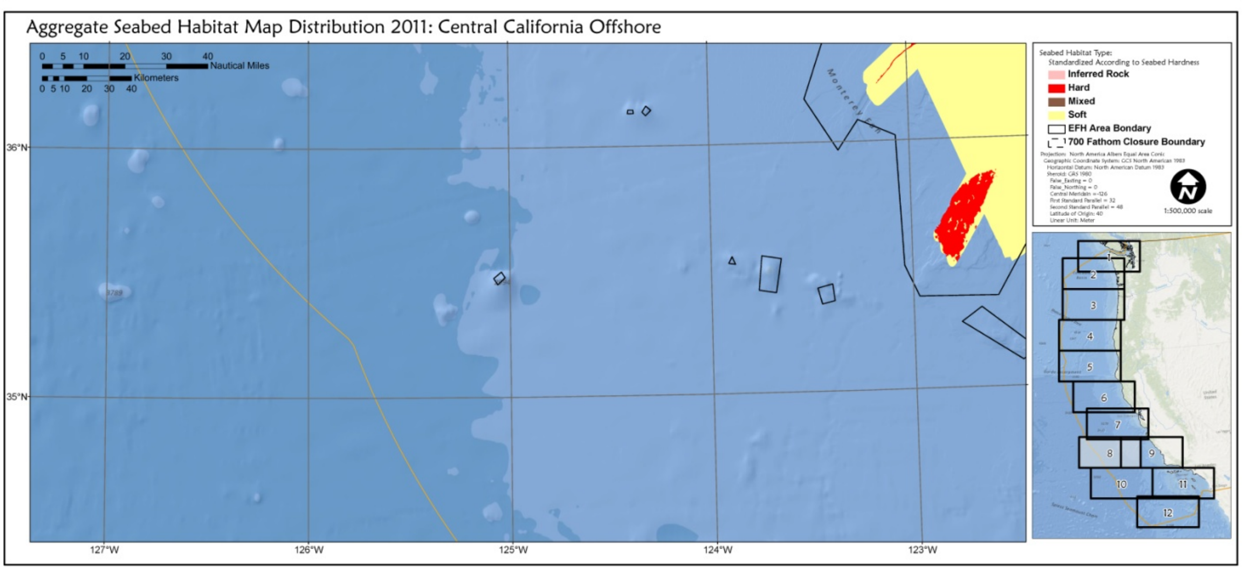




Apendix C-2: Substrate







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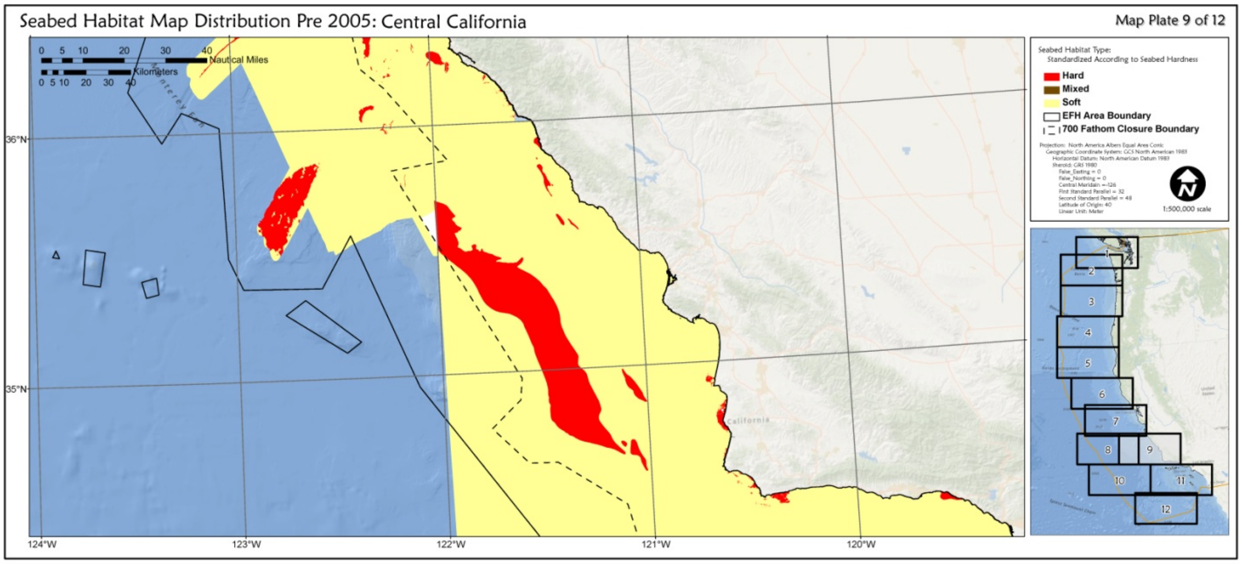

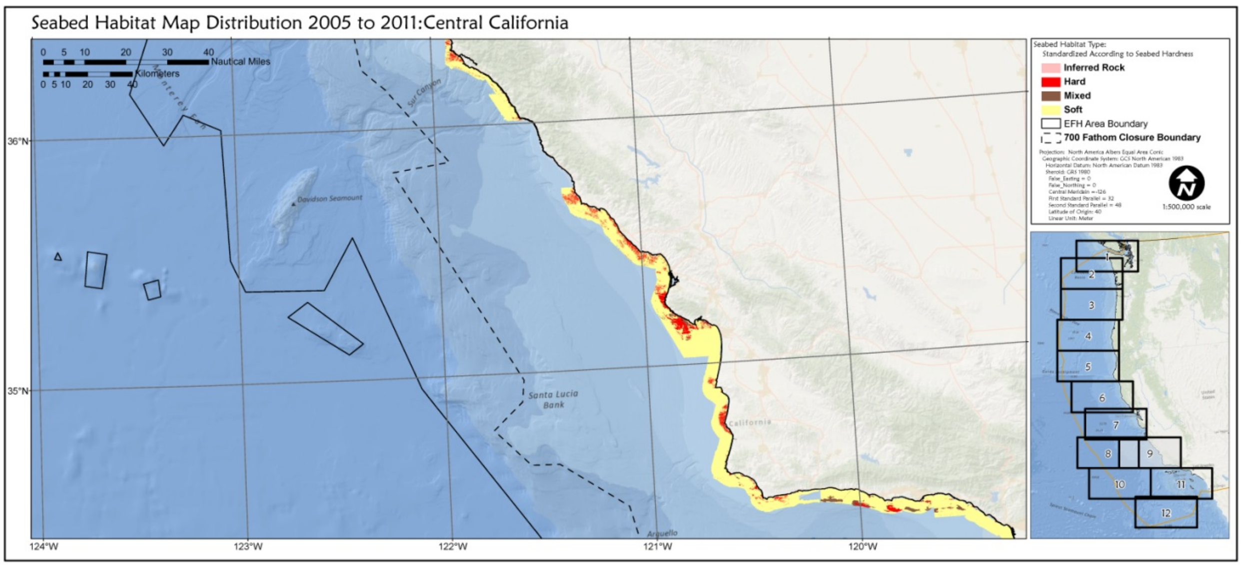

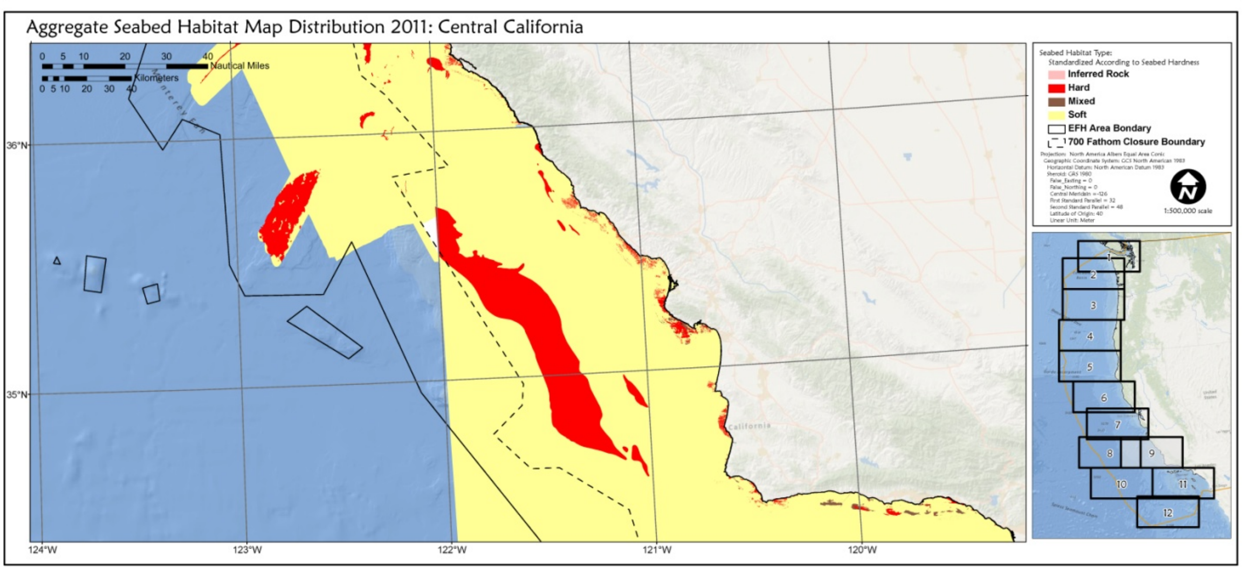

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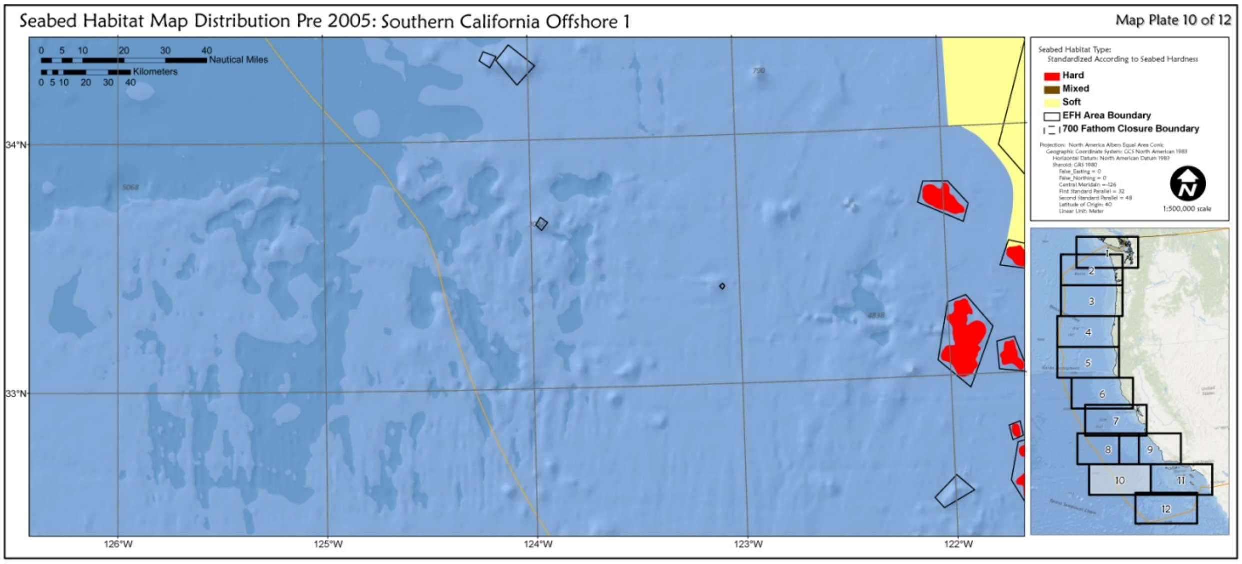

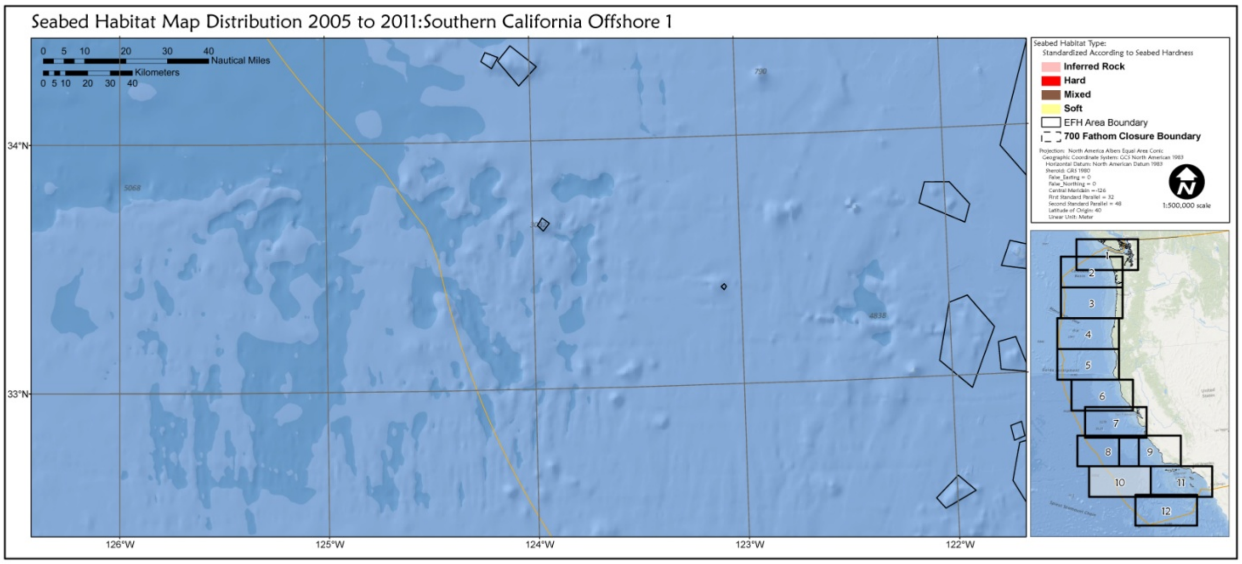

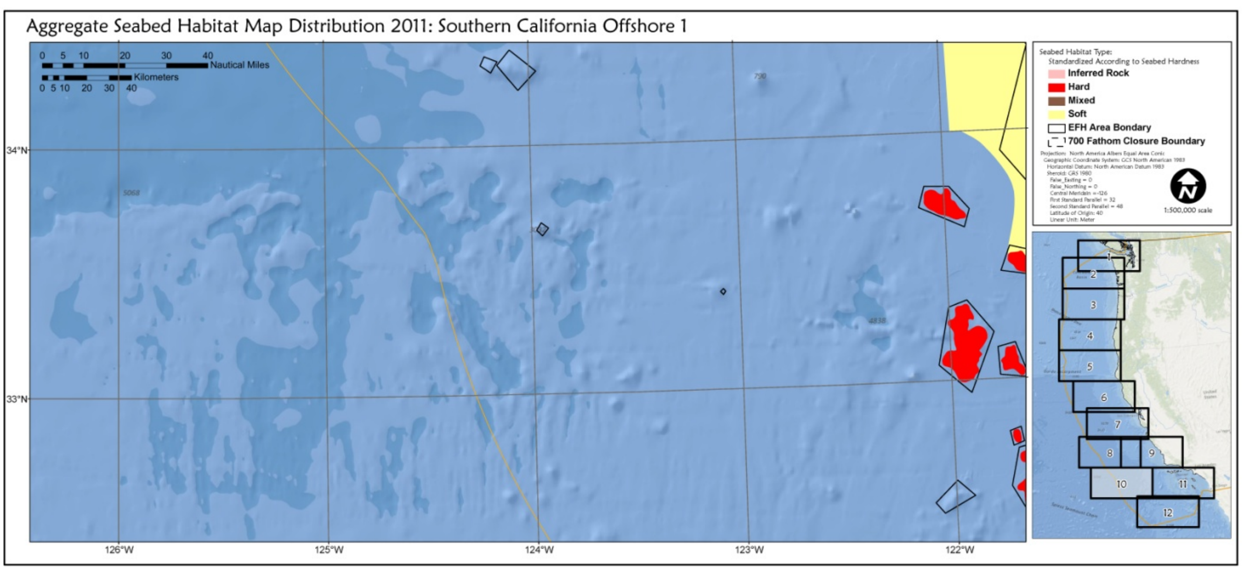

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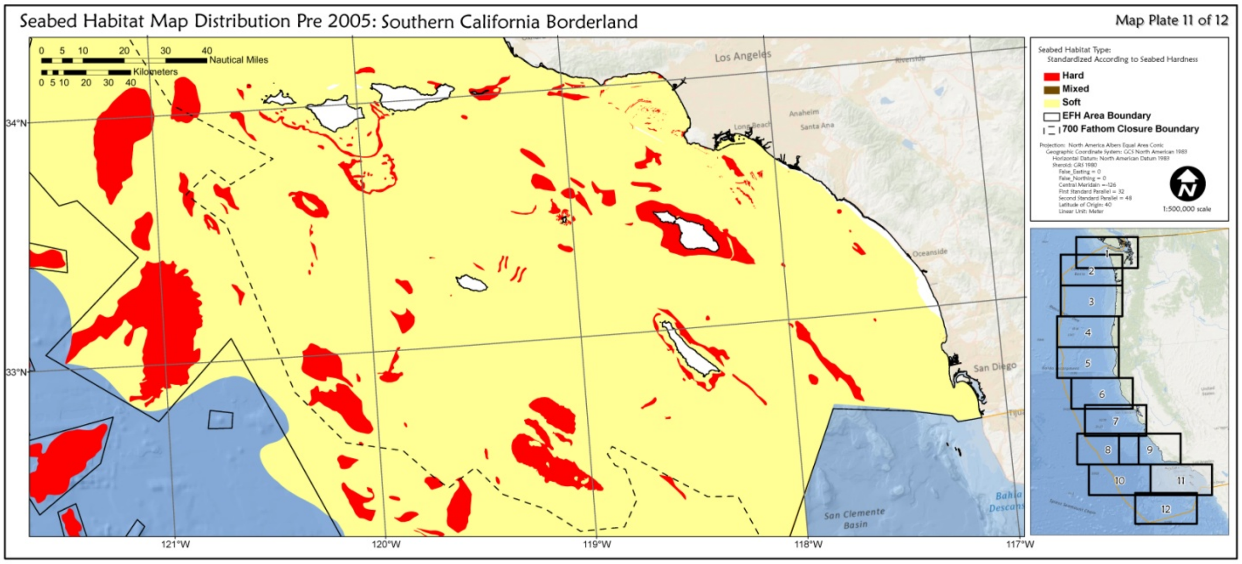
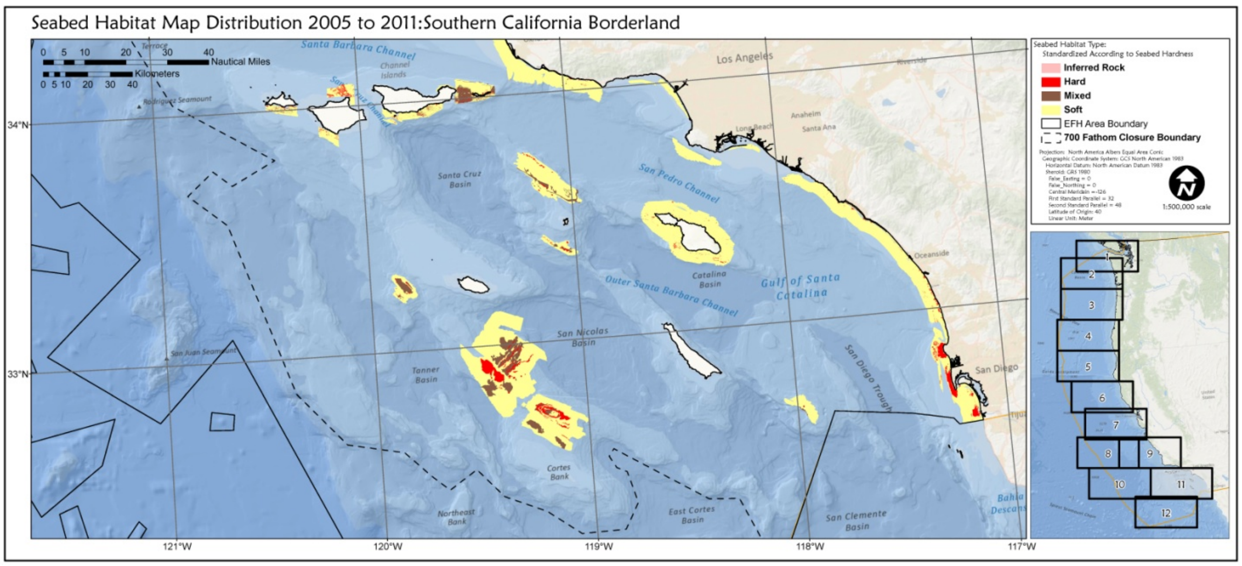
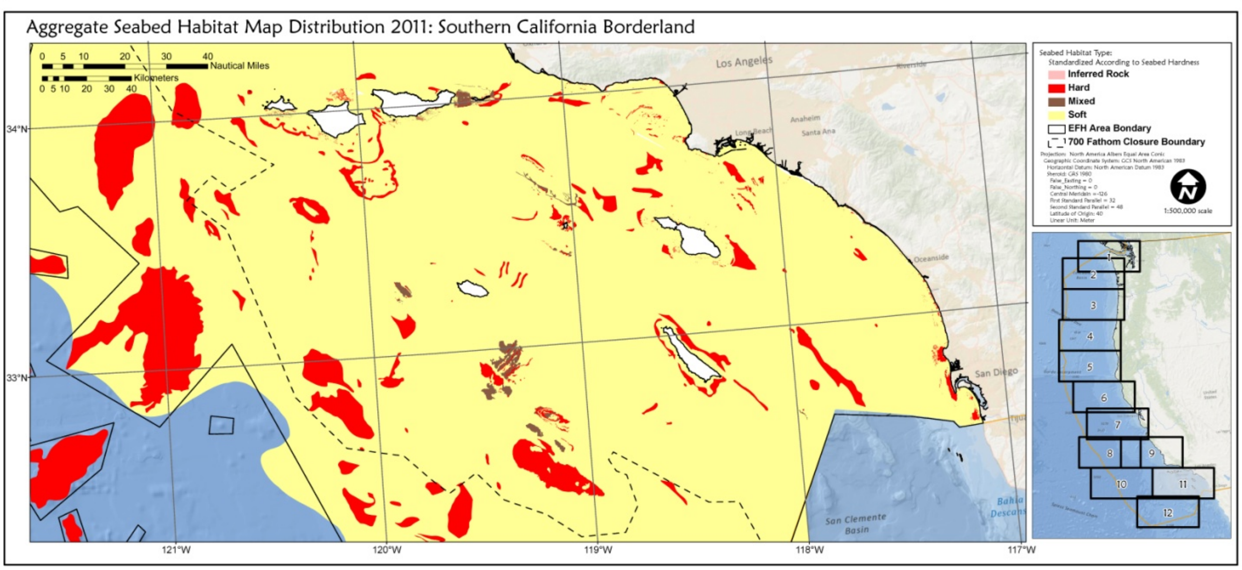
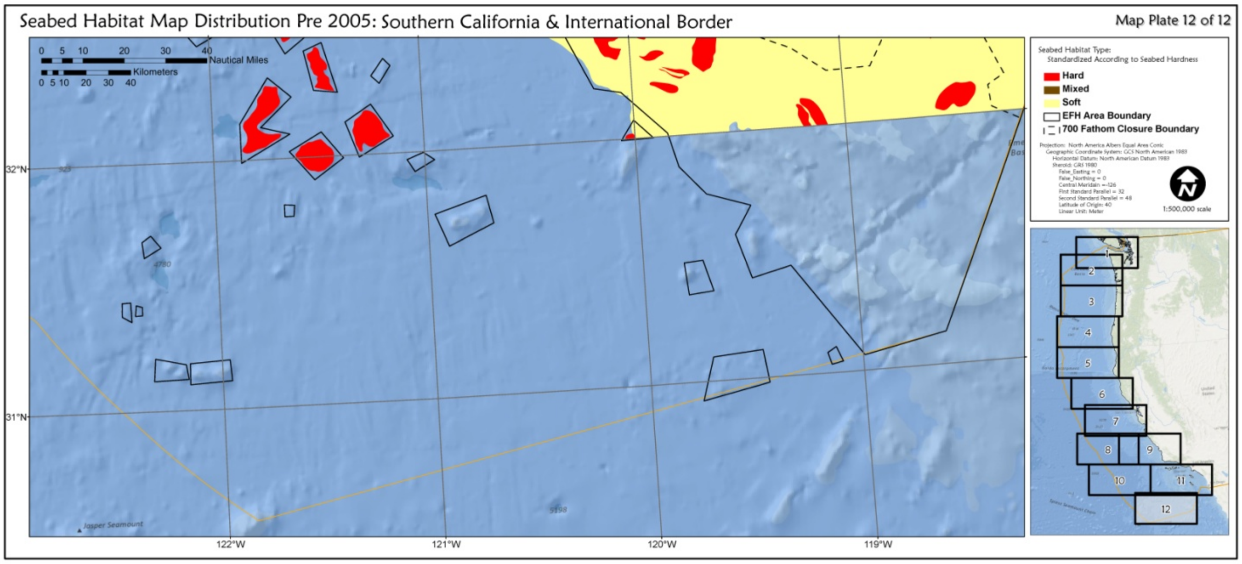
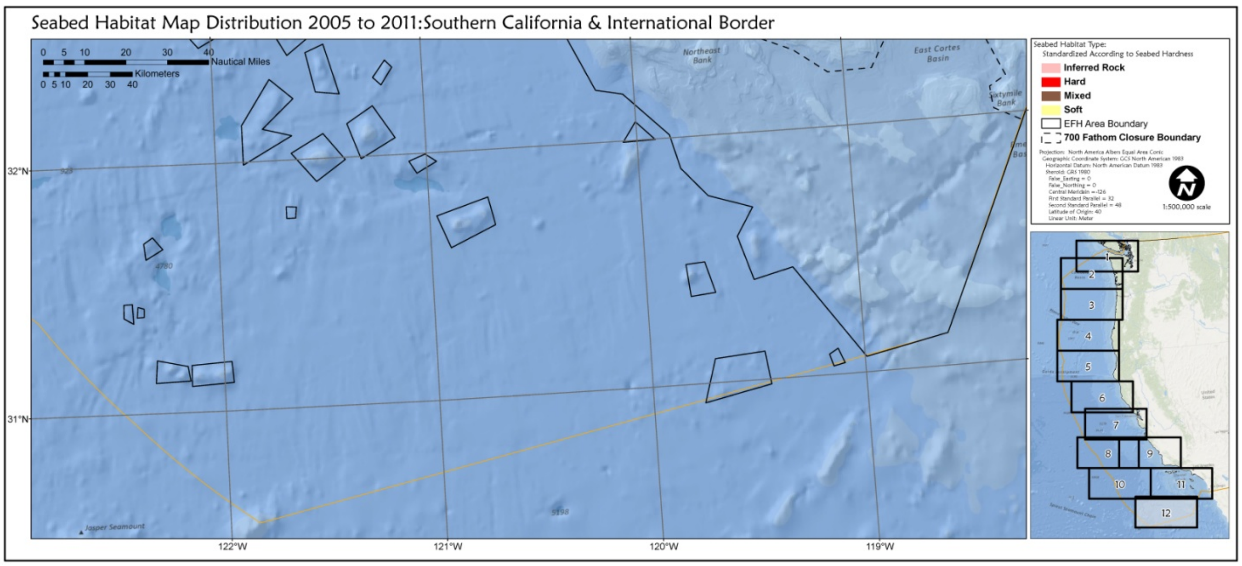


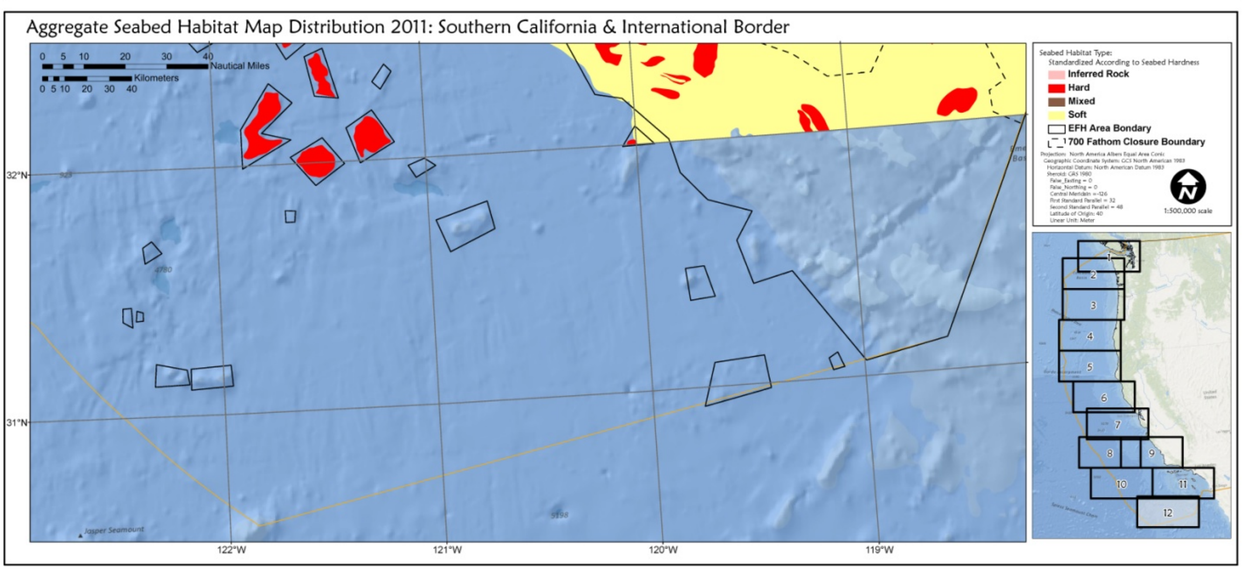




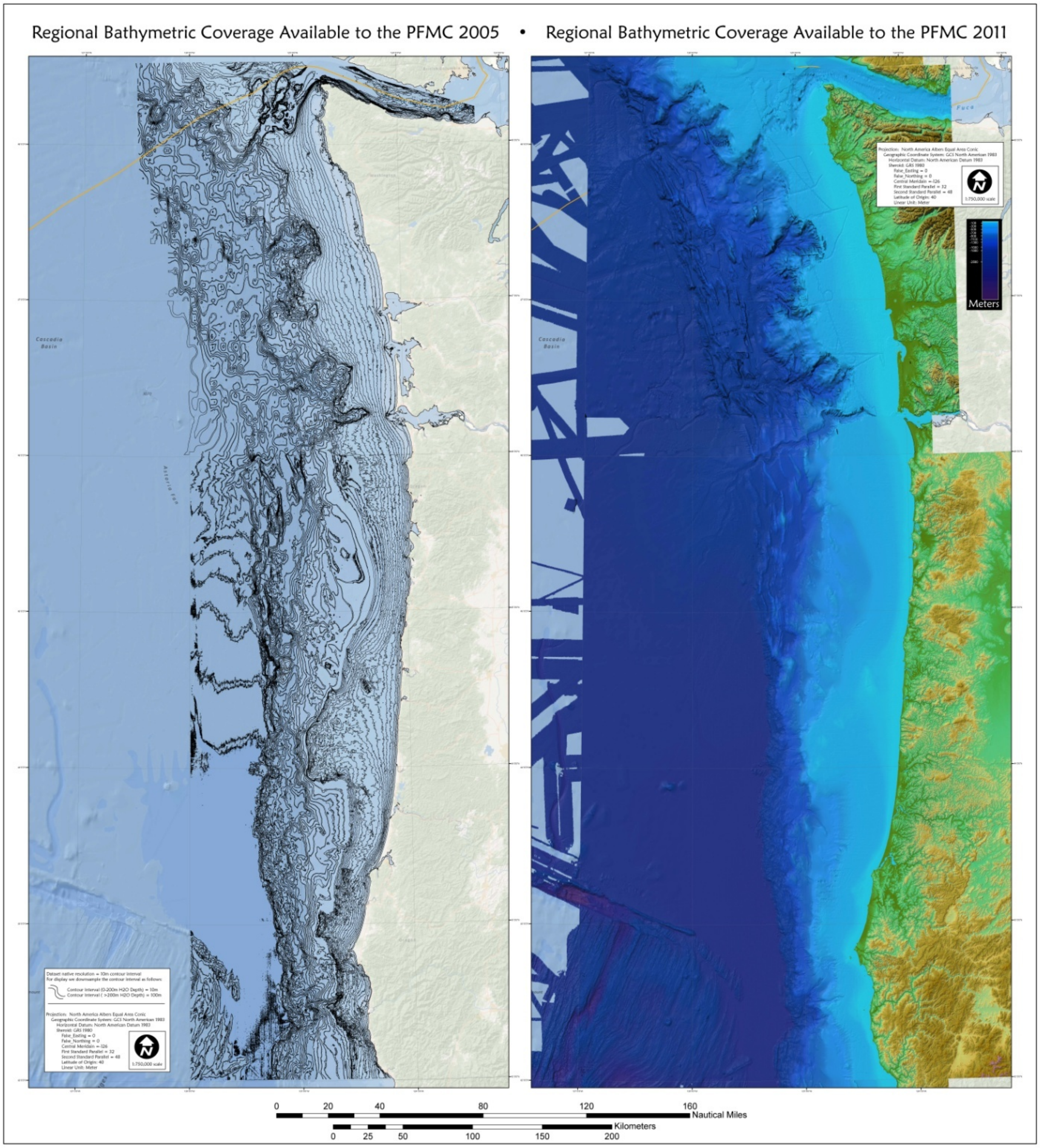
Apendix C-2: Substrate



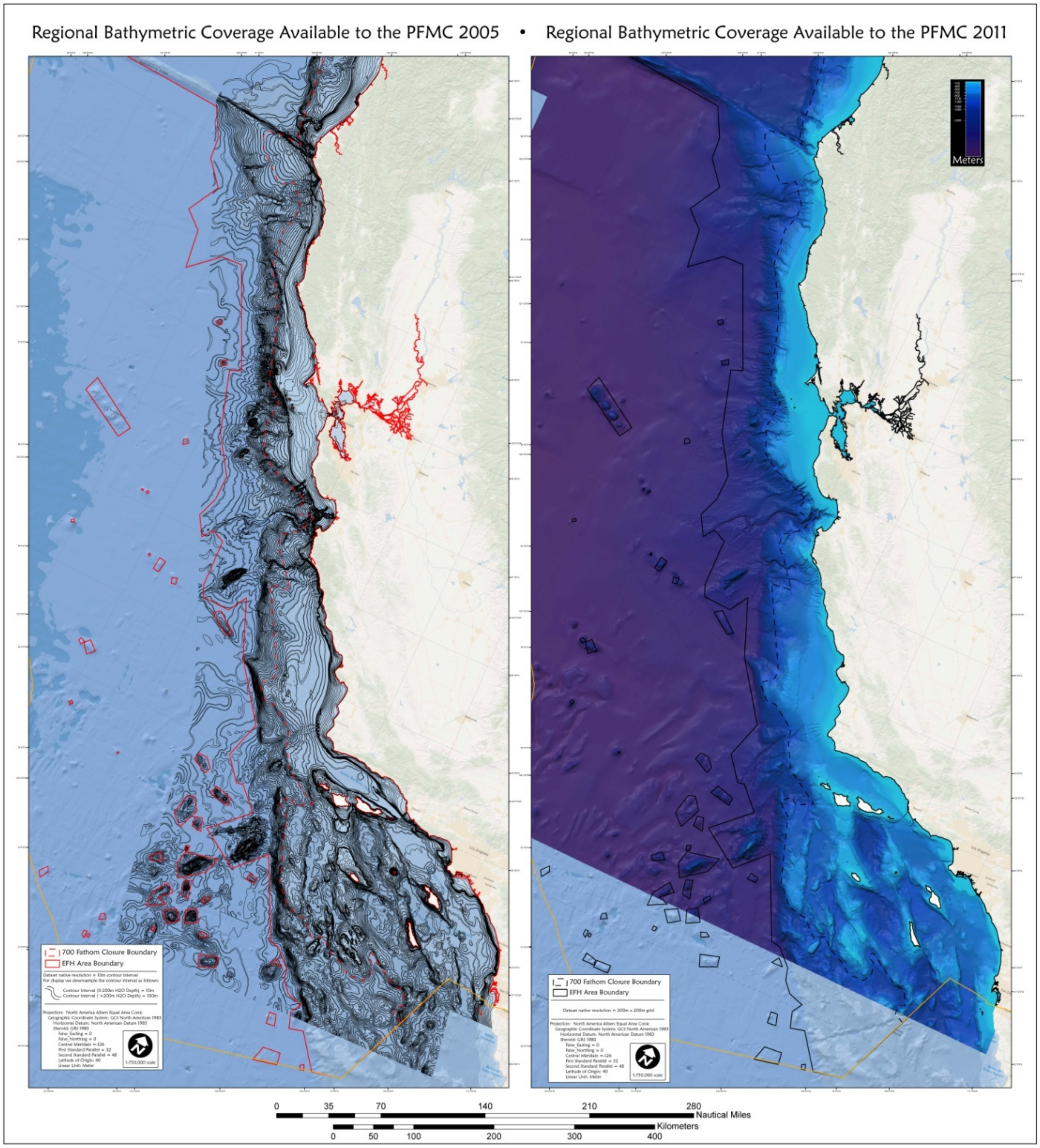




Apendix C-3: Regional Bathemetry



Apendix C-3: Regional Bathemetry



Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
1	1	X	X	X	Pacific Storm 2011, OCNMS North	OSU-AT&SML	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
2	1	X		X	San Juan Islands, WA	MLML-CHS	MLML-CHS	http://habitat.mlml.calstate.edu/pugetsound-georgiabasin/index.htm
3	1	X	X	X	Elwah River Delta West	USGS	USGS	http://pubs.usgs.gov/ds/320/index.html
4	1	X	X	X	Rainier 2001, Cape Flattery, OC-2 & OC-52	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
5	1	X	X	X	Rainier 2001, Cape Flattery, OC-3 & OC-56	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
6	1	X	X	X	Rainier 2001, Cape Flattery, OC-4 & OC-57	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
7	1	X	X	X	Rainier 2001, Anderson Pt, OC-5 & OC-58	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
8	1	X	X	X	Rainier 2002, Makah Bay, OC-6 & OC-65	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
9	1	X	X	X	Rainier 2002, Anderson Pt, OC-7 & OC-66	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
10	1	X	X	X	Rainier 2003, Makah Bay, OC-8 & OC-69	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
11	1	X	X	X	Rainier 2003, Makah Bay, OC-9 & OC-70	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
12	1	X	X	X	Rainier 2003, Anderson Pt, OC-10 & OC-71	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
13	1	X	X	X	Rainier 2003, Anderson Pt, OC-11 & OC-72	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
14	1	X	X	X	Rainier 2003, Anderson Pt, OC-12 &OC-73	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
15	1	X	X	X	Rainier 2003, Anderson Pt, OC-13 & OC-74	NOAA	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
16	1	X	X	X	OCNMS 2003, South of Cape Alava, OC-14 & OC-75	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
17	1	X	X	X	Rainier 2003, Neah Bay Region, OC-32 & OC-67	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
18	1		X	X	Mystery Bay 2002, Mystery Bay, offshore, OC-20	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
19	1		X		McArthur 2002, Anderson Pt, OC-23	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
20	1		X	X	McArthur 2004, Cape Alava, offshore, OC-27	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
21	1		X	X	McArthur 2004, West of Cape Flattery, OC-28	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
22	1		X	X	Tatoosh 2004, East of Neah Bay, OC-31	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
23	1		X	X	Tatoosh 2004, Cape Flattery, OC-33	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
24	1		X	X	McArthurII 2005, Cape Flattery, offshore, OC-34	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
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35	1		X	X	Tatoosh 2006, NA, OC-47	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
36	1		X	X	Tatoosh 2006, NA, OC-48	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
37	1	X	X		EX0801	NOAA OE		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
38	1	X	X		TN175	NSF		Contact: R. McDuff (gmcduff@uw.edu)
39	1	X			Rainier 2001, Sheet F, OC-50	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
40	1	X			Rainier 2001, Sheet C, OC-52	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
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45	1	X	X		Prelay Fiber Optics Survey Tyco,OC-17 & OC-60	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
46	1	X	X		Postlay Fiber Optics Survey Fugro, OC-16 & OC-61	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
47	1	X			Rainier 2002, Sheet P, OC-62	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
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49	1	X			Rainier 2002, Sheet S, OC 64	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
50	1	X			Rainier 2002, Sheet T, OC 67	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html

Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
51	1	X			Rainier 2003, Sheet T, OC-68	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
52	1	X			Rainier 2004, Sheet F, OC-77	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
53	1	X			Rainier 2004, Sheet T, OC-78	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
54	2	X			Rainier 2004, Sheet T, OC-79	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
55	3	X			Rainier 2004, Sheet T, OC-80	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
56	4	X			Rainier 2004, Sheet T, OC-81	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
57	5	X			Rainier 2004, Sheet A, OC-82	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
58	1	X			Rainier 2004, Sheet A, OC-83	NOAA NOS		http://olympiccoast.noaa.gov/library/gisdata.html
59	1	X	X		Sinclair Inlet to Rich Passage (F00541)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/F00001-F02000/F00541/
60	1	X			Commencement Bay (F00589)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/F00001-F02000/F00589/
61	1	X	X		Elliot Bay West Anchorage (F00568)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/F00001-F02000/F00568/
62	1	X			Possession Sound (H11018)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11018
63	1	X			H11039	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11039
64	1	X			H11040	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11040
65	1	X			H11188	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11188
66	1	X			H11190	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11190
67	1	X			H11268	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11268
68	1	X			H11269	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11269
69	1	X			H11292	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11292
70	1	X			H11293	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11293
71	1	X			H11316	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11316
72	1	X			H11317	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11317
73	1		X		H11370	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11370
74	1	X			Vicinity of Smith Island (H11371)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11371
75	1	X			Northwest coast of Whidbey Island (H11375)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11375
76	1	X			H11376	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11376
77	1	X			H11377	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11377
78	1	X			Bellingham Bay Vendovi Island to Post Point (H11419)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11419
79	1	X	X		H11420	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11420
80	1				H11458	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11458
81	1	X	X		H11548	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11548
82	1	X	X		H11549	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11549
83	1	X			H11550	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11550
84	1	X	X		H11551	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11551
85	1	X			Hale Passage (H11552)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11552
86	1	X			South Portion of Bellingham Bay (H11553)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11553
87	1	X	X		H11556	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11556
88	1	X	X		H11605	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11605
89	1	X			Vicinity of Patos and Sucia Islands (H11631)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11631
90	1	X			H11632	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11632
91	1	X			H11646	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11646
92	3	X			Approaches to Coos Bay to Empire (H11744_1)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11744
93	3	X			Approaches to Coos Bay to Empire (H11744_2)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11744
94	3	X			Approaches to Coos Bay to Empire (H11744_3)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11744
95	1	X			Vicinity of Dungeness Bay (H11749)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11749
96	1	X			Green Point to Dungeness Bay (H11750)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11750
97	1	X			Port Angeles to Green Point(H11751)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11751
98	1	X			Oak Harbor to Saratoga Passage (H11801)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11801
99	1	X			H11826	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H11826
100	1	X			Cultus Bay (H12053)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12053

Appendix C: Data Sources

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Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
101	1	X			NW Offshore Portion of cape Flattery (H12220)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12220
102	1	X			Central Offshore Portion of Cape Flattery (H12222)	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12222
104	1	X			H12281	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12281
105	1	X			H12311	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12311
106	1	X			H12322	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12322
107	1	X			H12323	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12323
108	1	X			H12368	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12368
109	1	X			H12369	NOAA NOS		ftp://ftp.ngdc.noaa.gov/pub/coast/H10001-H12000/H12369
110	1		X		Cape Alava 1999 Kvitek, Cape Alava, OC-18	CSUMB-SML		http://olympiccoast.noaa.gov/library/gisdata.html
111	1		X		USGS97 Corliss, Sanctuary,Southeast, OC-19	USGS		http://olympiccoast.noaa.gov/library/gisdata.html
112	1		X		Tatoosh CapeAlava 2002, Cape Alava, OC-21	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
113	1		X		Tatoosh CapeAlava 2002, Cape Alava, OC-22	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
114	1		X		Tatoosh LaPush 2003, La Push, OC-24	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
115	1		X		McArthur 2004, West of Cape Flattery, OC-29	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
116	1		X		McArthur 2004, West of Cape Flattery, OC-30	OCNMS		http://olympiccoast.noaa.gov/library/gisdata.html
117	1		X		Agate Pass, NA, OC-45	UN		http://olympiccoast.noaa.gov/library/gisdata.html
118	1		X		Agate Pass, NA, OC-46	UN		http://olympiccoast.noaa.gov/library/gisdata.html
119	1,2,3,4	X	X	X	WA & OR Shelf and Slope	AT&SML	AT&SML	http://pacoos.coas.oregonstate.edu
120	1,2	X	X	X	Kvitek Cake Carrol, La Push, OC-1 & OC-49	CSUMB-SML	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
121	1,2		X	X	McArthur 2004, La Push, offshore, OC-26	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
122	1,2,3,4,5	X	X		TN240	NSF		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
123	1,2,3,4,5	X	X		TN265	NSF		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
124	2	X	X	X	Seadside	AT&SML	AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
125	2	X	X	X	OCNMS 2003, La Push, OC-15 & OC-76	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
126	2		X	X	McArthur 2004, OC-25	OCNMS	OCNMS	http://olympiccoast.noaa.gov/library/gisdata.html
127	2	X	X		BOEM Grays Harbor	AT&SML		http://activetectonics.coas.oregonstate.edu/state_waters.htm
128	2	X	X		NOAA Sponge Reef	AT&SML		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
129	2	X	X		OOI WA Inshore 2009	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
130	2	X	X		OOI WA Inshore 2010	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
131	2	X	X		OOI WA Inshore 2011	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
132	2	X	X		OOI WA Shelf 2009	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
133	2	X	X		OOI WA Shelf 2010	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
134	2	X	X		OOI WA Offshore	NSF-OOI		http://pacoos.coas.oregonstate.edu/OOI
135	2	X			Tillamook Head (H12122)	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
136	2	X	X		TN177	UW		http://pacoos.coas.oregonstate.edu/OOI
137	2	X	X		TN207	UW		http://pacoos.coas.oregonstate.edu/OOI
138	2	X	X		TN252	OSU-ATSML		http://pacoos.coas.oregonstate.edu/OOI
139	2	X			Approaches to Columbia River (H11723)	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
140	2	X			Approaches to Grays harbor (H11939)	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
141	2,3	X	X	X	H12122Plus	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
142	3	X	X	X	Cannon Beach to Arch Cape (H12123)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
143	3	X	X	X	Cape Falcon (H12124)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
144	3	X	X	X	Cape Lookout to Cascade Head (H12127)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
145	3	X	X	X	Cape Mears (H12126)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
146	3	X	X	X	Cape Perpetua (H12129)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
147	3	X	X	X	Cascade head to Siletz Bay (H12128)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
148	3	X	X	X	Depoe Bay Extension	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
149	3	X	X	X	Florence	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
150	3	X	X	X	Netarts	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
151	3	X	X	X	Newport	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm

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Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
152	3	X	X	X	Ocean Explorer Nehalem Bank	OSU-AT&SML	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
153	3	X	X	X	Siletz Reef North	ODFW	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
154	3	X	X	X	Siletz Reef South	ODFW	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
155	3	X	X	X	USGS Depoe Bay	USGS	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
156	3	X	X	X	Vacinity of Rockaway Beach (H12125)	NOAA NOS	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
157	3	X		X	ODFW Seal Rock	ODFW	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
158	3	X	X		BOEM Nehalem	OSU-AT&SML		http://activetectonics.coas.oregonstate.edu/state_waters.htm
159	3	X	X		BOEM Newport	OSU-AT&SML		http://activetectonics.coas.oregonstate.edu/state_waters.htm
160	3	X	X		Ocean Explorer Daisy Bank & Margin	NOAA OE		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
161	3	X	X		Ocean Explorer R2 TN173	NOAA PMEL		http://pacoos.coas.oregonstate.edu
162	3	X	X		OOI Newport	NSF OOI		http://pacoos.coas.oregonstate.edu/OOI
163	3	X			H11989	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
164	3,4	X	X	X	Heceta Bank	NOAA PMEL	NOAA NWFSC	Contact: W. Wakefield (waldo.wakefield@noaa.gov)
165	3,4,11	X	X	X	TN 174, NOAA ATC 2004	OSU-AT&SML	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
166	3,4,6	X	X		NOAA ATC/OSU 2005	OSU-AT&SML		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
167	4	X	X	X	Cape Arago	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
168	4	X	X	X	Cape Blanco	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
169	4	X	X	X	Humbug Mountain	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
170	4	X	X	X	Island Rock	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
171	4	X	X	X	Lakeside	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
172	4	X	X	X	Redfish Rocks	OSU-AT&SML	OSU-AT&SML	http://activetectonics.coas.oregonstate.edu/state_waters.htm
173	4	X		X	ODFW Bandon Reef	ODFW	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
174	4	X		X	ODFW Orford Reef	ODFW	OSU-AT&SML	http://pacoos.coas.oregonstate.edu
175	4	X	X		BOEM Lakeside	OSU-AT&SML		http://activetectonics.coas.oregonstate.edu/state_waters.htm
176	4	X			Cape Ferrolo to Winchuck River (H12131)	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
177	4	X			Crook Point to Cape Ferrelo (H12130)	NOAA NOS		http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html
178	4, 5	X	X	X	Pelican Bay (H11985)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
179	5	X	X	X	Saint George Reef (H11984)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
180	5	X	X	X	Point Saint George (H11983)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
181	5	X	X	X	Midway Point to Split Rock (H11982)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
182	5	X	X	X	Johnson Creek to Mussel Point (H11981)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
183	5	X	X	X	Conical Rock to Rocky Point (H11980)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
184	5	X	X	X	Trinidad (H11979)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
185	5	X	X	X	West of Arcata Bay (H11978)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
186	5	X	X	X	Humboldt (H11977)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
187	5	X	X	X	Eel River to Mussel Rock (H11976)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
188	5	X	X	X	Cape Mendocino (H11975)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
189	5	X	X	X	Mussel Rocks to Punta Gorda (H11974)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
190	5	X	X	X	Spanish Canyon (H11973)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
191	5			X	Eel River Basin		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
192	5	X	X		Humboldt Bay North	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
193	5	X	X		Humboldt Bay South	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
194	5	X			Humboldt Bay Data Fusion Project	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
195	5	X	X		Approach to Humboldt Bay to Arcata Bay (H11919)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
196	5	X	X		North of the Entrance Channel Humboldt Bay (F00579)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
197	5	X	X		Crescent City Harbor (F00562)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
198	5, 6	X	X	X	Point Delgada (H11972)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
199	6	X	X	X	North Central Coast Block A11	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
200	6	X	X	X	North Central Coast Block B01	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
201	6	X	X	X	North Central Coast Block B02	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm

Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
202	6	X	X	X	North Central Coast Block B03	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
203	6	X	X	X	North Central Coast Block B04	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
204	6	X	X	X	North Central Coast Block B05	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
205	6	X	X	X	North Central Coast Block B06	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
206	6	X	X	X	North Central Coast Block B07	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
207	6	X	X	X	North Central Coast Block B08	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
208	6	X	X	X	North Central Coast Block B09	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
209	6	X	X	X	North Central Coast Block B10	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
210	6	X	X	X	North Central Coast Block B11	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
211	6	X	X	X	North Central Coast Block B12	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
212	6	X	X	X	North Central Coast Block B13	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
213	6	X	X	X	Bear Landing (H11971)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
214	6	X	X	X	Big White Rock to Abalone Point (H11970)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
215	6	X	X	X	De Haven to Laguna Point (H11969)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
216	6	X	X	X	Fort Bragg to Little River (H11968)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
217	6	X	X	X	Still Well Point to Greenwood Cover (H11967)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
218	6	X	X	X	Punta Arena Lighthouse (H11966)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
219	6	X	X		Mackerricher State Reserve	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
220	6	X	X		Point Arena	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
221	6	X	X		Northern San Andreas Fault	OSU-AT&SML		Contact: C. Goldfinger (gold@coas.oregonstate.edu)
222	6, 7			X	Pt. Reyes		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
223	6, 7	X	X	X	Cordell Bank	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
224	6, 7	X	X	X	North Central Coast Block A03	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
225	6, 7	X	X	X	North Central Coast Block A04	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
226	6, 7	X	X	X	North Central Coast Block A05	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
227	6, 7	X	X	X	North Central Coast Block A06	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
228	6, 7	X	X	X	North Central Coast Block A07	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
229	6, 7	X	X	X	North Central Coast Block A08	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
230	6, 7	X	X	X	North Central Coast Block A09	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
231	6, 7	X	X	X	North Central Coast Block A10	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
232	6, 7			X	Bodega Basin (Inshore)		MLML-CHS	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
233	6, 7			X	Bodega Basin (Offshore)		MLML-CHS	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
234	6, 7	X			Northern California Coast (H11739)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
235	6, 7	X	X		Tomales Point (H11767)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
236	6, 7	X	X		Tomales Bay	USGS		http://pubs.er.usgs.gov/
237	7			X	Golden Gate National Recreational Area		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
238	7			X	Carmel Canyon		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
239	7	X	X	X	Yankee Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
240	7	X	X	X	Cypress Point to Point Pinos	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
241	7	X	X	X	Point Pinos to Shale Beds	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
242	7	X	X	X	Soquel Canyon West	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
243	7	X	X	X	Soquel Canyon East	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
244	7	X	X	X	Kasler Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
245	7	X	X	X	Point Lobos	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
246	7	X	X	X	Monastery to Cypress Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
247	7	X	X	X	Central Monterey Bay South	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
248	7	X	X	X	Central Monterey Bay North	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
249	7	X	X	X	Portuguese Ledge	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
250	7	X	X	X	Asilomar	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm

Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
251	7	X	X	X	Central Coast Block 00 (Stinson Beach)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
252	7	X	X	X	Central Coast Block 01	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
253	7	X	X	X	Central Coast Block 02	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
254	7	X	X	X	Central Coast Block 03	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
255	7	X	X	X	Central Coast Block 04 and 05	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
256	7				Central Coast Block 05	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
257	7	X	X	X	Central Coast Block 06	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
258	7	X	X	X	Central Coast Block 07	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
259	7	X	X	X	Central Coast Block 08	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
260	7	X	X	X	Central Coast Block 09	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
261	7	X	X	X	Central Coast Block 10	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
262	7	X	X	X	Central Coast Block 11	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
263	7	X	X	X	North Central Coast Block A01	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
264	7	X	X	X	North Central Coast Block A02	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
265	7	X	X	X	Soberanes Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
266	7	X	X	X	North Monterey Bay Block 1	USGS	CSUMB-SML	http://pubs.er.usgs.gov/; http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
267	7	X	X	X	North Monterey Bay Block 2	USGS	CSUMB-SML	http://pubs.er.usgs.gov/; http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
268	7	X		X	Rittenburg Bank	USGS	USGS	Contact: P. Etnoyer (peter.etnoyer@noaa.gov); G. Cochrane (gcochrane@usgs.gov)
269	7		X	X	Outer Continental Shelf, North-Central CA	USGS	USGS	http://pubs.er.usgs.gov/
270	7	X	X		San Pablo Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
271	7	X	X		Presidio Shoals	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
272	7	X	X		West San Francisco Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
273	7	X	X		South San Francisco Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
274	7	X	X		North San Francisco Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
275	7	X			Entrance San Francisco Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
276	7	X			Monterey Bay Canyon (Fall 2008)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
277	7	X			Monterey Bay Canyon (Spring 2008)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
278	7	X			Monterey Bay Canyon (Fall 2007)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
279	7	X			Monterey Bay Canyon (Spring 2007)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
280	7	X			Monterey Bay Canyon (Fall 2006)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
281	7	X			Monterey Bay Canyon (Winter 2006)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
282	7	X			Monterey Bay Canyon (Fall 2005)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
283	7	X			Monterey Bay Canyon (Winter 2005)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
284	7	X			Monterey Bay Canyon (Fall 2004)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
285	7	X			Monterey Bay Canyon (Fall 2003)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
286	7	X			Monterey Bay Canyon (Spring 2003)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
287	7	X			Monterey Bay Canyon (Fall 2002)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
288	7	X			Soquel Canyon (2006)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
289	7	X			Elkhorn Slough (2001)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
290	7	X			Elkhorn Slough (2003)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
291	7	X			Elkhorn Slough (2005)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
292	7	X			Offshore San Francisco Bay (H11965)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
293	7	X			San Pablo Point to 1.5 Miles West of Pinole Point (H117	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
294	7	X			San Francisco Bay (H11639)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
295	7	X			Gulf of Farallons (H12109)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
296	7	X			Gulf of Farallons (H12110)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
297	7	X			Gulf of Farallons (H12111)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
298	7	X			Gulf of Farallons (H12112)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
299	7	X			Gulf of Farallons (H12113)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
300	7	X	X		Monterrey Bay (Pt. Ano Nuevo to Moss Landing)	USGS		http://pubs.er.usgs.gov/

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Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
301	7	X	X		San Francisco	USGS		http://pubs.er.usgs.gov/
302	7	X			Farallon Escarpment	USGS		Contact: P. Etnoyer (peter.etnoyer@noaa.gov); G. Cochrane (gcochrane@usgs.gov)
303	7, 9	X	X	X	Grimes Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
304	7, 9	X	X	X	Point Sur	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
305	7, 9	X	X	X	Hurricane Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
306	7, 9	X	X	X	Cooper Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
307	9			X	California Seafloor Mapping Project (Block 54)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
308	9			X	California Seafloor Mapping Project (Block 55)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
309	9			X	California Seafloor Mapping Project (Block 62)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
310	9			X	California Seafloor Mapping Project (Block 63)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
311	9			X	California Seafloor Mapping Project (Block 64)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
312	9			X	California Seafloor Mapping Project (Block 65)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
313	9			X	California Seafloor Mapping Project (Block 66)		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
314	9	X	X	X	Santa Barbara Channel Block E	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
315	9	X	X	X	Santa Barbara Channel Block F	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
316	9	X	X	X	Santa Barbara Channel Block G	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
317	9	X	X	X	Santa Barbara Channel Block H	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
318	9	X		X	Coal Oil Point (H11950)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
319	9	X		X	Coal Oil Point (H11951)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
320	9	X		X	Point Conception (H11952)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
321	9	X	X	X	Point Arguello (H11953)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
322	9	X	X	X	South Central Coast Block 1	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
323	9	X	X	X	South Central Coast Block 2	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
324	9	X	X	X	South Central Coast Block 3	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
325	9	X	X	X	South Central Coast Block 4	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
326	9	X	X	X	South Central Coast Block 5	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
327	9	X	X	X	South Central Coast Block 6	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
328	9	X	X	X	South Central Coast Block 7	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
329	9	X	X	X	South Central Coast Block 8	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
330	9	X	X	X	South Central Coast Block 9	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
331	9	X	X	X	South Central Coast Block 10	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
332	9	X	X	X	South Central Coast Block 11	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
333	9	X	X	X	South Central Coast Block 12	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
334	9	X	X	X	South Central Coast Block 13	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
335	9	X	X	X	South Central Coast Block 14	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
336	9	X	X	X	South Central Coast Block 15	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
337	9	X	X	X	South Central Coast Block 16	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
338	9	X	X	X	South Central Coast Block 17	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
339	9	X	X	X	South Central Coast Block 18	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
340	9	X	X	X	South Central Coast Block 19	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
341	9	X	X	X	South Central Coast Block 20	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
342	9	X	X	X	South Central Coast Block 21	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
343	9	X	X	X	South Central Coast Block 22	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
344	9	X	X	X	South Central Coast Block 23	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
345	9	X	X	X	South Central Coast Block 24	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
346	9	X	X	X	South Central Coast Block 25	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
347	9	X	X	X	South Central Coast Block 26	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
348	9	X	X	X	South Central Coast Block 27	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
349	9	X	X	X	South Central Coast Block 28	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
350	9	X	X	X	South of Morro Bay - Avila Bay Block A1	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm

Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
351	9	X	X	X	South of Morro Bay - Avila Bay Block A2	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
352	9	X	X	X	South of Morro Bay - Avila Bay Block A3	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
353	9	X	X	X	South of Morro Bay - Avila Bay Block B	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
354	9	X	X	X	South of Morro Bay - Avila Bay Block C	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
355	9	X	X	X	South of Morro Bay - Avila Bay Block D	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
356	9	X	X	X	South of Morro Bay - Avila Bay Block E	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
357	9	X	X	X	South of Morro Bay - Avila Bay Block F	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
358	9	X	X	X	South of Morro Bay - Avila Bay Block G	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
359	9	X	X	X	South of Morro Bay - Avila Bay Block H	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
360	9	X	X	X	South of Morro Bay - Avila Bay Block I	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
361	9	X	X	X	South of Morro Bay - Avila Bay Block J	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
362	9	X	X	X	Point Buchon Control	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
363	9	X	X	X	Point Buchon MPA	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
364	9	X	X	X	Big Creek North	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
365	9	X	X	X	Big Creek South	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
366	9	X	X	X	Slate Rock	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
367	9	X	X	X	Lopez Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
368	9	X	X	X	Santa Barbara Channel (Northeastern)	USGS	USGS	http://pubs.er.usgs.gov/
369	9		X	X	South Vandenberg Reserve	USGS	USGS	http://pubs.er.usgs.gov/
370	9	X			Morro Bay Harbor	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
371	9	X	X		Morro Bay	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
372	9	X	X		Santa Barbara Channel (F00512)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d=2
373	9	X	X		Gaviota	USGS		http://pubs.er.usgs.gov/
374	9	X	X		Northern Santa Barbara Channel	USGS		http://pubs.er.usgs.gov/
375	9	X			Coal Oil Point	USGS		http://pubs.er.usgs.gov/
376	9, 11			X	Hueneme		MLML-CHS	Contact: H.G. Greene (greene@mlml.calstate.edu)
377	9, 11	X	X	X	Santa Barbara Channel D	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
378	9, 11	X	X		Santa Barbara Channel (Coastal)	USGS		http://pubs.er.usgs.gov/
379	9, 11	X	X		Northeastern Channel Islands	USGS		http://pubs.er.usgs.gov/
380	11	X	X	X	Ocean Beach (H11875)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
381	11	X	X	X	Pacific Beach (H11876)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
382	11	X		X	San Elijo Lagoon (H11877)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
383	11	X		X	Santa Margarita River (H11878)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
384	11	X		X	Dana Point to Cupola (H11879)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
385	11	X		X	Newport Beach to Three Arch Bay (H11880)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
386	11	X		X	San Pedro Bay (H11881)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
387	11	X		X	San Pedro Escarpment (H11882)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
388	11	X	X	X	Santa Catalina Island Block 1	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
389	11	X	X	X	Santa Catalina Island Block 2	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
390	11	X	X	X	Santa Catalina Island Block 3	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
391	11	X	X	X	Santa Catalina Island Block 4	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
392	11	X	X	X	Santa Catalina Island Block 5	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
393	11	X	X	X	Santa Catalina Island Block 6	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
394	11	X	X	X	Santa Catalina Island Block 7	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
395	11	X	X	X	Santa Catalina Island Block 8	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
396	11	X	X	X	Santa Catalina Island Block 9	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
397	11	X	X	X	Santa Catalina Island Block 10	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
398	11	X	X	X	Santa Catalina Island Block 11	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
399	11	X	X	X	Santa Catalina Island Block 12	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
400	11	X		X	Santa Monica (H11883)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm

Appendix C: Data Sources

Table C-1. Source data (bathymetry, backscatter, habitat) included in high resolution acoustic data and seabed habitat map plates 1-12. Abbreviations are as follows: CSUMB-SML = California State Univeristy, Seafloor Mapping Lab; MLML_CHS = Moss Landing Marine Laboratories, Center for Habitat Studies; NOAA OCNMS = NOAA Olympic Coast National Marine Sanctuary; NOAA OE = NOAA Ocean Explorer; NOAA NOS = NOAA National Ocean Service; NOAA PMEL = Pacific Marine Environmental Laboratory; NSF = National Science Foundation; NSF OOI = NSF Ocean Observing Initiative; OSU_AT&SML = Oregon State University, Active Tectonics and Seafloor Mapping Lab; USGS = United States Geological Survey; USN = United States Navy

Ref#	Plate Number	Bathymetry	Backscater	Habitat	Site Name	Imagery Source	Habitat Source	Data Archive(s)
401	11	X		X	Malibu (H11891)	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
402	11	X	X	X	Santa Barbara Channel A	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
403	11	X	X	X	Santa Barbara Channel B	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
404	11	X	X	X	Santa Barbara Channel C	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
405	11	X	X	X	Scorpion Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
406	11	X	X	X	Gull Island	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
407	11	X	X	X	Carrington Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
408	11	X	X	X	South Point	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
409	11	X		X	San Clemente-Oceanside-San Diego	CSUMB-SML	CSUMB-SML	http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
410	11	X		X	43 Fathom Bank	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
411	11	X		X	Cherry Bank	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
412	11	X		X	Osborn Bank	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
413	11	X		X	Pilgrim/Kidney Banks	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
414	11	X		X	Potato Bank	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
415	11	X		X	Tanner Bank	OSU-AT&SML	OSU-AT&SML	Contact: C. Goldfinger (gold@coas.oregonstate.edu)
416	11		X	X	South San Miguel Island	USGS	USGS	http://pubs.er.usgs.gov/
417	11		X	X	Big Sycamore Reserve	USGS	USGS	http://pubs.er.usgs.gov/
418	11		X	X	Southern Anacapa Island	USGS	USGS	http://pubs.er.usgs.gov/
419	11		X	X	Southern Anacapa Passage	USGS	USGS	http://pubs.er.usgs.gov/
420	11		X	X	Santa Cruz Island	USGS	USGS	http://pubs.er.usgs.gov/
421	11		X	X	North Anacapa Island	USGS	USGS	http://pubs.er.usgs.gov/
422	11		X	X	Northern Anacapa Passage	USGS	USGS	http://pubs.er.usgs.gov/
423	11	X	X		Cortes Bank	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
424	11	X			Tanner Bank	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
425	11	X			San Clemente Island South	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
426	11	X			San Clemente Island North	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
427	11	X			Santa Barbara Island	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
428	11	X			San Clemente Island (Eel Point)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
429	11	X			San Clemente Island (Mail Point)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
430	11	X			San Clemente Island (Lost Point)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
431	11	X			San Clemente Island (Cove Point)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
432	11	X			San Clemente Island (China Point)	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
433	11	X			Farnsworth Bank	CSUMB-SML		http://seafloor.csumb.edu/SFMLwebDATA_SURVEYMAP.htm
434	11	X	X		Oxnard (H11501)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
435	11	X	X		San Pedro Bay (F00507)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
436	11	X	X		Los Angeles Harbor (H11471)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
437	11	X	X		San Diego (F00513)	NOAA NOS		http://ngdc.noaa.gov/nndc/struts/form?&t=101523&s=2&d=1&d-2
438	11	X	X		Los Angeles Margin (2004)	USGS		http://pubs.er.usgs.gov/
439	11	X			San Diego Margin	USGS		http://pubs.er.usgs.gov/
440	11	X	X		Los Angeles Margin (2002)	USGS		http://pubs.er.usgs.gov/
441	11	X	X		San Diego	USGS		http://pubs.er.usgs.gov/
442	11	X	X	X	Santa Monica	USGS	CSUMB-SML	http://pubs.er.usgs.gov/

APPENDIX D SELECTED OBSERVATIONS OF CORALS AND SPONGES

Appendix D maps depict the spatial distribution of selected observations of corals and sponges from visual surveys conducted by a number of agencies and institutions. Many of the locations of observations are included in a national database prepared under the auspices of NOAA's Deep-Sea Coral Research and Technology Program (NOAA 2011). Although there are a number of records of additional observations recorded at various research institutes, this database is currently the most comprehensive source of electronically available records of coral and, to a lesser extent, sponge observations in the region. Development of this database is ongoing and additional records of observations will be added as they become available. Appendix D plates also depict records from two other database query results: 1) selected observations of corals and sponges from submersible and remotely operated vehicle (ROV) surveys off southern California (NMFS SWFSC [M. Yoklavich]), and 2) a database maintained by Brian Tissot (Washington State University Vancouver) containing records of coral observations from submersibles and ROV surveys off Oregon and central and southern California (Bianchi, 2011; Bright, 2007; Pirtle, 2005). These additional records were added to the map figures because they were not yet included in the version of the national database. Compared to the 2006 groundfish EFH review, this database represents a major advancement in access and dissemination of records of coral and sponge presence in the region. Furthermore, this database was not available during the Amendment 19 process.

The Appendix D maps depict point locations of observations of corals and sponges recorded via a variety of collection methods. Records with the label "in situ observation" were made using direct count methods utilizing submersible, ROV, or camera sled platforms. The precision of these point locations varies between data sets, ranging from very precise estimates of vehicle position at the location of the individual coral or sponge specimen observed in situ, to more general representations of a vehicle dive transect. Almost all records of corals and sponges collected via "trawls" or "dredges" originate from surveys conducted by NMFS during the past three decades; however, numerous records from museum collections within the "various" category also originate from very early NMFS trawl surveys conducted over the last century. Trawl and dredge records exhibit less locational precision, because trawls often operate over 100's of meters to 10's of kilometers. It is very difficult to estimate over the course of a trawl or dredge track when and where a particular specimen was collected. As mentioned above, records termed "various" most often are part of museum collections, for which the original collection method varies between the other four general categories or is not specified. The final category, "ROV collection" refers to specimens that were physically extracted from their benthic habitat by an ROV. Often times, these specimens are accessed in a museum collection. Consequently, this database of observations may contain duplicate records. Due to the varying and often unrecorded precision of the location information, particularly from trawl samples, users of these data should exercise caution when conducting any fine scale spatial analysis.

These records of selected coral and sponge observations are presented in map view to highlight the geographic scope of the observations (see Appendix D figures). The spatial distribution of these locations of coral and sponge presence is largely driven by survey effort. The largest number of records originates from in situ observations (red) at discrete survey sites. Major areas of direct count *in situ* studies include sites in the Olympic Coast National Marine Sanctuary, numerous rocky banks off Oregon, central California (e.g., Cordell Bank National Marine Sanctuary) and in the southern California Bight, and submarine canyons off Oregon and central California, including a very large number of records from sites in and around Monterey Bay.

The second most numerous category of records comes from trawl surveys (blue), which were conducted mostly by the NMFS starting in the mid 1970's and continuing through 2010, at least for the current version of the database. These observations are limited to "trawlable" areas of the continental shelf and slope, while survey focus was often to make fishery-independent estimates of groundfish biomass. It is important to note that most trawl gear is not designed to sample sessile benthic invertebrates, nor is it designed to access the types of habitats in which these organisms typically reside. The exception is sea pens and sea whips, since they don't require hard substrate for attachment. For this reason, sea pens and sea whips are encountered much more frequently in the catch of trawl surveys than any other coral taxa (see Whitmire and Clarke, 2007).

Lastly, records in the "various" category (yellow) are less numerous and occur in areas off Washington and central and southern California. When they appear in dense clusters around a feature such as seamounts (e.g., Figure 8), they almost certainly originate from ROV or submersible surveys. Such records would have been members of the "*in situ* observation" had the data attributes indicated this. Often times, these records were provided as queries of museum specimen collections or online databases for which observations are compiled from a variety of sources.

In contrast to the existing databases of observations described above, the last review of groundfish EFH that concluded in 2006 utilized significantly fewer records of observations. A summary of data sources, total records reviews, and numbers of observations used during the last review is detailed in Appendix B of the Final Environmental Impact Statement (NMFS, 2005).

To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
To request a copy of the most current version of the national database, please contact Dan Dorman (NOAA), Dan.Dorfman@noaa.gov, (301) 713-3028 x112.

Literature Cited:

Bianchi, C. 2011. Abundance and distribution of megafaunal invertebrates in NE Pacific submarine canyons and their ecological associations with dermersal fishes. M.S. Thesis. Washington State Univ. Vancouver.

Bright, J.L. 2007. Abundance and distribution of structure-forming invertebrates and their associations with fishes at the Channel Islands "Footprint" off the southern coast of California. M.S. Thesis. Washington State Univ. Vancouver.

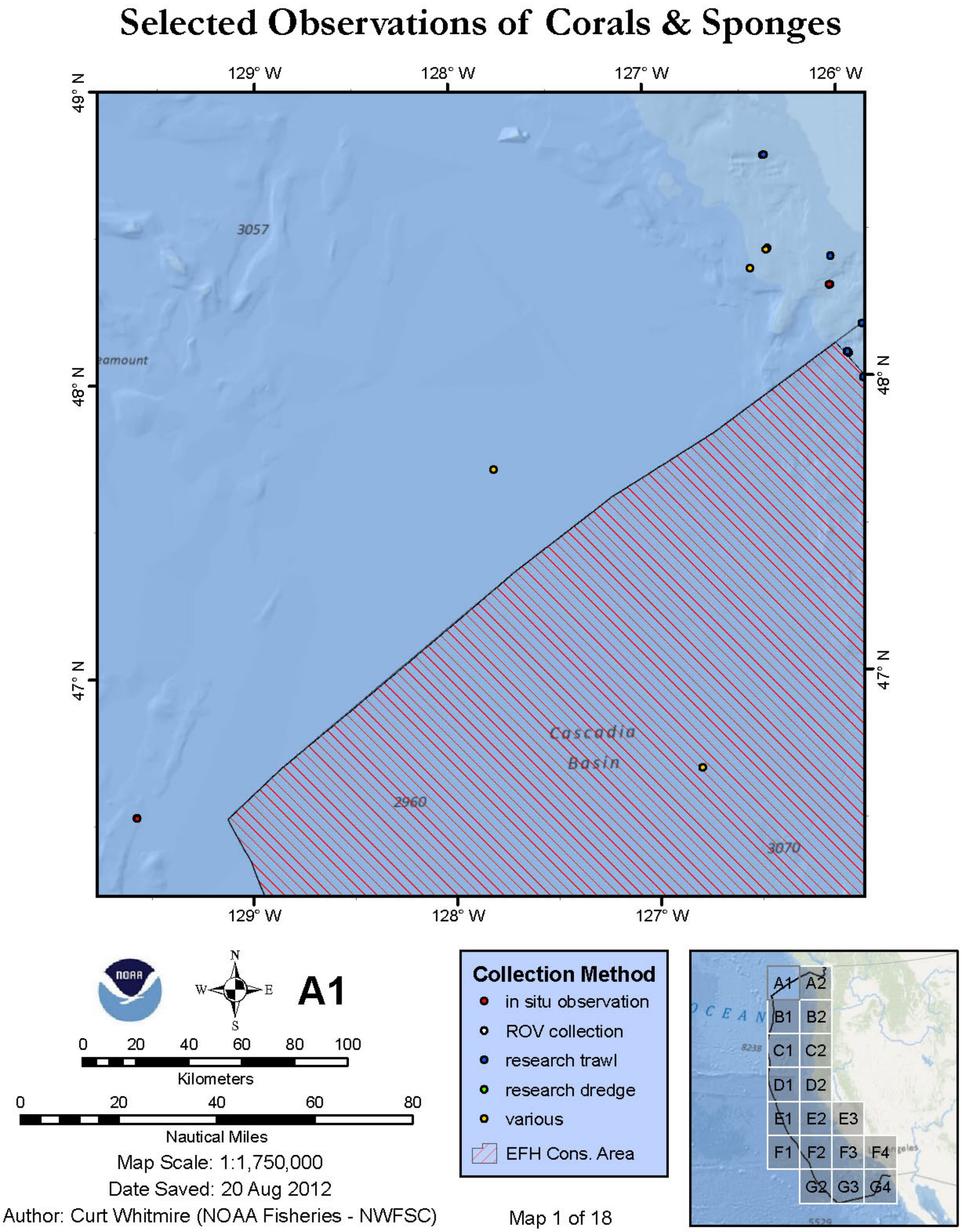
NOAA Deep Sea Coral Research and Technology Program. 2011. Deep-Sea Coral National Geographic Database, version 2.0. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD.
Data Manager: Dan Dorfman (NOAA), Dan.Dorfman@noaa.gov, (301) 713-3028 x112.

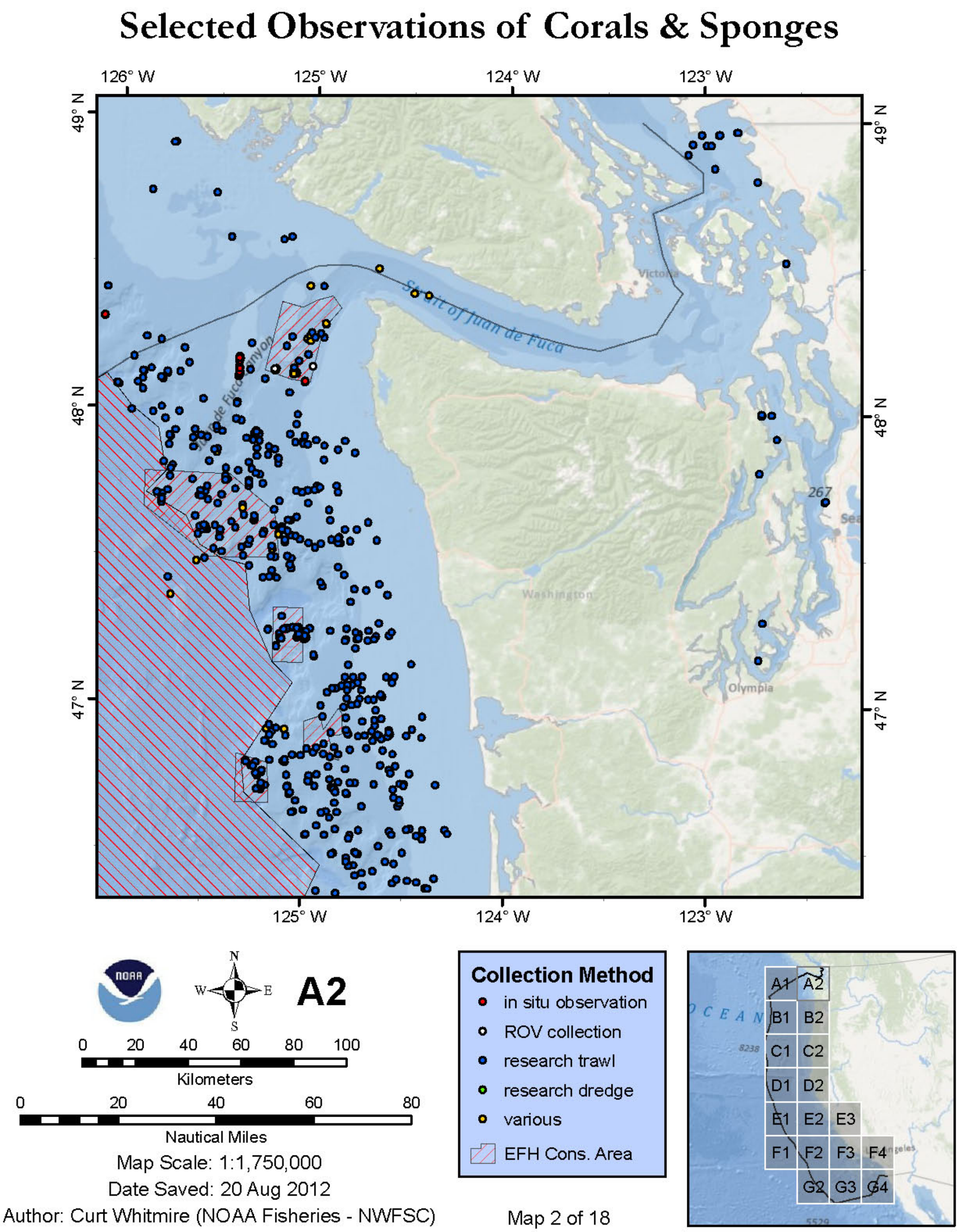
Pirtle, J.L. 2005. Habitat-based assessment of structure-forming megafaunal invertebrates and fishes on Cordell Bank, California. M.S. Thesis. Washington State Univ. Vancouver.

Stocks, K. 2009. SeamountsOnline: an online information system for seamount biology. Version 2009-1. World Wide Web electronic publication. http://seamounts.sdsc.edu

Whitmire, C.E. and Clarke, M.E. 2007. State of Deep Coral Ecosystems of the U.S. Pacific Coast: California to Washington. pp. 109-154. In: S.E. Lumsden, Hourigan T.F., Bruckner A.W. and Dorr G. (eds.) The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD. 365 pp.

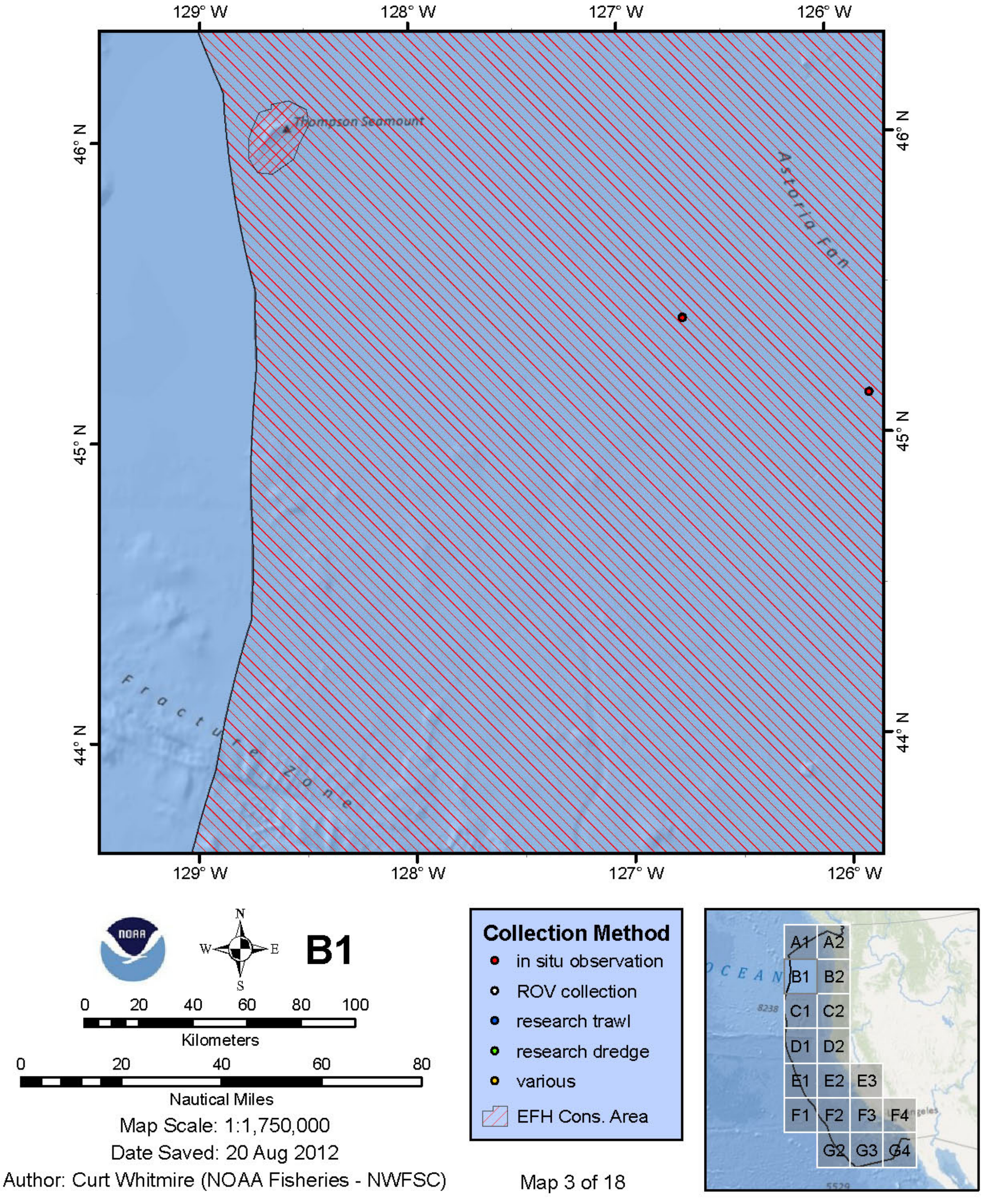
Appendix D: Selected Observations of Corals and Sponges



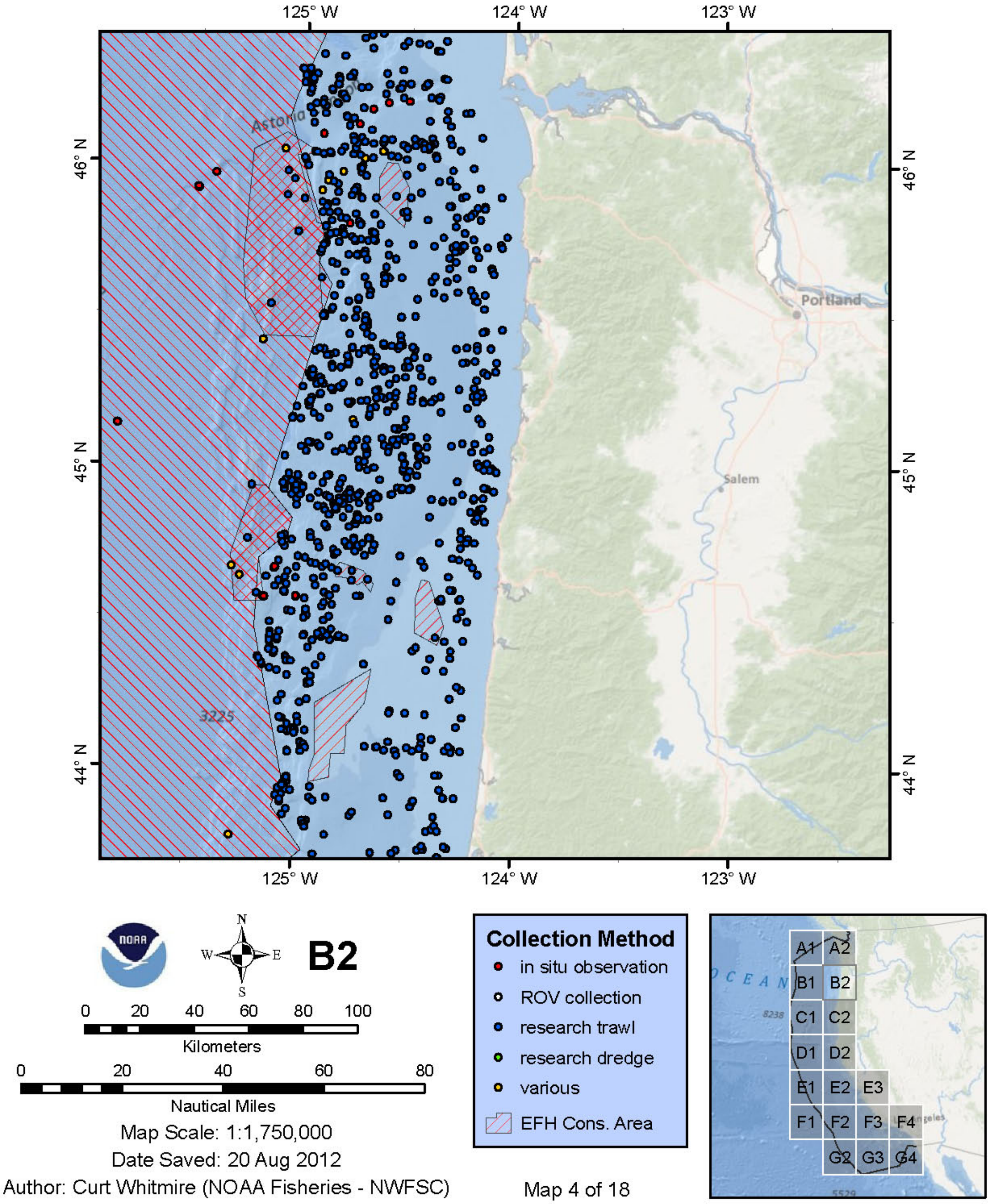


Selected Observations of Corals & Sponges
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Victoria
Washington
Olympia
A2
Kilometers
Nautical Miles
Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
Collection Method
in situ observation
ROV collection
research trawl
research dredge
various
EFH Cons. Area
Map 2 of 18
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4

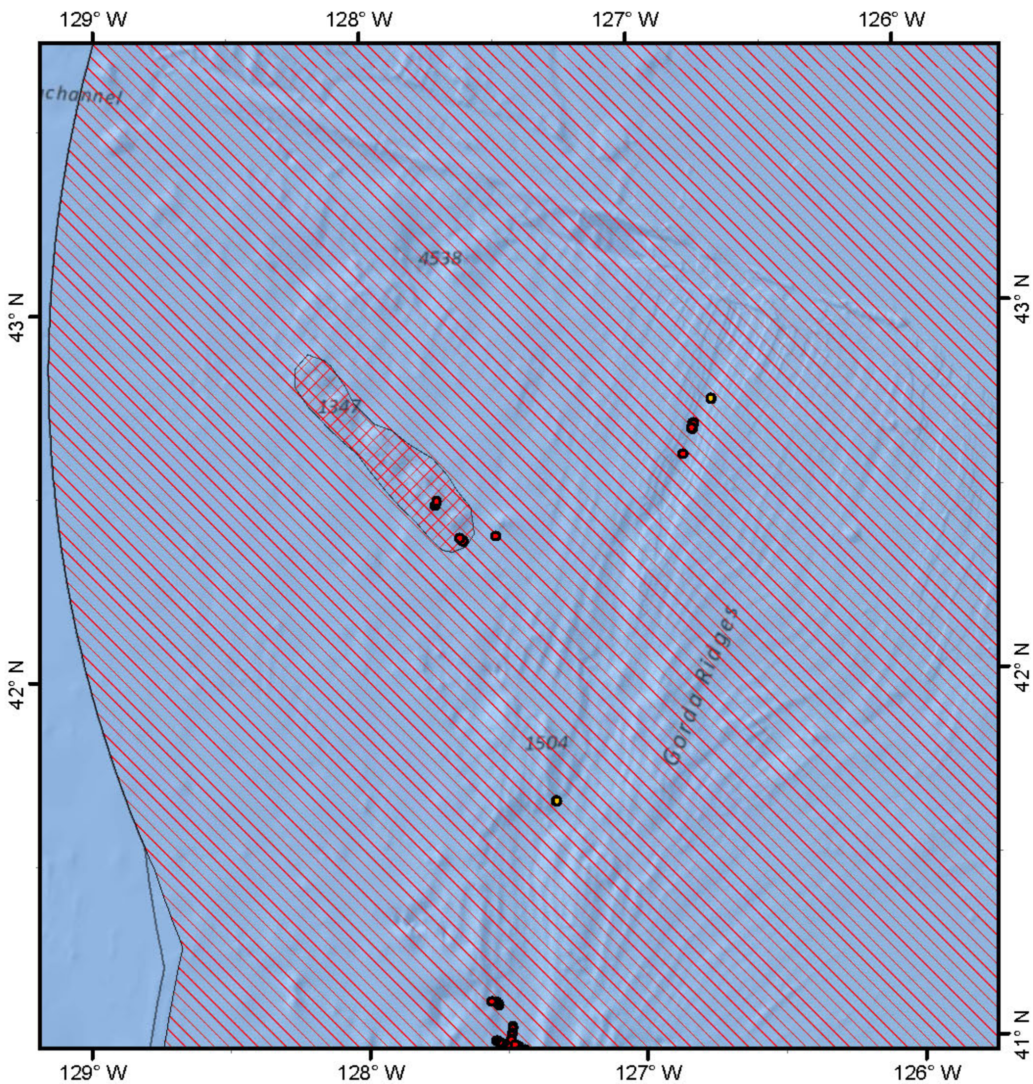
Selected Observations of Corals & Sponges



Selected Observations of Corals & Sponges



Selected Observations of Corals & Sponges



C1

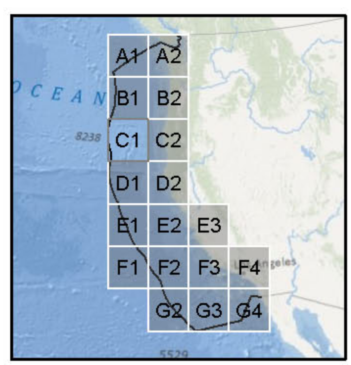
0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

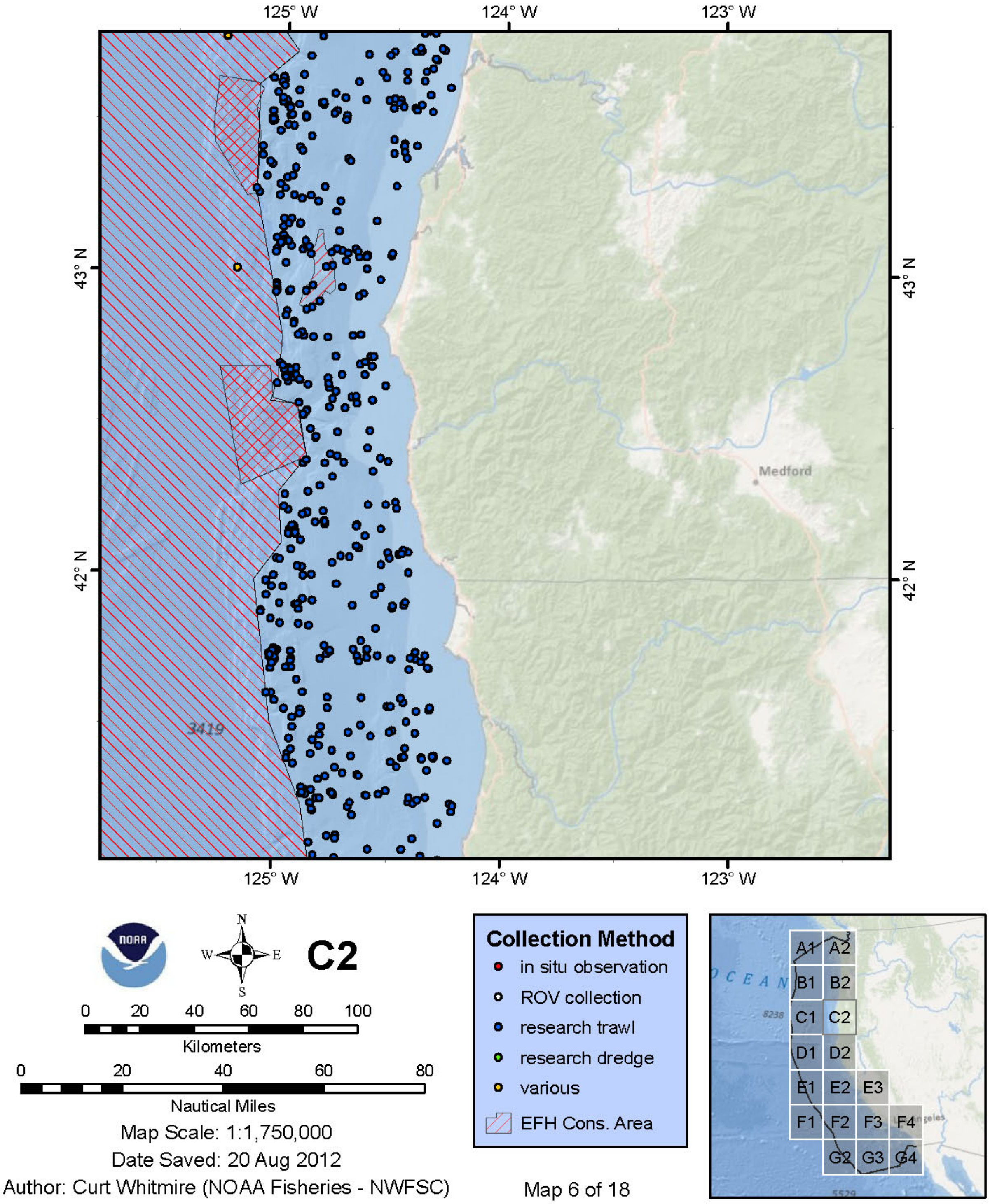
Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

Collection Method
- in situ observation
- ROV collection
- research trawl
- research dredge
- various
- EFH Cons. Area

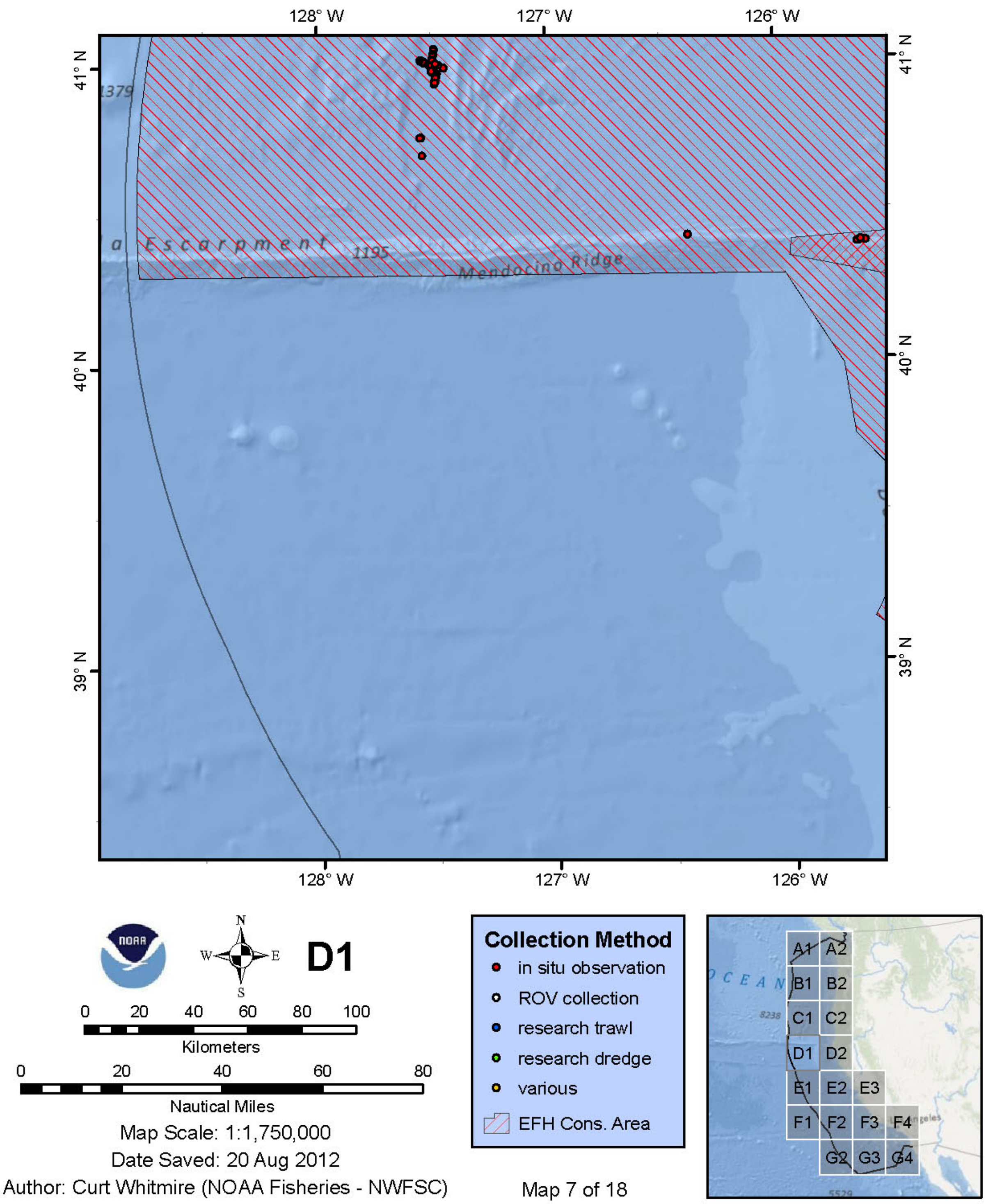
Map 5 of 18

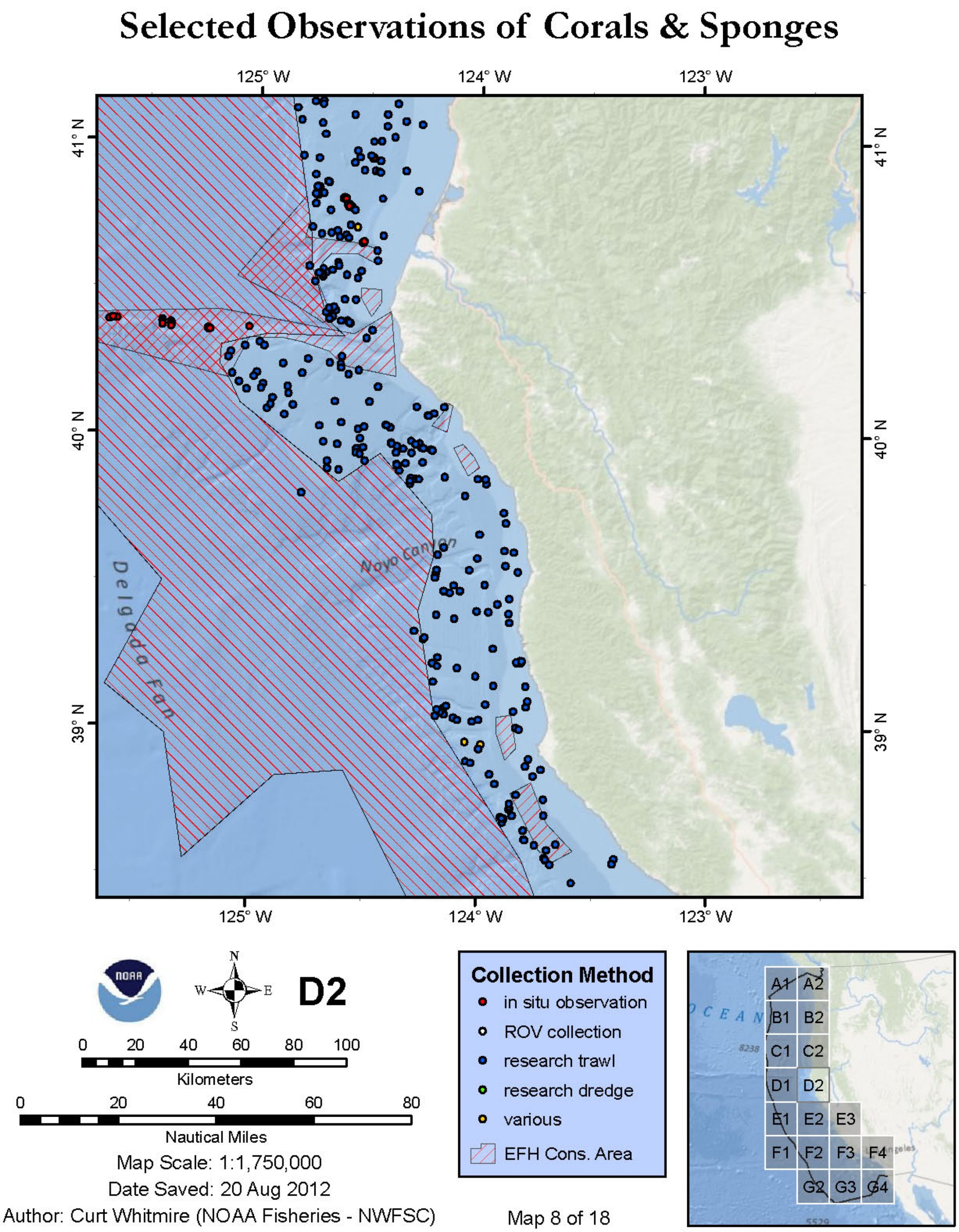


Selected Observations of Corals & Sponges

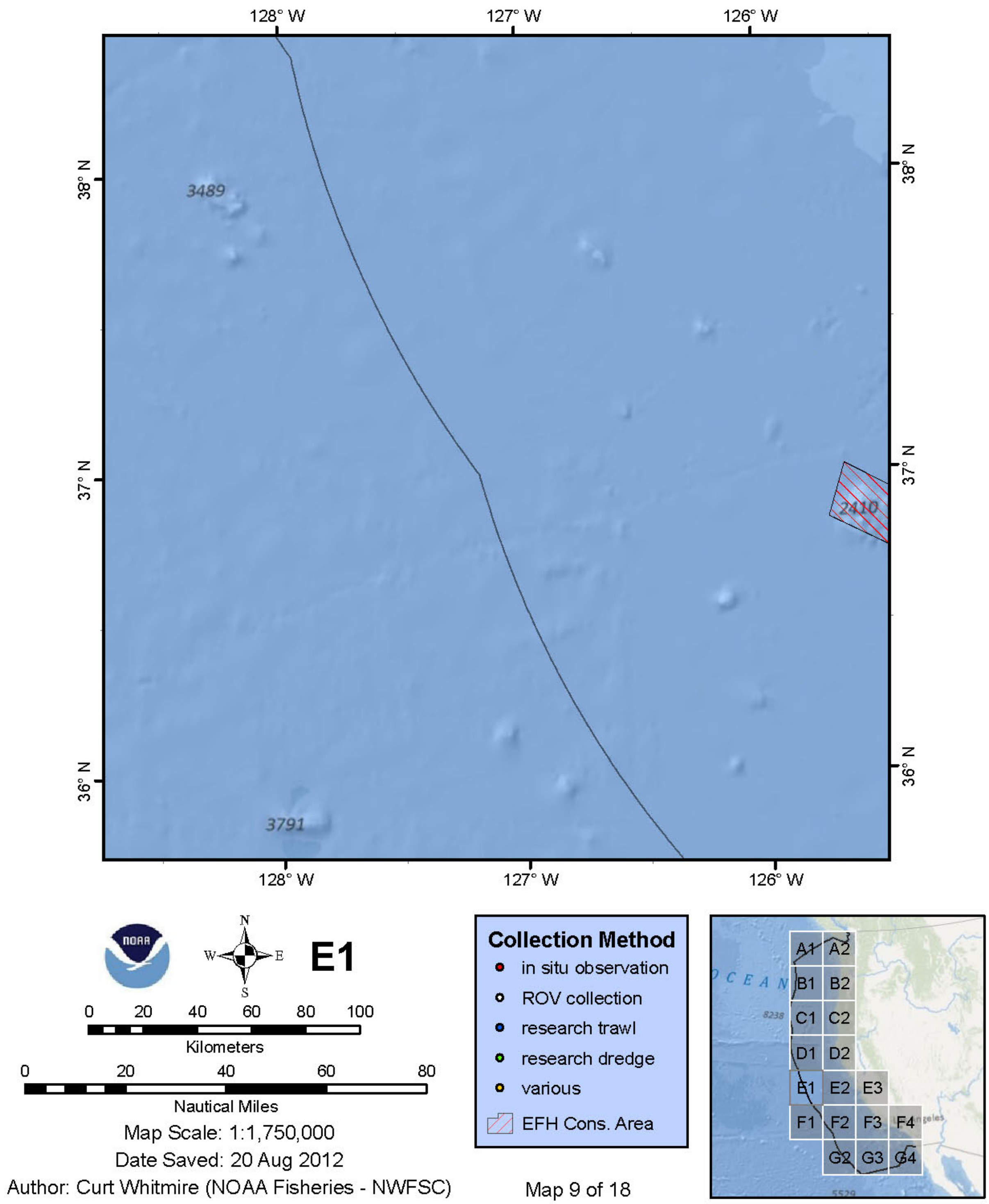


Selected Observations of Corals & Sponges

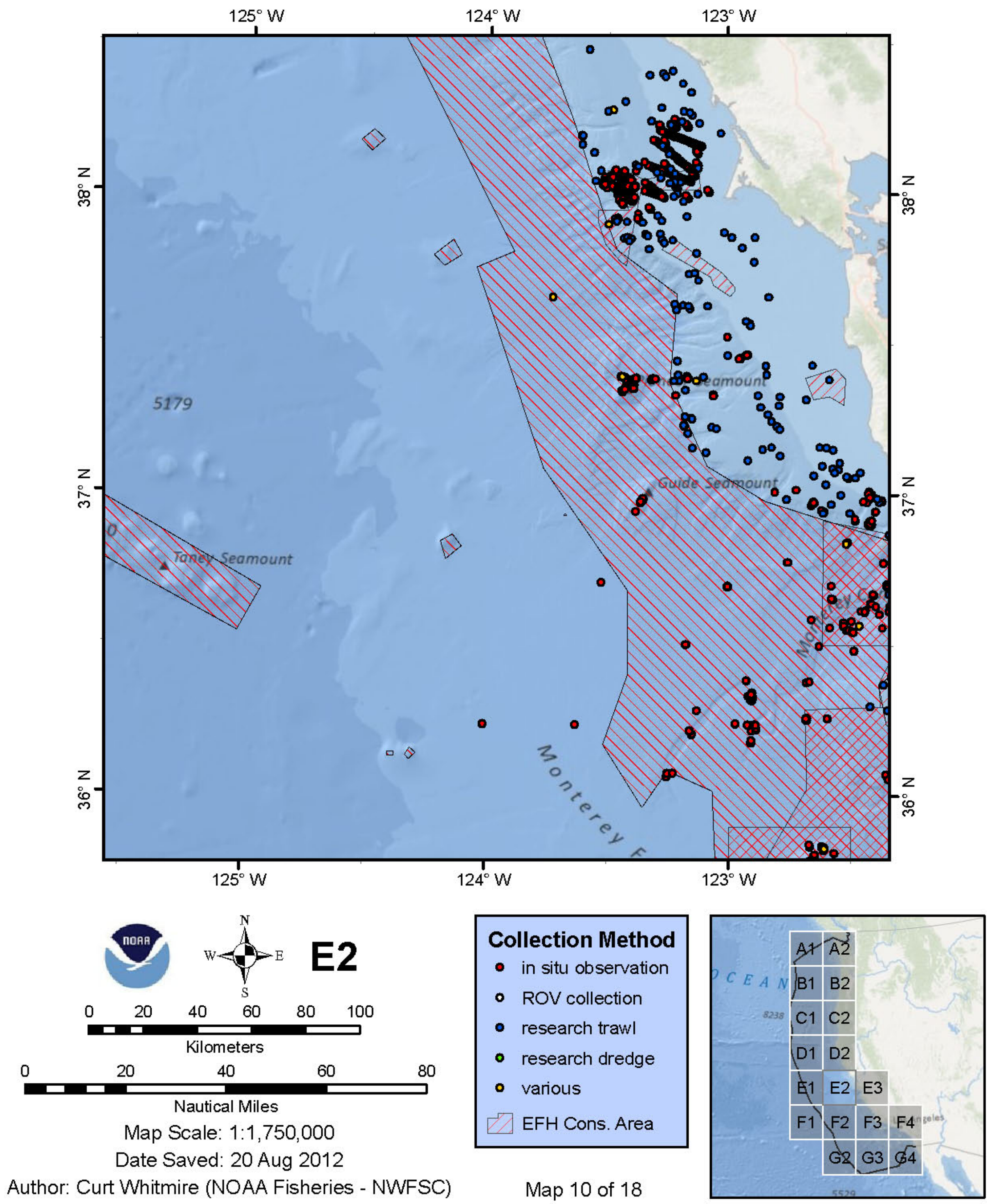



Selected Observations of Corals & Sponges
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
Collection Method
in situ observation
ROV collection
research trawl
research dredge
various
EFH Cons. Area
Map 8 of 18
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4

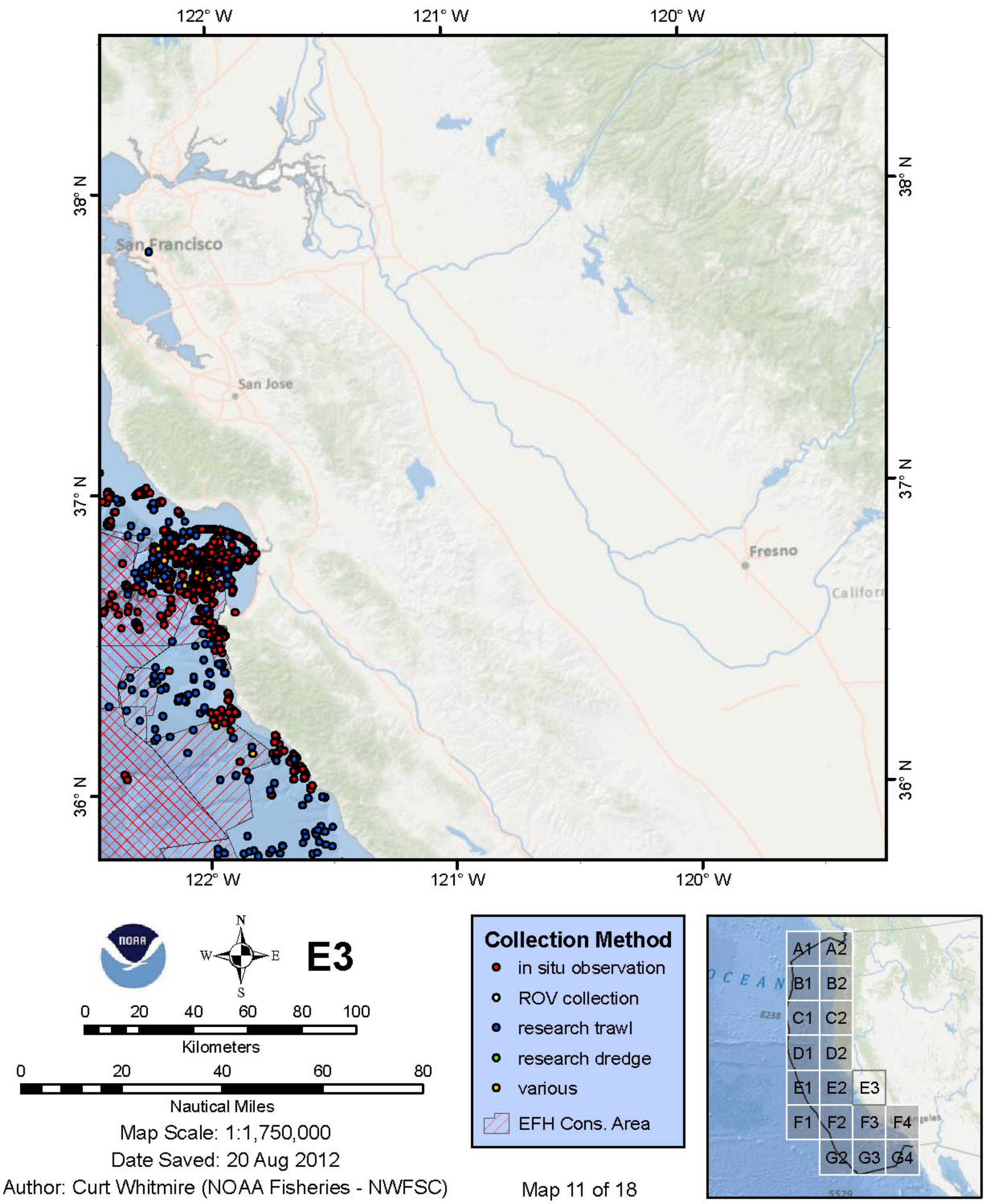
Selected Observations of Corals & Sponges



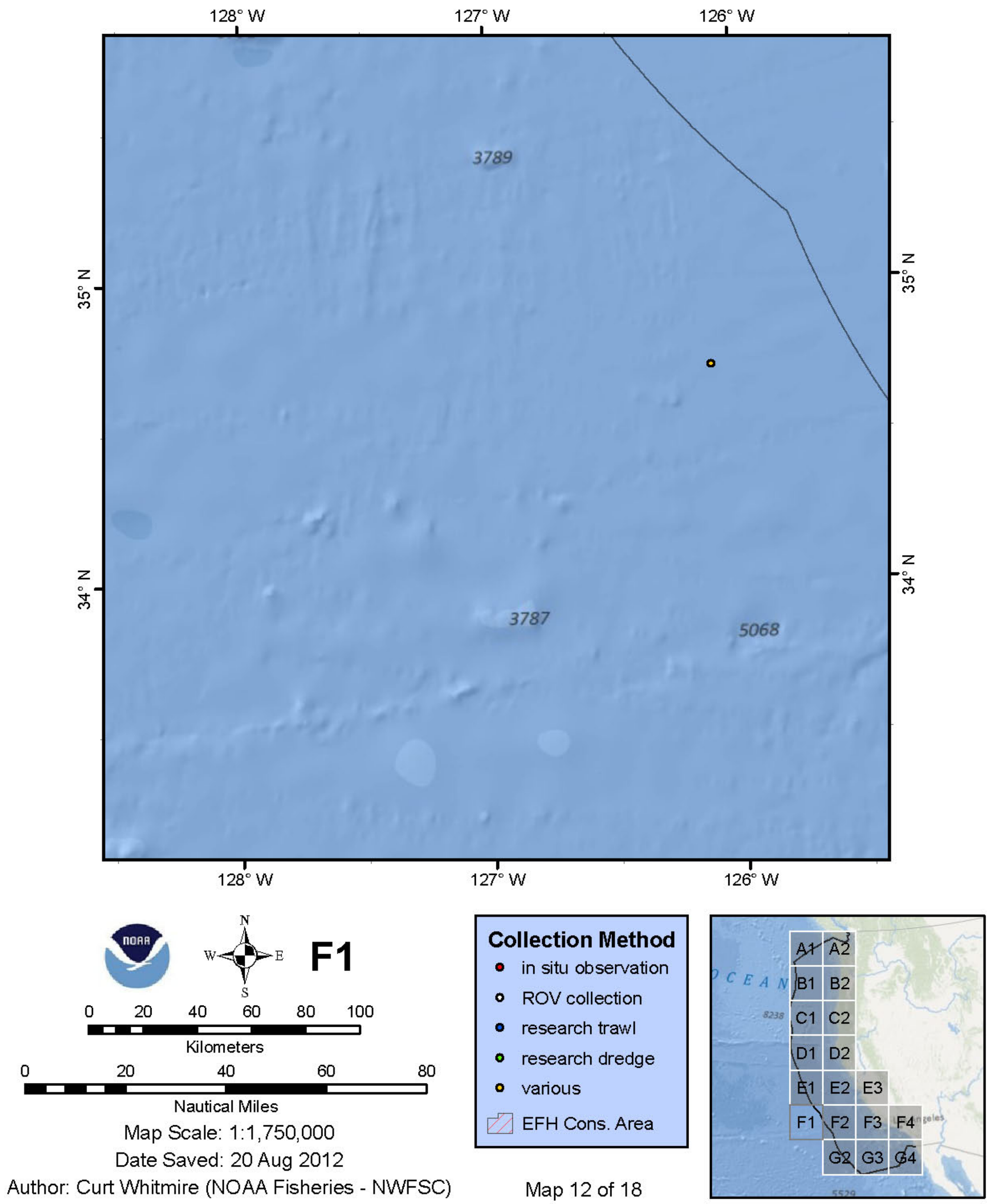
Selected Observations of Corals & Sponges



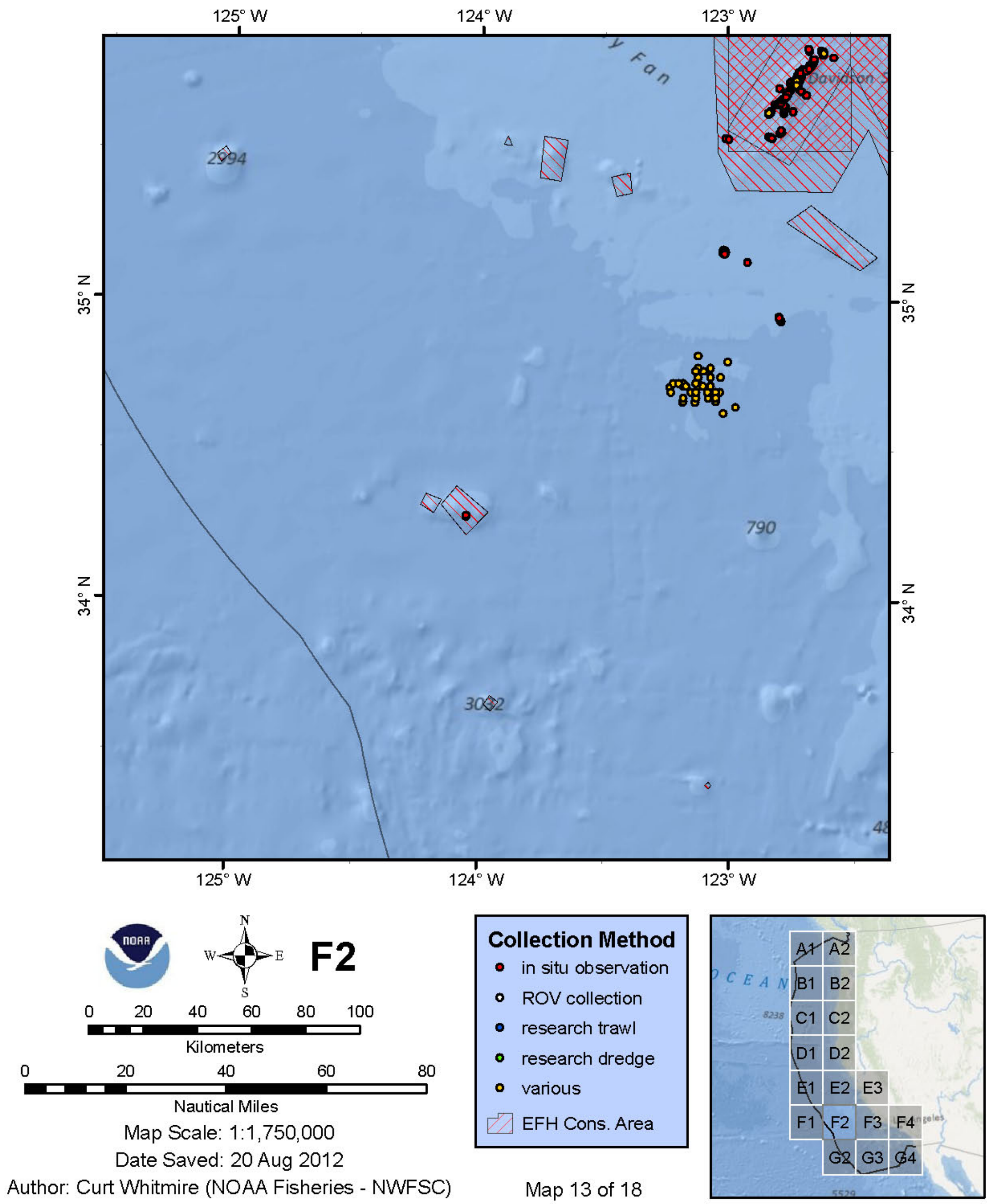
Selected Observations of Corals & Sponges



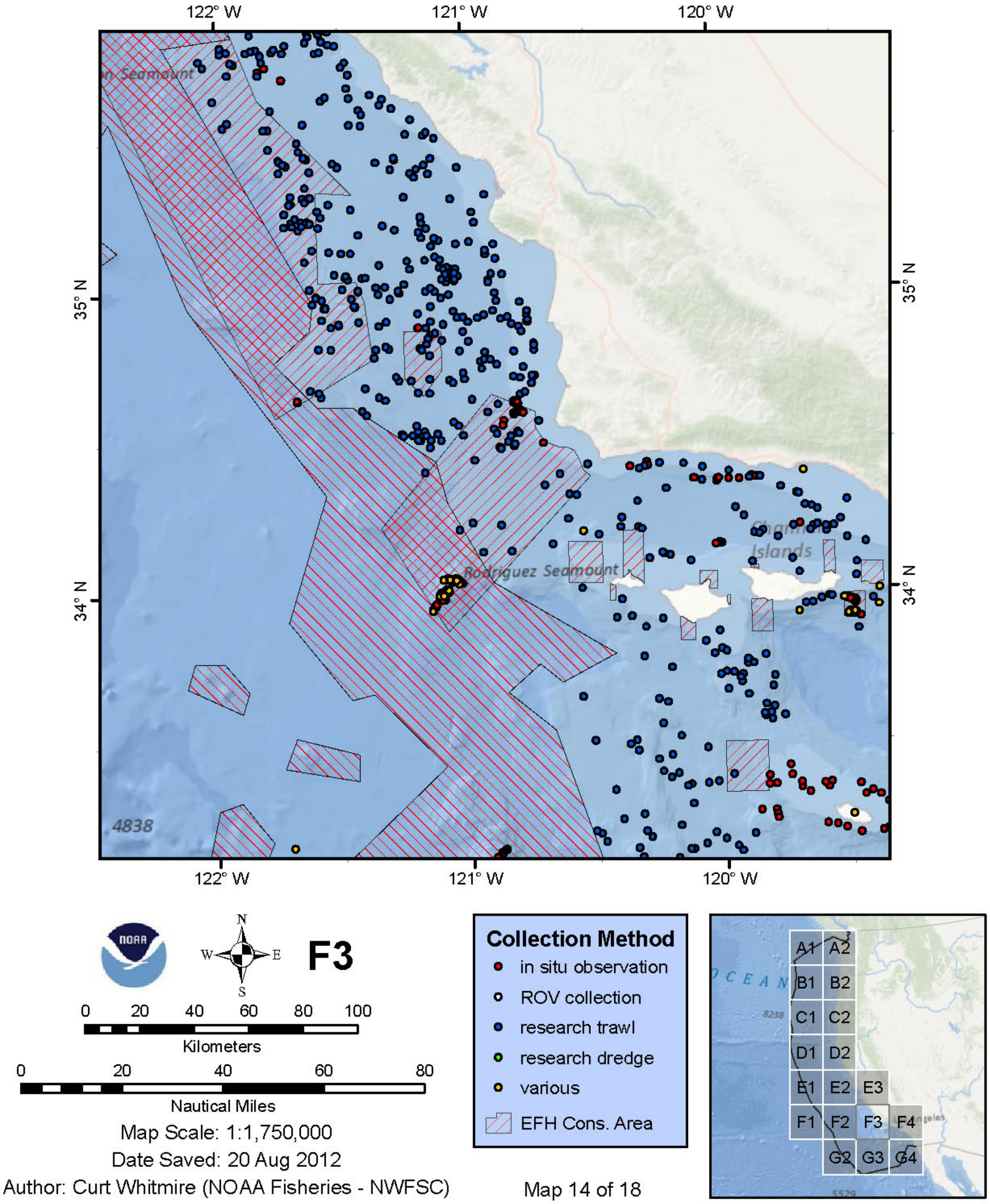
Selected Observations of Corals & Sponges



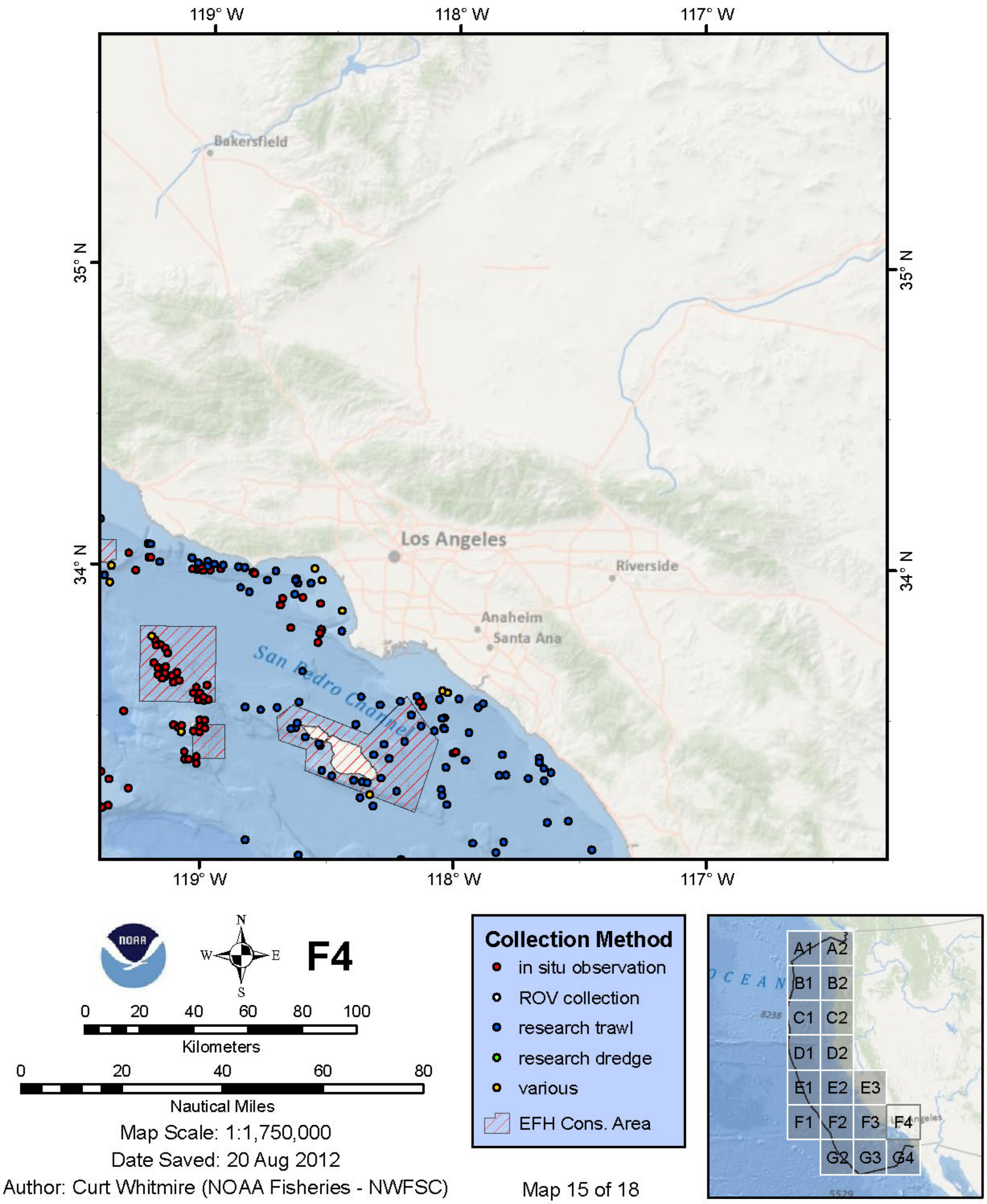
Selected Observations of Corals & Sponges



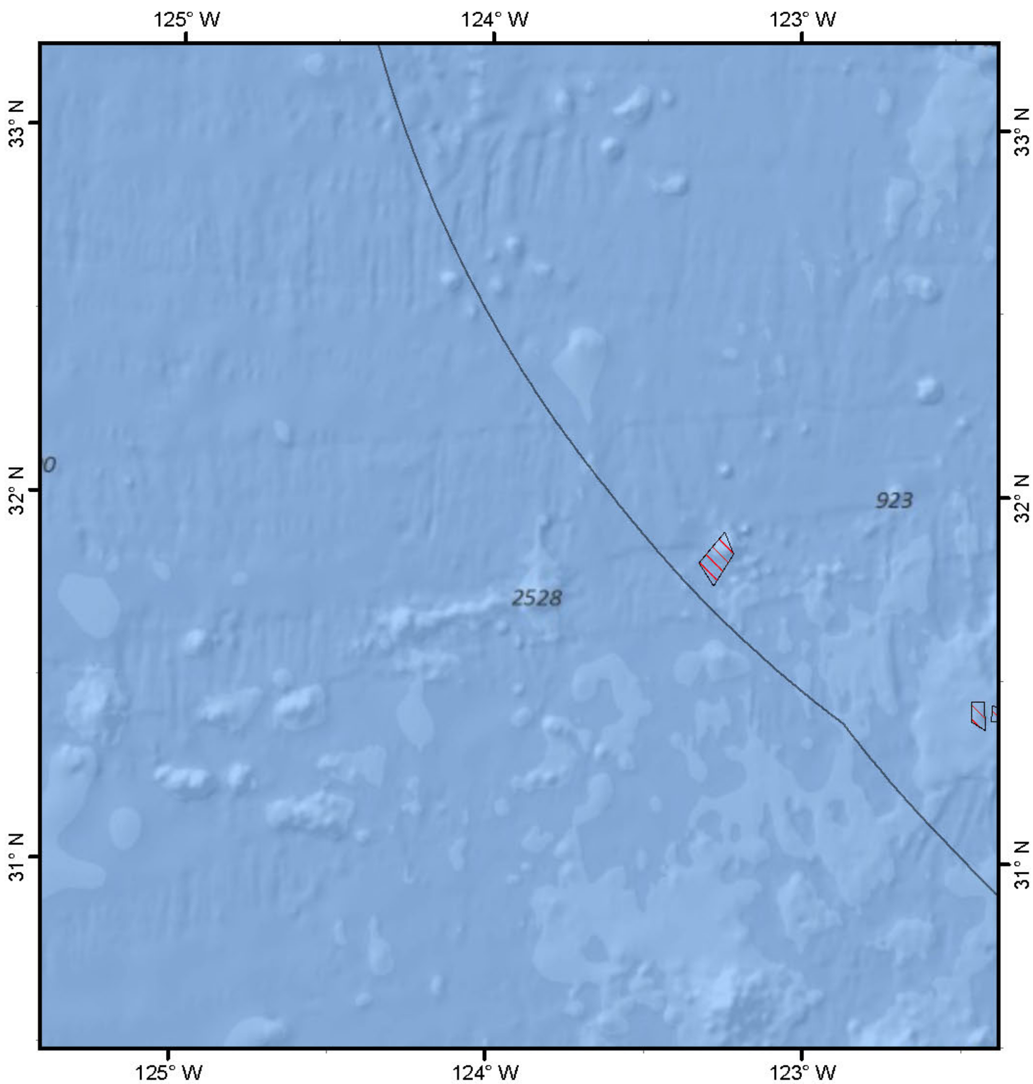
Selected Observations of Corals & Sponges



Selected Observations of Corals & Sponges



Selected Observations of Corals & Sponges



G2

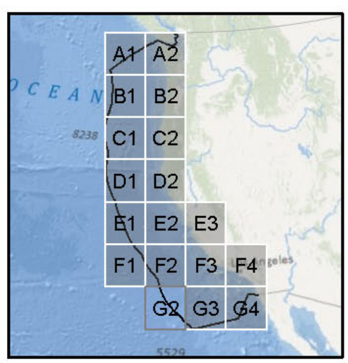
0 20 40 60 80 100
Kilometers

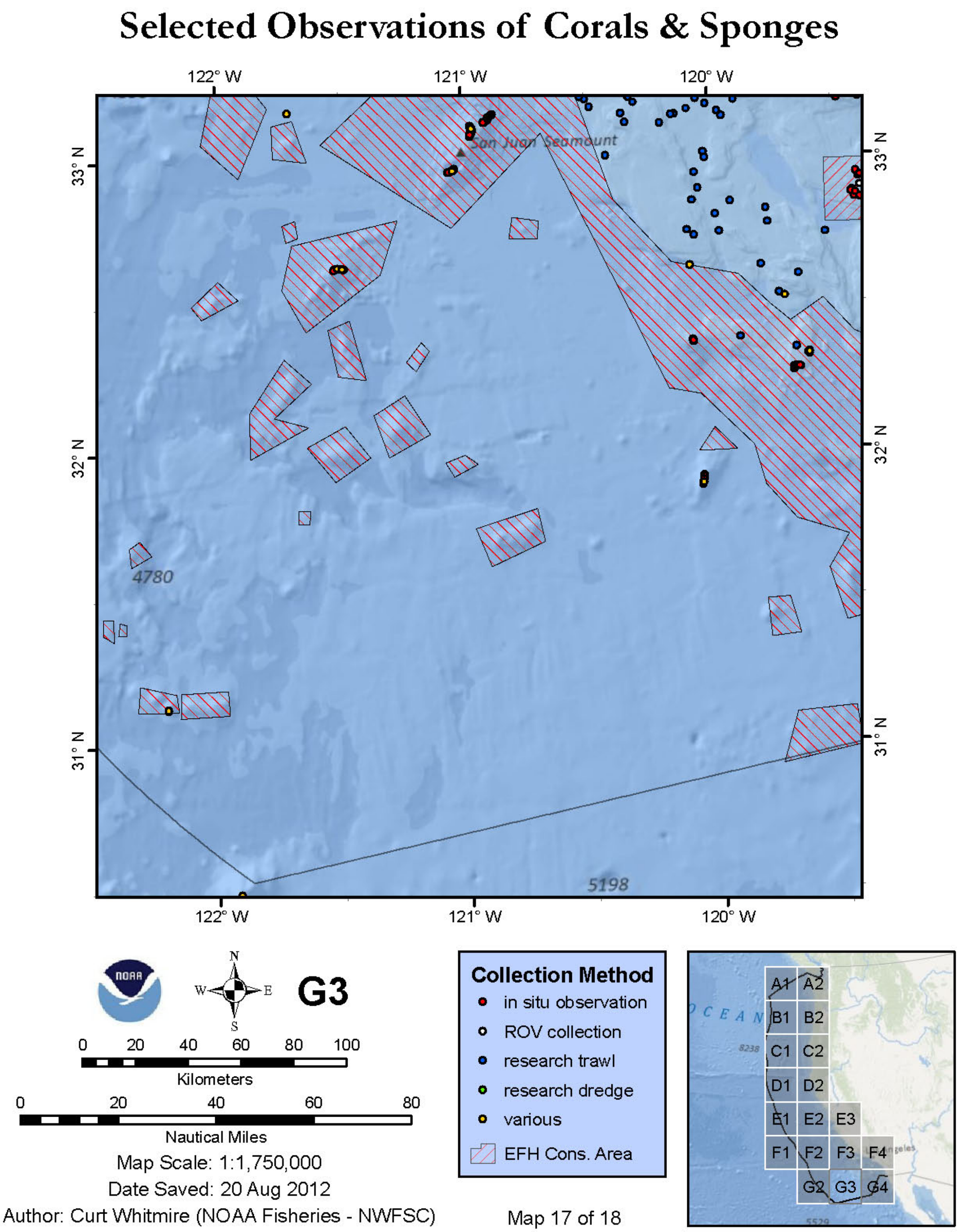
0 20 40 60 80
Nautical Miles

Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

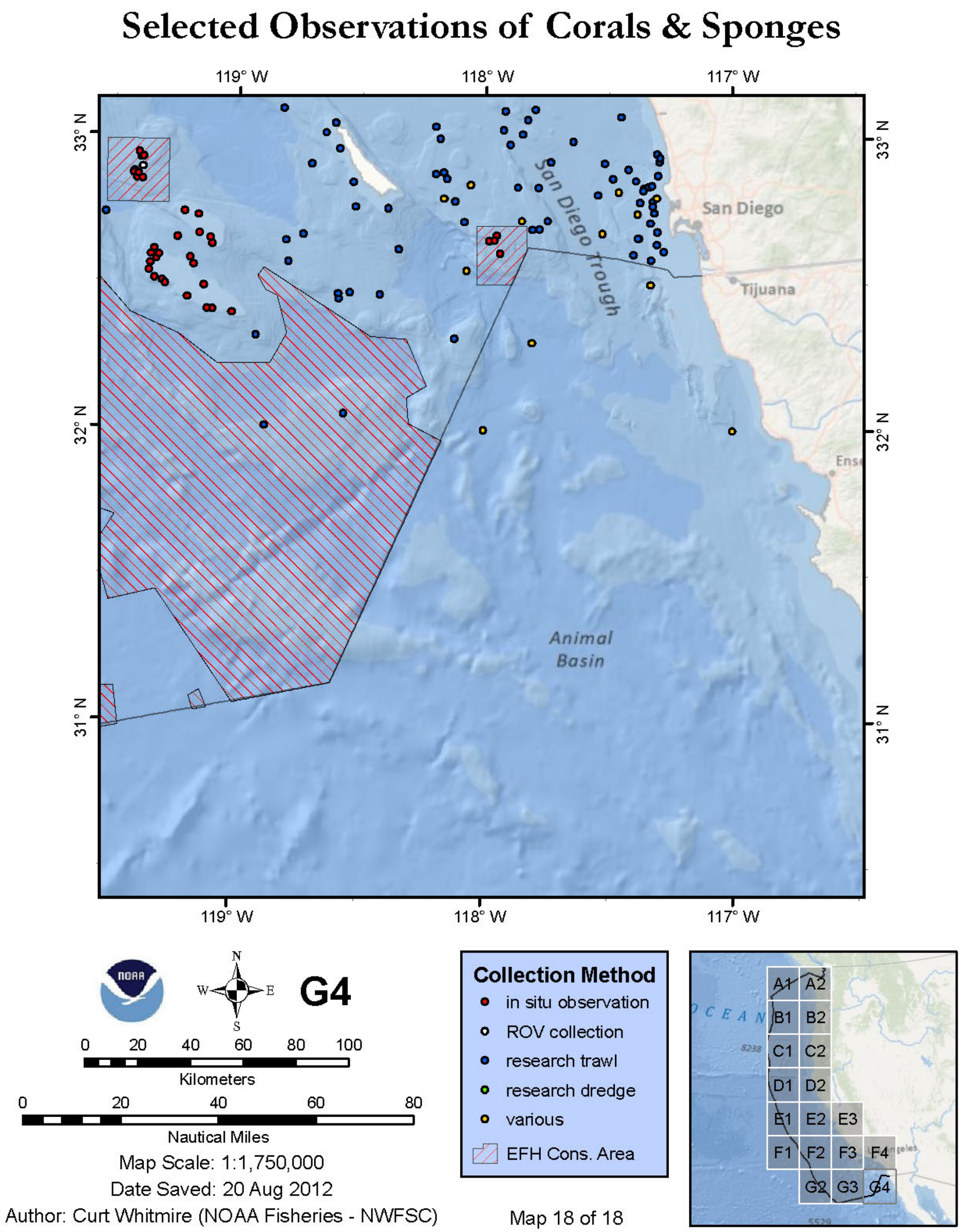
Collection Method
- in situ observation
- ROV collection
- research trawl
- research dredge
- various
- EFH Cons. Area

Map 16 of 18





Selected Observations of Corals & Sponges
122° W
121° W
120° W
33° N
32° N
31° N
San Juan Seamount
4780
5198
N
S
W
E
G3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
Collection Method
in situ observation
ROV collection
research trawl
research dredge
various
EFH Cons. Area
Map 17 of 18
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4


Selected Observations of Corals & Sponges
119° W
118° W
117° W
33° N
32° N
31° N
San Diego Trough
San Diego
Tijuana
Animal Basin
G4
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:1,750,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
Collection Method
in situ observation
ROV collection
research trawl
research dredge
various
EFH Cons. Area
Map 18 of 18
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4

APPENDIX E DISTRIBUTION OF CORALS AND SPONGES FROM STANDARDIZED CATCH IN THE NMFS WEST COAST GROUNDFISH BOTTOM TRAWL SURVEY CONDUCTED BEFORE AND AFTER THE 2006 EFH REVIEW

Appendix E plates depict the spatial distribution of standardized survey catch of corals and sponges within two time periods: "Before" (2003-05 survey cycles) and "After" (2006-10 survey cycles) implementation of Amendment 19 regulations. The sole data source for the map layers is catch records from the WCGBTS. Since 2003, the WCGBTS has been a combined survey of demersal species residing in both continental shelf (i.e., 30-100 fm) and slope (i.e., 100-700 fm) habitats. Each year, the WCBGTS sampled about 750 stations during two passes (May-July, August-October) operating north to south from the Canadian to Mexican maritime borders. Tow durations were targeted at 15 minutes, with a mean tow distance of 1.4 km. Invertebrates in the catch were sorted, weighed and identified down to the lowest possible taxonomic level. Consequently, taxonomic resolution was dependent upon the expertise of onboard biologists. A full description of the survey design and protocols can be found in past cruise reports at: http://www.nwfsc.noaa.gov/research/divisions/fram/index.cfm.

Standardized catch was defined as the total weight of organisms (kg) per linear distance towed (km) witin a standard area and calculated for four taxonomic groupings of organisms: 1) corals (excluding sea pens and sea whips) and sponges, 2) corals (excluding sea pens and sea whips), 3) sponges, and 4) sea pens and seas whips (Appendix E-1 to E-4). The numerator (catch) was calculated using a kernel density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California). The kernel density algorithm distributes catch over a surface that is defined by a user-specified distance from the line, where the catch is highest on the line and dimishes proportionally with distance from the line. Each kernel surface encompasses the toal catch value for a given tow. The denominator (effort) was calculated using a line density algorithm that sums the total portions of lines intersecting a circular search area. Both density values are assigned to grid cells of user-specified dimensions. Cells with values greater than zero indicate areas of positive catch, while cells of zero value indicate areas where effort occurred but no corals and/or sponges were present in the catch. The density parameters used for calculating both catch and effort were a 6-km search radius and a 500x500 m cell size. By standardizing catch by effort, the resulting catch outputs were standardized over both space and time. Since density outputs are highly sensitive to the specified radius and cell size, the absolute values are less important than the relative nature of them. The benefit of this output over depicting towlines themselves is that the density output better identifies areas where catch is concentrated.

In order to evaluate how fishing effort has changed between the two time periods, the color ramps for the intensity layers are scaled to the same range of values in each panel (see Appendix E figures). Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. White areas repreent those where no catch occurred but where effort still existed. The value in the map legends is the lowest "high" value between the time periods. It was necessary to set the color ramp to the lowest "high" value in order for the colors in each panel to perfectly match and therefore be comparative.

In the maps showing standardized catch of corals excluding sea pens/whips (Appendix E-2), areas of highest relative CPUE occurred off northern California in both time periods. Two areas off northern Washington show moderate CPUE, one within the Olympic 2 EFH conservation area in the recent time period (Figure 12).

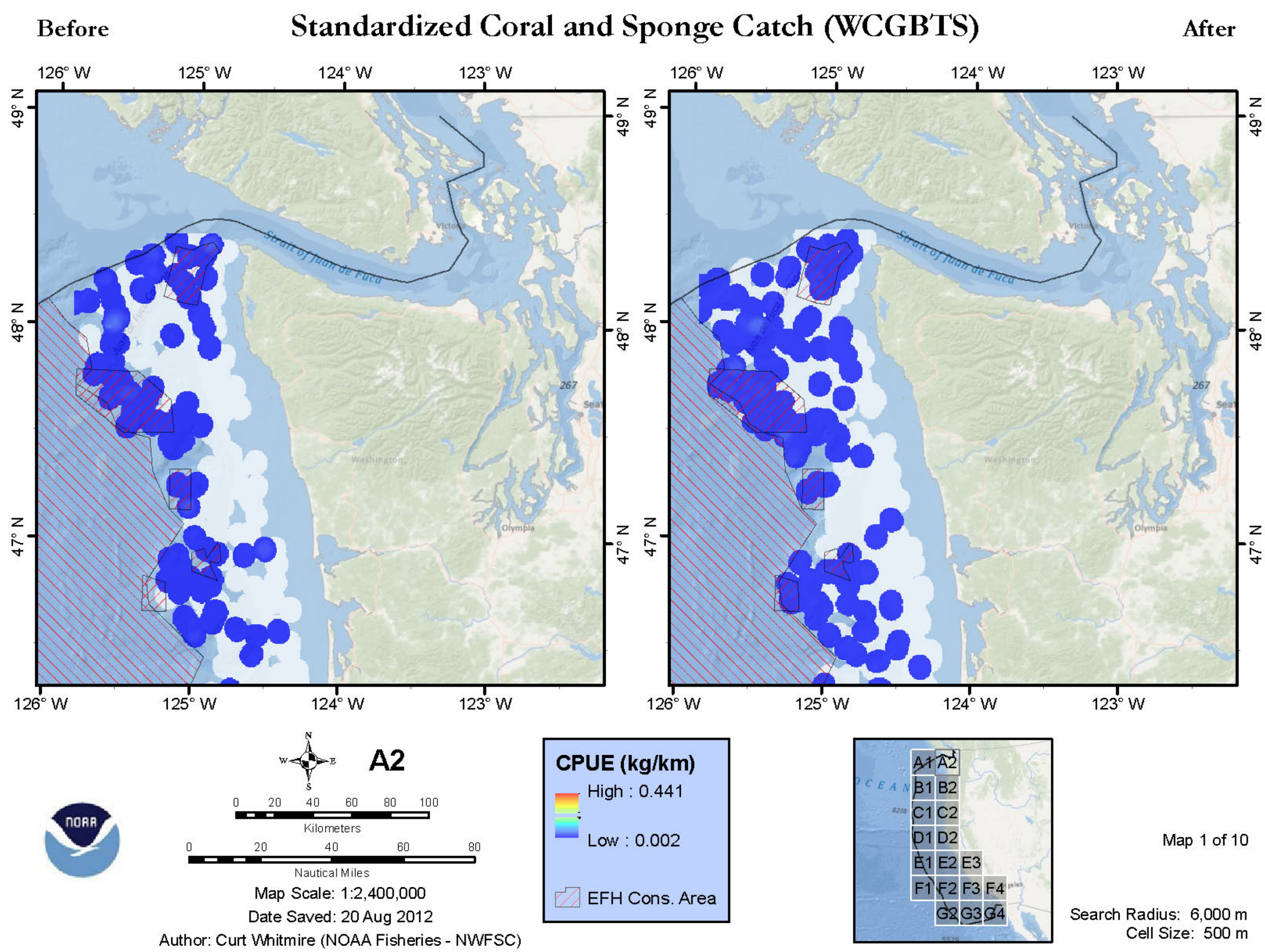
In the maps showing sponges only (Appendix E-3), the areas of highest relative CPUE occurred off southern California, two sites in the before period and one in the after (Plate F3). The one area of highest

CPUE in the recent time period also showed relative moderate catches of sponges in the before period. Other areas of moderate catch of sponges occurred near the Eel River Canyon (Plate D2, before) and off central Oregon in both time periods (Plate B2).

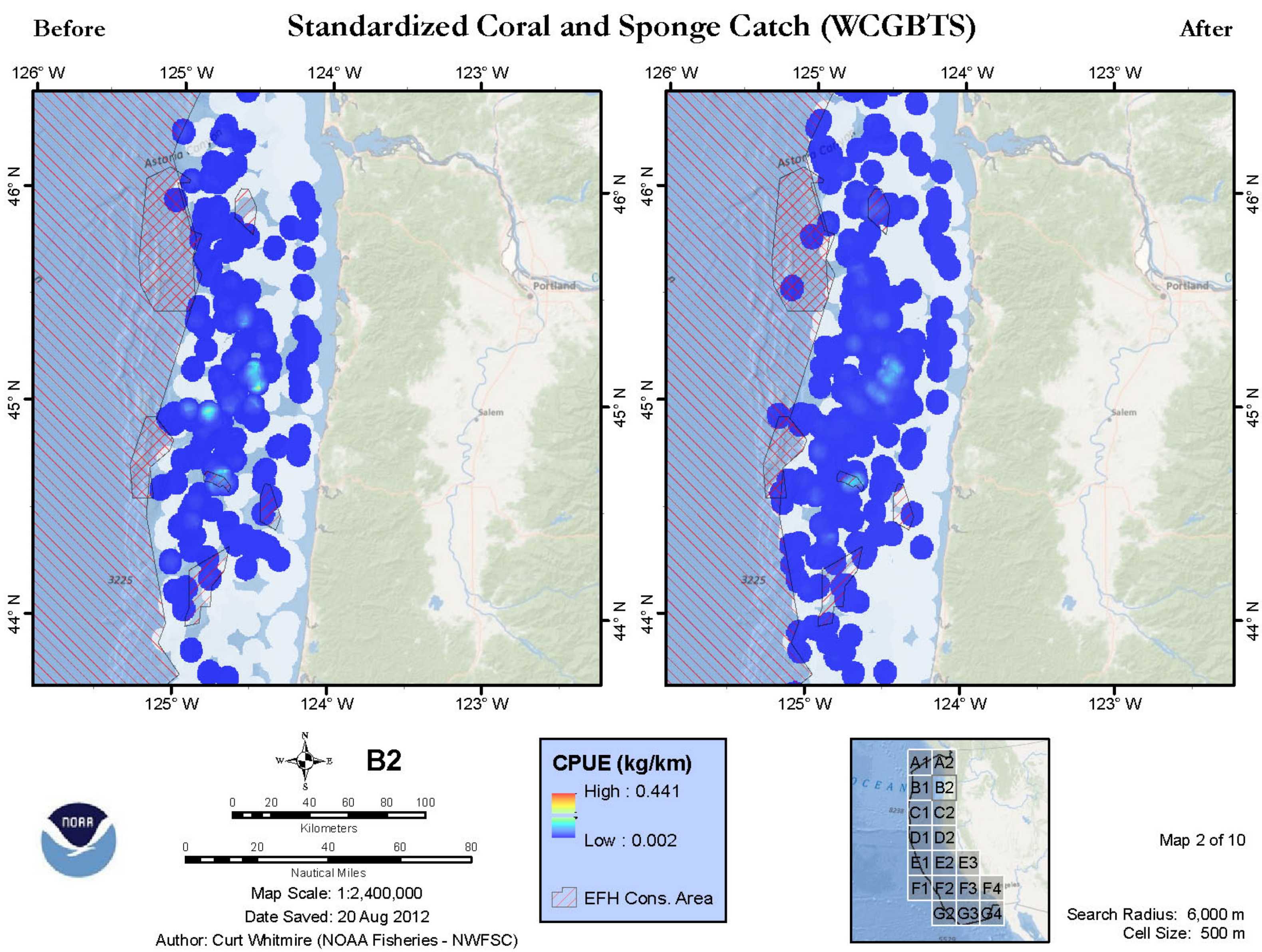
Areas of highest CPUE for sea pens/whips (Appendix E-4) occurred off northern and central Oregon (Plate B-2) and central California (Plate F3). Other areas of moderate CPUE are apparent off San Francisco in the recent time period (Plate E2) and central (Plate F3) and southern California (Plates F4 and F5).

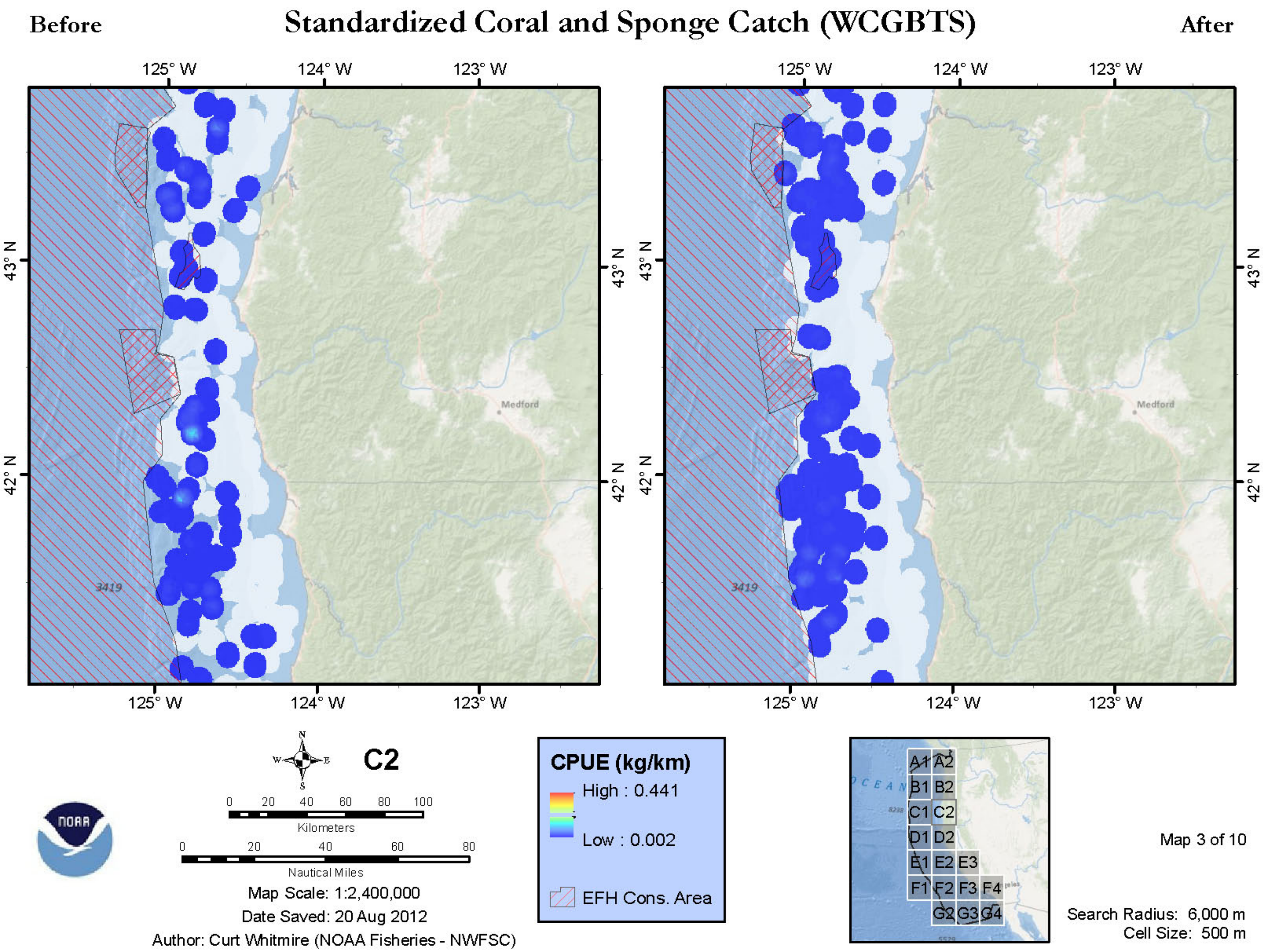
One important consideration when evaluating catch records of invertebrates from trawl surveys is the sampling gear itself. Bottom trawl gear used in the WCGBTS is not designed to sample sessile invertebrates, nor is it designed to access many of the preferred habitats for coral and sponge settlement or habitats known to support corals and sponges. Regardless of the limitations of the gear, corals or sponges were recorded in almost half of all survey tows. The average length of survey tows is much shorter in duration than commercial tows, and vessel captains can often prosecute a tow in areas where they normally would not during commercial operations. This may in part account for the fact that corals and sponges are recorded more frequently in survey catches (see Section 3.2.2.3, Table 5).

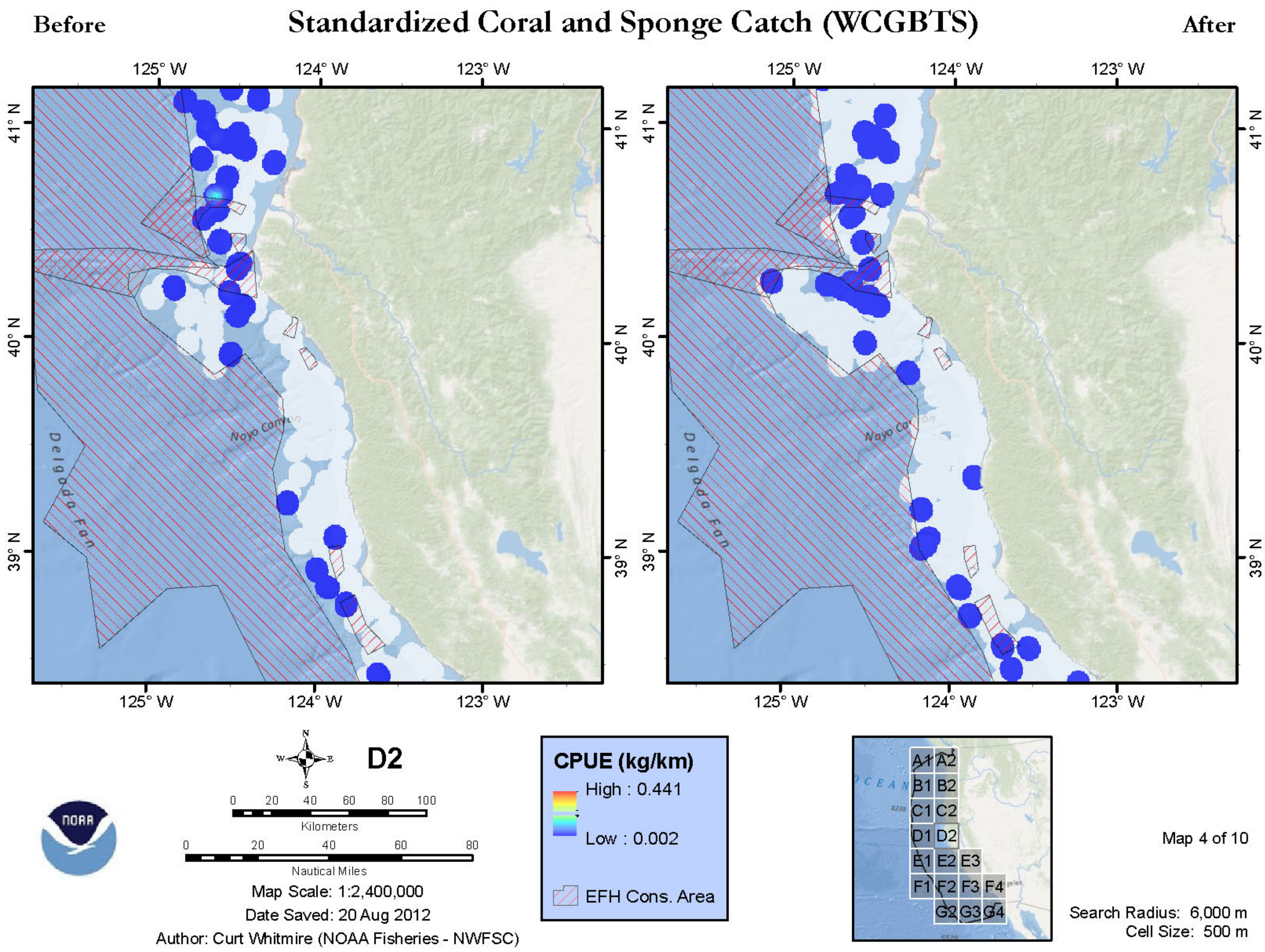
To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.

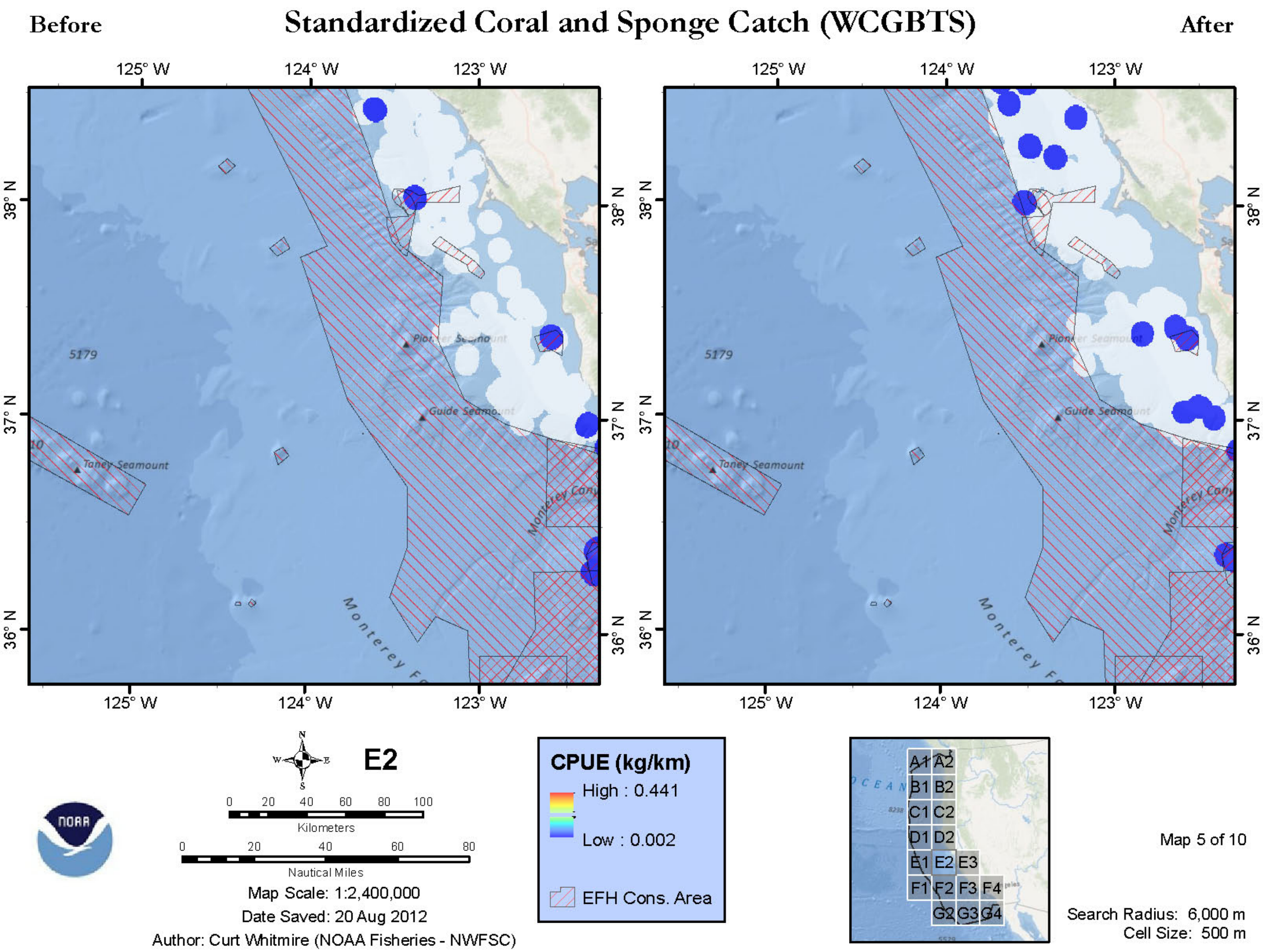


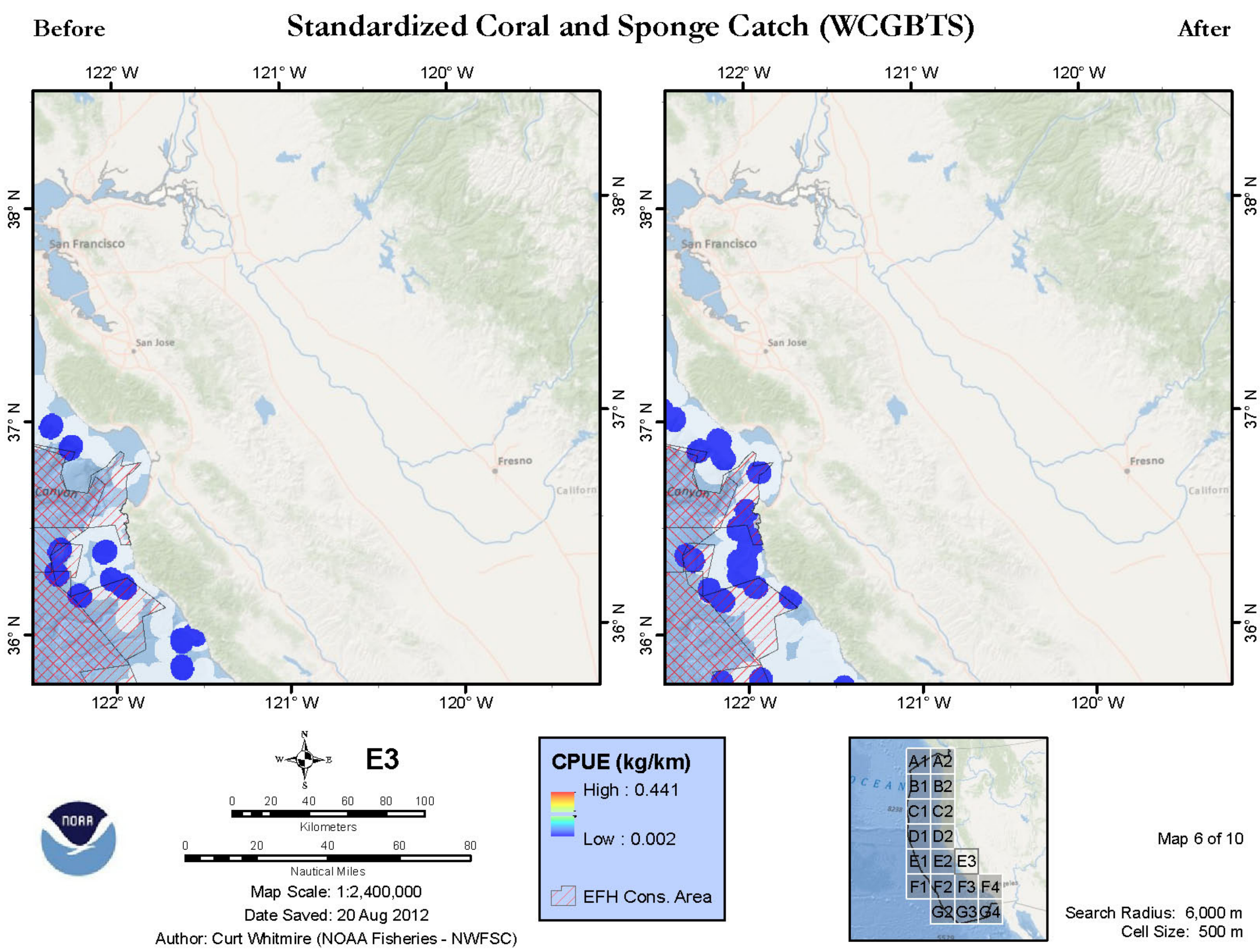
Before
Standardized Coral and Sponge Catch (WCGBTS)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Washington
Olympia
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 10
Search Radius: 6,000 m
Cell Size: 500 m

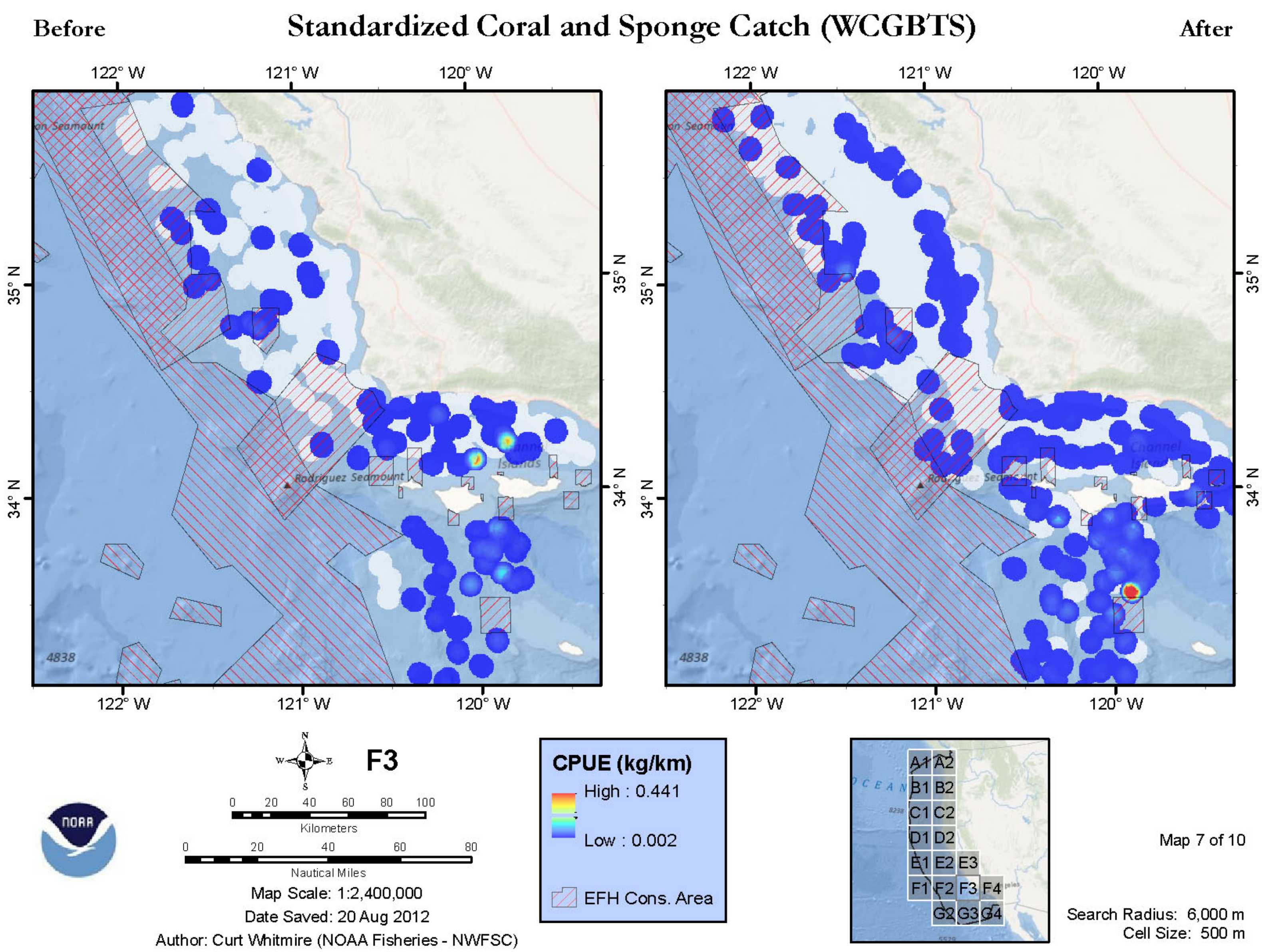

Before
Standardized Coral and Sponge Catch (WCGBTS)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria
Portland
Salem
3225
B2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 10
Search Radius: 6,000 m
Cell Size: 500 m

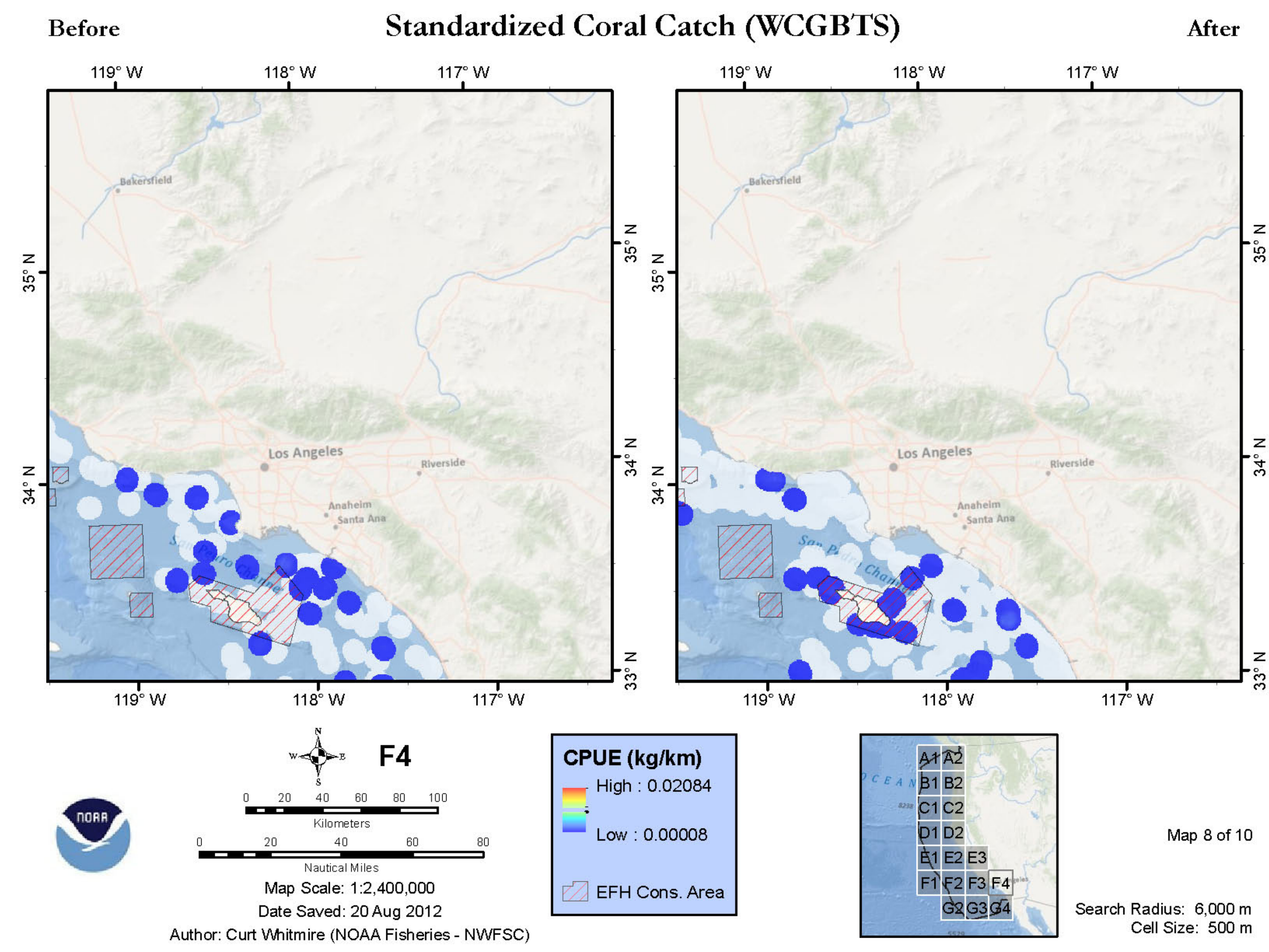

Before
Standardized Coral and Sponge Catch (WCGBTS)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 10
Search Radius: 6,000 m
Cell Size: 500 m


Before
Standardized Coral and Sponge Catch (WCGBTS)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
N
S
E
W
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 10
Search Radius: 6,000 m
Cell Size: 500 m

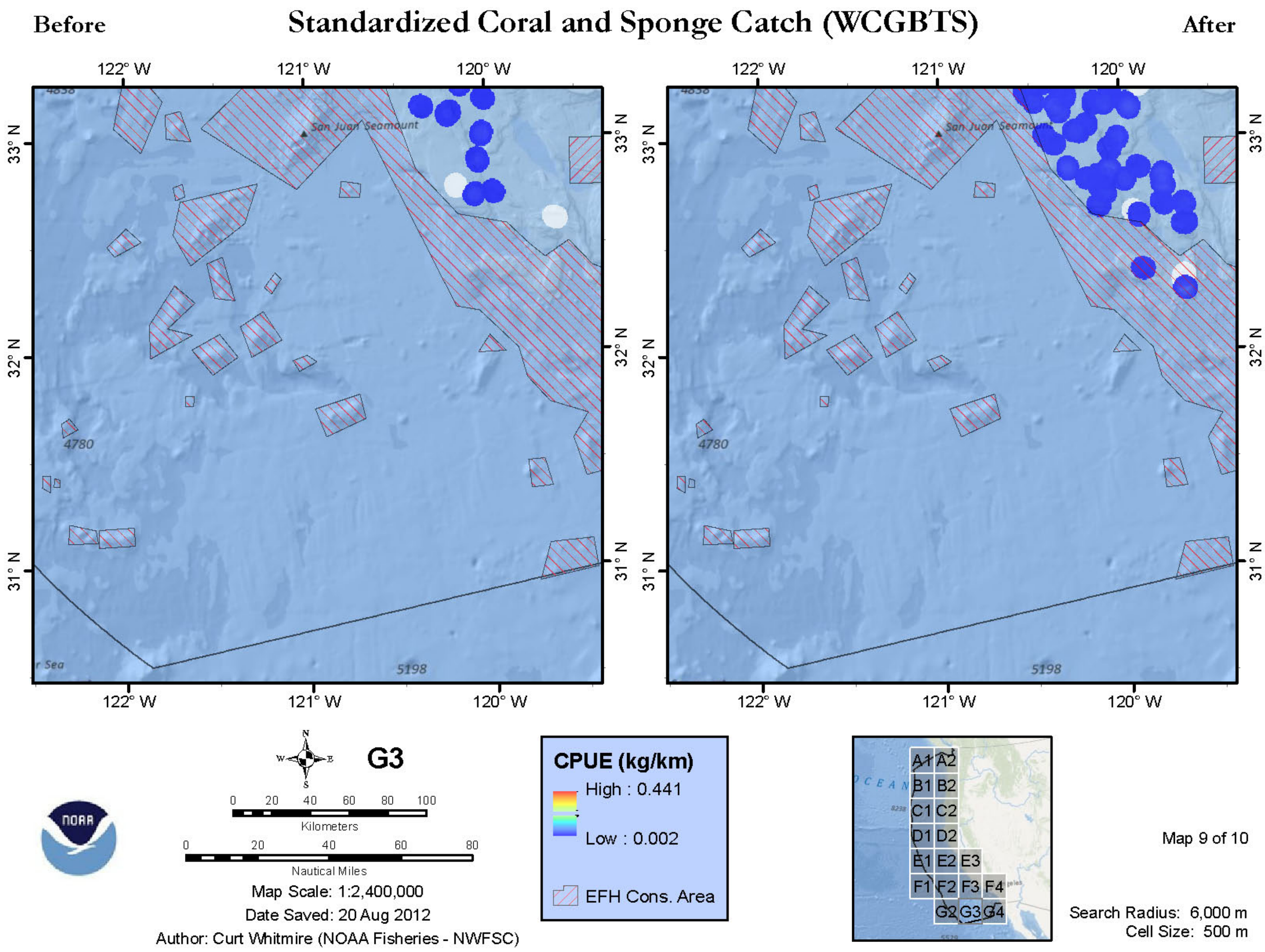

Before
Standardized Coral and Sponge Catch (WCGBTS)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 10
Search Radius: 6,000 m
Cell Size: 500 m

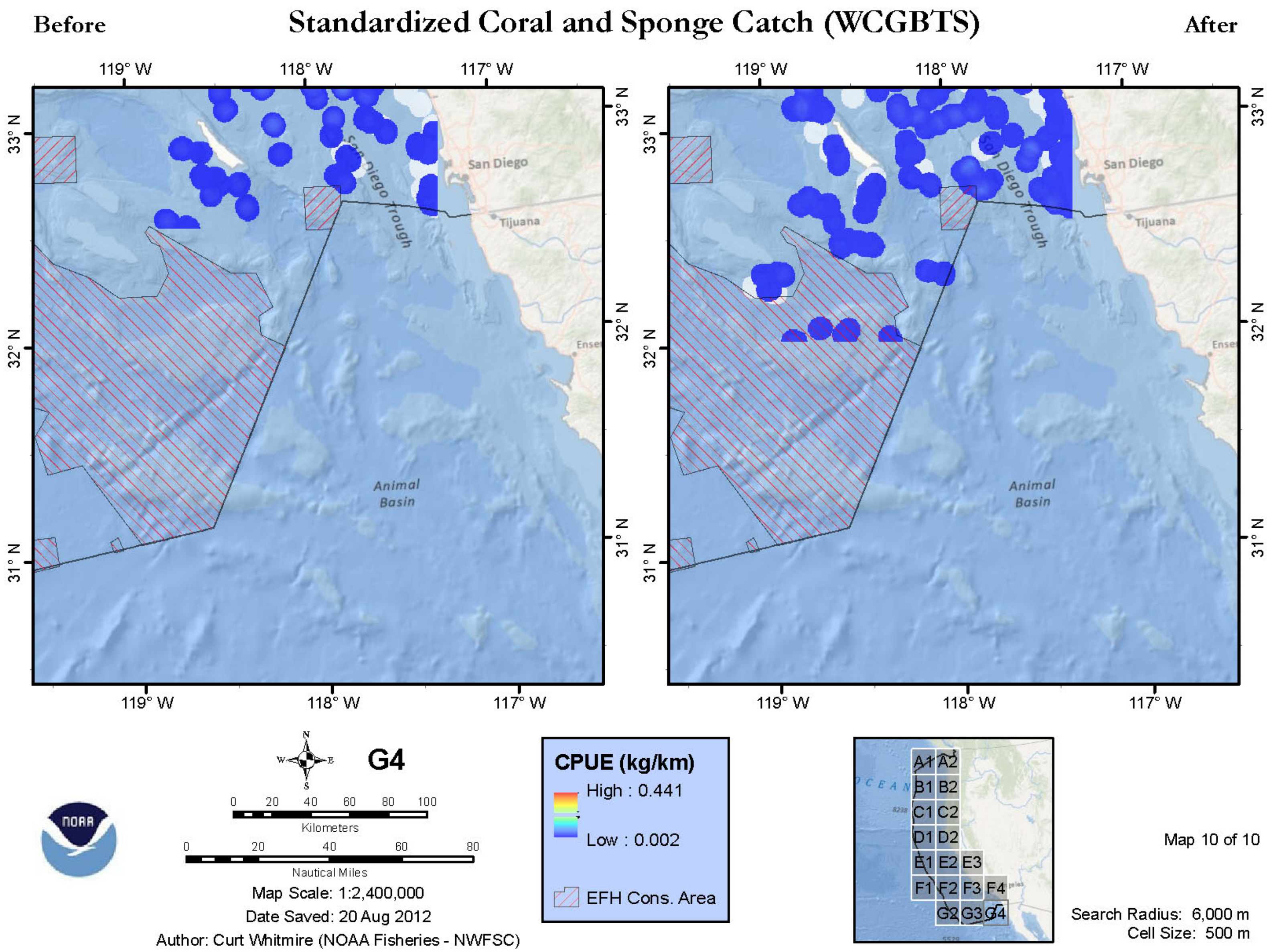

Before
Standardized Coral and Sponge Catch (WCGBTS)
After
122° W
121° W
120° W
38° N
37° N
36° N
San Francisco
San Jose
Fresno
Canyon
E3
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 6 of 10
Search Radius: 6,000 m
Cell Size: 500 m


Before
Standardized Coral and Sponge Catch (WCGBTS)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
4838
F3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 10
Search Radius: 6,000 m
Cell Size: 500 m

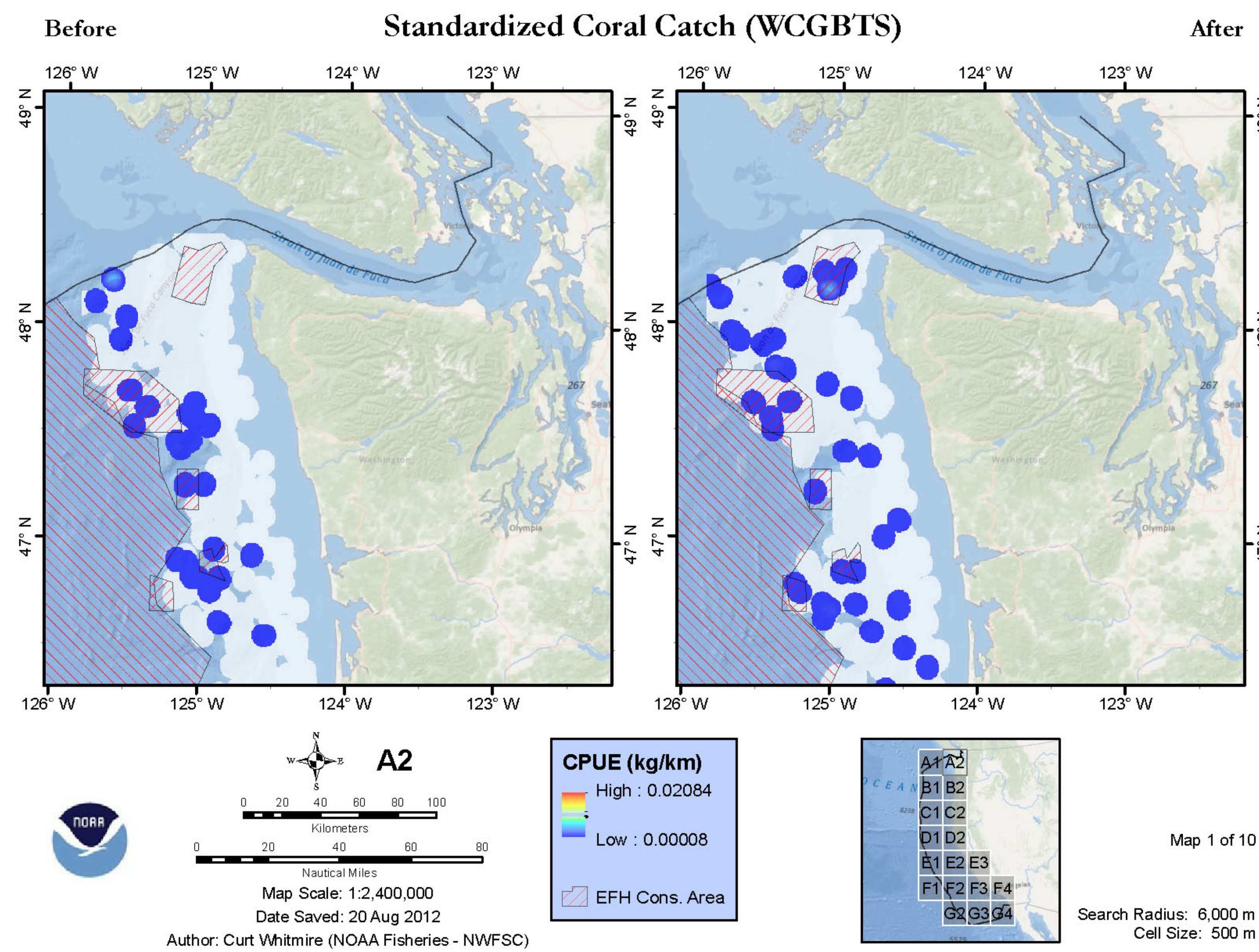


Before
Standardized Coral Catch (WCGBTS)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
F4
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
Map 8 of 10
Search Radius: 6,000 m
Cell Size: 500 m

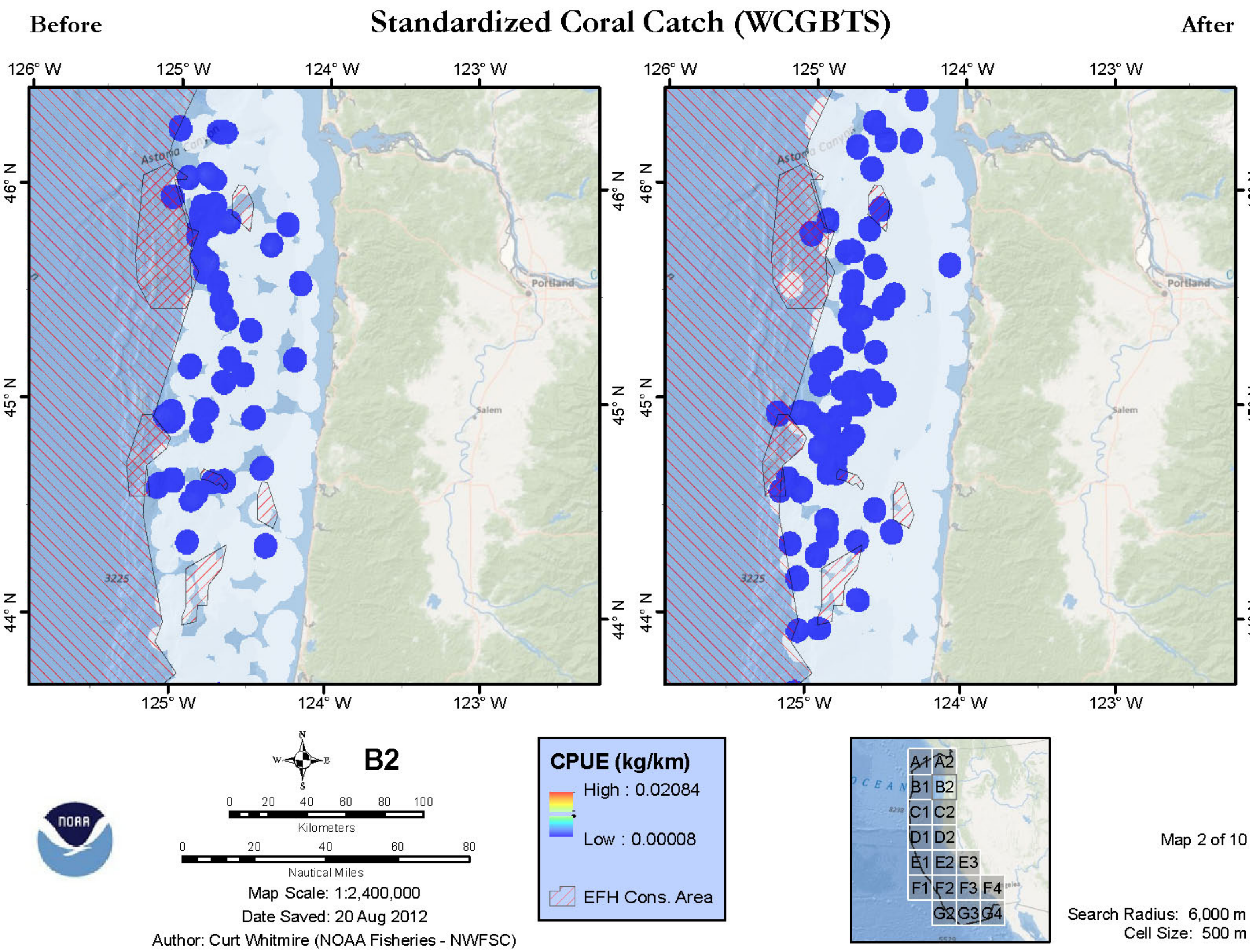

Before
Standardized Coral and Sponge Catch (WCGBTS)
After
122° W
121° W
120° W
33° N
32° N
31° N
San Juan Seamount
4780
5198
G3
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 9 of 10
Search Radius: 6,000 m
Cell Size: 500 m


Before
Standardized Coral and Sponge Catch (WCGBTS)
After
119° W
118° W
117° W
33° N
32° N
31° N
San Diego
Tijuana
San Diego Trough
Animal Basin
G4
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 10 of 10
Search Radius: 6,000 m
Cell Size: 500 m

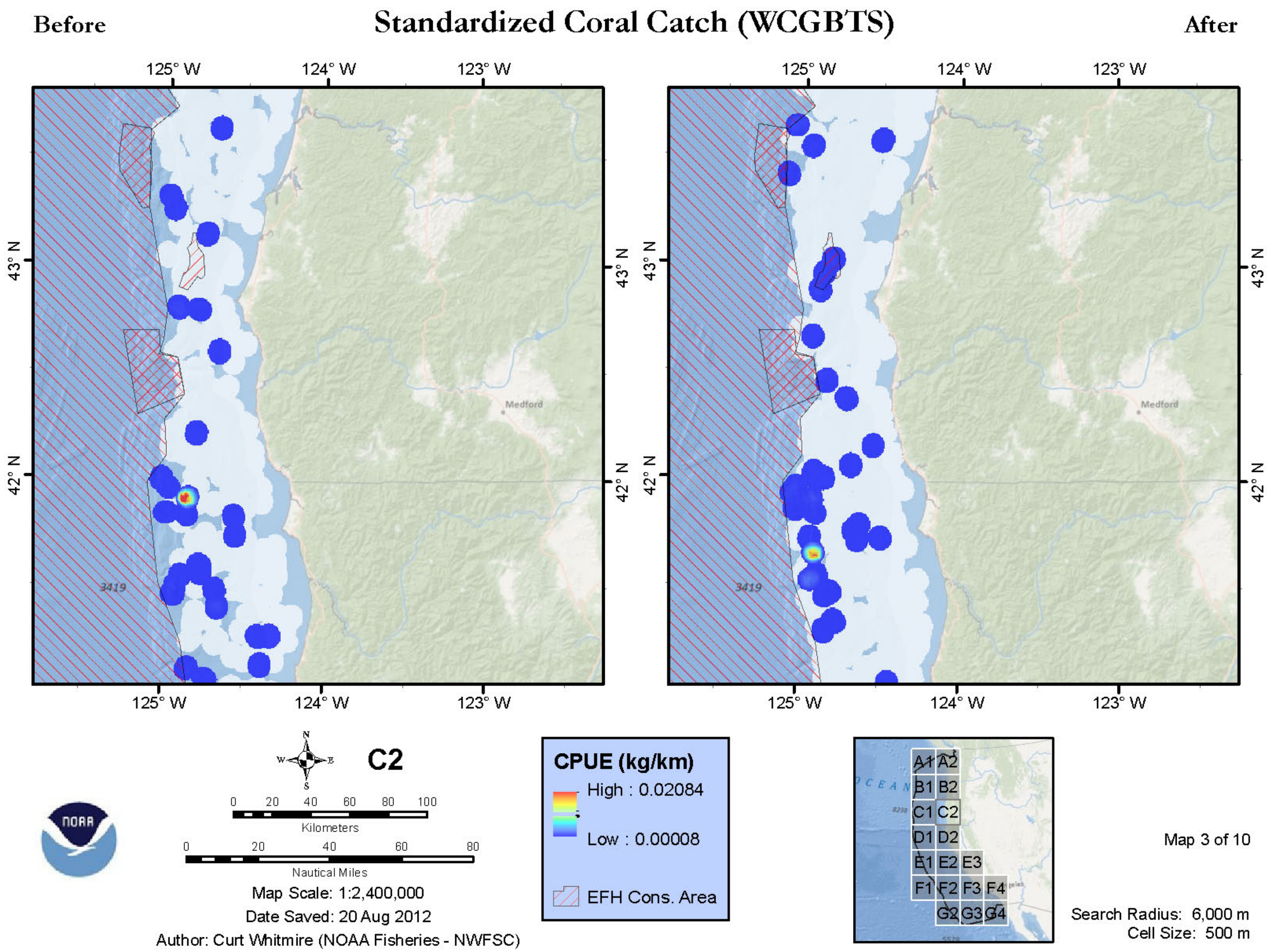
Appendix E-2: WCGBTS Coral

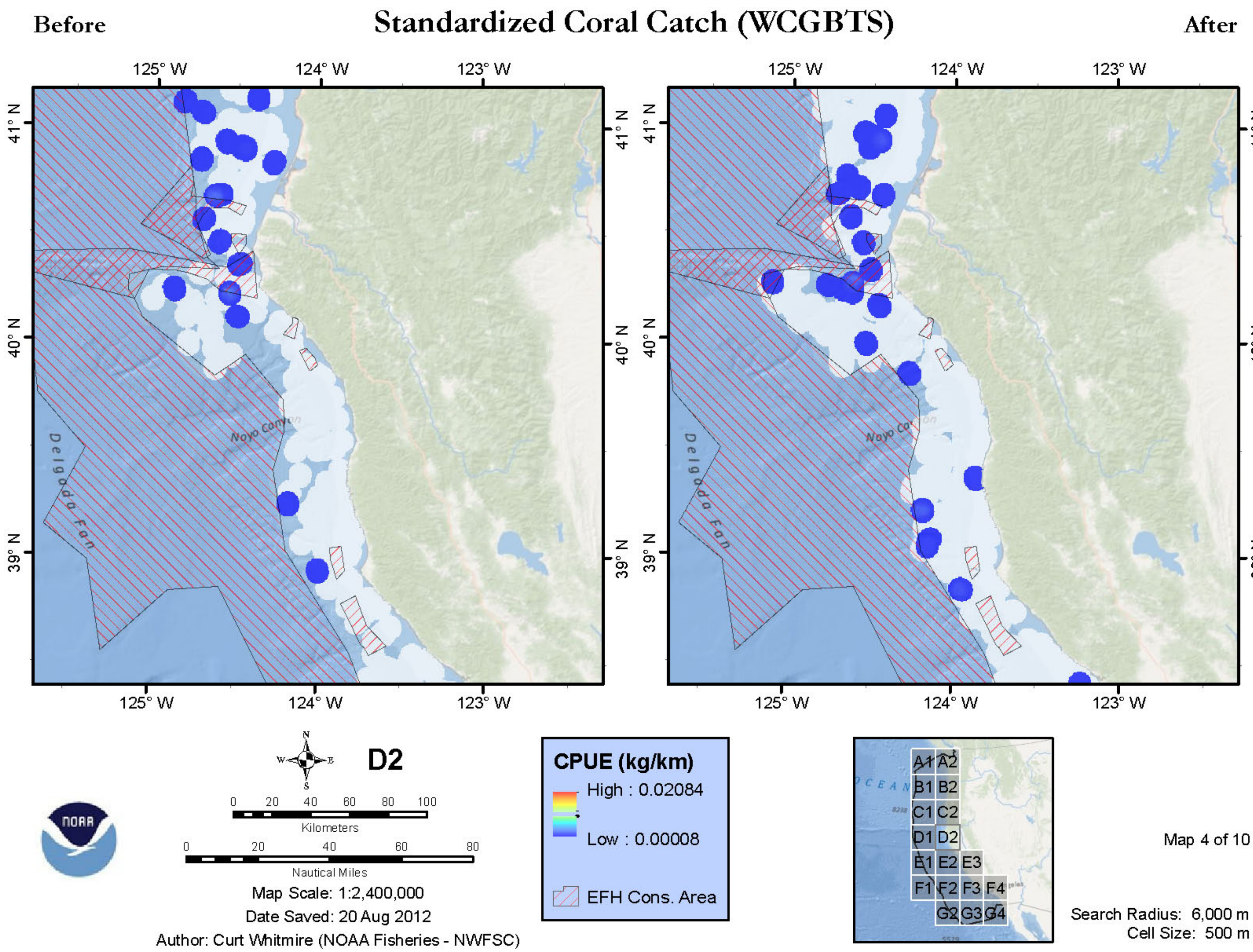


Appendix E-2: WCGBTS Coral

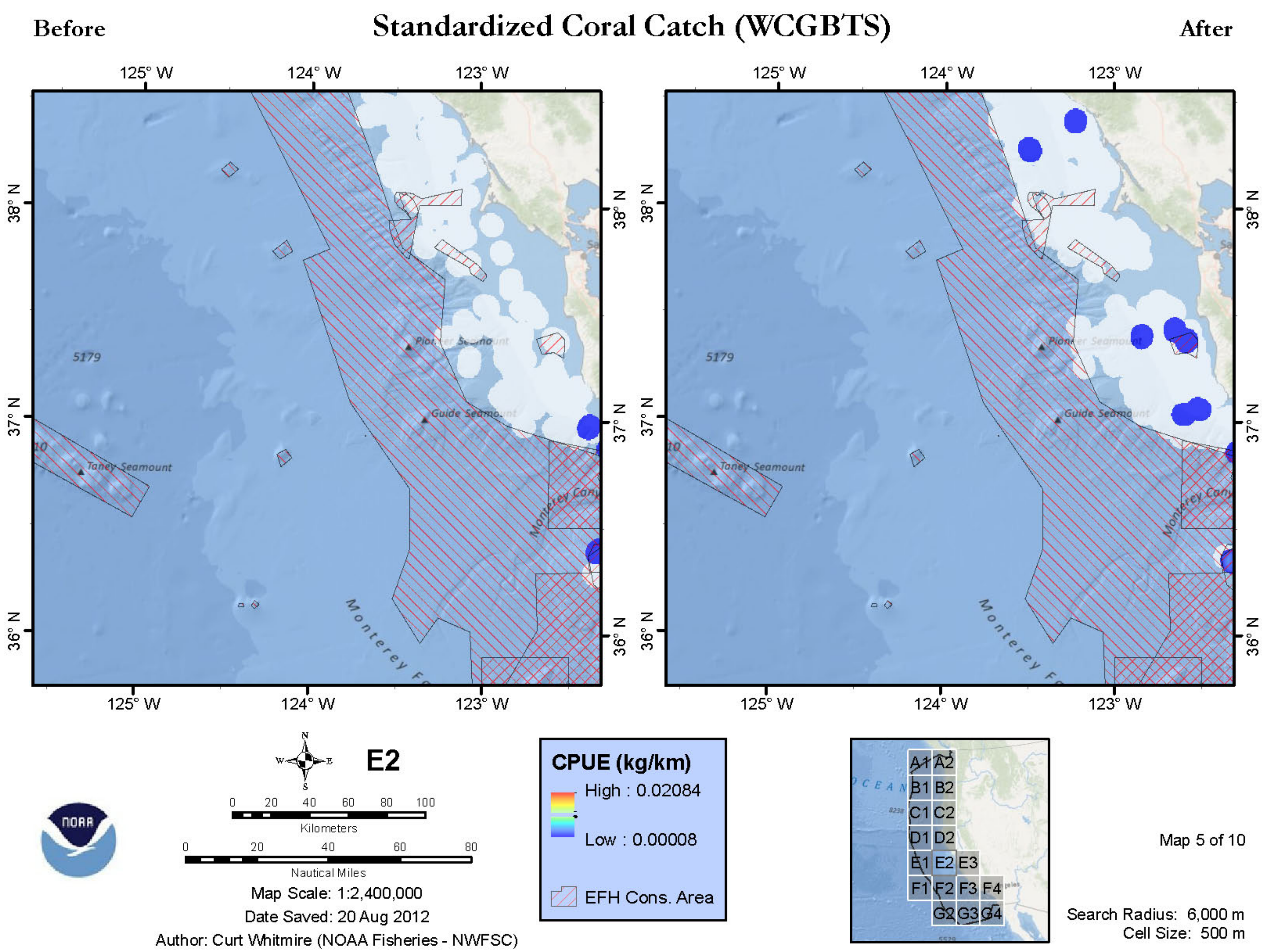


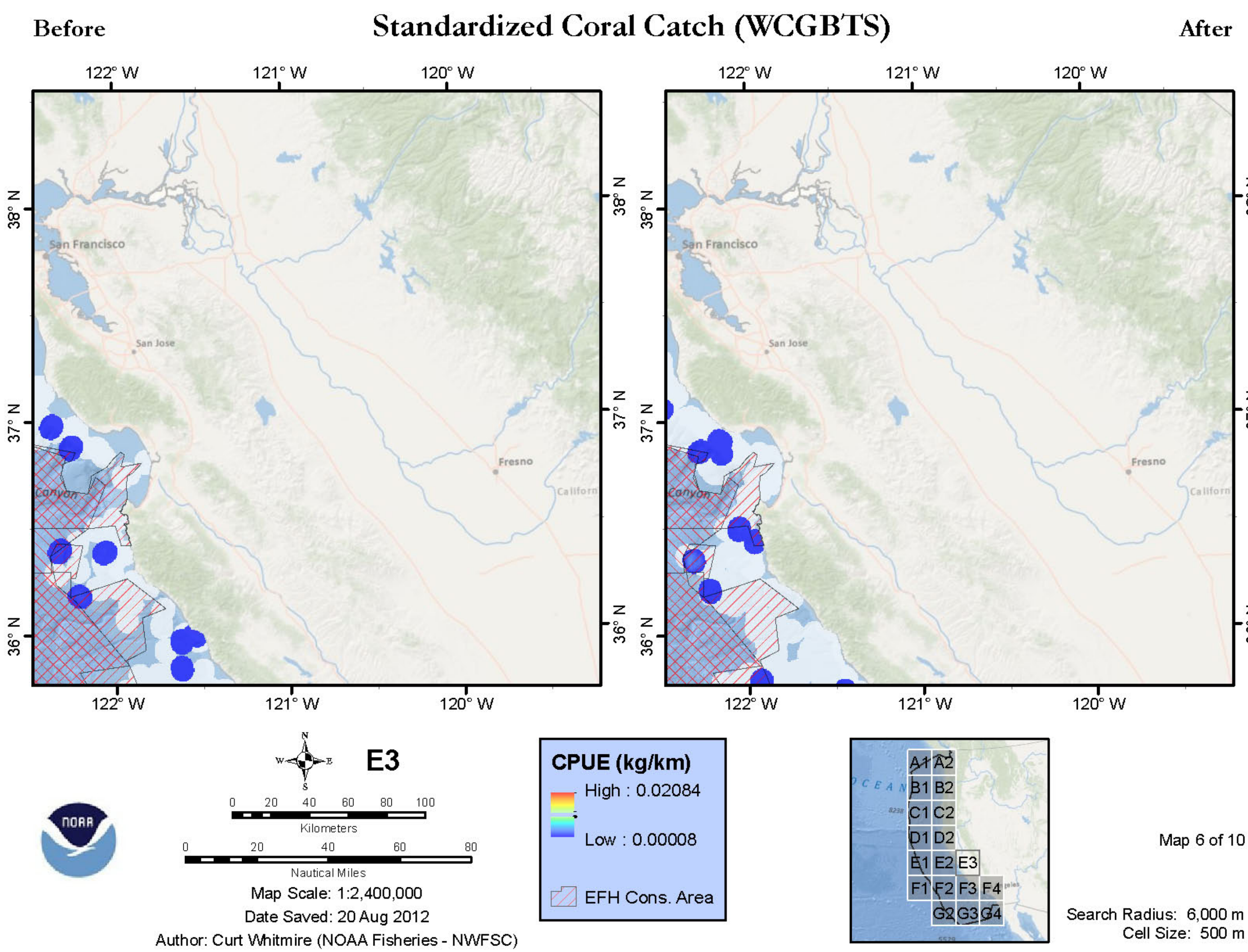
Appendix E-2: WCGBTS Coral

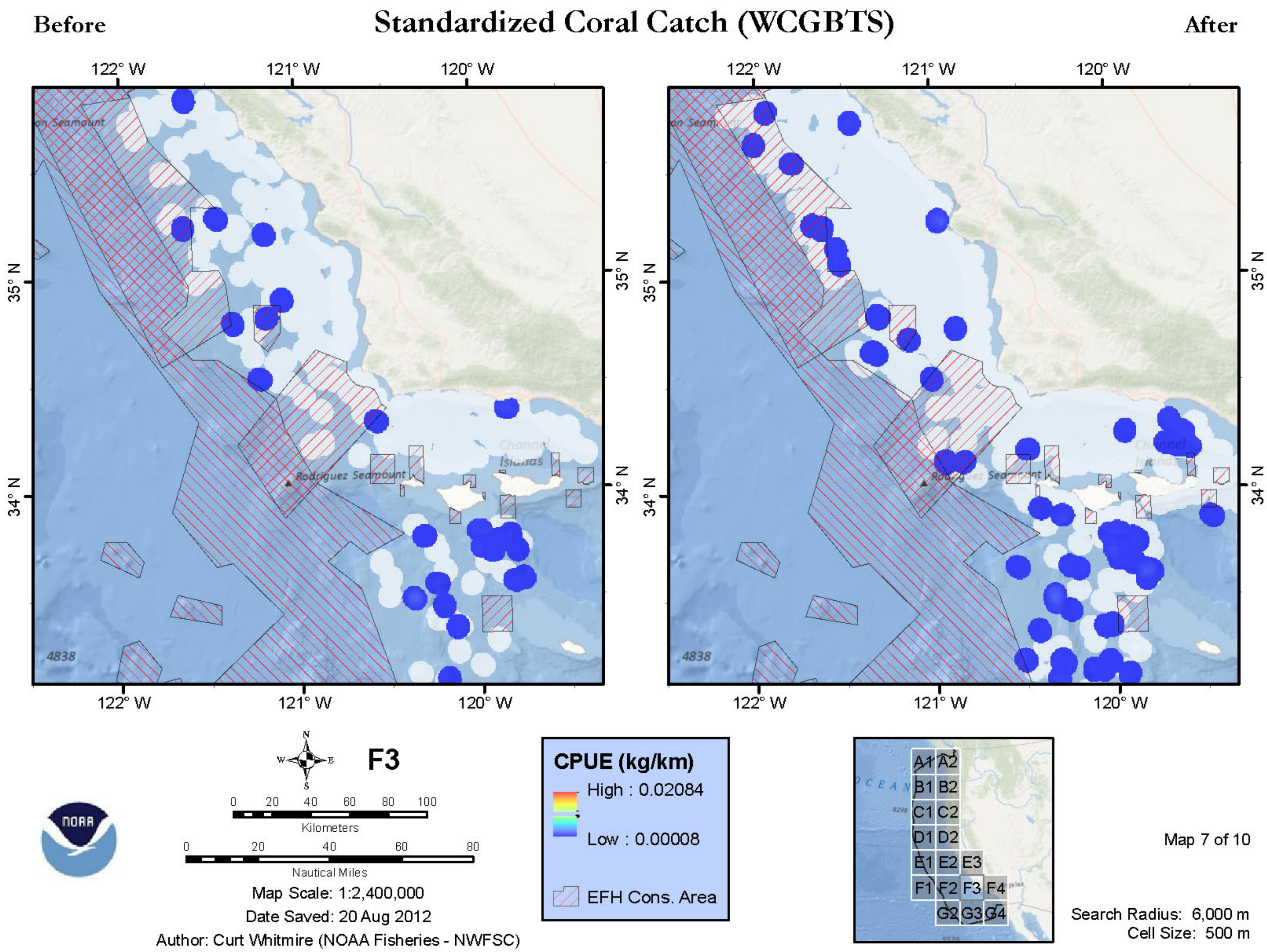



Before
Standardized Coral Catch (WCGBTS)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Appendix E-2: WCGBTS Coral

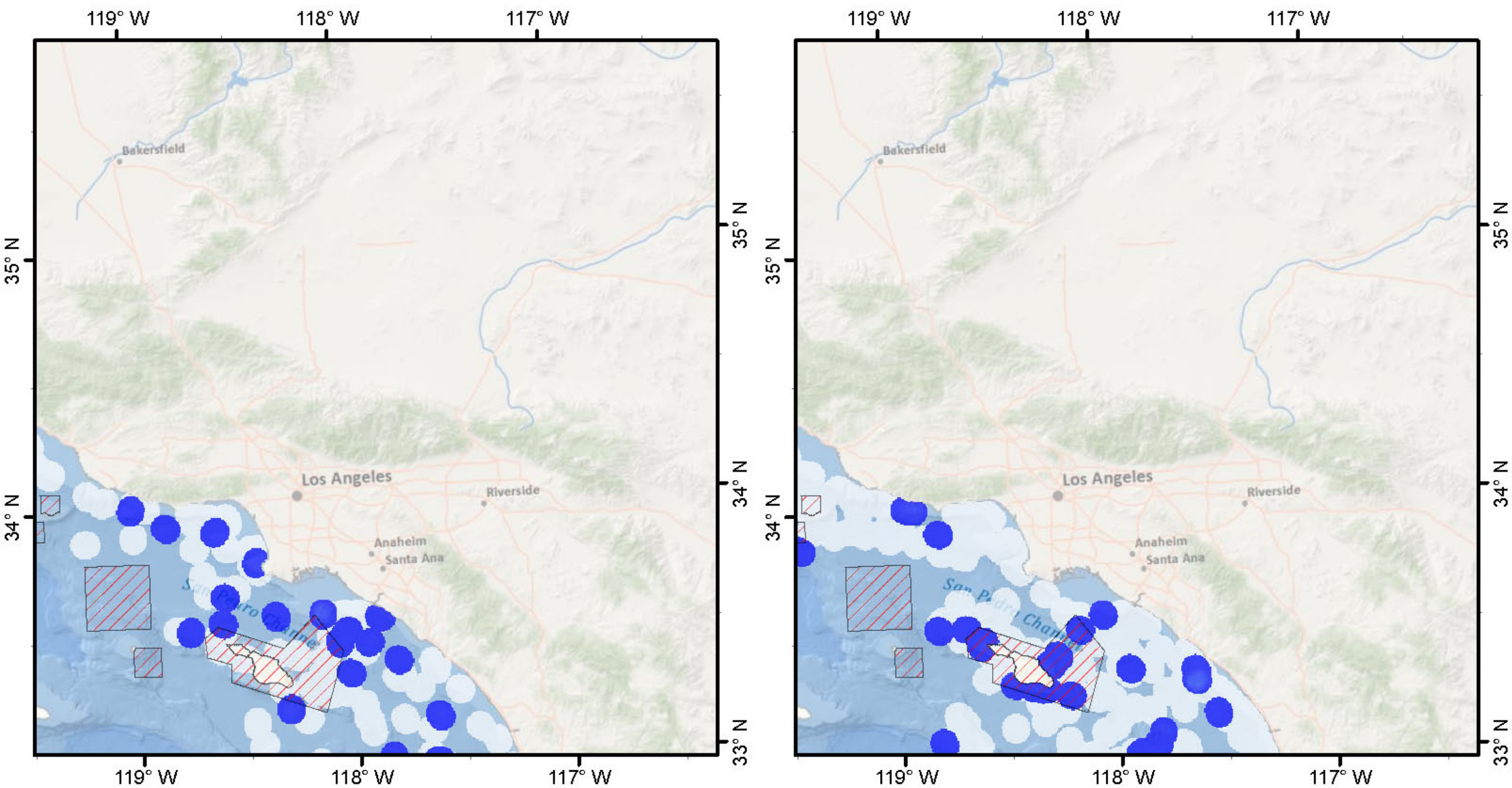



Before
Standardized Coral Catch (WCGBTS)
After
122° W
121° W
120° W
38° N
37° N
36° N
San Francisco
San Jose
Fresno
Canyon
E3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 6 of 10
Search Radius: 6,000 m
Cell Size: 500 m



Before
Standardized Coral Catch (WCGBTS)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
Channel Islands
4838
F3
N
S
E
W
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
NOAA
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Before **Standardized Coral Catch (WCGBTS)** **After**



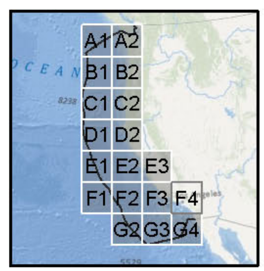
F4

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

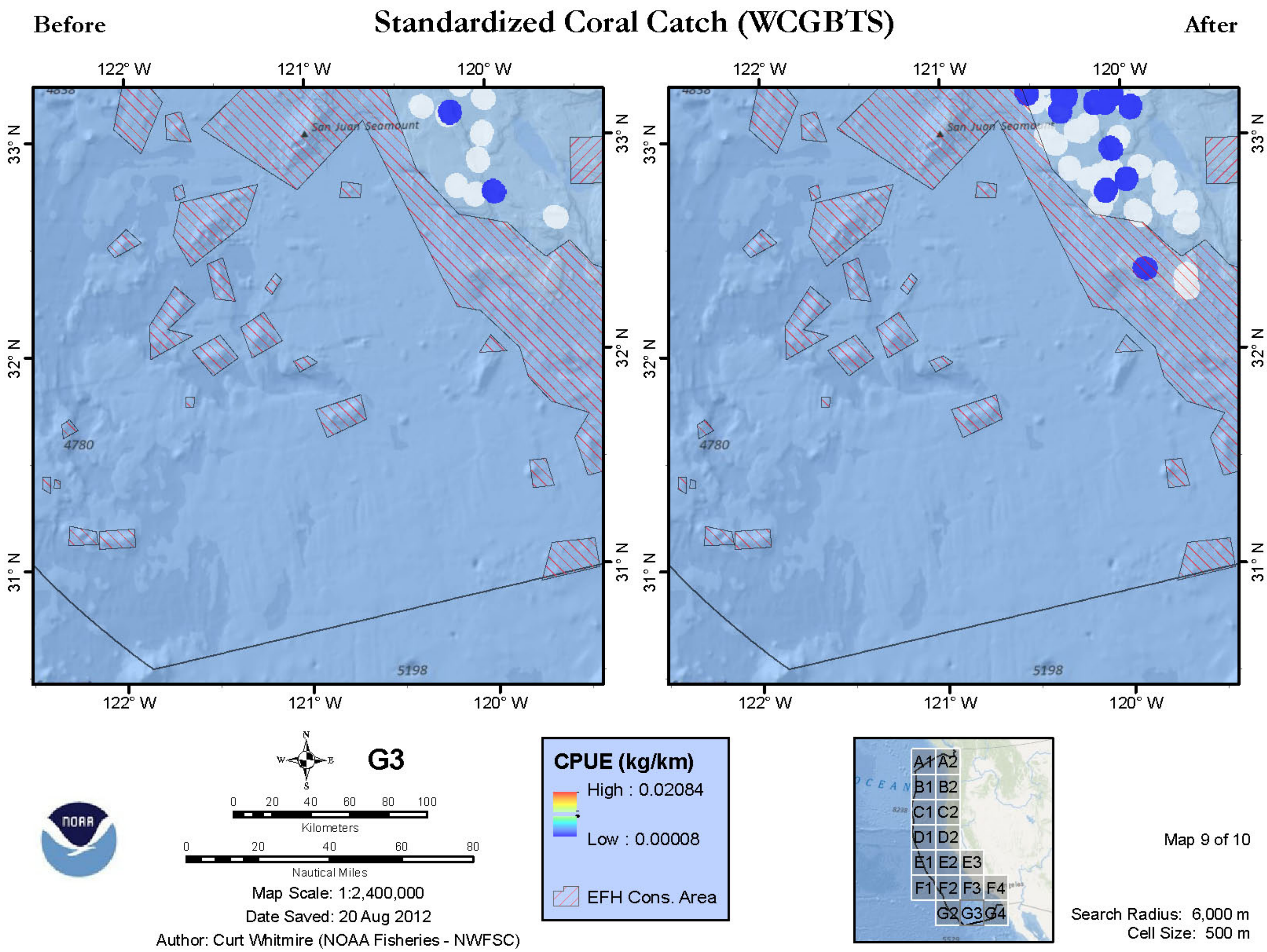
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

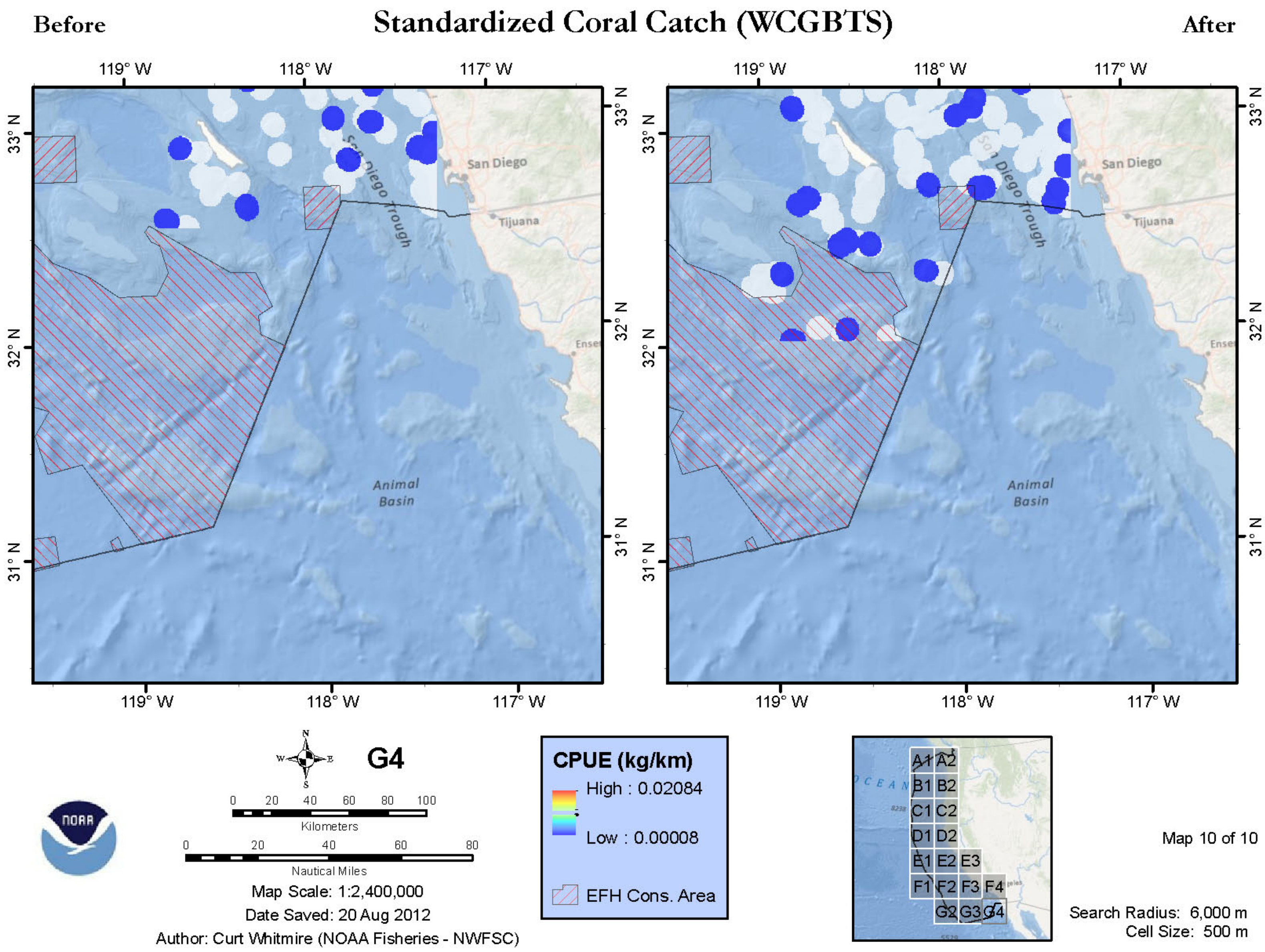
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area

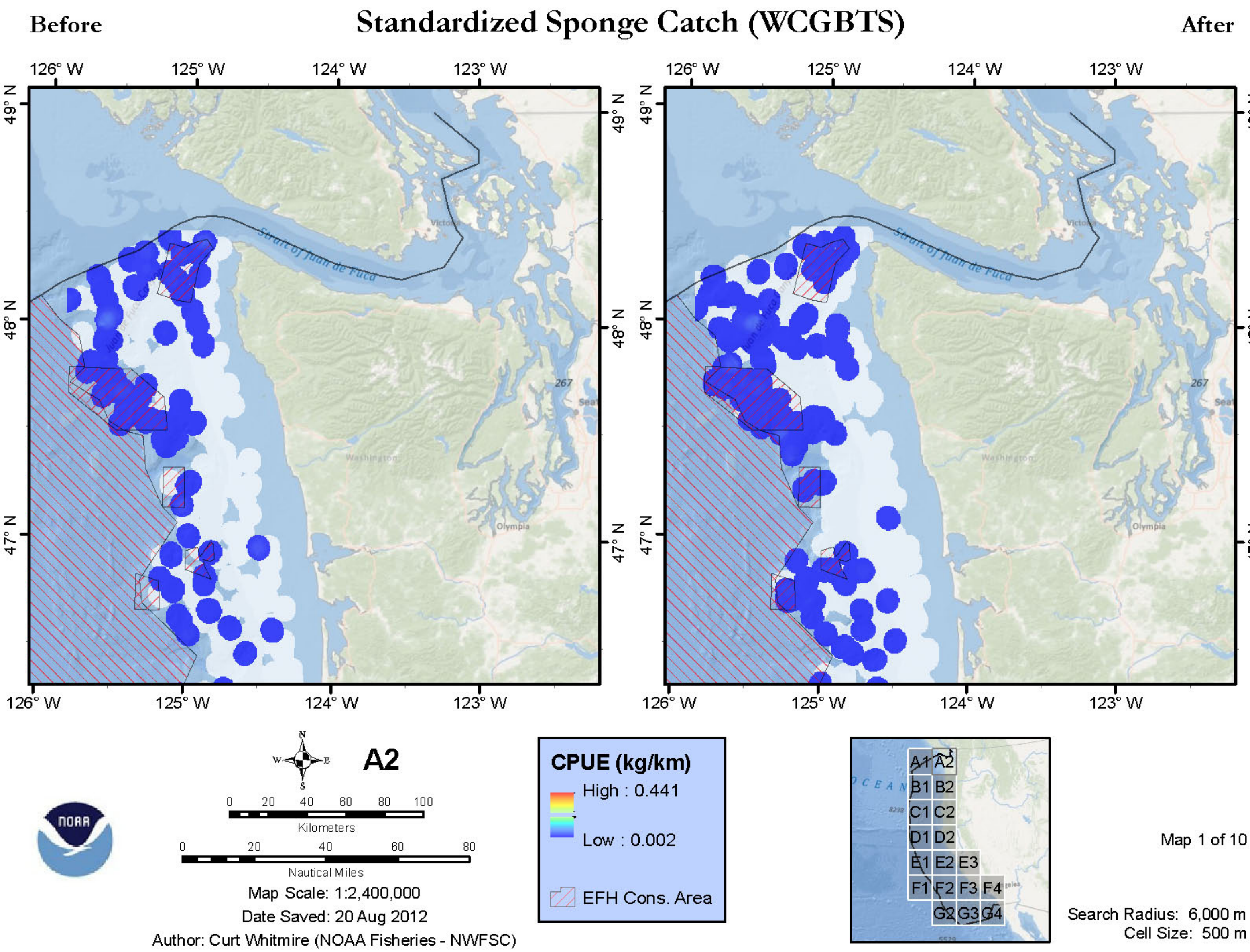


Map 8 of 10

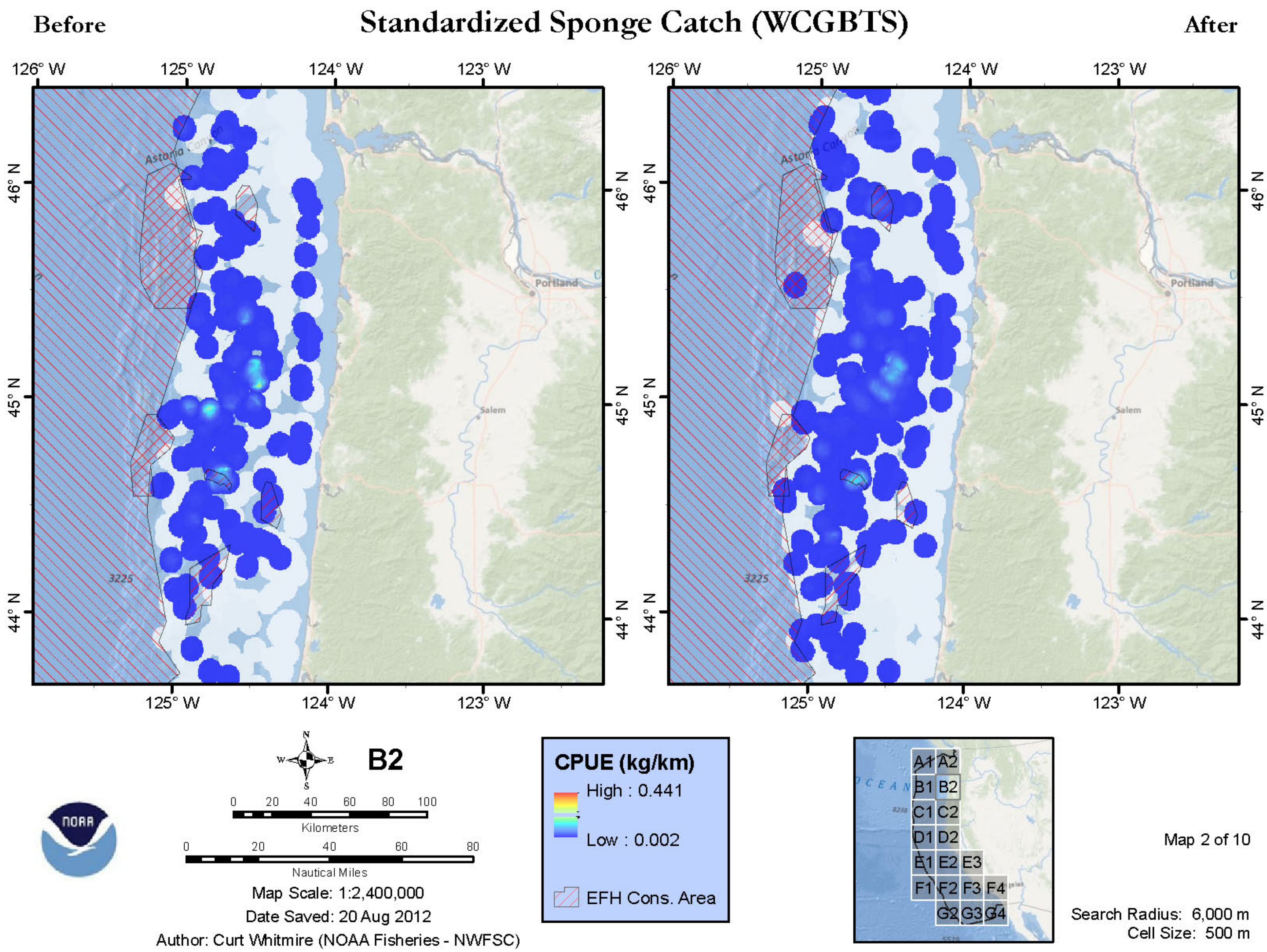
Search Radius: 6,000 m
Cell Size: 500 m

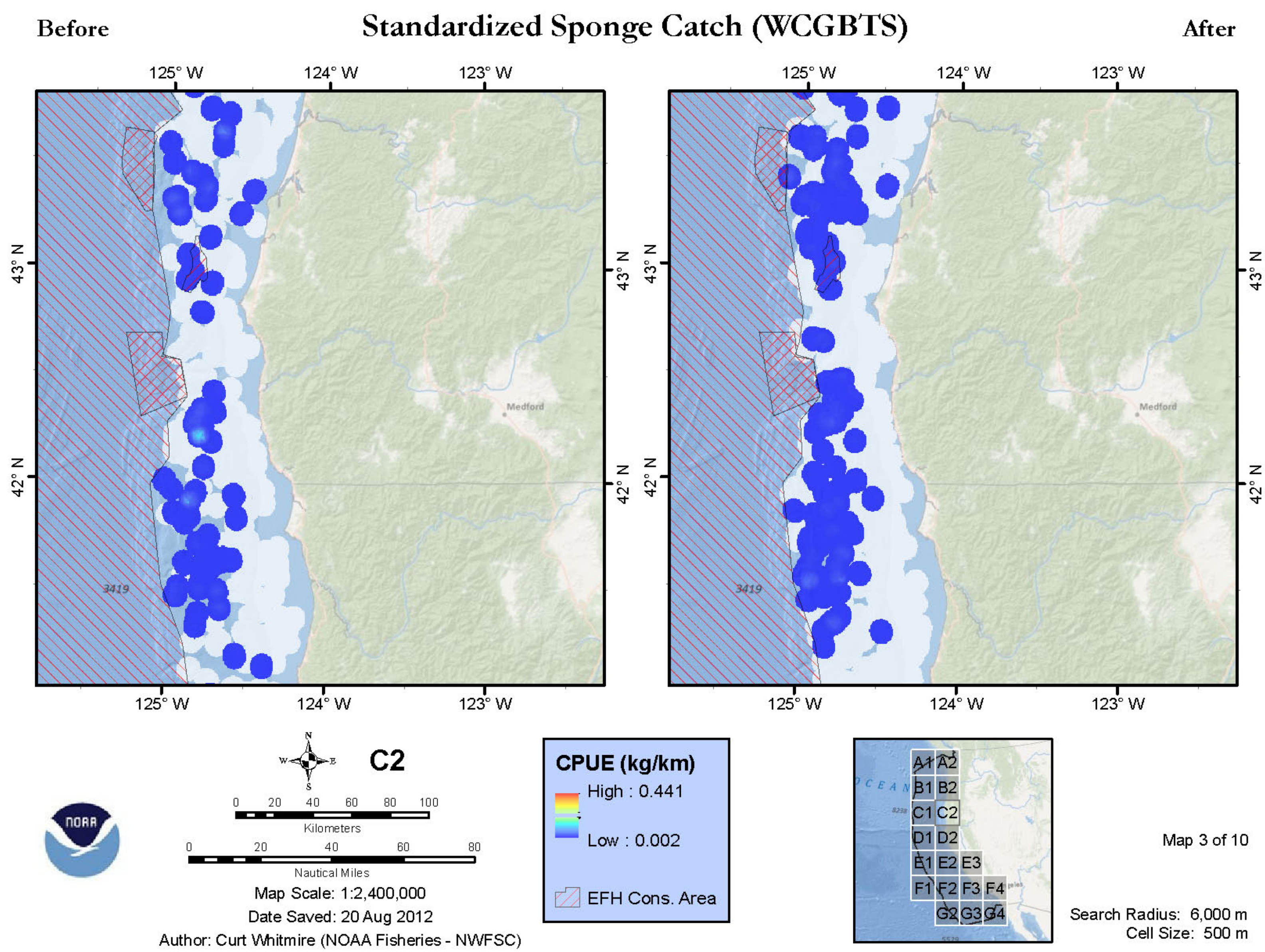

Before
Standardized Coral Catch (WCGBTS)
After
122° W
121° W
120° W
33° N
32° N
31° N
San Juan Seamount
4780
5198
G3
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 9 of 10
Search Radius: 6,000 m
Cell Size: 500 m


Before
Standardized Coral Catch (WCGBTS)
After
119° W
118° W
117° W
33° N
32° N
31° N
San Diego
Tijuana
San Diego Trough
Animal Basin
G4
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.02084
Low : 0.00008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 10 of 10
Search Radius: 6,000 m
Cell Size: 500 m

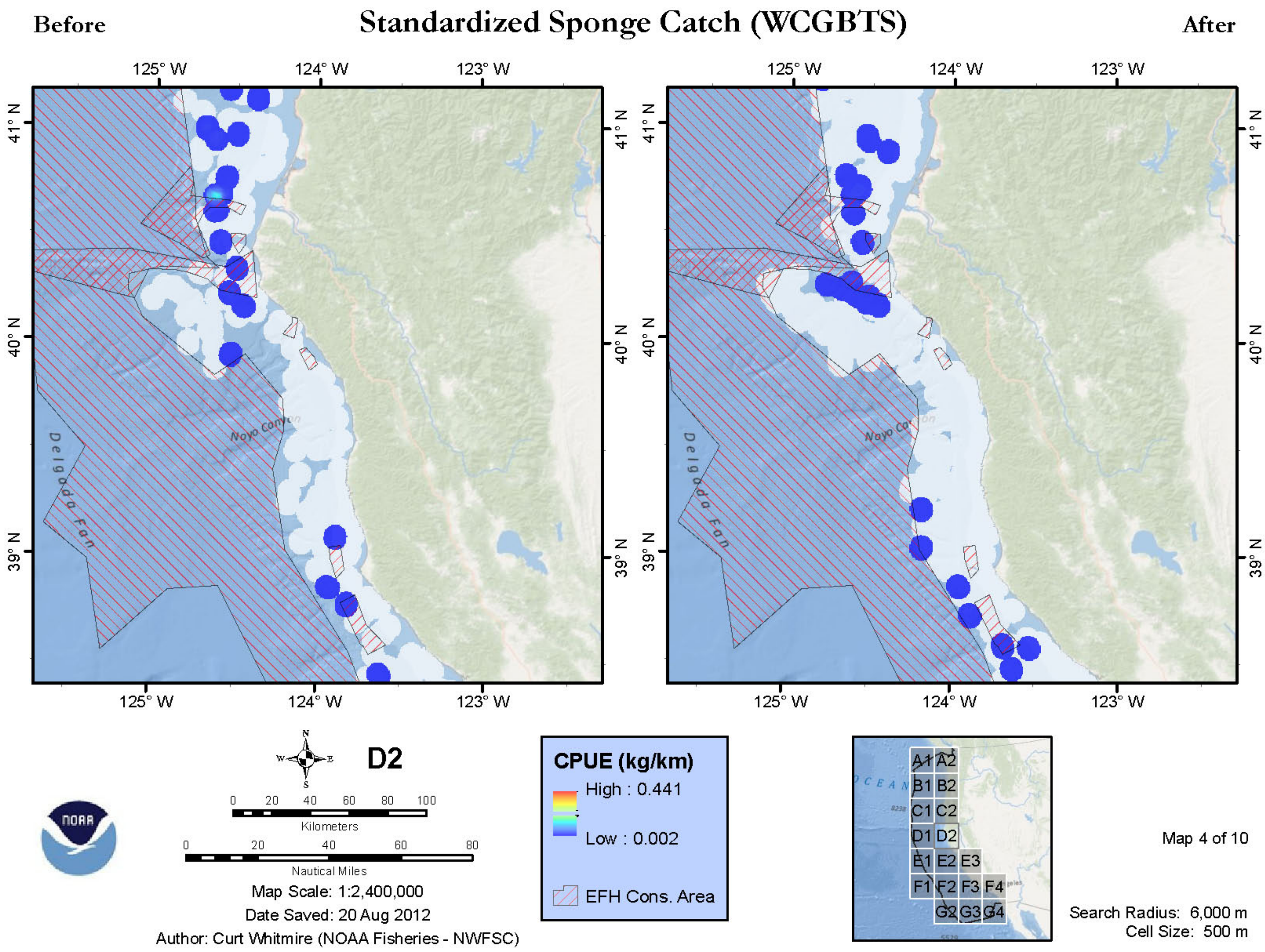

Before
Standardized Sponge Catch (WCGBTS)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Victoria
Washington
Olympia
267
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 10
Search Radius: 6,000 m
Cell Size: 500 m

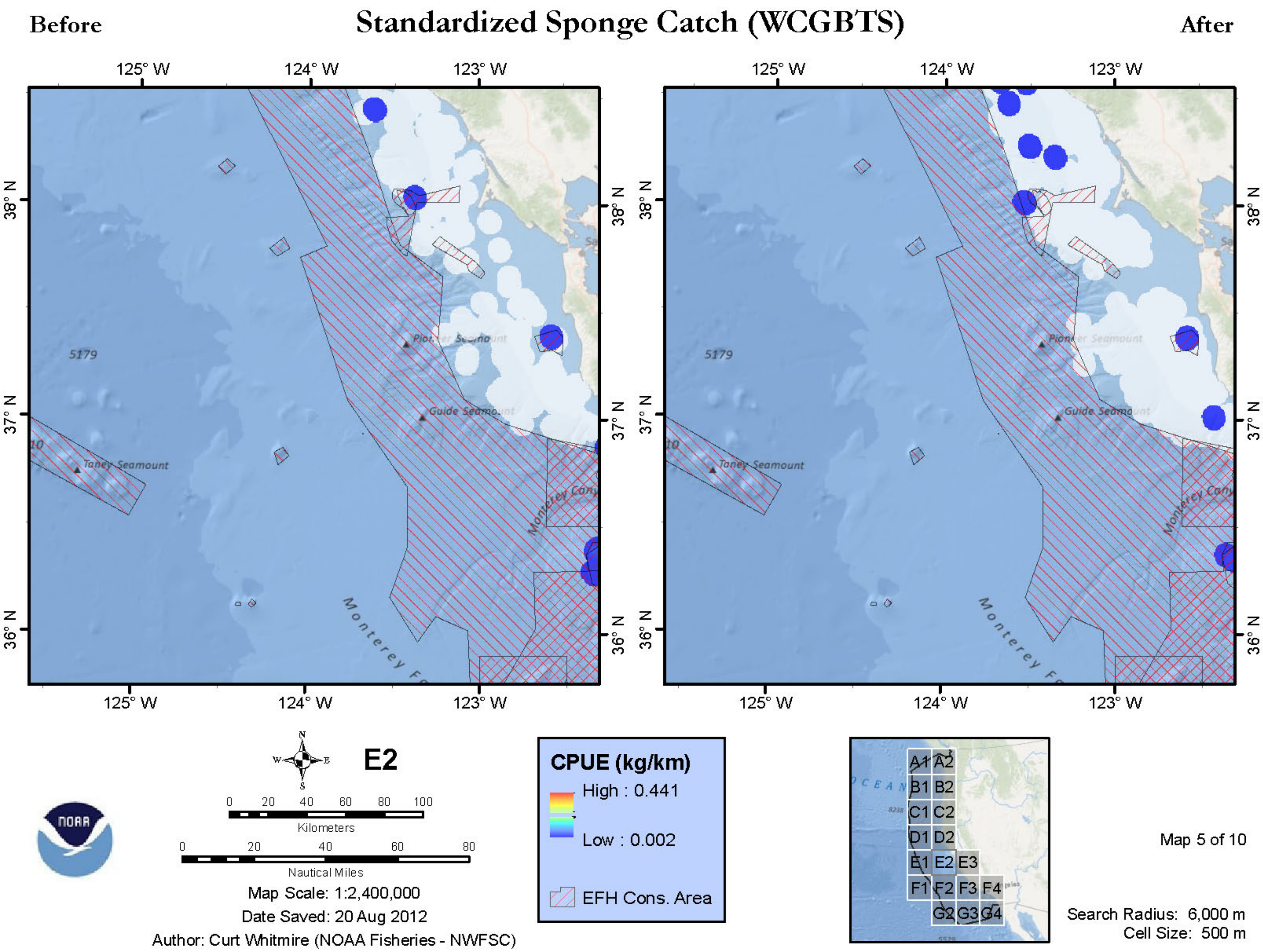
Appendix E-3: WCGBTS Sponge




Before
Standardized Sponge Catch (WCGBTS)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 10
Search Radius: 6,000 m
Cell Size: 500 m

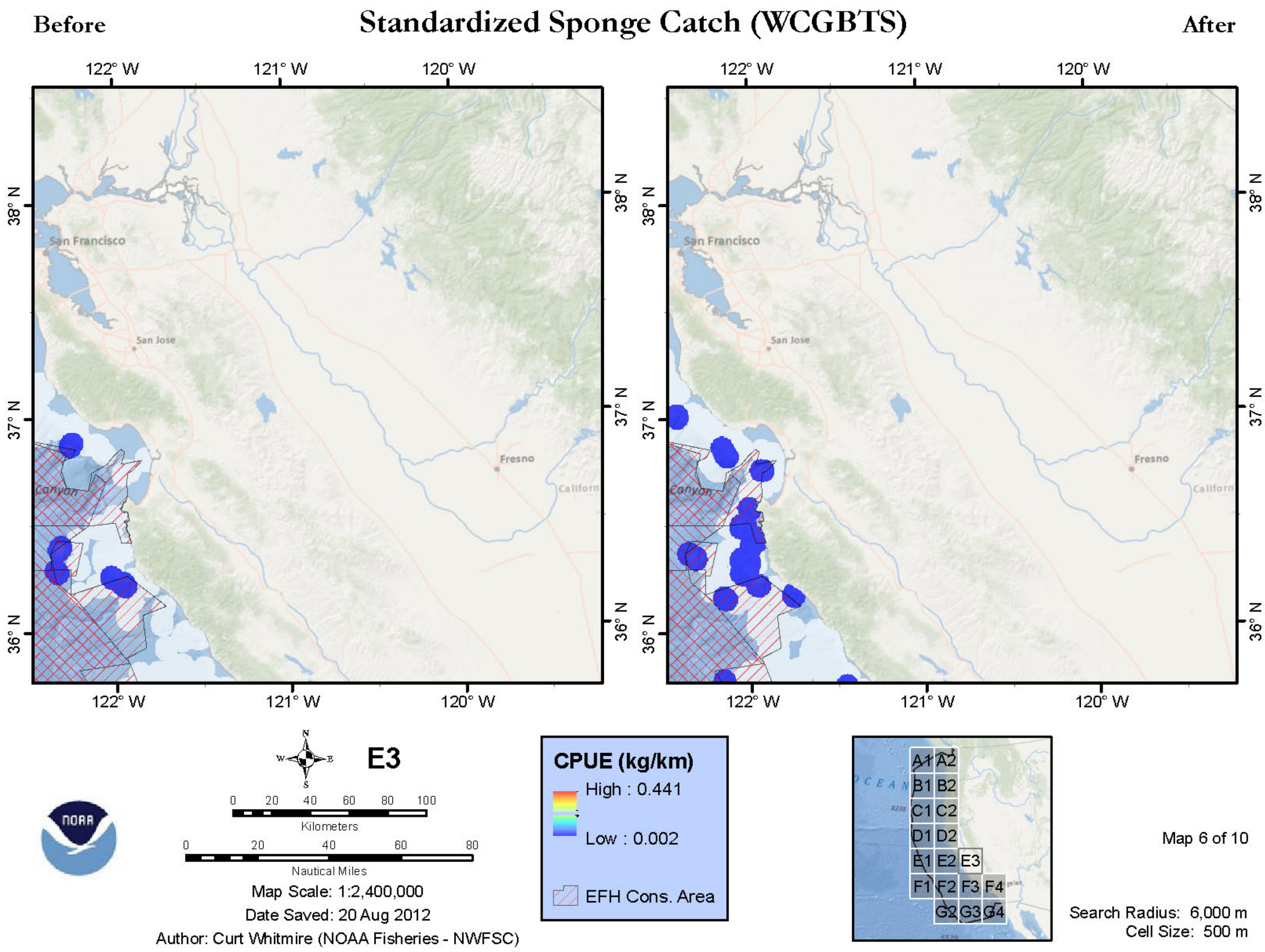
Appendix E-3: WCGBTS Sponge

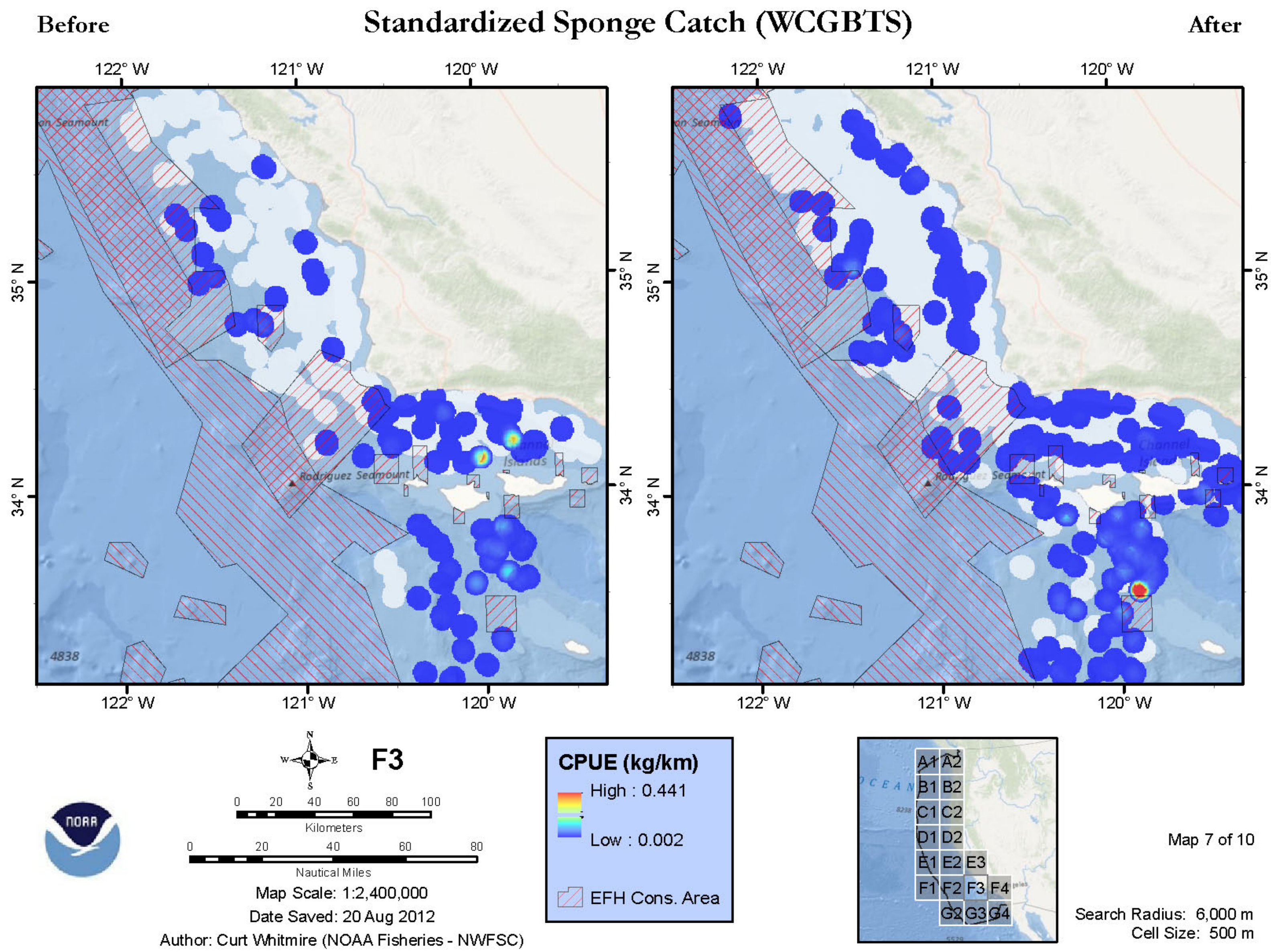


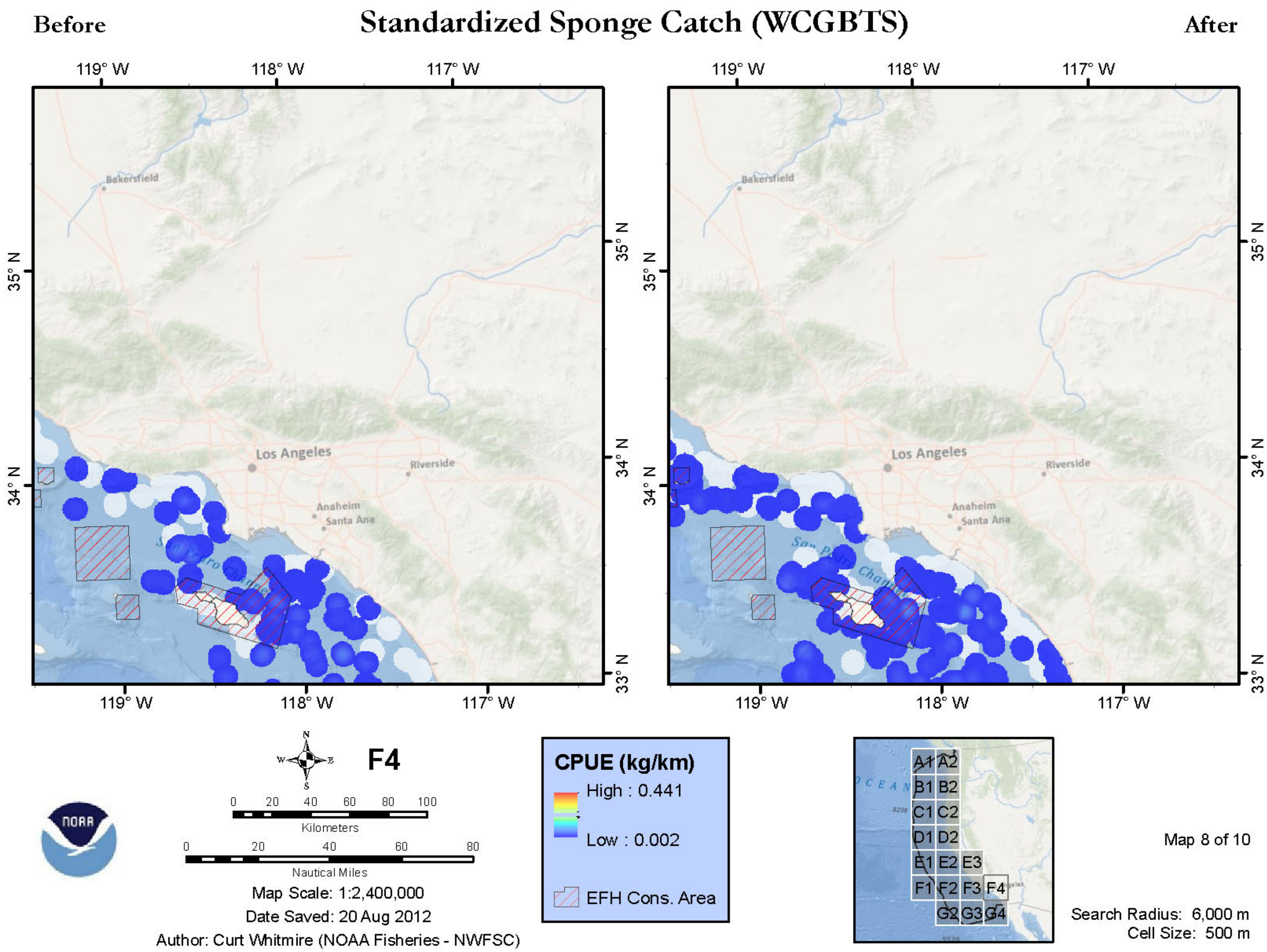


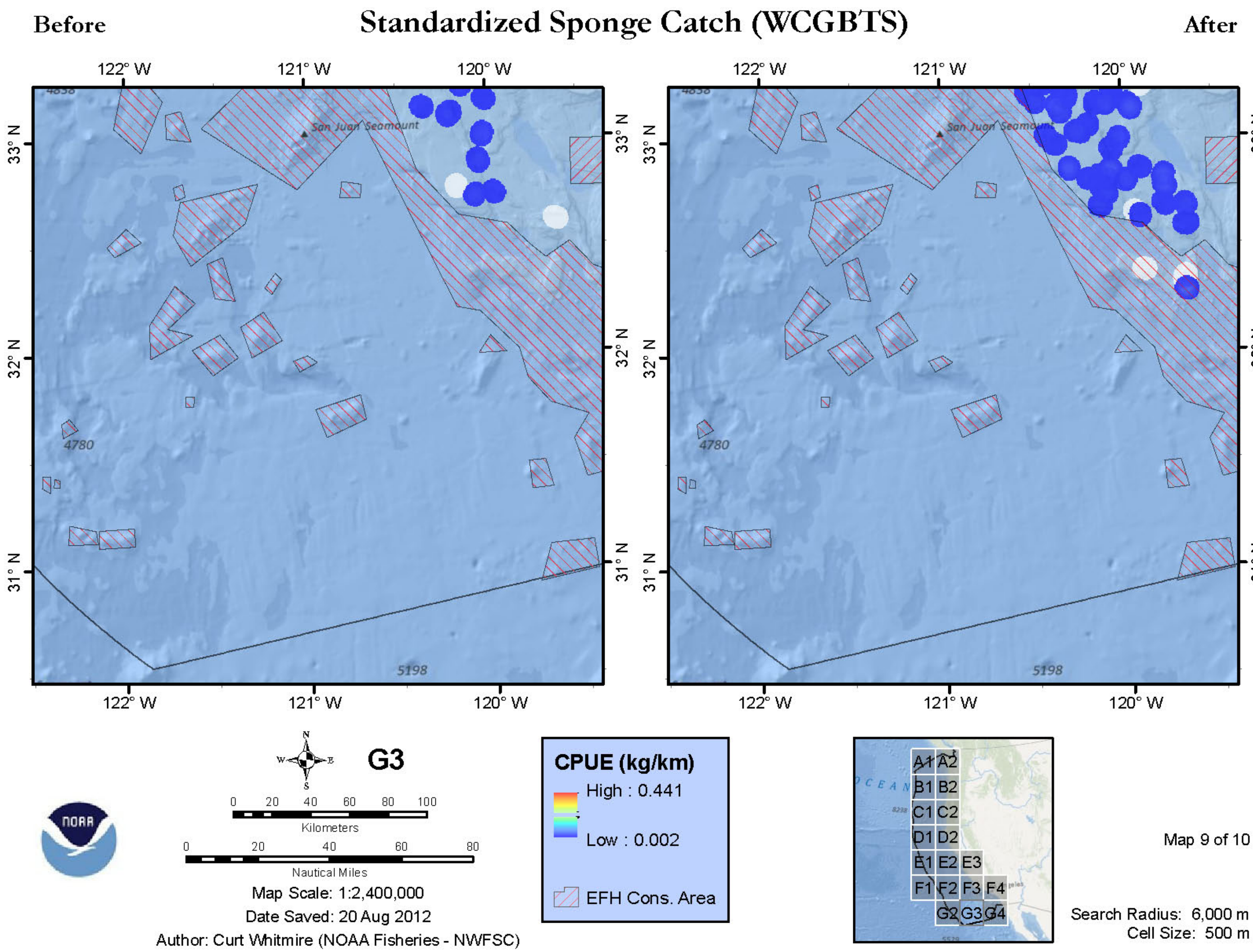
Before
Standardized Sponge Catch (WCGBTS)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 10
Search Radius: 6,000 m
Cell Size: 500 m

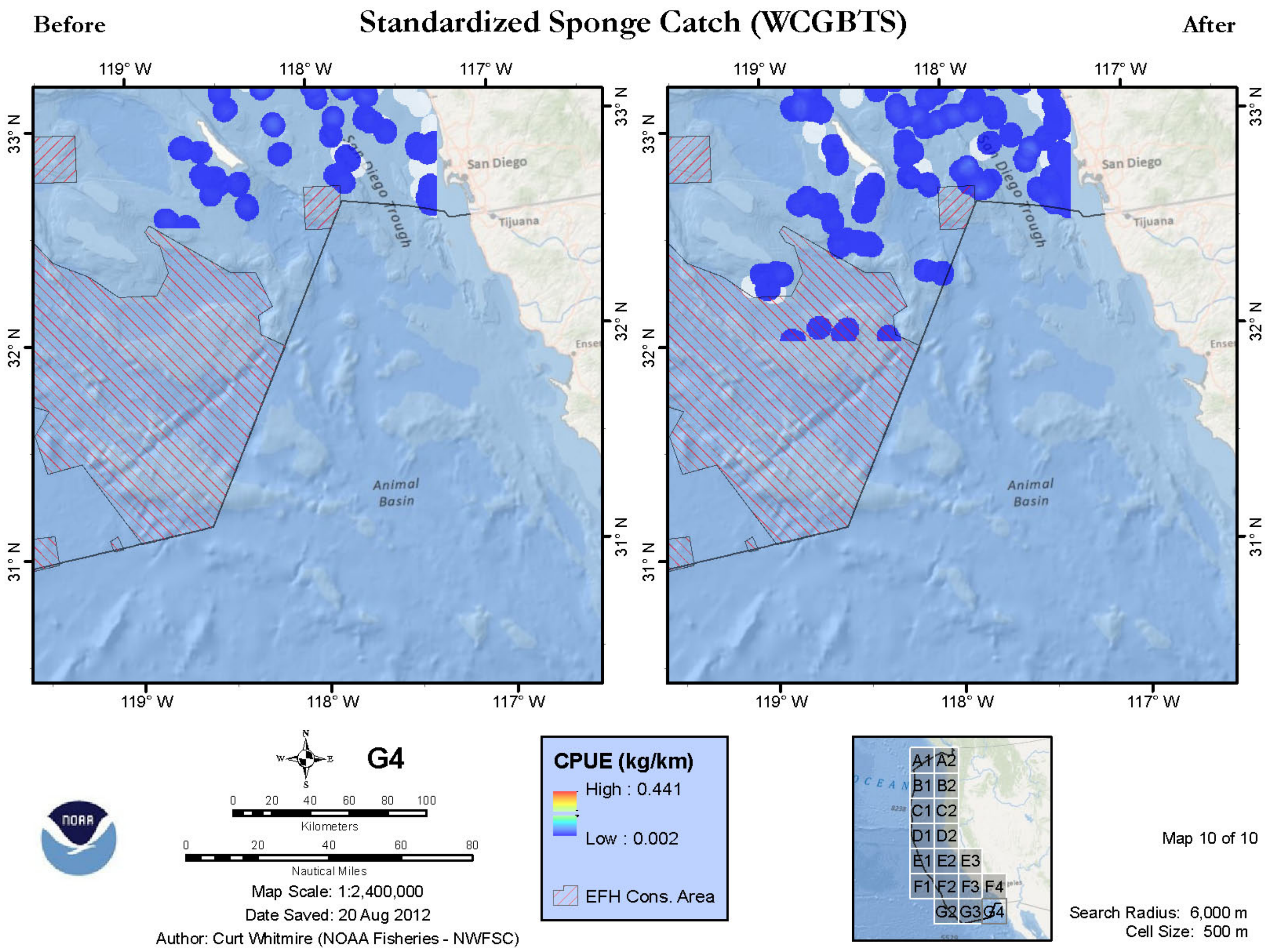
Appendix E-3: WCGBTS Sponge



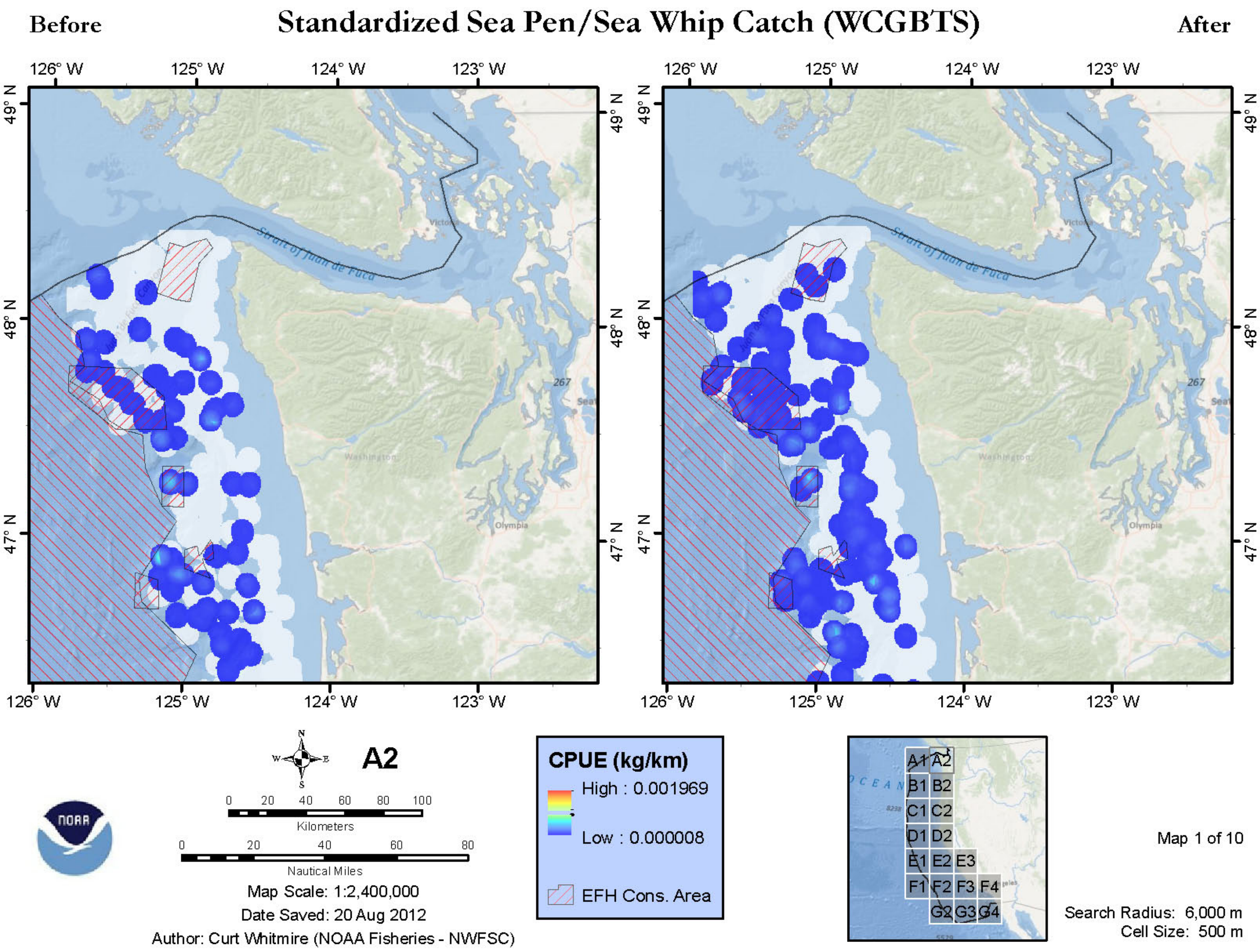

Before
Standardized Sponge Catch (WCGBTS)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
4838
F3
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 10
Search Radius: 6,000 m
Cell Size: 500 m

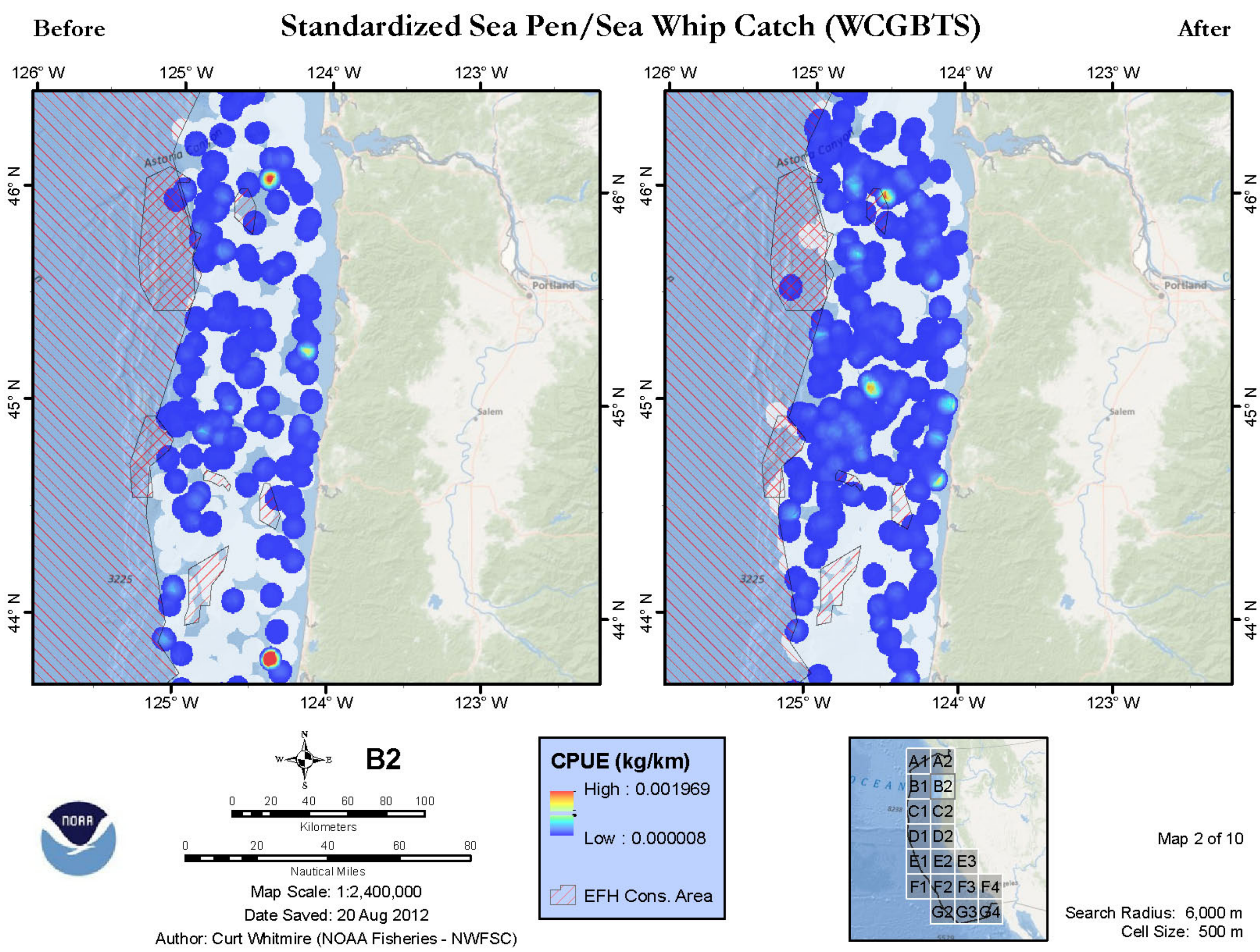

Before
Standardized Sponge Catch (WCGBTS)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 10
Search Radius: 6,000 m
Cell Size: 500 m

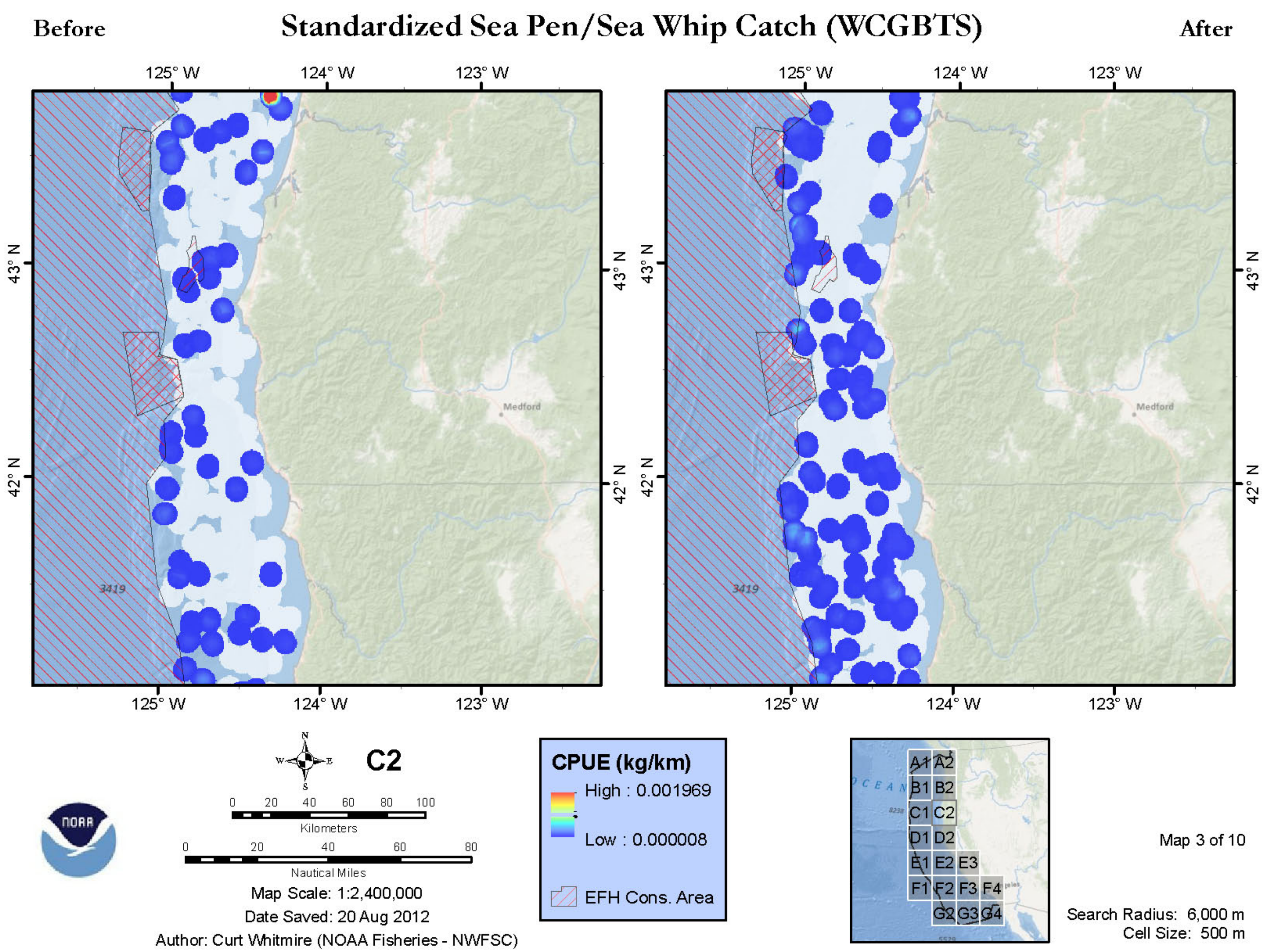

Standardized Sponge Catch (WCGBTS)
Before
After
122° W
121° W
120° W
33° N
32° N
31° N
San Juan Seamount
4780
5198
G3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 9 of 10
Search Radius: 6,000 m
Cell Size: 500 m

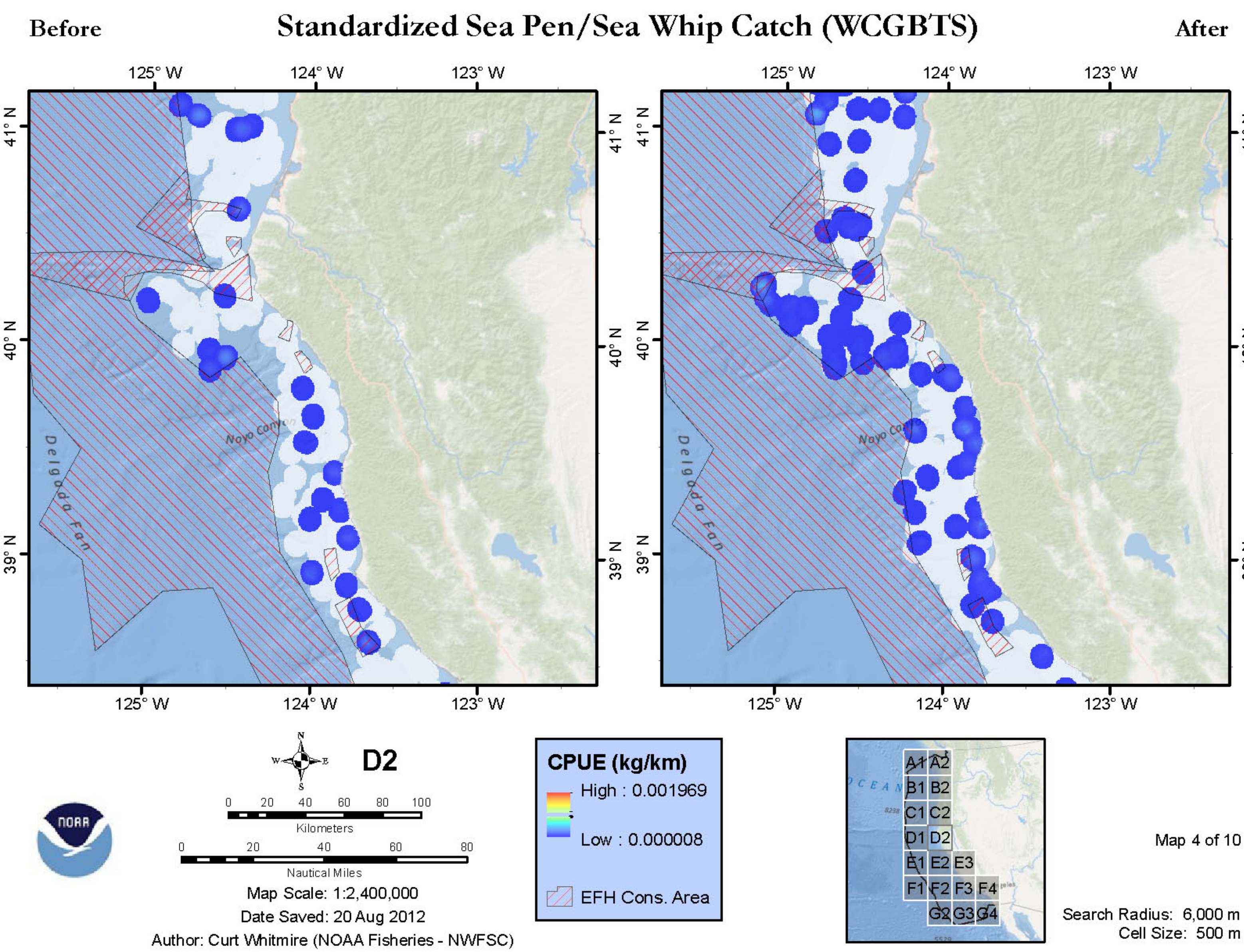

Before
Standardized Sponge Catch (WCGBTS)
After
119° W
118° W
117° W
33° N
32° N
31° N
San Diego
Tijuana
San Diego Trough
Animal Basin
G4
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.441
Low : 0.002
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 10 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Appendix E-4: WCGBTS Sea Pens/Whips



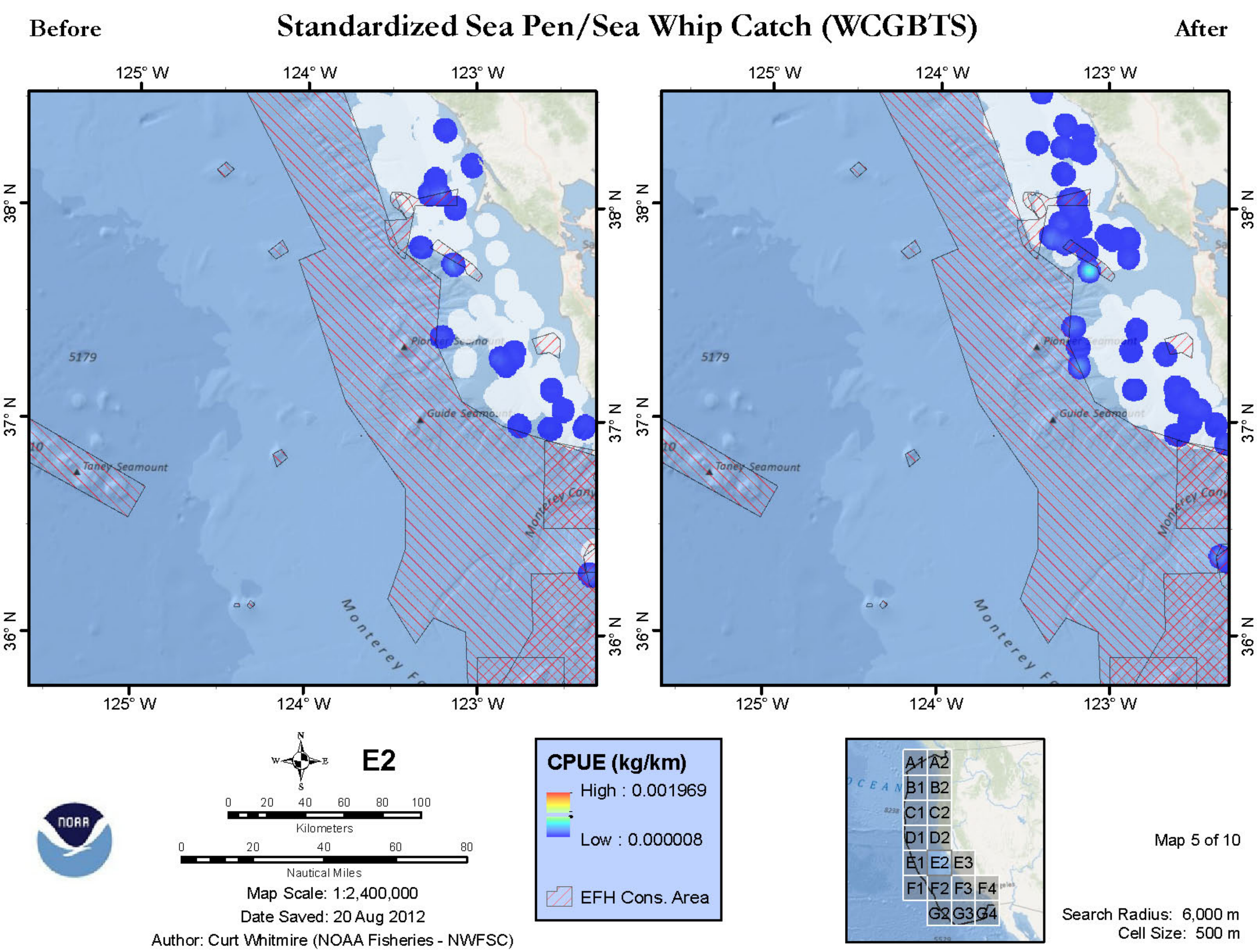

Before
Standardized Sea Pen/Sea Whip Catch (WCGBTS)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria Canyon
Portland
Salem
3225
B2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.001969
Low : 0.000008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 10
Search Radius: 6,000 m
Cell Size: 500 m

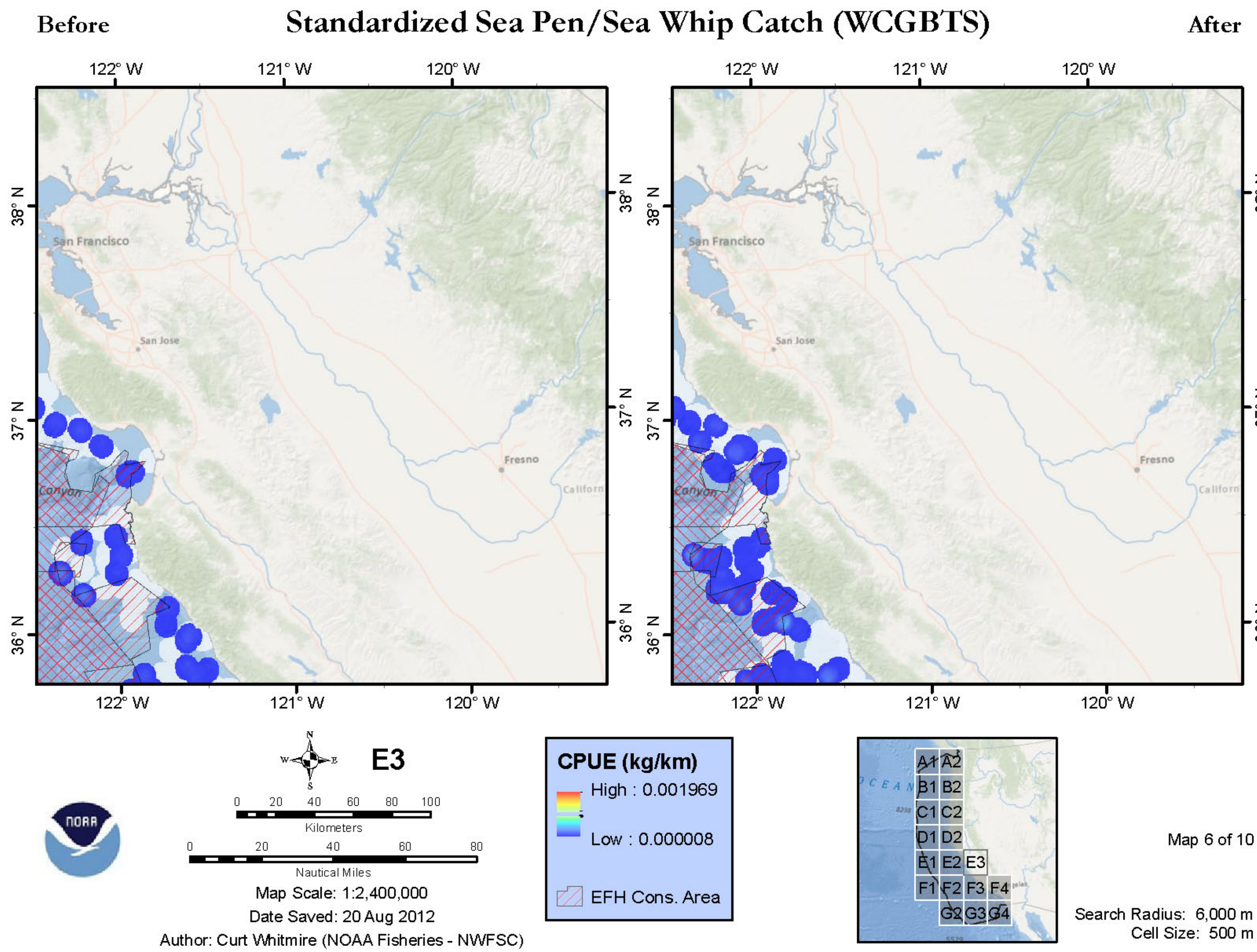

Before
Standardized Sea Pen/Sea Whip Catch (WCGBTS)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.001969
Low : 0.000008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 10
Search Radius: 6,000 m
Cell Size: 500 m



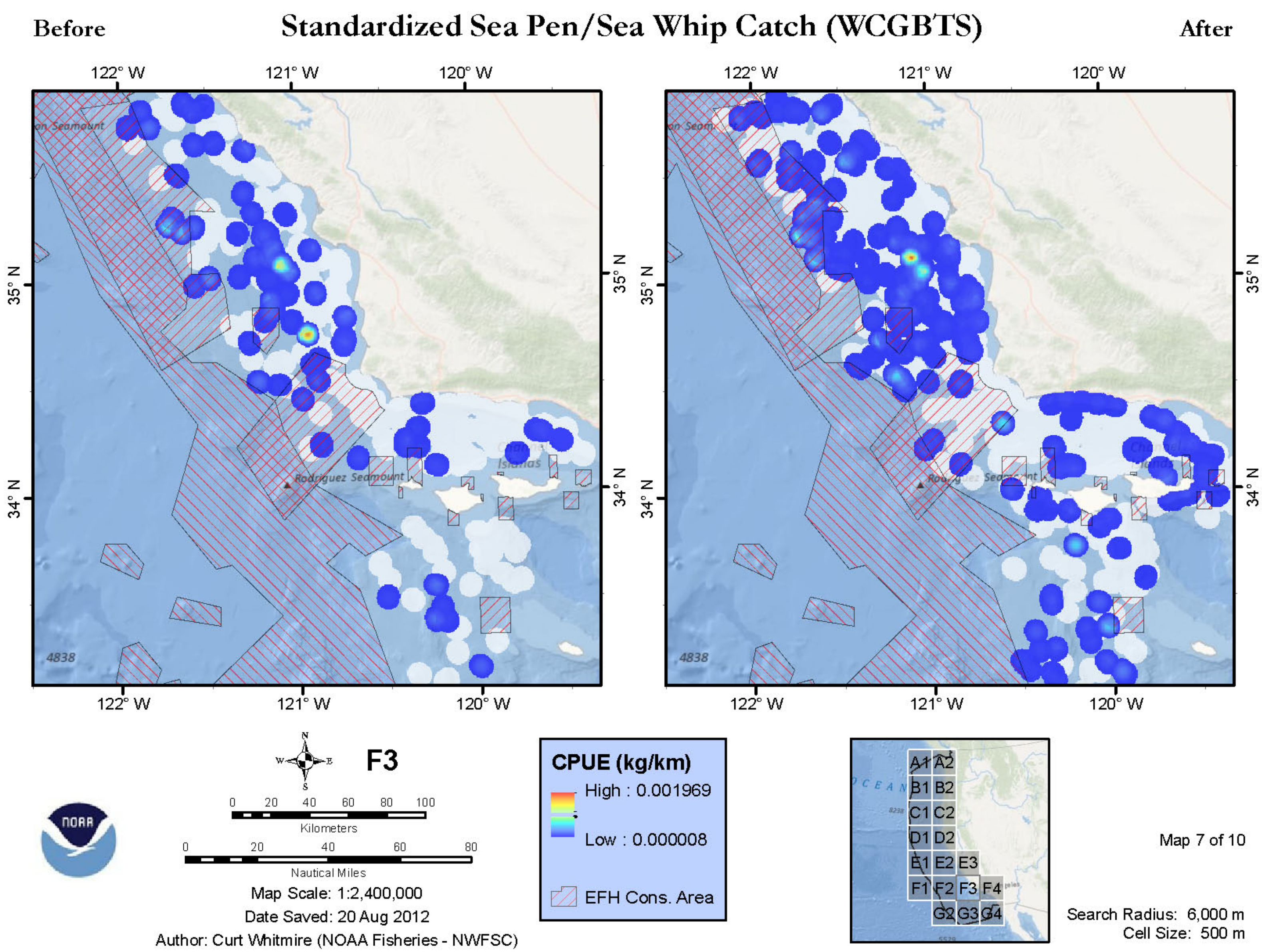
Before
Standardized Sea Pen/Sea Whip Catch (WCGBTS)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
N
S
E
W
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.001969
Low : 0.000008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Appendix E-4: WCGBTS Sea Pens/Whips

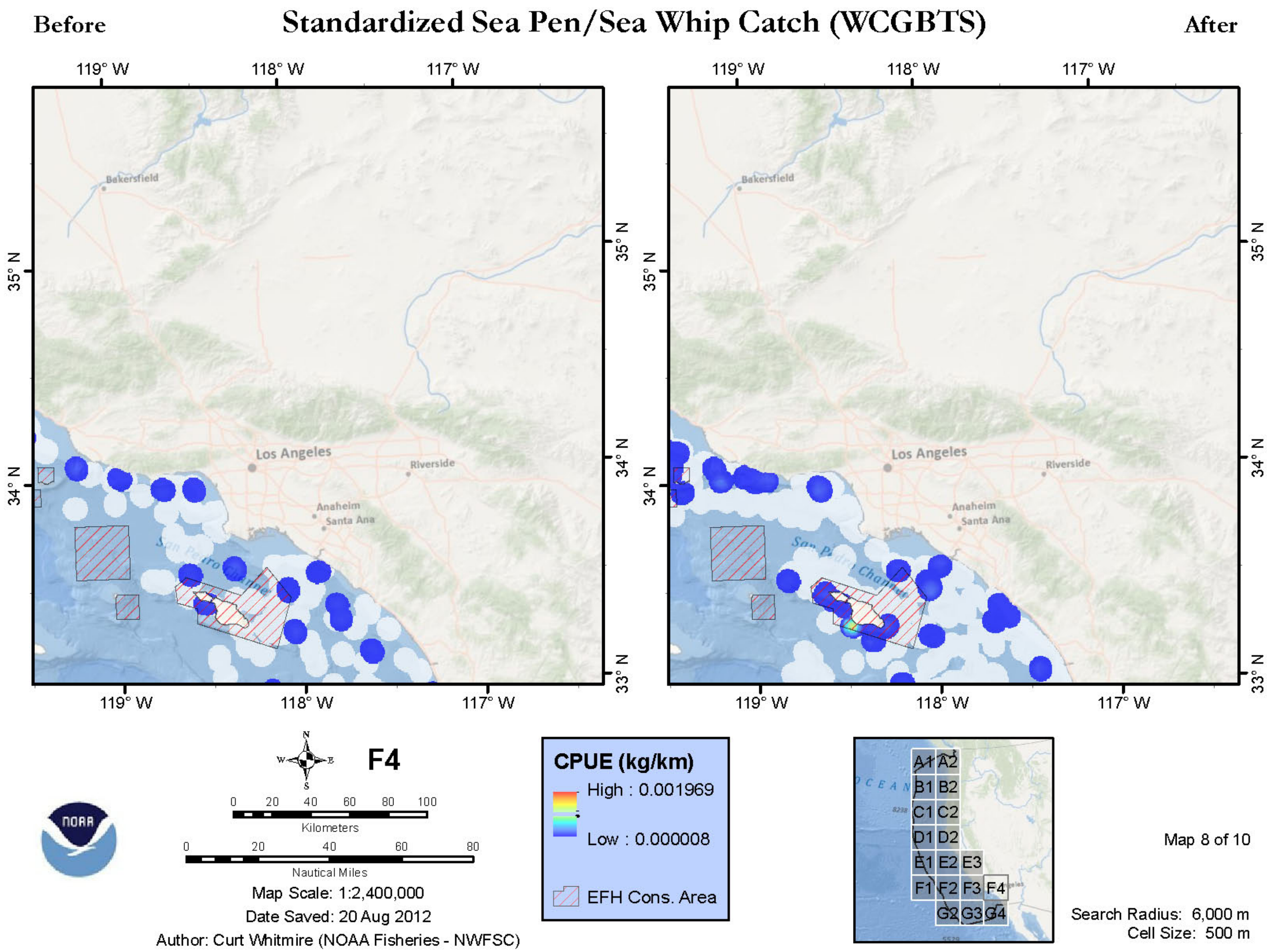


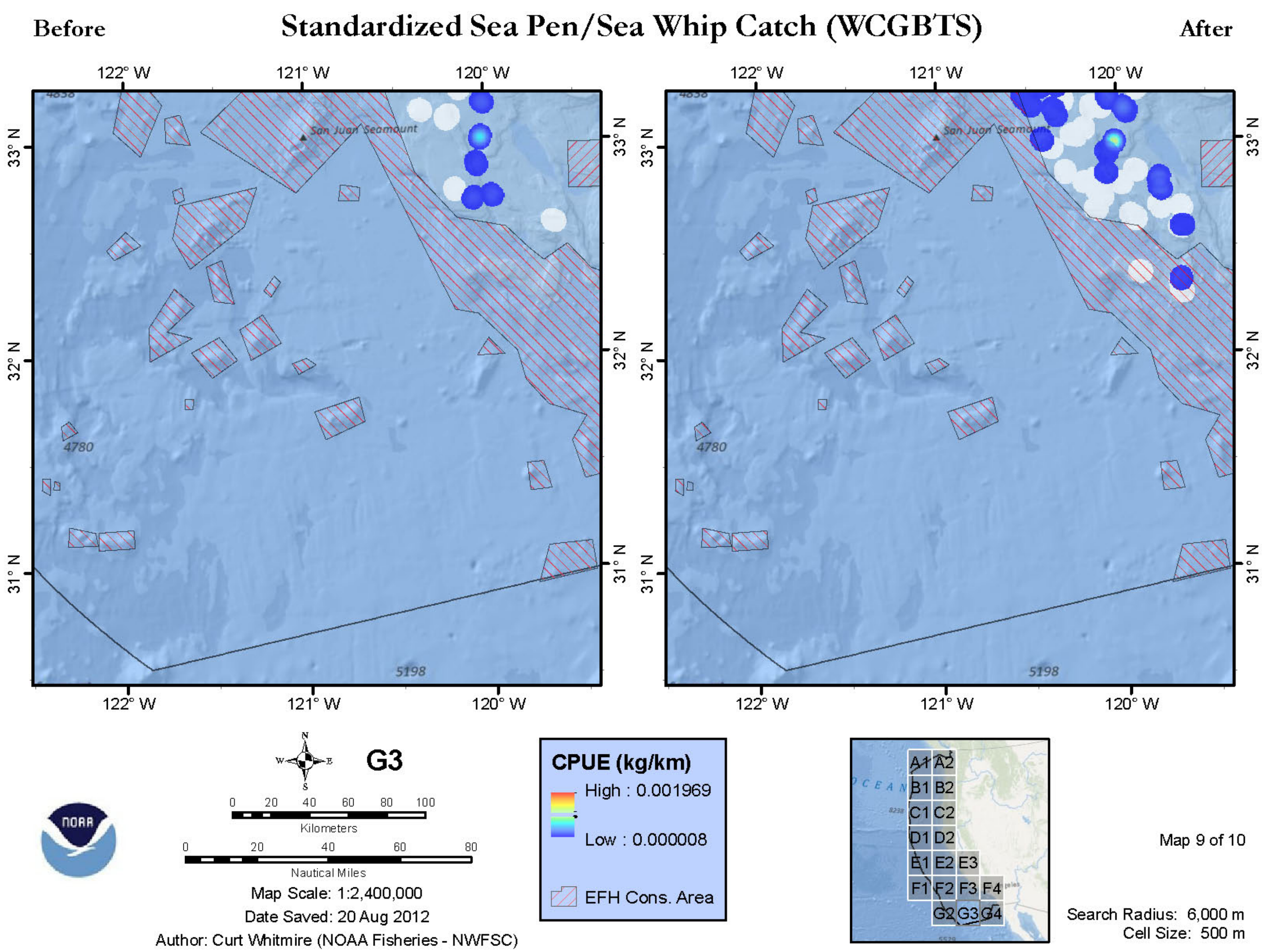

Before
Standardized Sea Pen/Sea Whip Catch (WCGBTS)
After
122° W
121° W
120° W
38° N
37° N
36° N
San Francisco
San Jose
Fresno
Canyon
E3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.001969
Low : 0.000008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 6 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Appendix E-4: WCGBTS Sea Pens/Whips

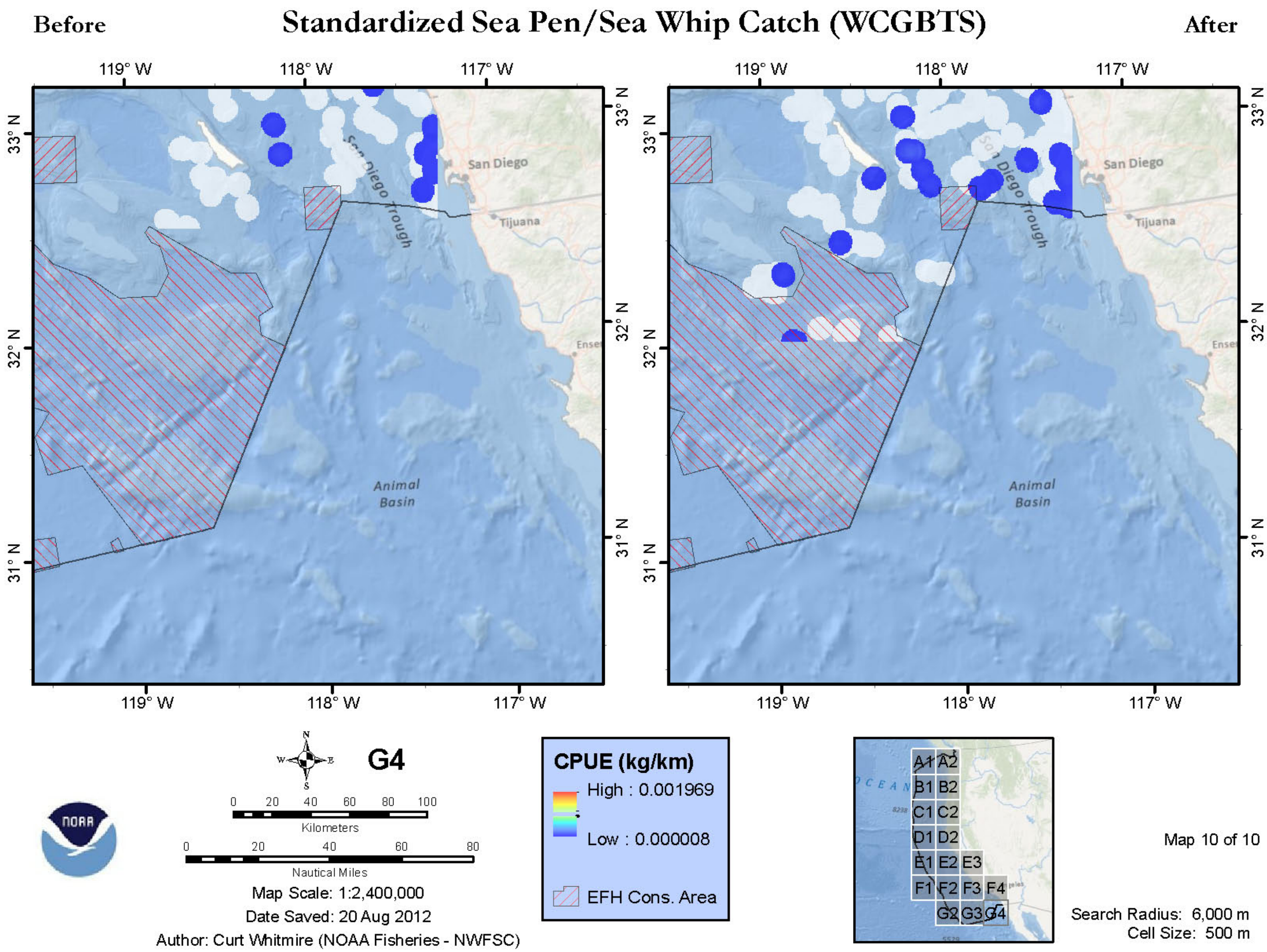


Appendix E-4: WCGBTS Sea Pens/Whips




Before
Standardized Sea Pen/Sea Whip Catch (WCGBTS)
After
122° W
121° W
120° W
33° N
32° N
31° N
San Juan Seamount
4780
5198
G3
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (kg/km)
High : 0.001969
Low : 0.000008
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 9 of 10
Search Radius: 6,000 m
Cell Size: 500 m

Appendix E-4: WCGBTS Sea Pens/Whips



APPENDIX F DISTRIBUTION OF CORALS AND SPONGES IN STANDARDIZED COMMERCIAL BYCATCH FROM WEST COAST GROUNDFISH OBSERVER PROGRAM CONDUCTED BEFORE AND AFTER THE 2006 EFH REVIEW

Appendix F plates depict the spatial distribution of standardized commercial bycatch of corals and sponges within two time periods: "Before" (3 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of limited-entry trawl tows were compiled from one source: observer records from the WCGOP database. The WCGOP database includes records of trips for vessels using a variety of bottom trawl gear configurations, including small and large footrope groundfish trawl, set-back flatfish net, and double rigged shrimp trawl, to name a few. Records of tows using mid-water trawl gear were not included in this analysis, since observers recorded no bycatch of corals or sponges using this gear type. Furthermore, since all fishing operations are not observed, neither the maps nor the data can be used to characterize bycatch completely. We urge caution when utilizing these data due to the complexity of groundfish management and fleet harvest dynamics. Annual WCGOP coverage of the limited-entry trawl sector can be found online at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm.

Trawl events were represented by a straight line connecting the start and end points. Towlines intersecting land, outside the U.S. EEZ, deeper than 2,000 m, or with a calculated straight-line speed over 5 knots were removed from the spatial analysis. Bycatch was analyzed for four taxonomic groupings of organisms: 1) corals (excluding sea pens and sea whips) and sponges, 2) corals (excluding sea pens and sea whips), 3) sponges, and 4) sea pens and seas whips. For each of the four taxonomic groups, two standardized bycatch metrics were calculated: 1) standardized CPUE (units: lb/km; Appendix F-1 to F-4), and 2) catch-per-unit-of groundfish catch (i.e., CPUC, units: lb/ton of groundfish; Appendix F-5 to F-8).

The numerator for both bycatch metrics was catch density, calculated using a kernel density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California). Catch density was calculated for all tows with presence of one of the four taxonomic groups of corals and sponges.

The denominator for either the CPUE or CPUC was calculated using the same line density algorithm utilized in the two trawl effort intensity layers. For the CPUC metric, the line density algorithm weights each linear feature representing a tow by the weight of groundfish catch (tons). Effort density of density of groundfish catch was calculated for all tows, regardless of presence of corals or sponges in the catch.

By standardizing catch by either amount of effort (km/km^2; Appendix F-1 to F-4) or catch of groundfish (lb/km^2; Appendix F-5 to F-8), the resulting bycatch outputs were standardized over both space and time. In order to maintain the confidentiality of individual vessels, any cells with density values calculated from fewer than three vessels were removed from the final map layers. This did not significantly change how bycatch was represented since almost all bycatch occurred within areas where more than two vessels were operating. The density parameters used for calculating standardized bycatch were a 3-km search radius and a 500x500 m cell size.

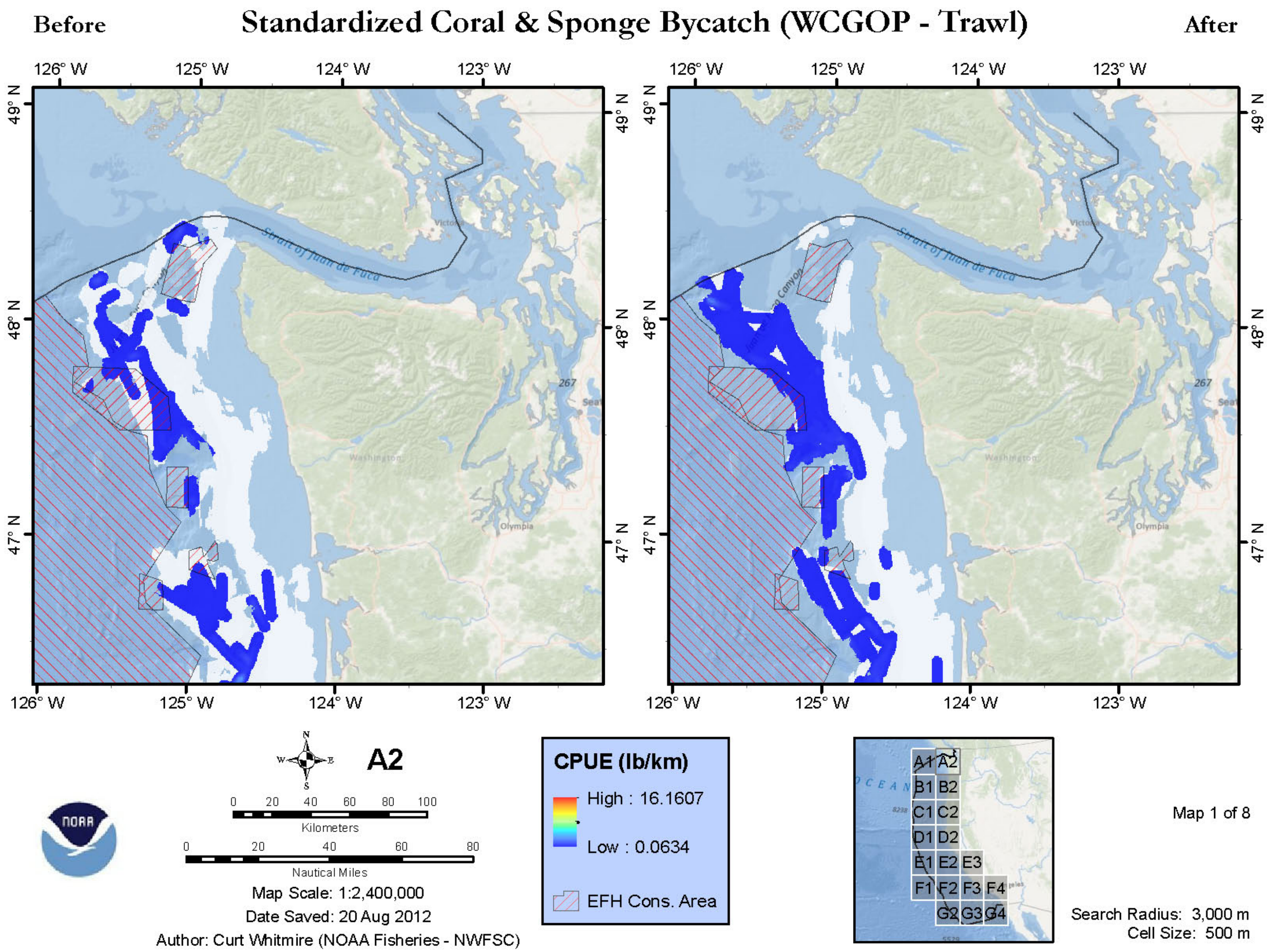
Before interpreting the data and map figures, there are a few points about the methods used to create them that are important to consider. First, trawl tracks are only represented by straight lines connecting start and end points. Trawls rarely follow straight lines; therefore, the longer the line the higher the uncertainty as to its actual path. Second, since we are uncertain as to when bycatch occurred during the course of a trawl, bycatch was assumed to occur consistently and proportionally over the entire course of the straight trawl line. Third, only observed trips are represented. Fourth, different trawl gear configurations will access different types of habitats and topographic relief. Fifth, the boundaries of the trawl rockfish conservation areas have changed throughout both of these time periods, effectively changing access to trawlable (and biogenic) habitats within these areas. Lastly, implementation of the EFH conservation areas in June 2006 significantly curtailed access to some known biogenic habitats. The effects of these closures on protection of biogenic habitats are not fully understood.

Eight (four taxonomic groups by two bycatch metrics) sets of map figures (Plates) were created to show temporal comparisons of standardized bycatch, (Appendix F). In order to evaluate how bycatch has changed between two time periods in any given map set, the color ramps for the density layers in each time period were scaled to the same range of values. Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. White areas repreent those where no bycatch occurred but where effort still existed. The upper value in the map legends is the lowest “high” value between the time periods. It was necessary to set the color ramp to the lowest “high” value in order for the colors in each panel to perfectly match and therefore be comparative.

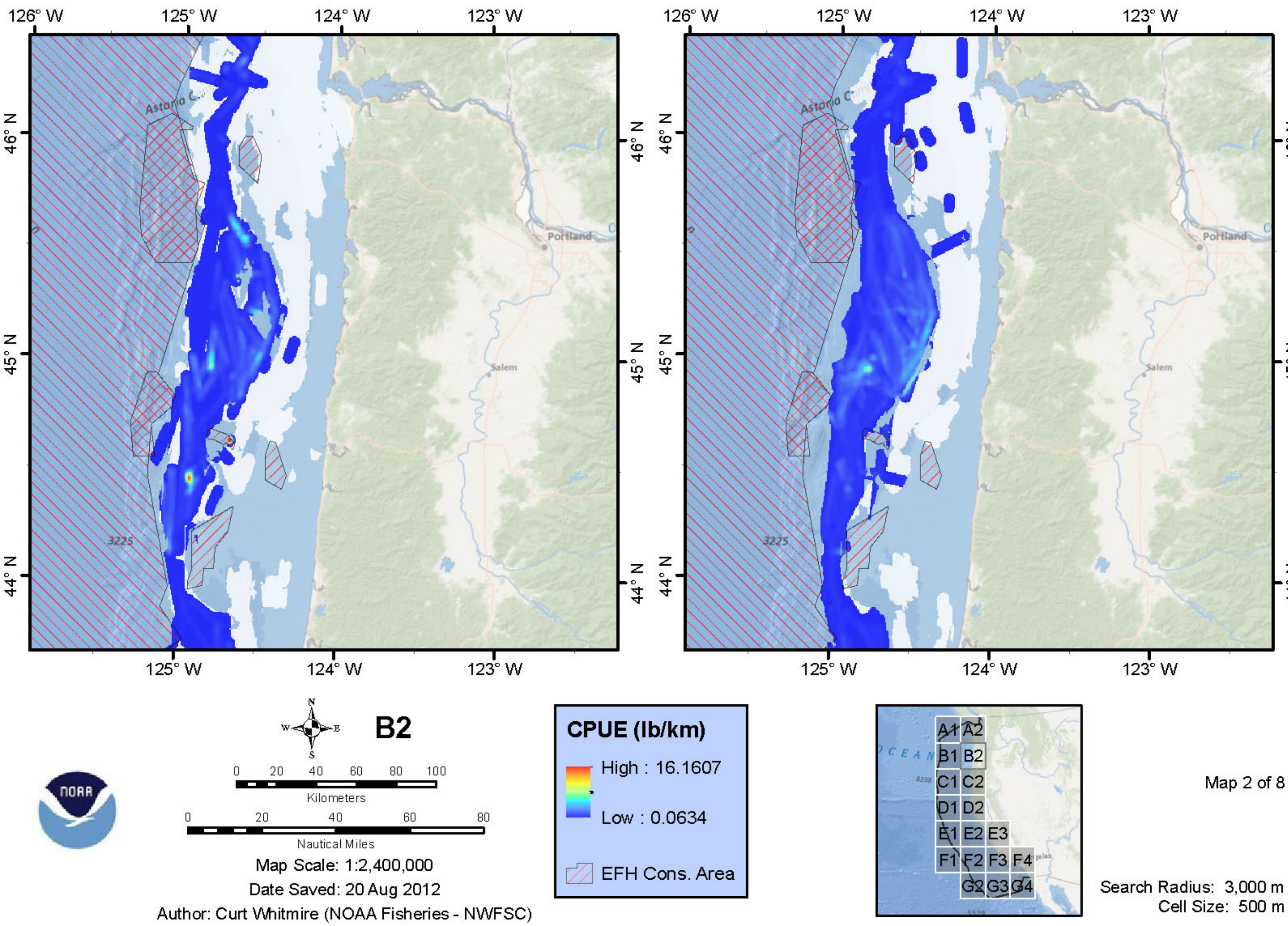
One apparent feature of all map figures is that few areas of high relative bycatch are evident. This is a result of having to scale the color ramps for each panel to facilitate temporal comparison. Since the range of standardized bycatch values between each time period is significantly different and since many values are very low (near zero), most areas of the map layers appear dark blue (zero to low bycatch). The areas of the map that appear lighter blue (teal) or red represent areas where bycatch was higher in one time period versus the other.

For sponges (Appendices F-3 and F-7) and corals/sponges combined (Appendices F-1 and F-5), areas that show consistently higher relative amounts of bycatch are located on the northern Oregon slope (Plate B2) and a couple areas off southern Oregon (Plate C2). Areas of decreased bycatch for sponges (Appendix F-3) and corals/sponges combined (Apendix F-1 and F-5) occur at two small areas on the central Oregon slope (Plate B2) and near the Eel River Canyon (Plate D2). One area of increased bycatch of these taxonomic groups is evident off Cape Arago, Oregon (Plate C2). For corals (Appendicies F-2 and F-6), bycatch has decreased significantly in many areas, especially at one small area off the Columbia River mouth and a number of areas off northern Oregon (Plate B2), and two areas off southern Oregon (Plate C2). Bycatch has only increased in one area off Crescent City, California (Plate C2). And finally, bycatch of sea pens/whips (Appendices F-4 and F-8) has decreased significantly in three areas off northern Oregon (Plate B2) and one small area shoreward of the Bandon High Spot (Plate C2).

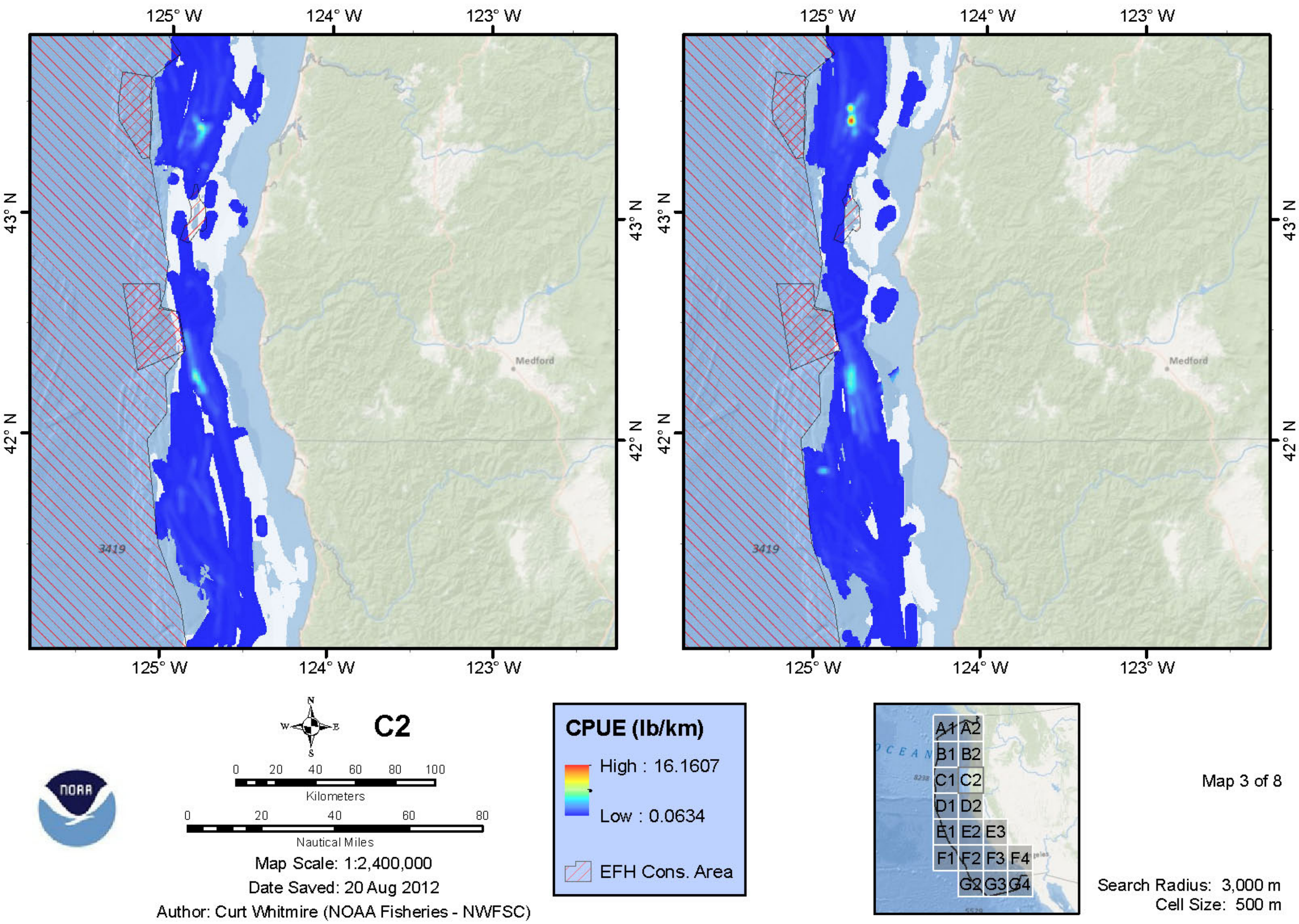
To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.


Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Victoria
Washington
Olympia
267
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 16.1607
Low : 0.0634
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 8
Search Radius: 3,000 m
Cell Size: 500 m

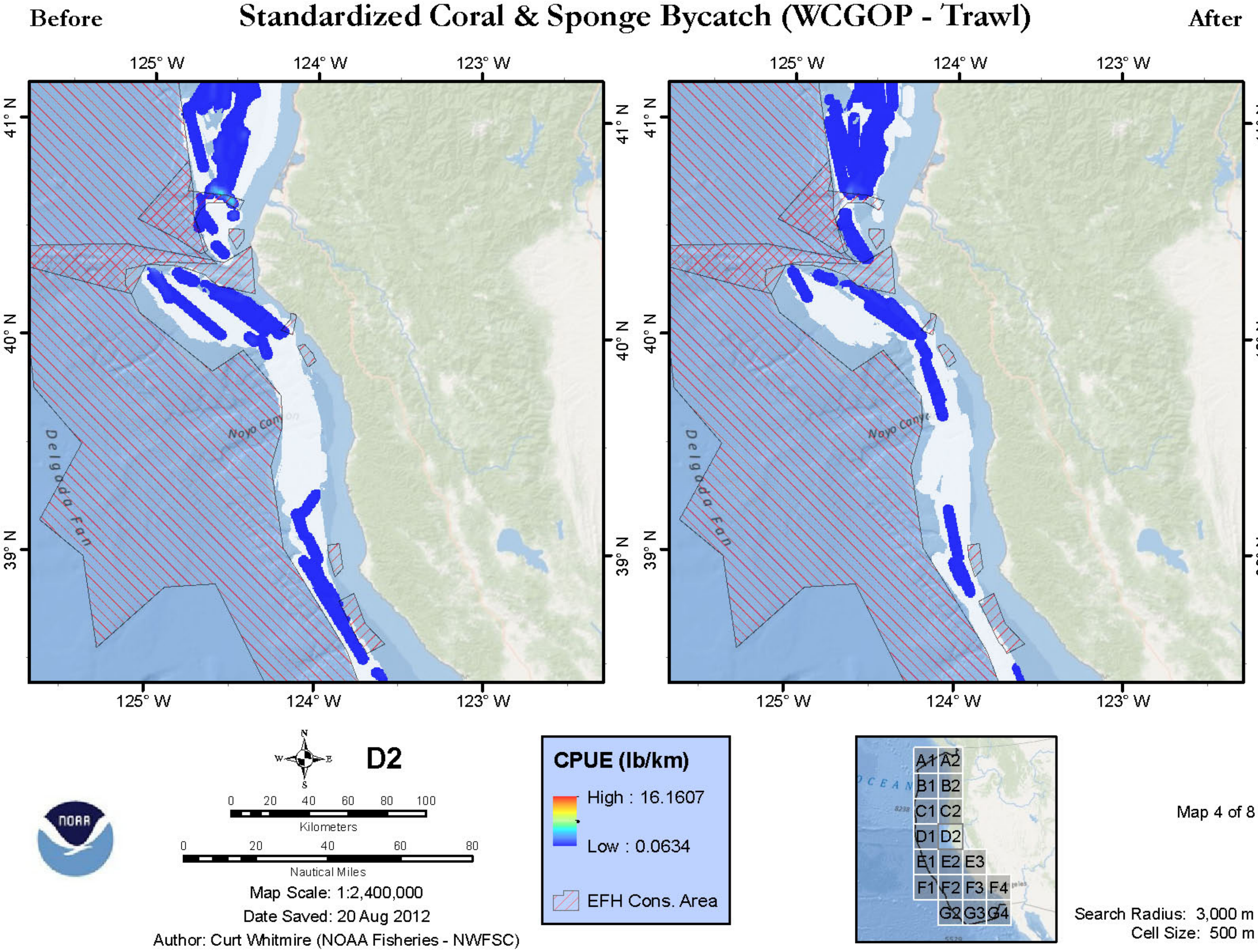
Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After

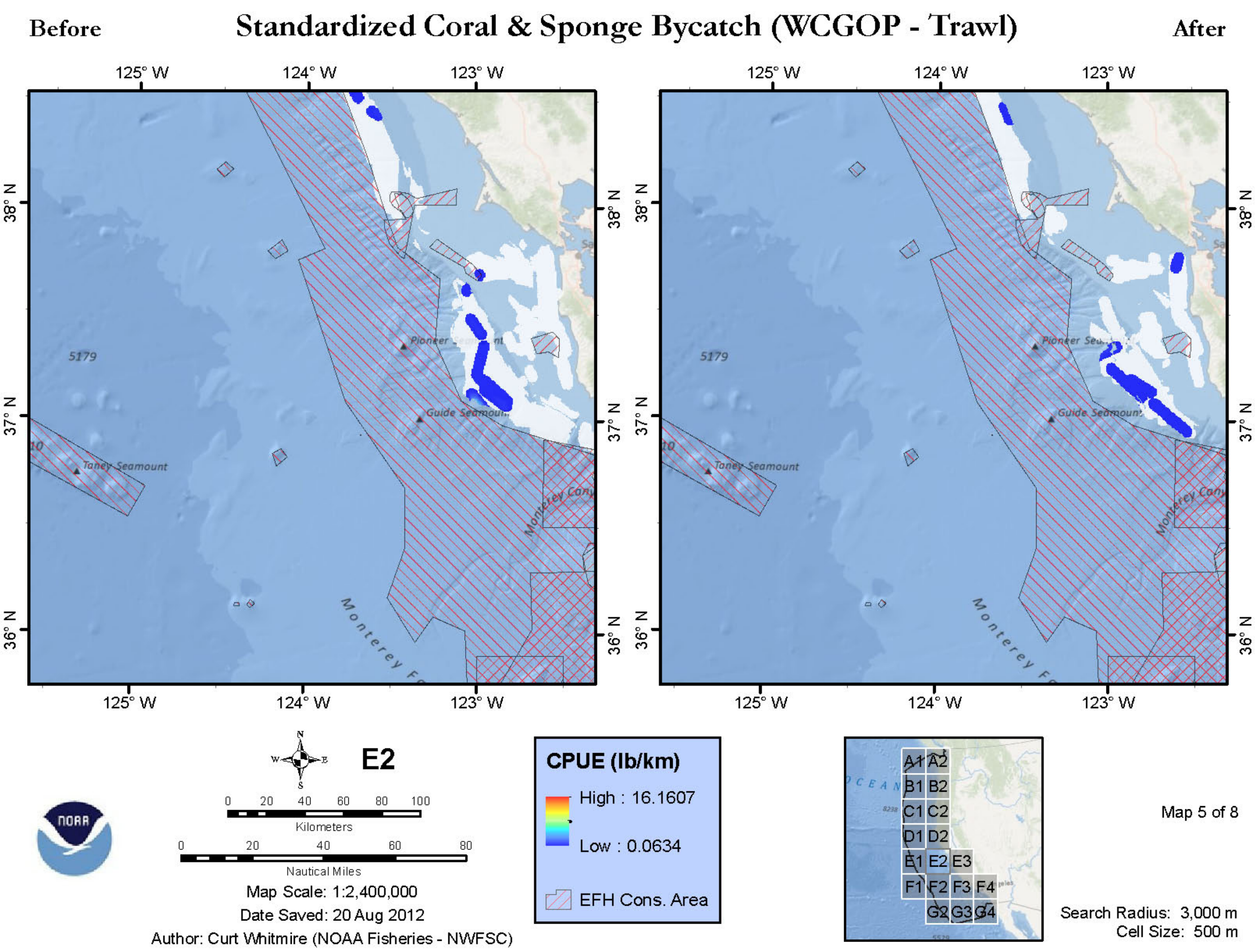


Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After



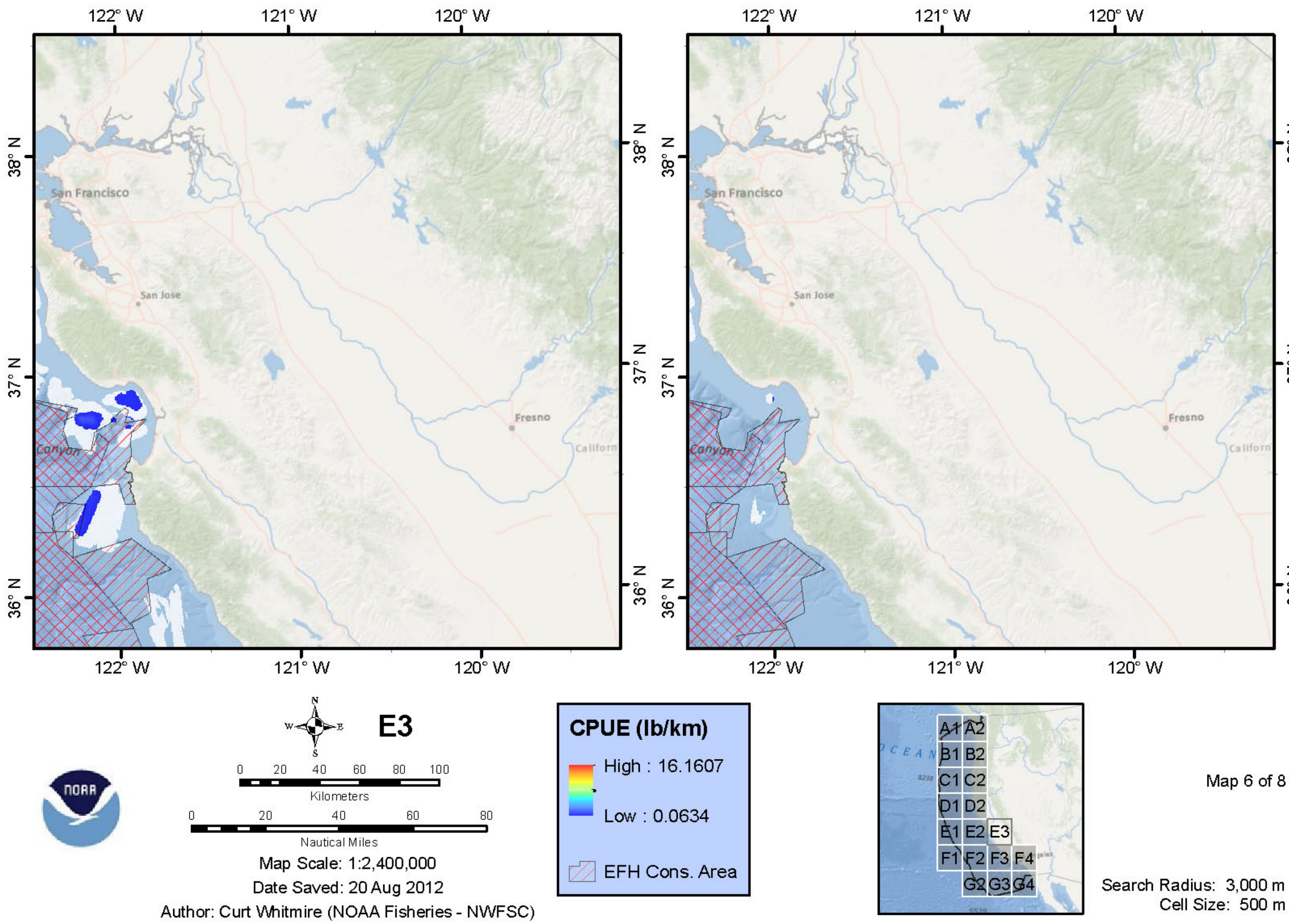
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)

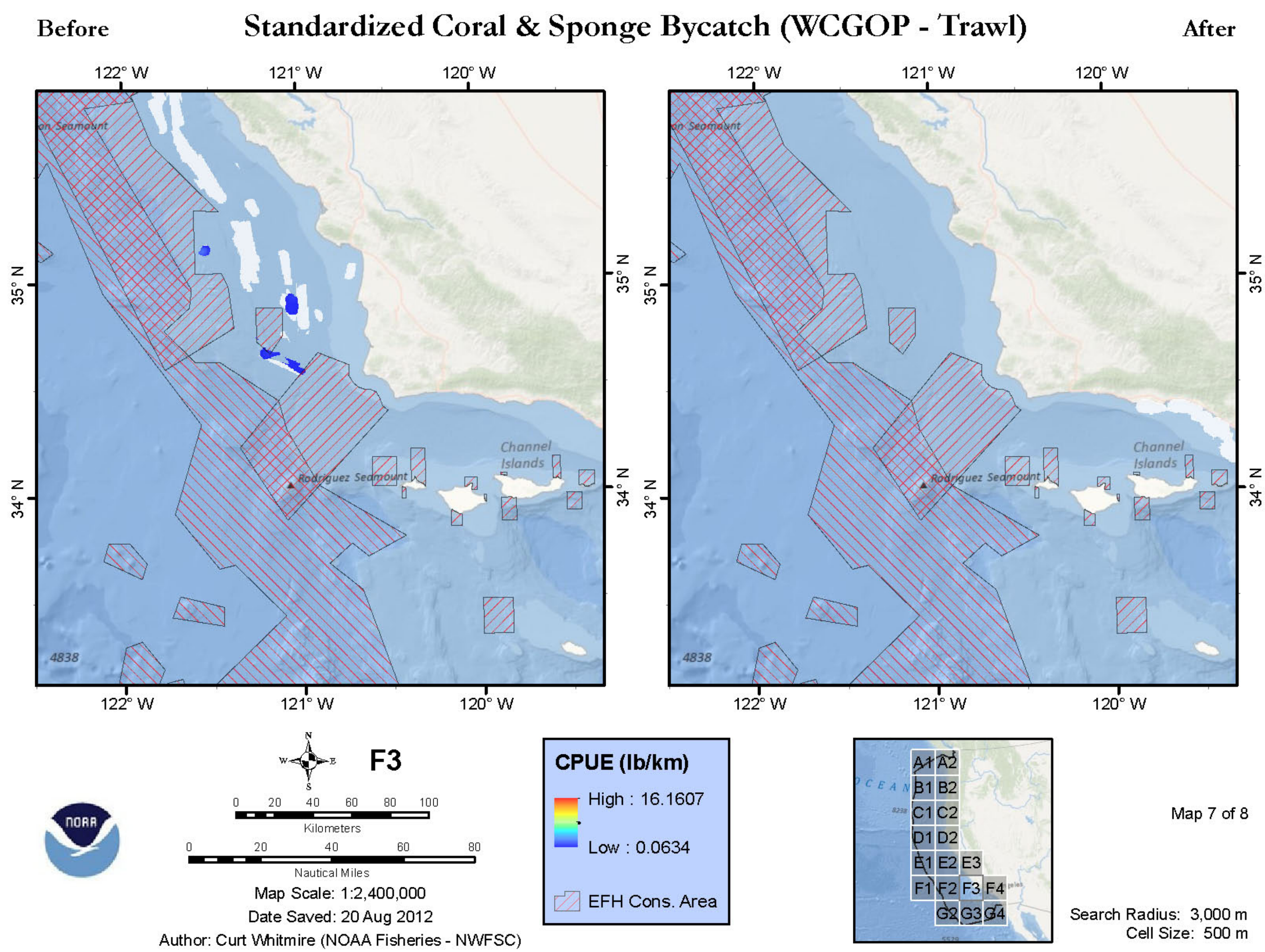




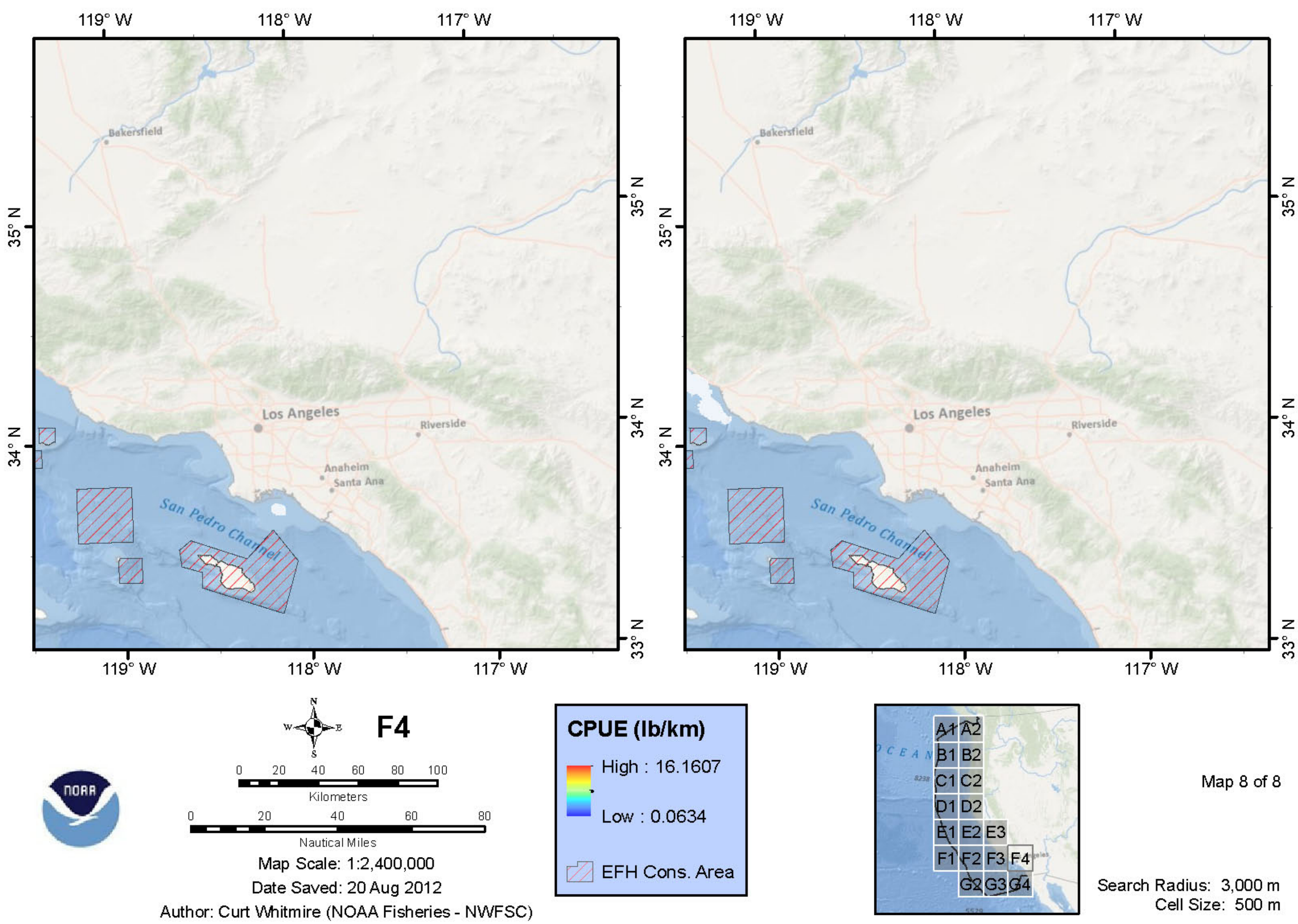
Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 16.1607
Low : 0.0634
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After

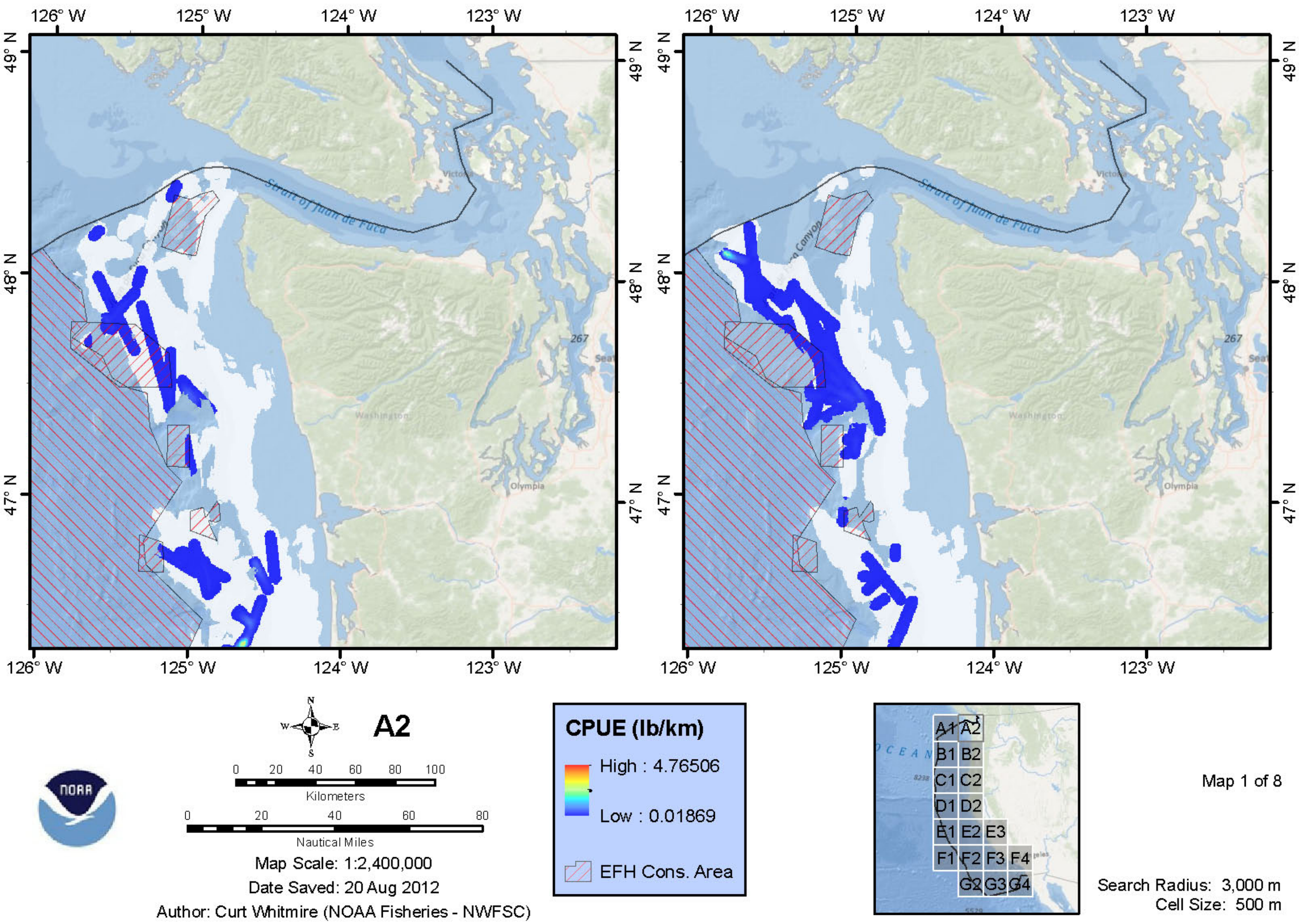


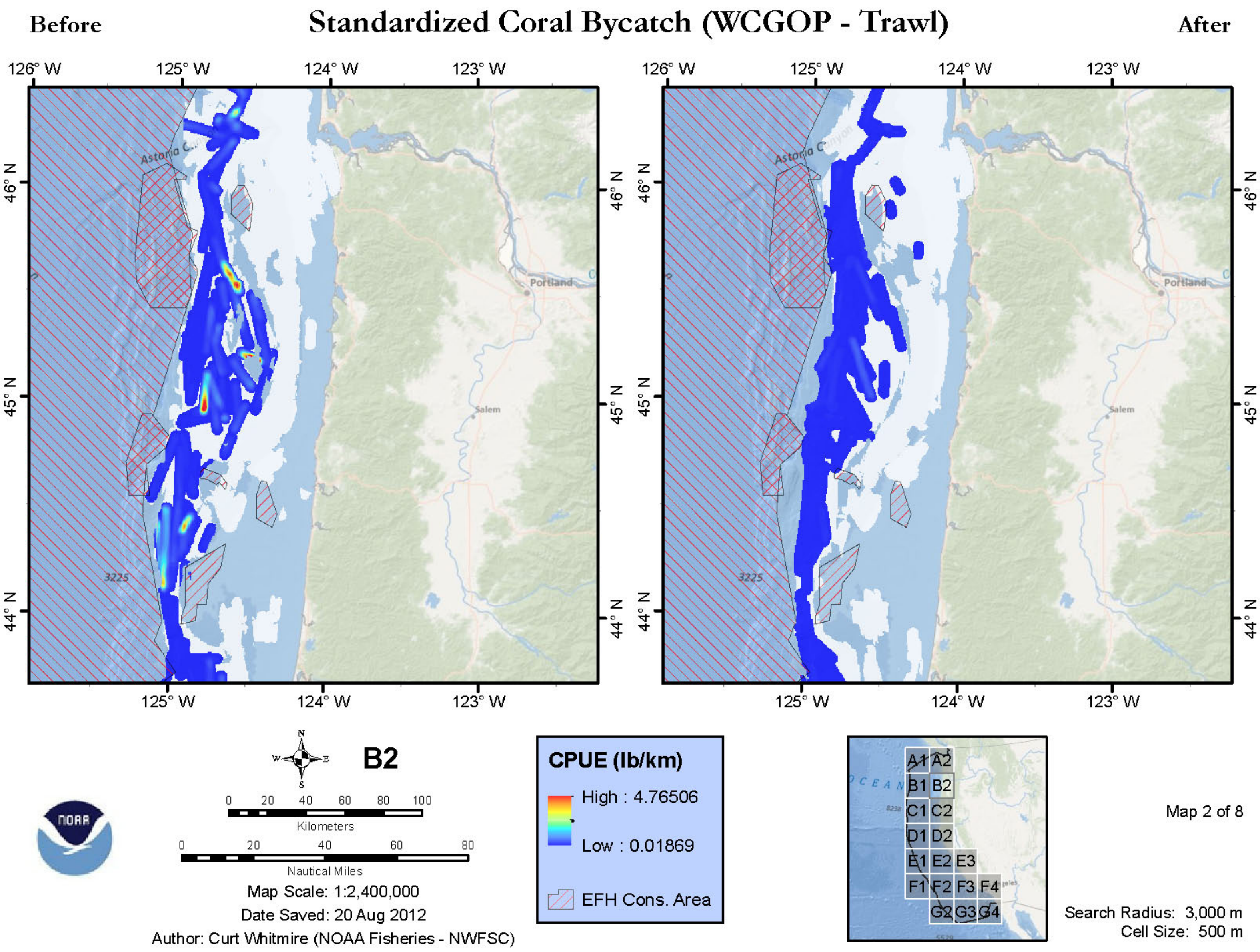

Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
Channel Islands
4838
F3
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 16.1607
Low : 0.0634
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 8
Search Radius: 3,000 m
Cell Size: 500 m

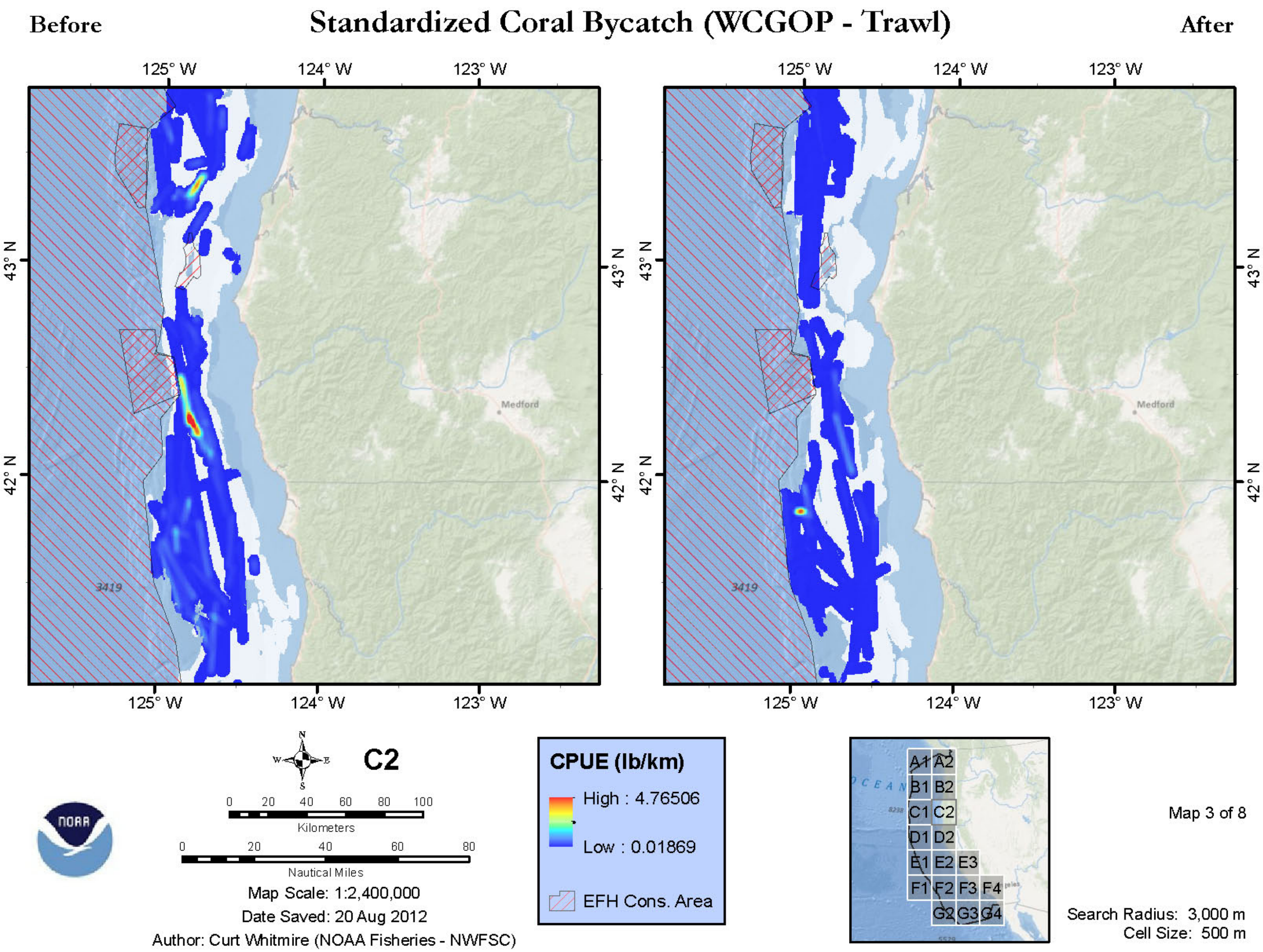
Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After



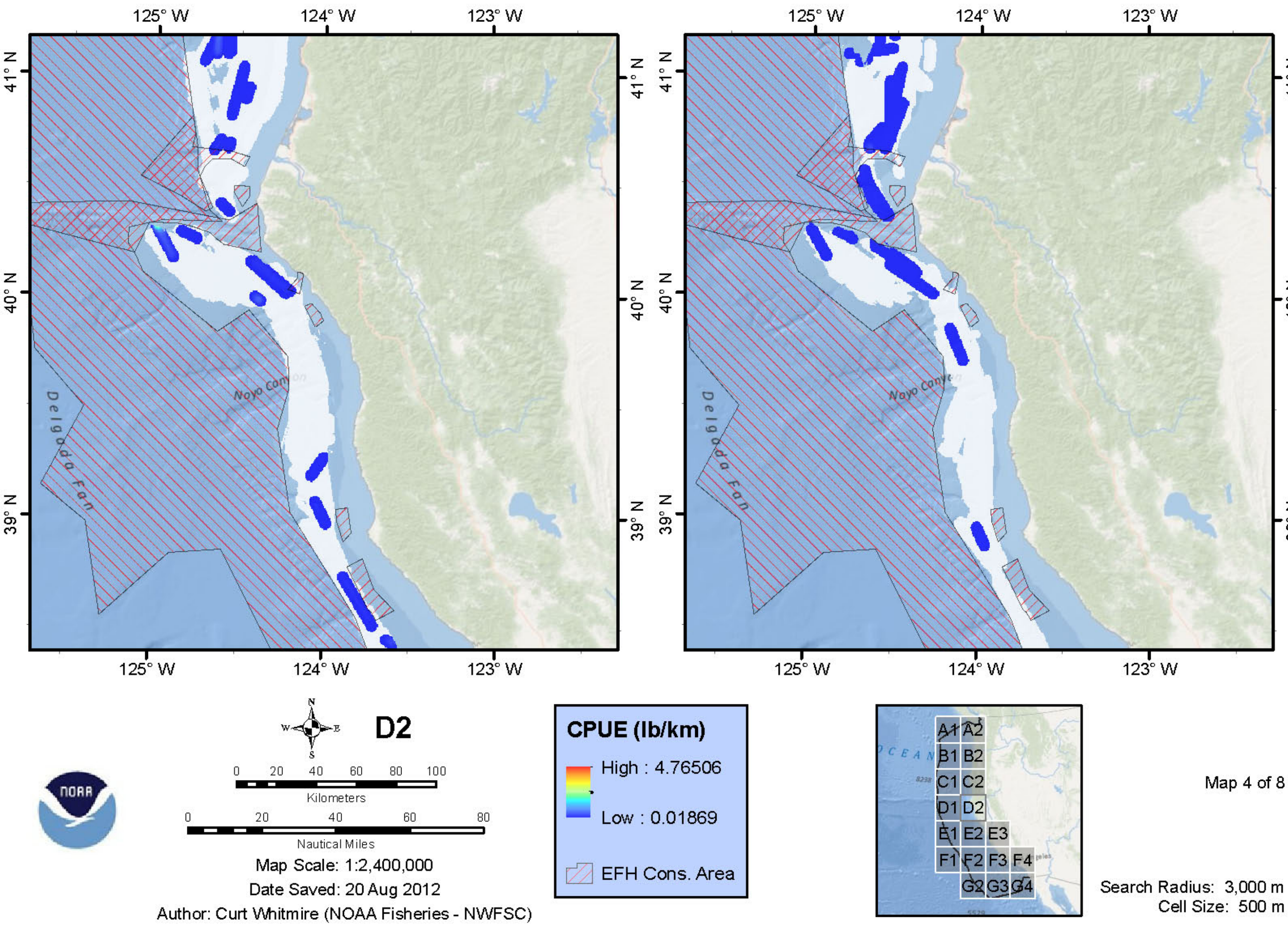
Before **Standardized Coral Bycatch (WCGOP - Trawl)** **After**

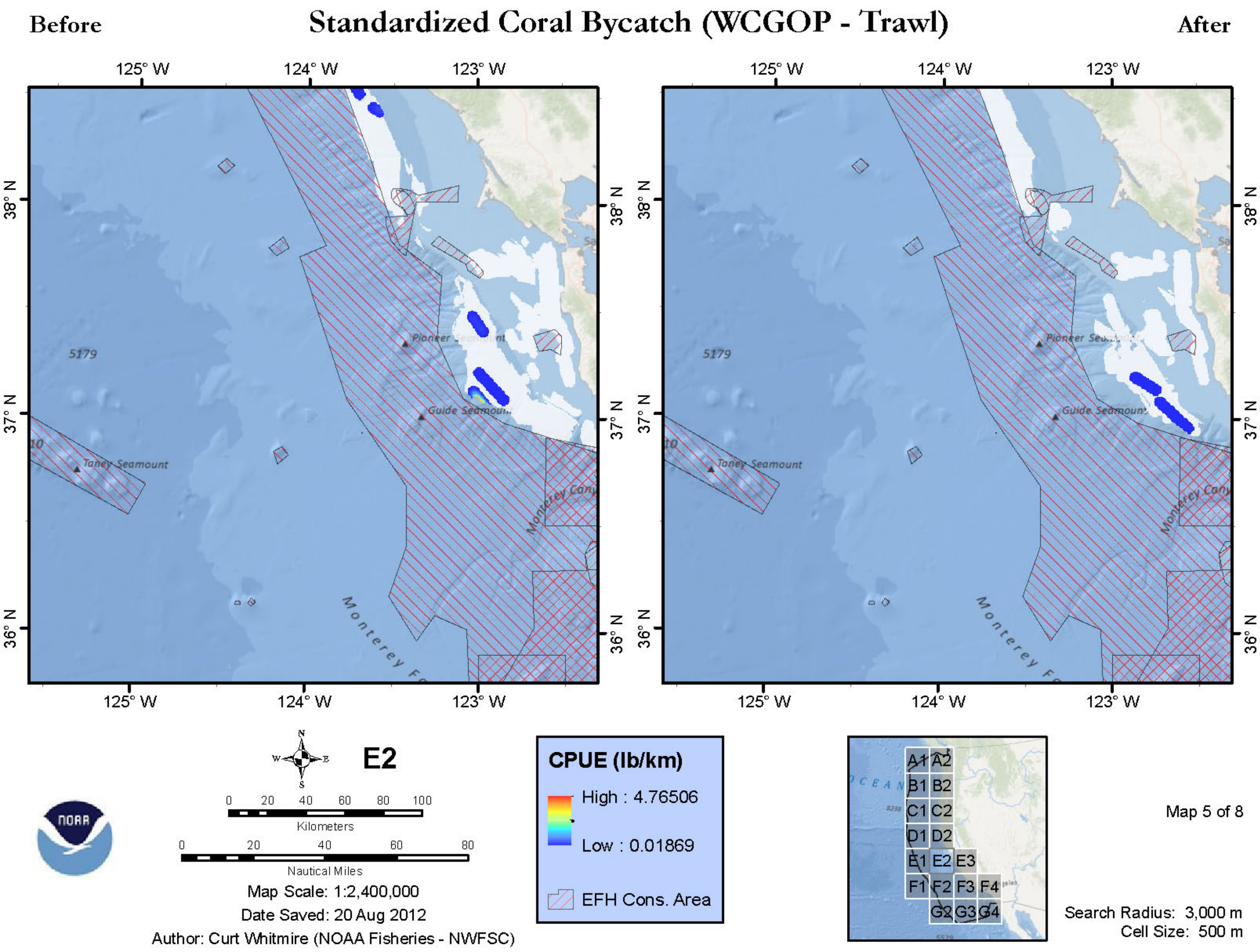



Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria C...
Astoria Canyon
Portland
Salem
3225
B2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 4.76506
Low : 0.01869
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 4.76506
Low : 0.01869
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 8
Search Radius: 3,000 m
Cell Size: 500 m

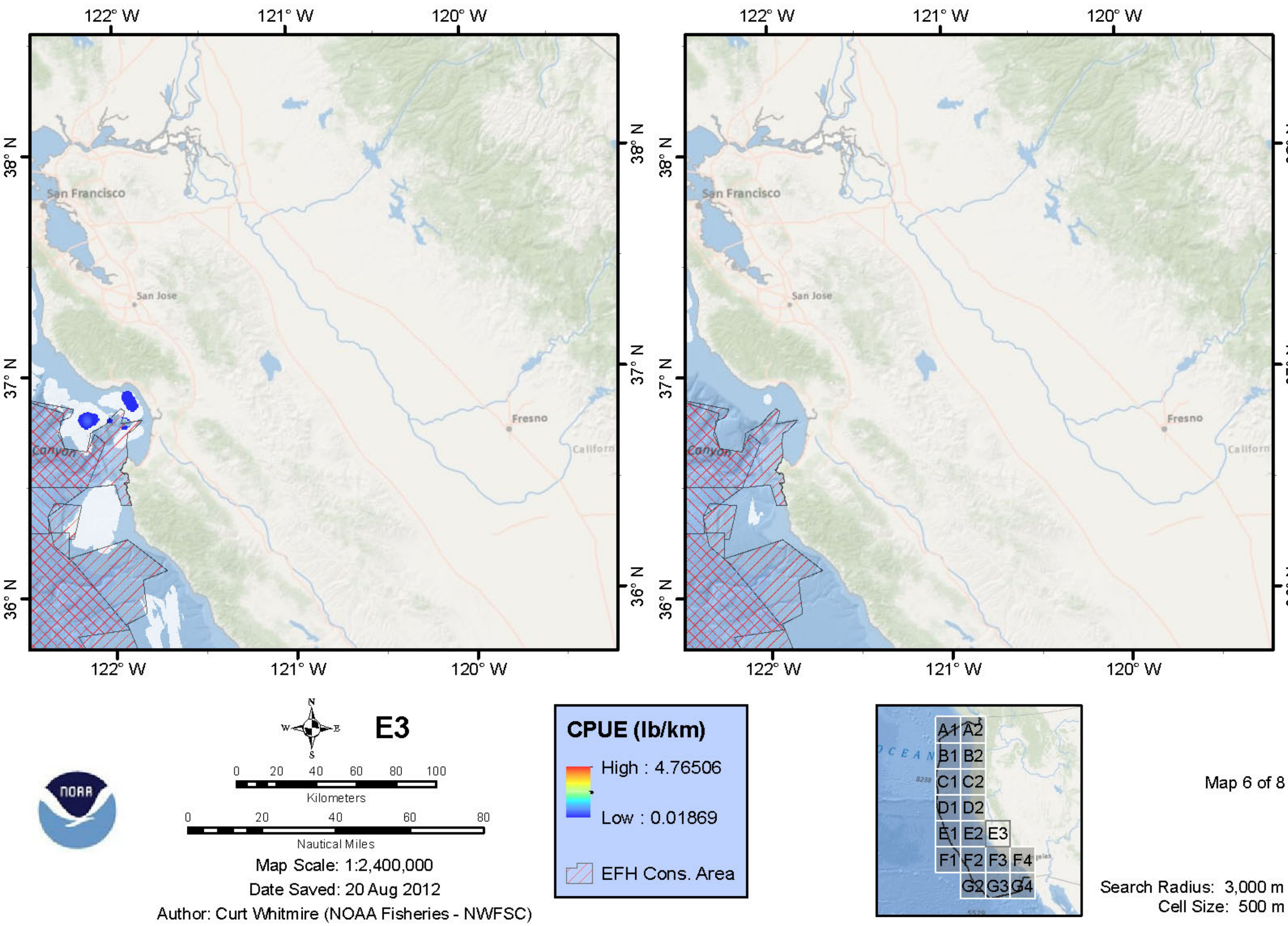
Before **Standardized Coral Bycatch (WCGOP - Trawl)** After




Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 4.76506
Low : 0.01869
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

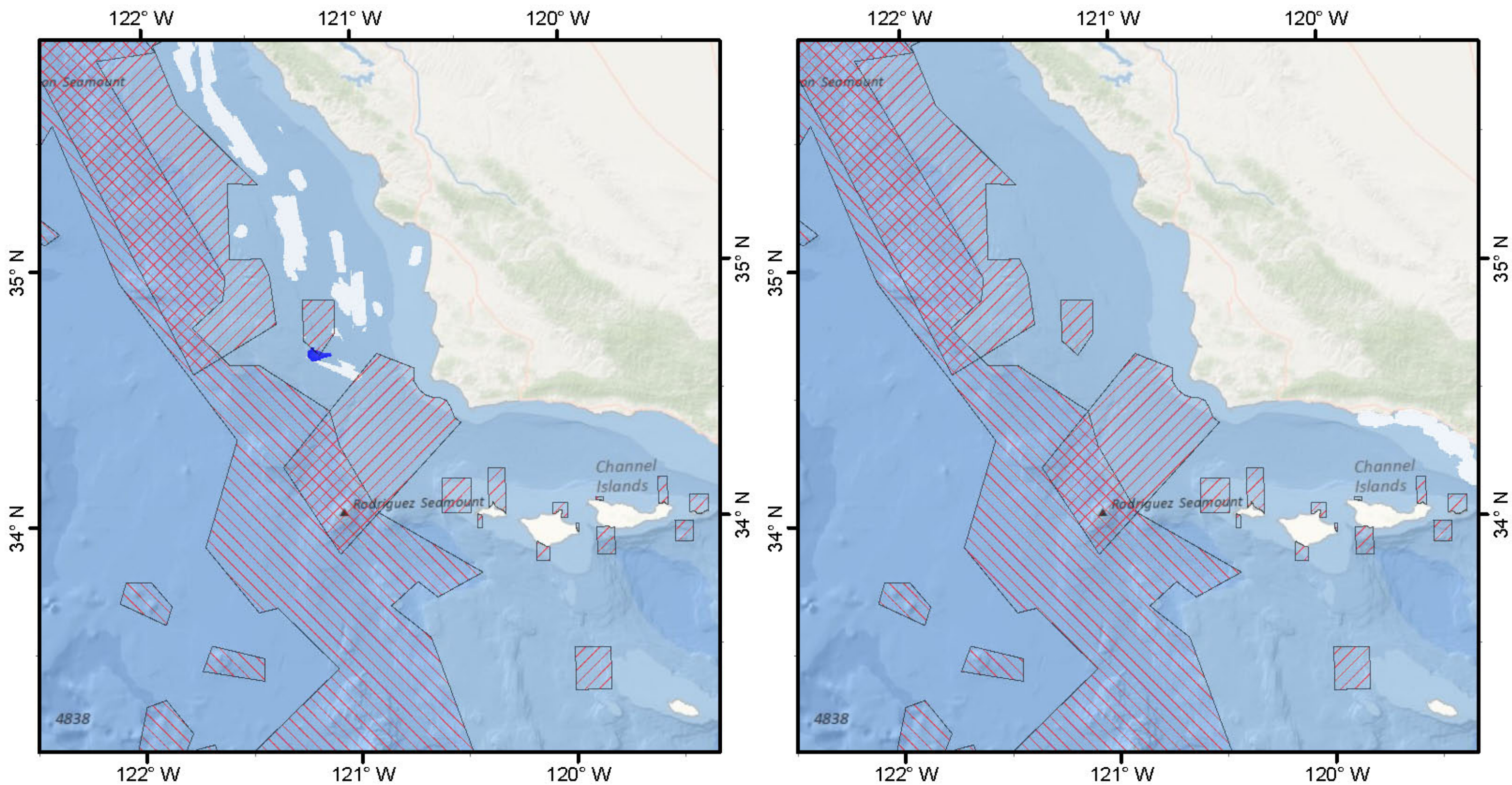
Standardized Coral Bycatch (WCGOP - Trawl)

Before **After**



Standardized Coral Bycatch (WCGOP - Trawl)

Before **After**



F3

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

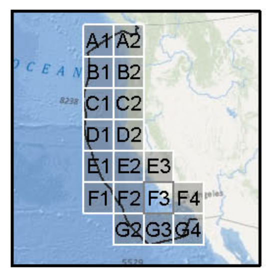
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

CPUE (lb/km)

High : 4.76506

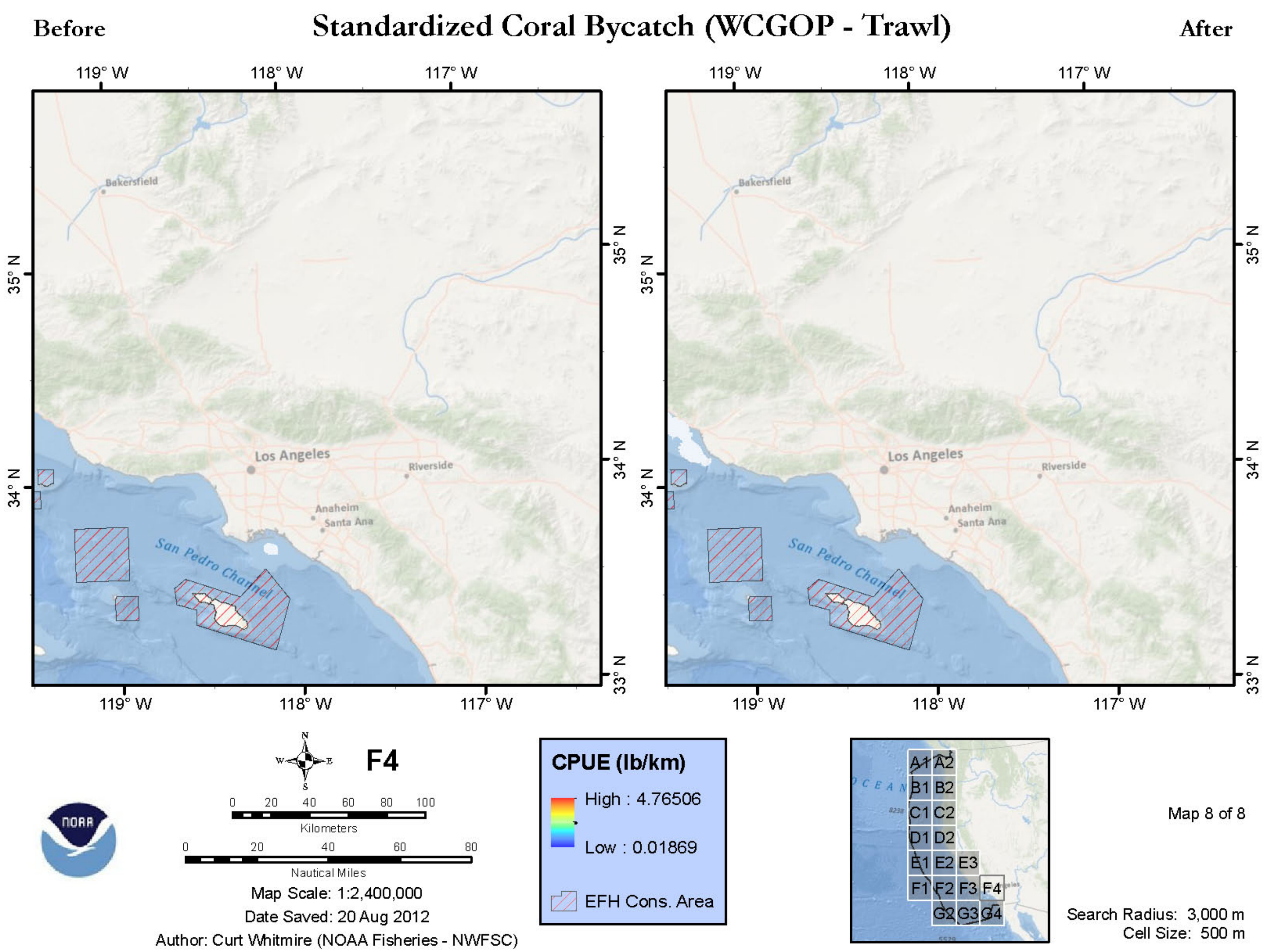
Low : 0.01869

EFH Cons. Area

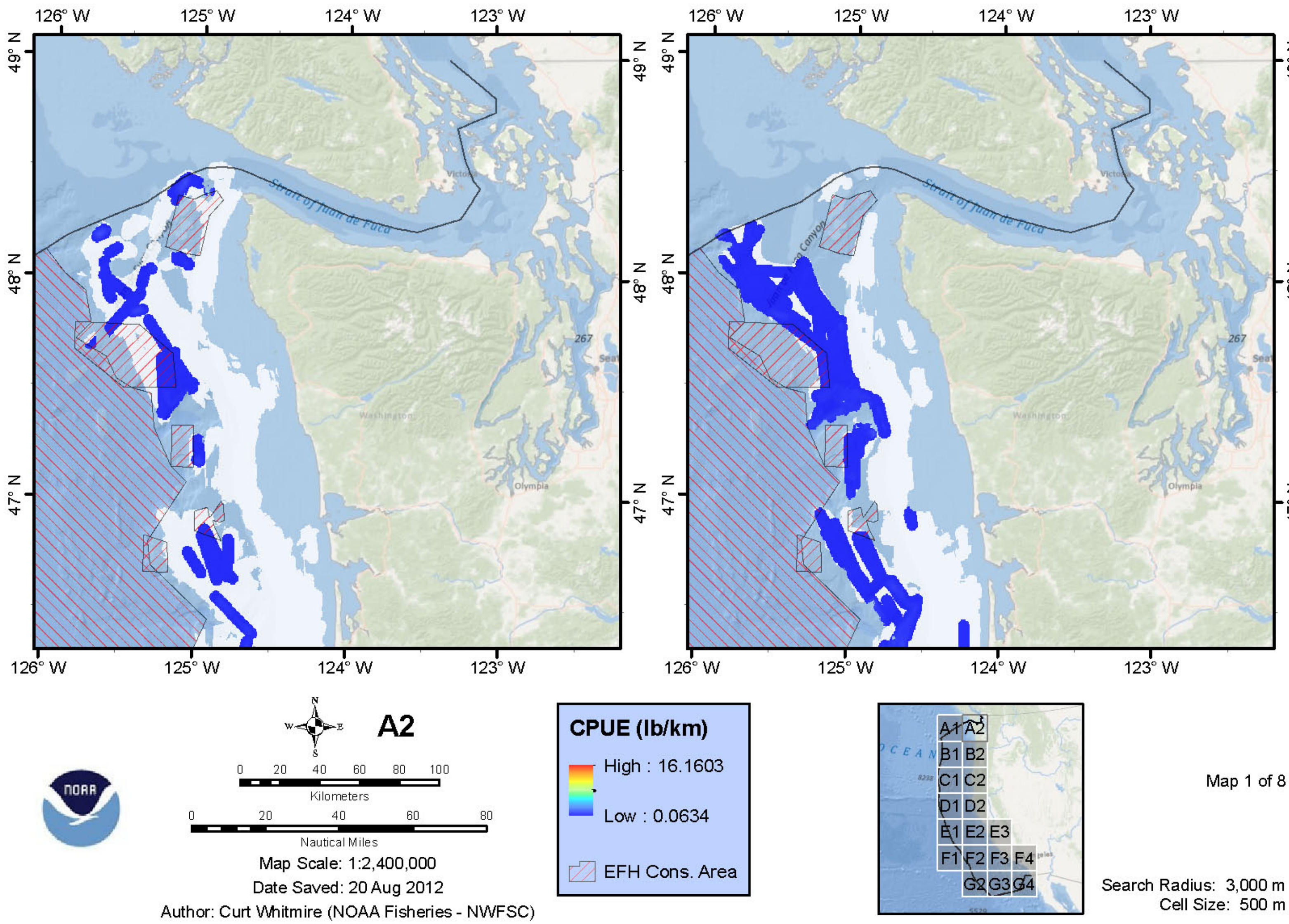


Map 7 of 8

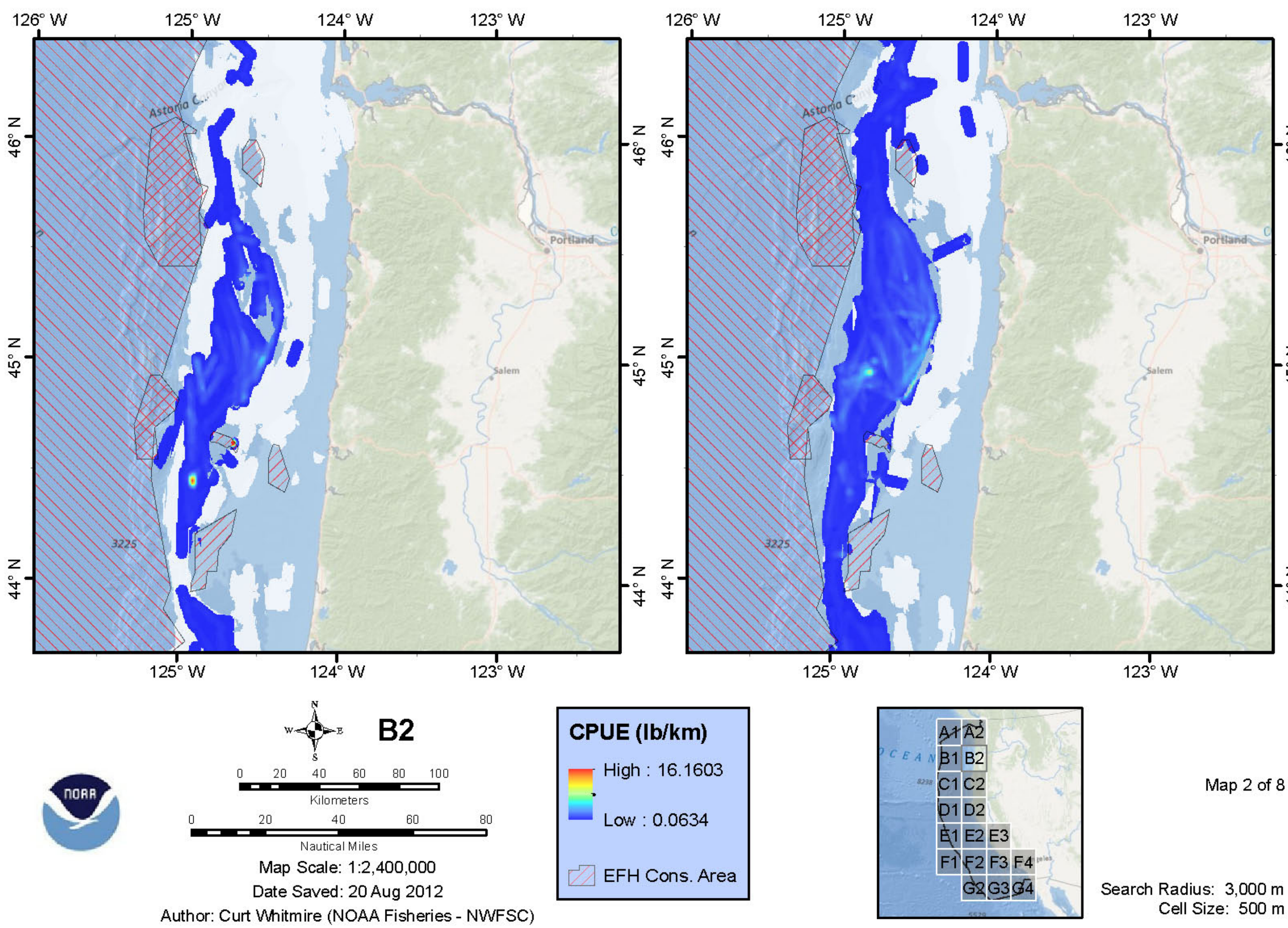
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 4.76506
Low : 0.01869
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Sponge Bycatch (WCGOP - Trawl)** After



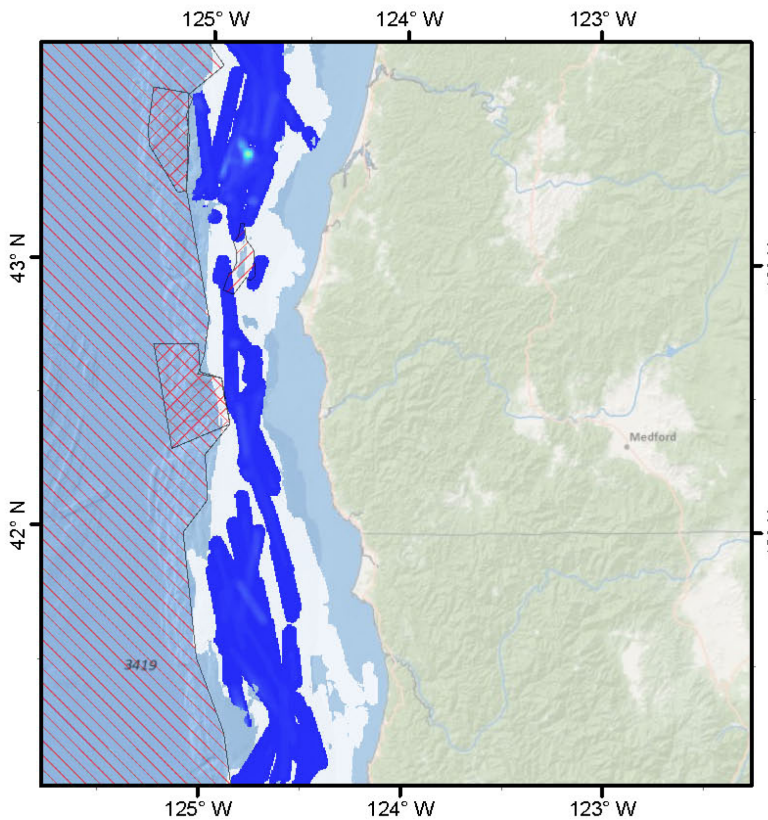
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** **After**

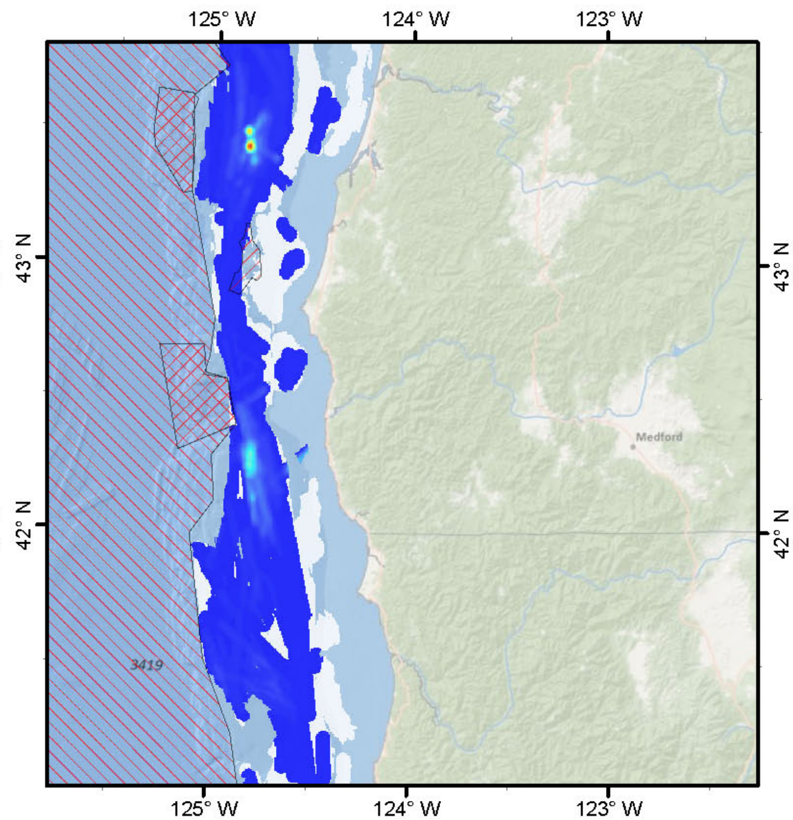


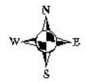
Before

Standardized Sponge Bycatch (WCGOP - Trawl)

After







C2

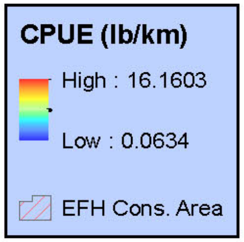
0 20 40 60 80 100
Kilometers

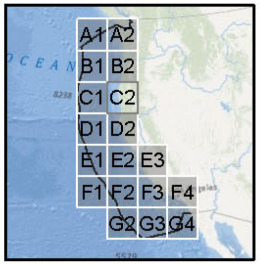
0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Author: Curt Whitmire (NOAA Fisheries - NWFSC)

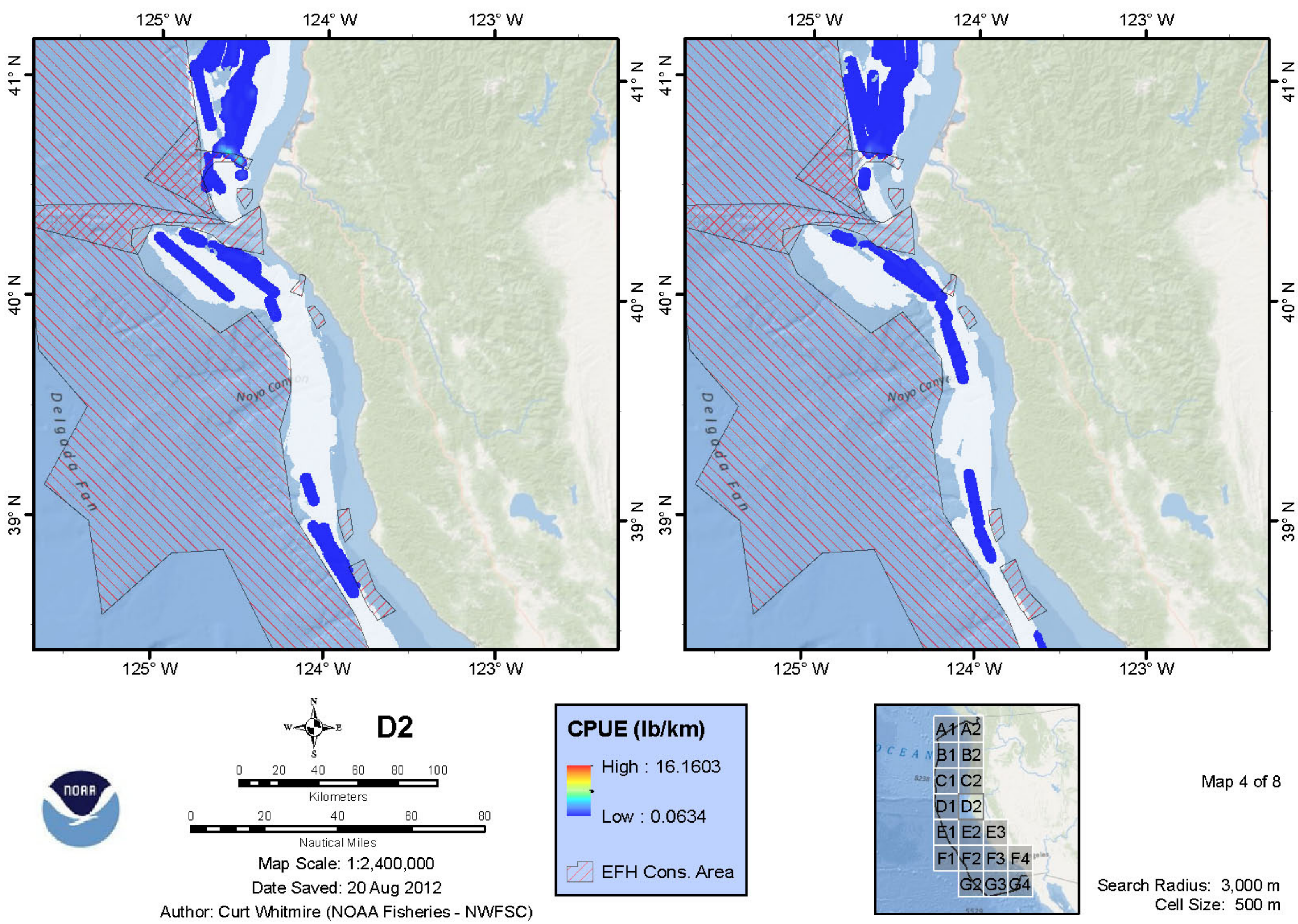




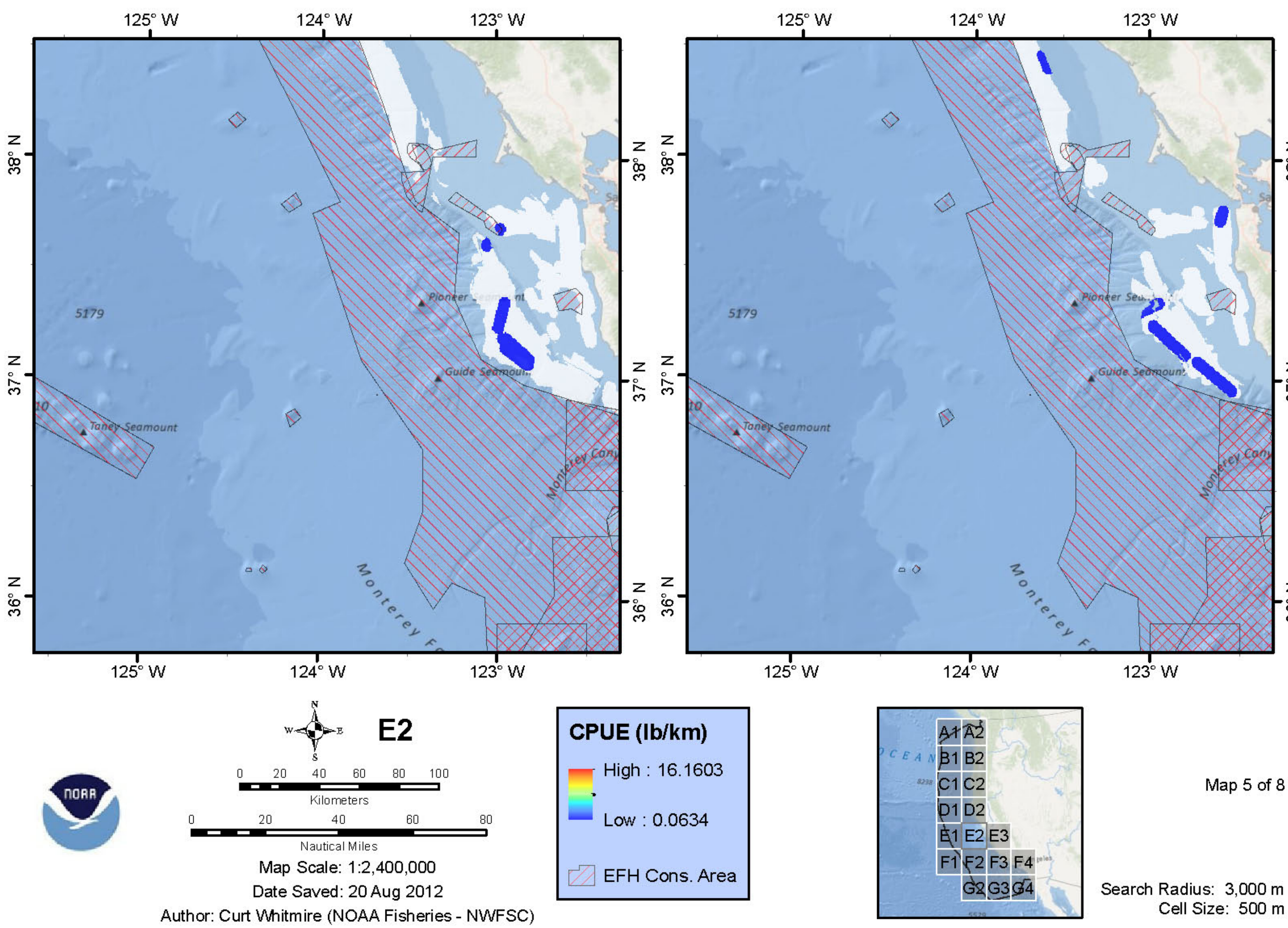
Map 3 of 8

Search Radius: 3,000 m
Cell Size: 500 m

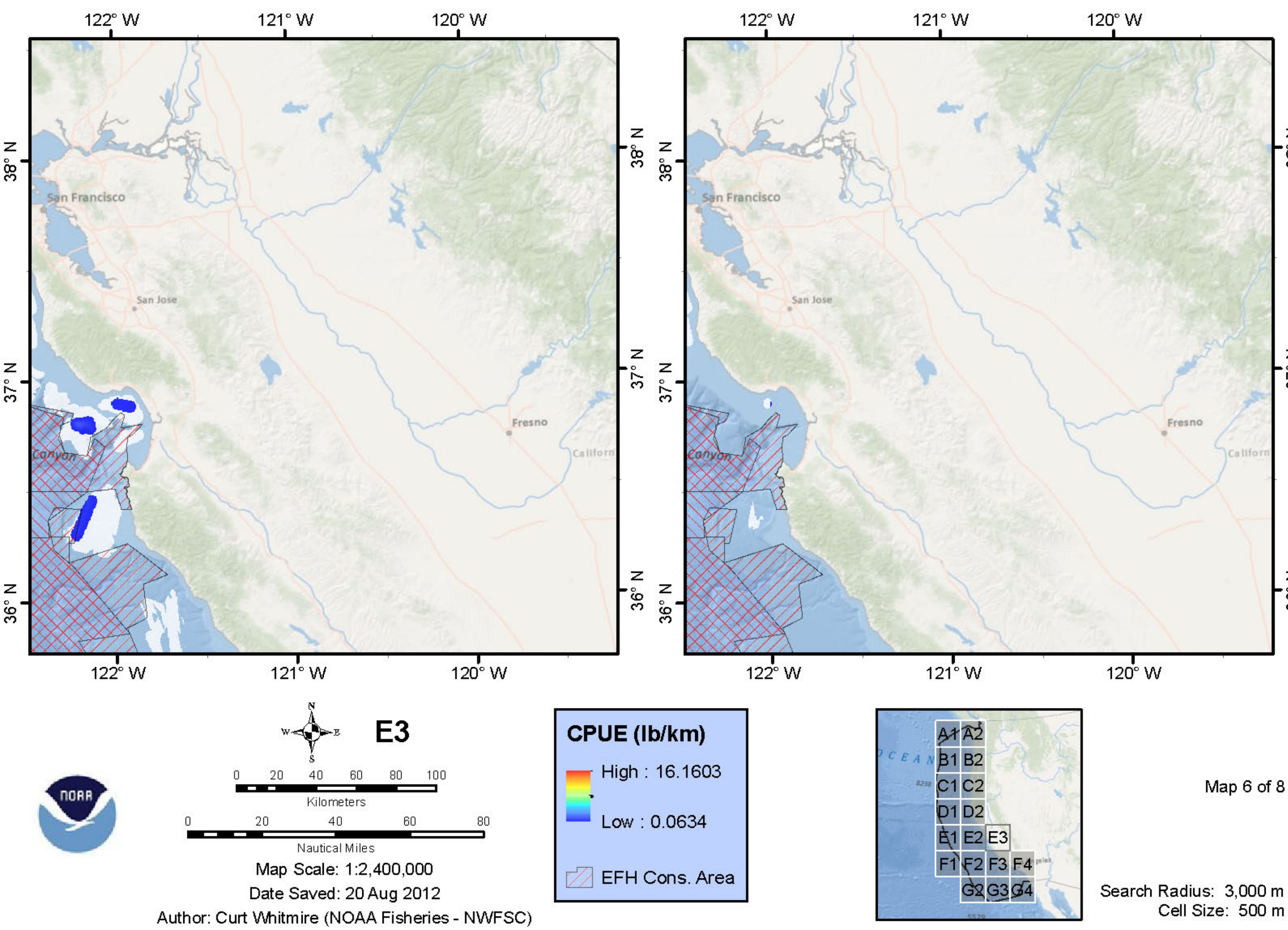
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** **After**



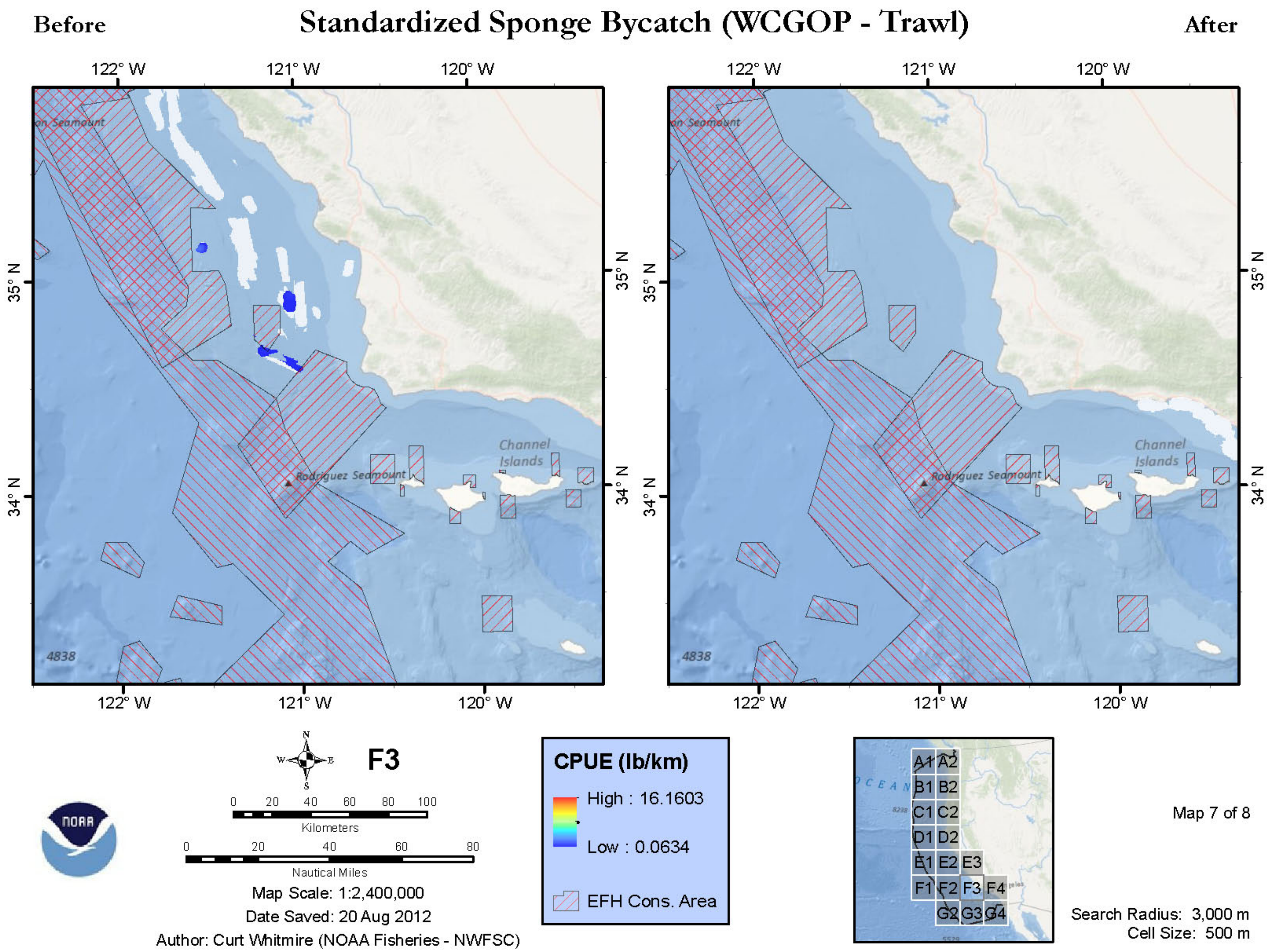
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** **After**



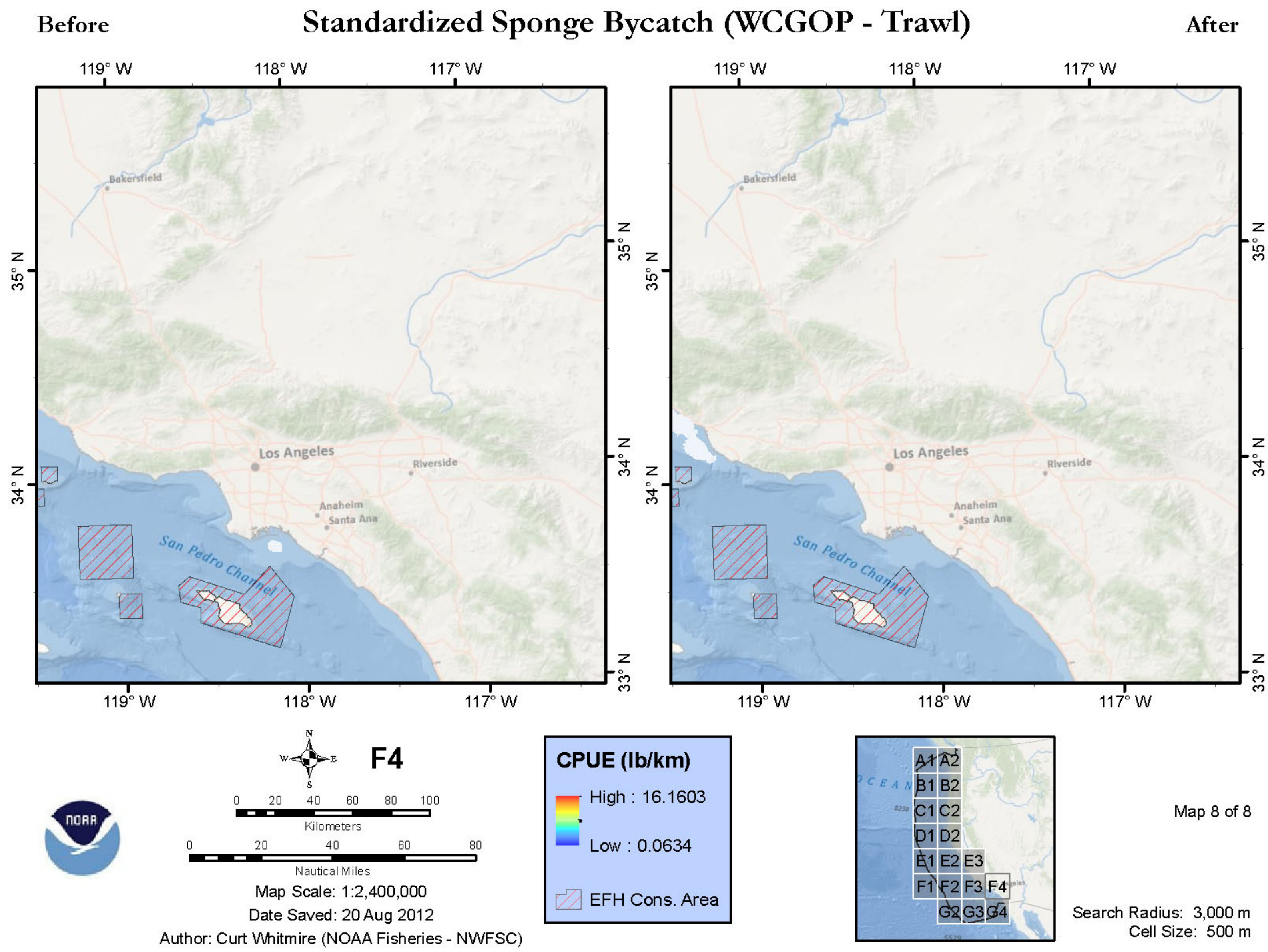
Before — **Standardized Sponge Bycatch (WCGOP - Trawl)** — **After**

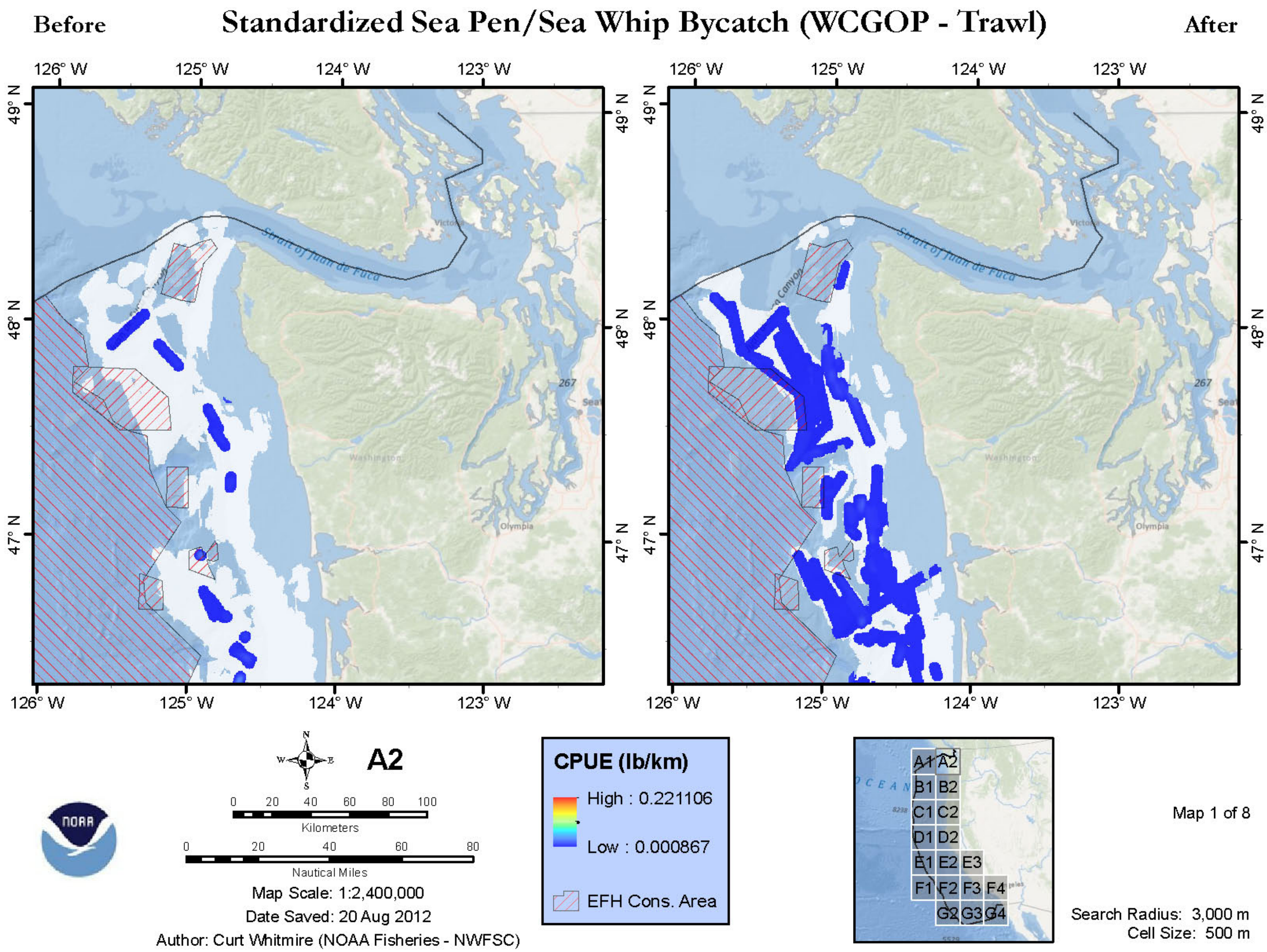


Appendix F-3

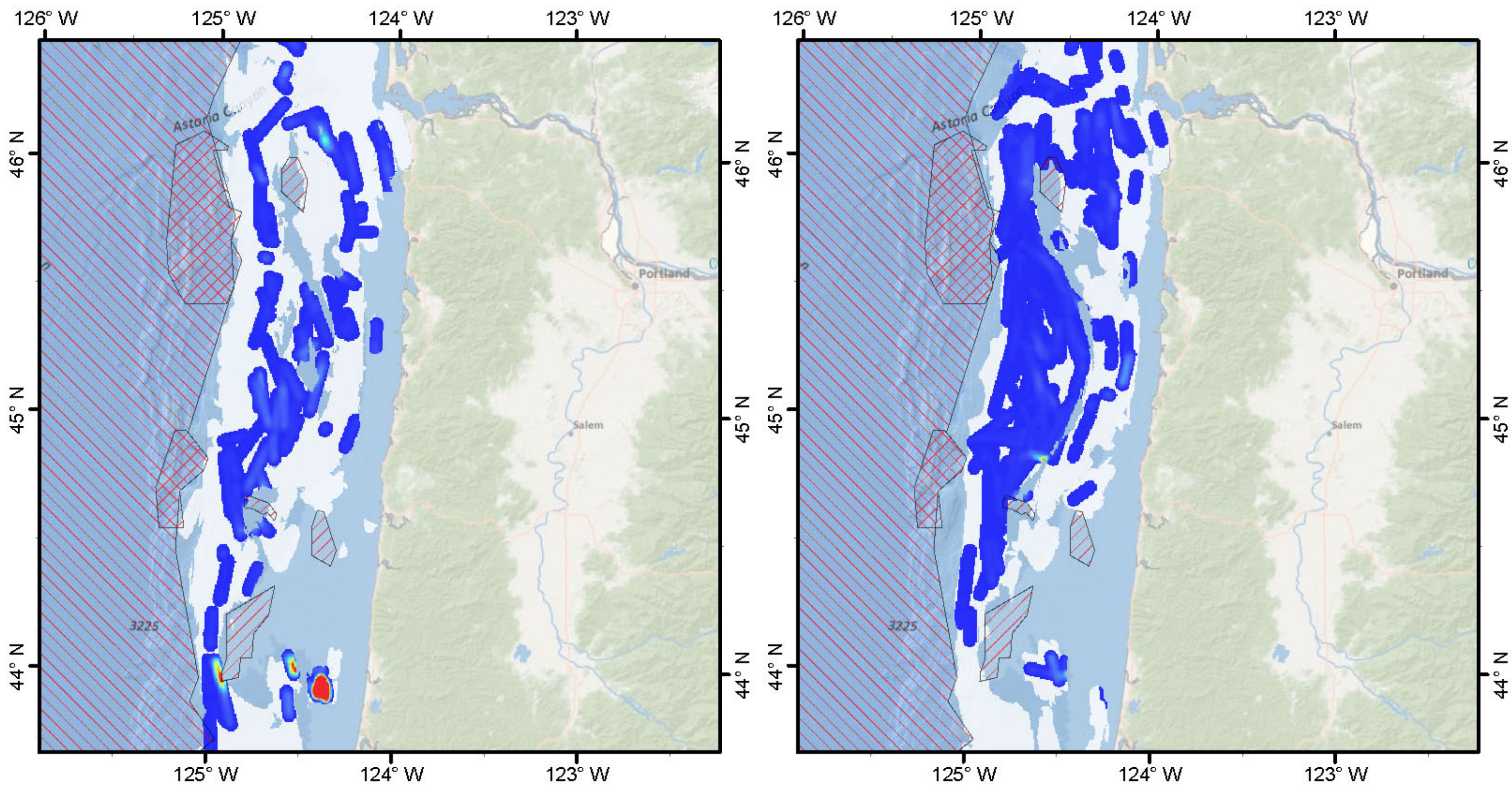


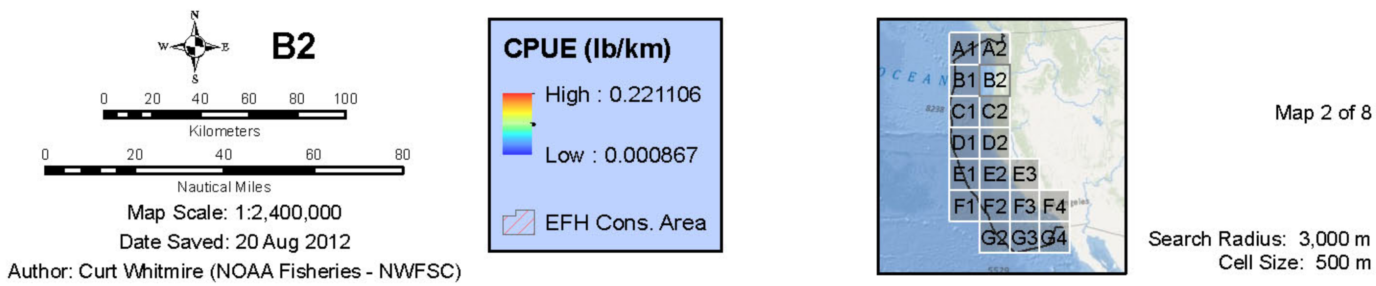
Before
Standardized Sponge Bycatch (WCGOP - Trawl)
After
122° W
121° W
120° W
35° N
34° N
Channel Islands
Rodriguez Seamount
4838
F3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 16.1603
Low : 0.0634
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 8
Search Radius: 3,000 m
Cell Size: 500 m

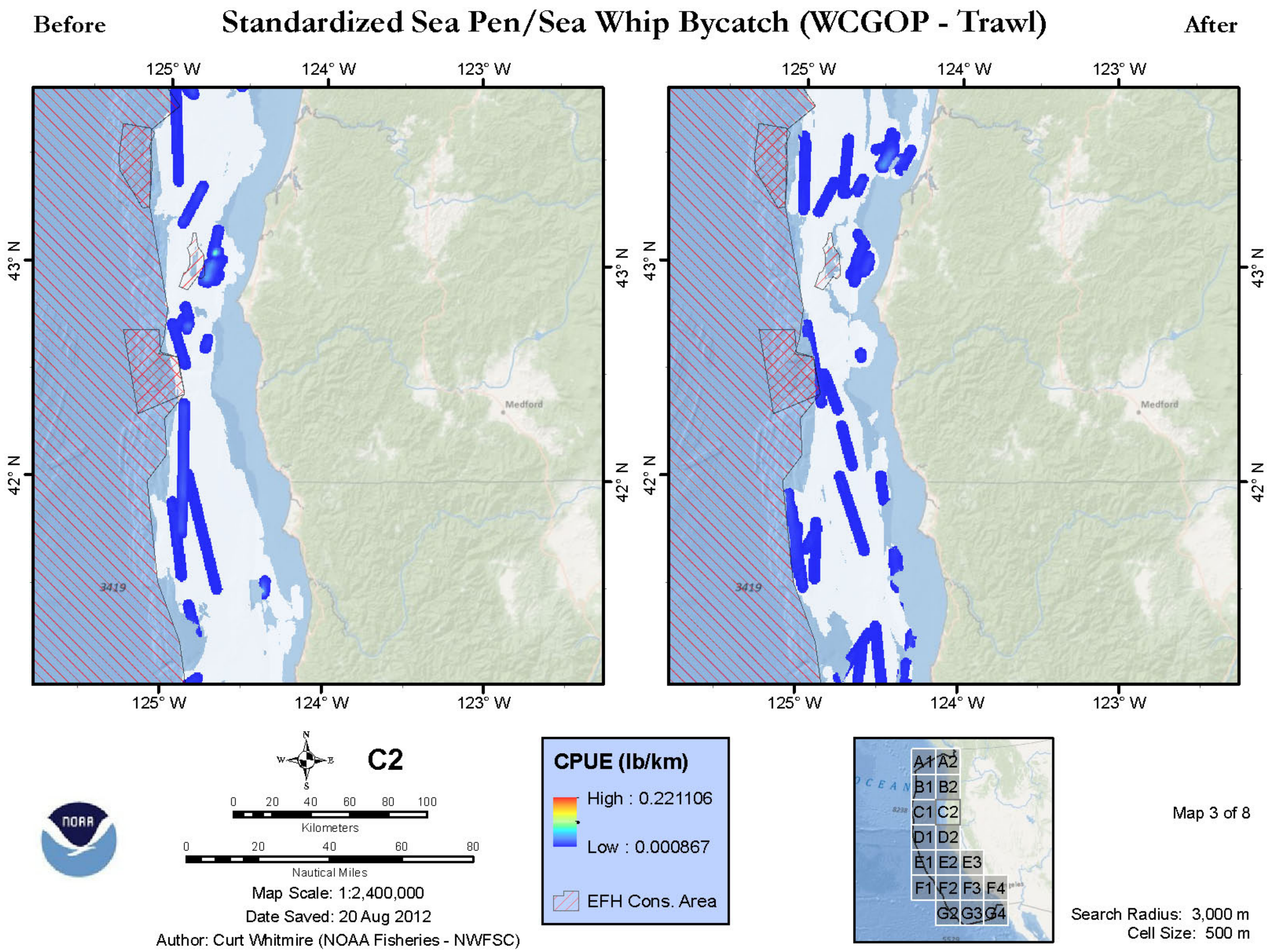

Before
Standardized Sponge Bycatch (WCGOP - Trawl)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 16.1603
Low : 0.0634
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Victoria
Washington
Olympia
267
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 0.221106
Low : 0.000867
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 8
Search Radius: 3,000 m
Cell Size: 500 m

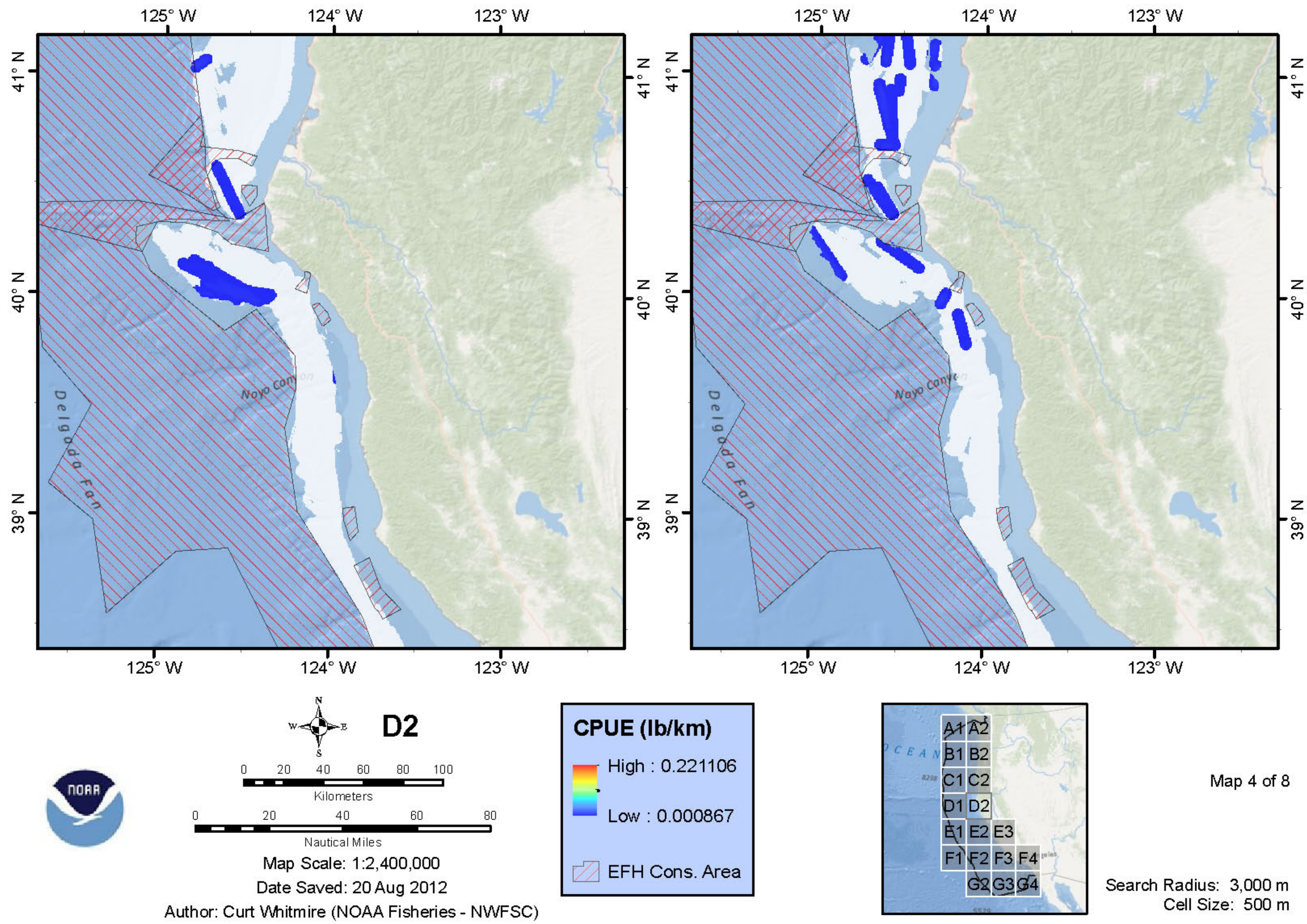
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)





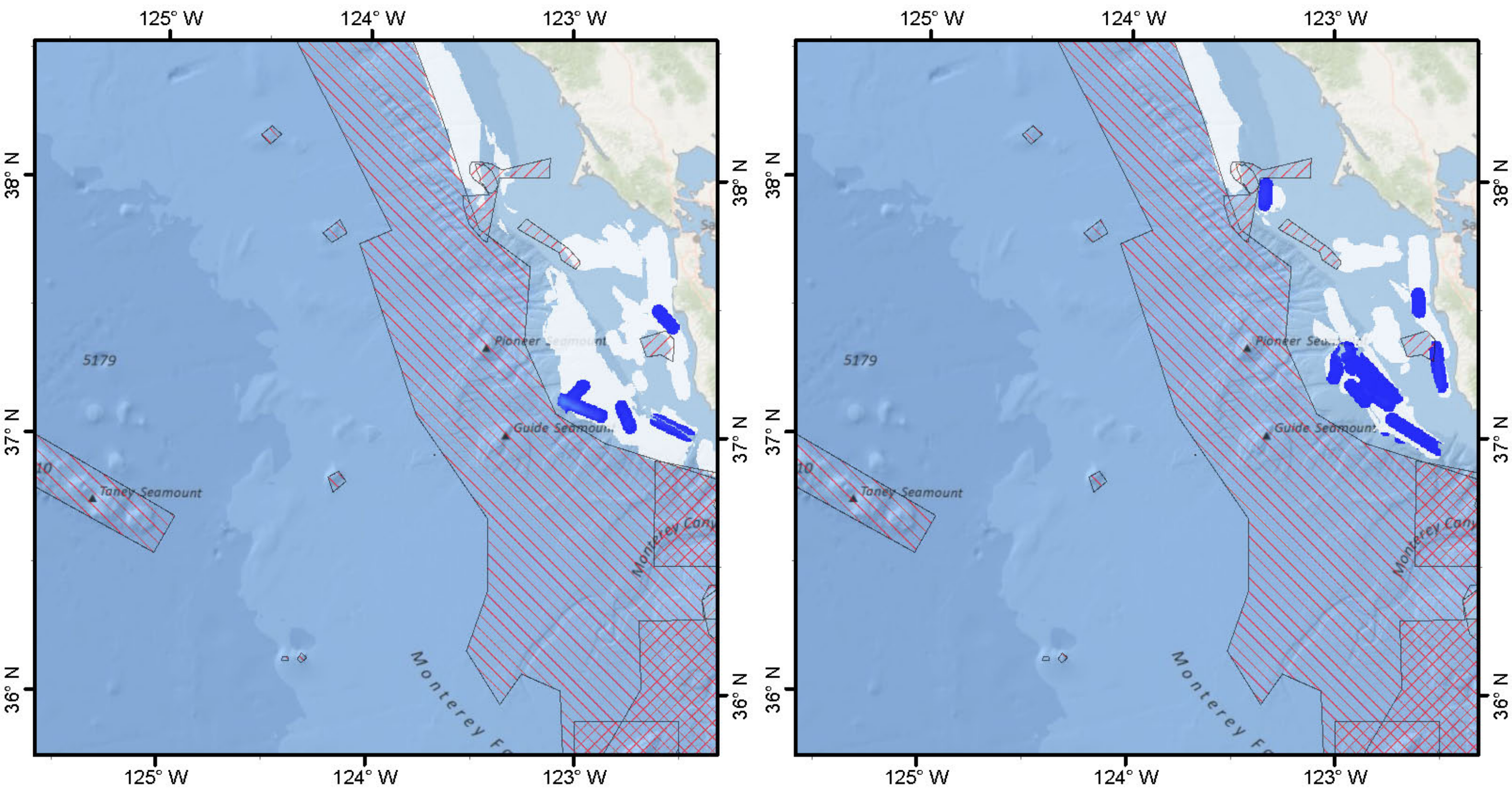

Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 0.221106
Low : 0.000867
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 8
Search Radius: 3,000 m
Cell Size: 500 m

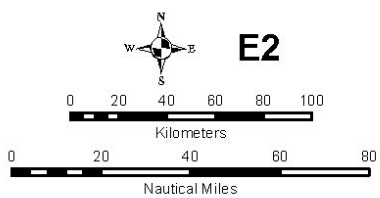
Before **Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)** **After**



Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)

Before | After





E2

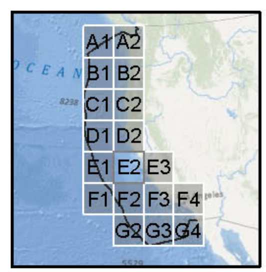
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

CPUE (lb/km)

High : 0.221106

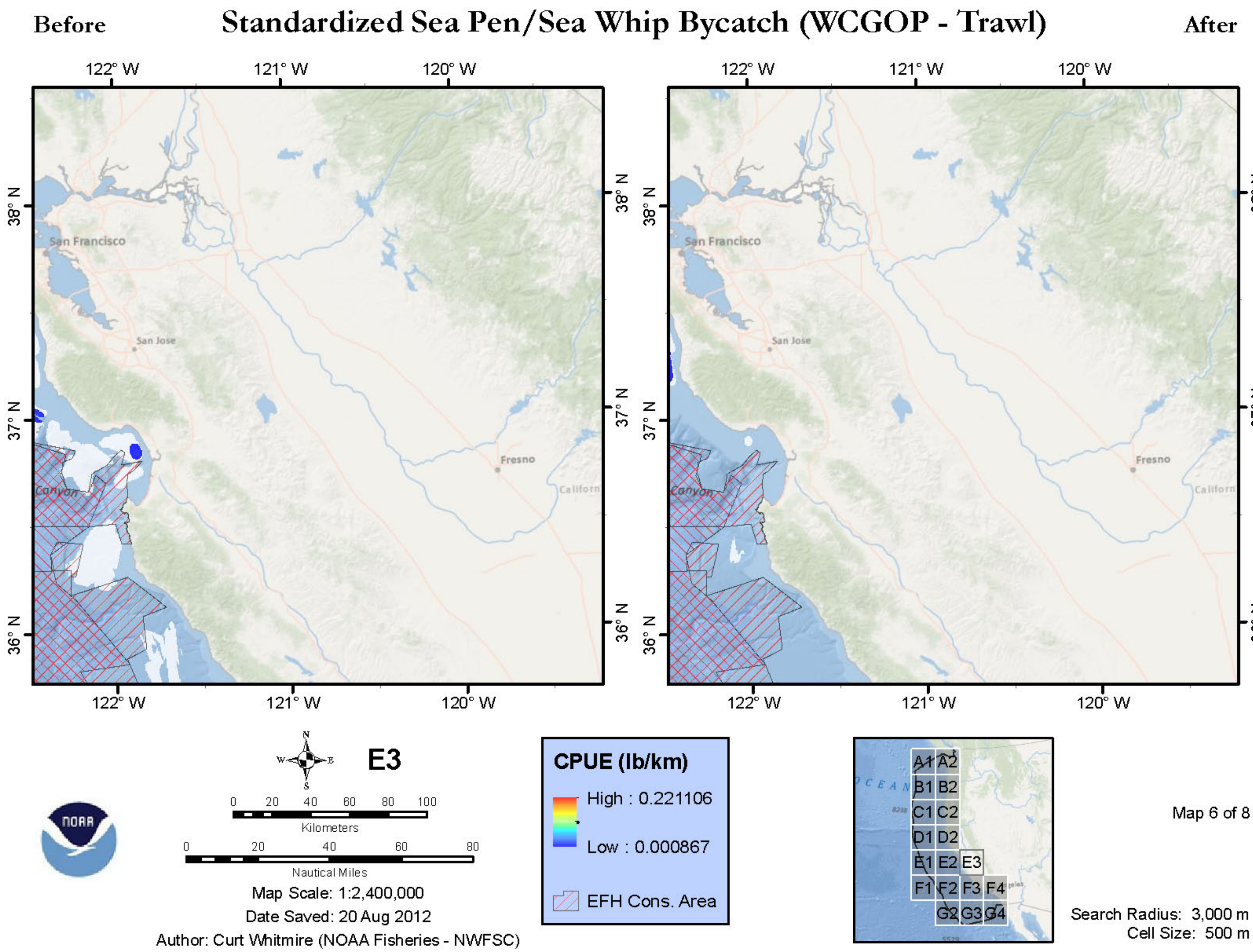
Low : 0.000867

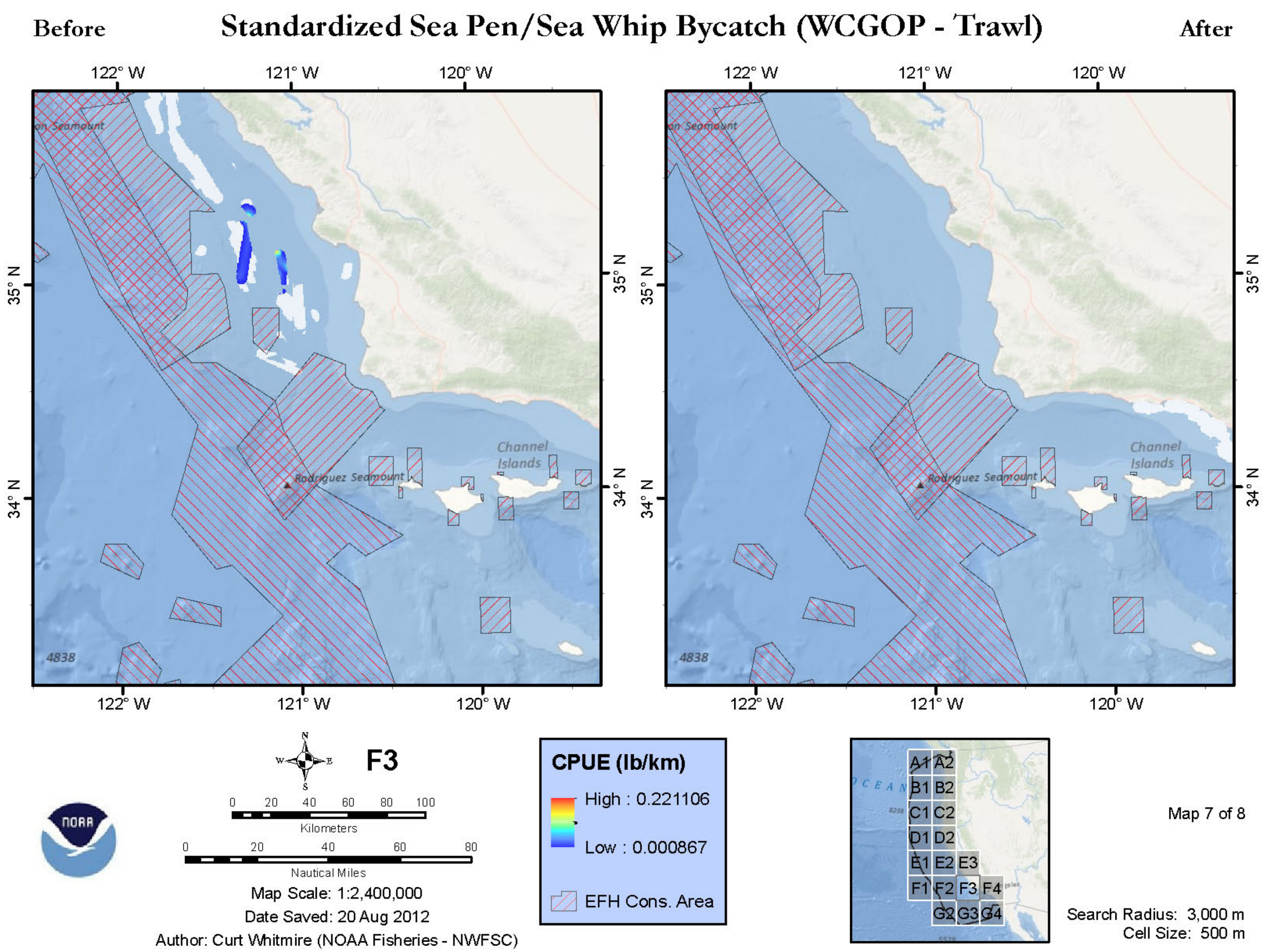
EFH Cons. Area



Map 5 of 8

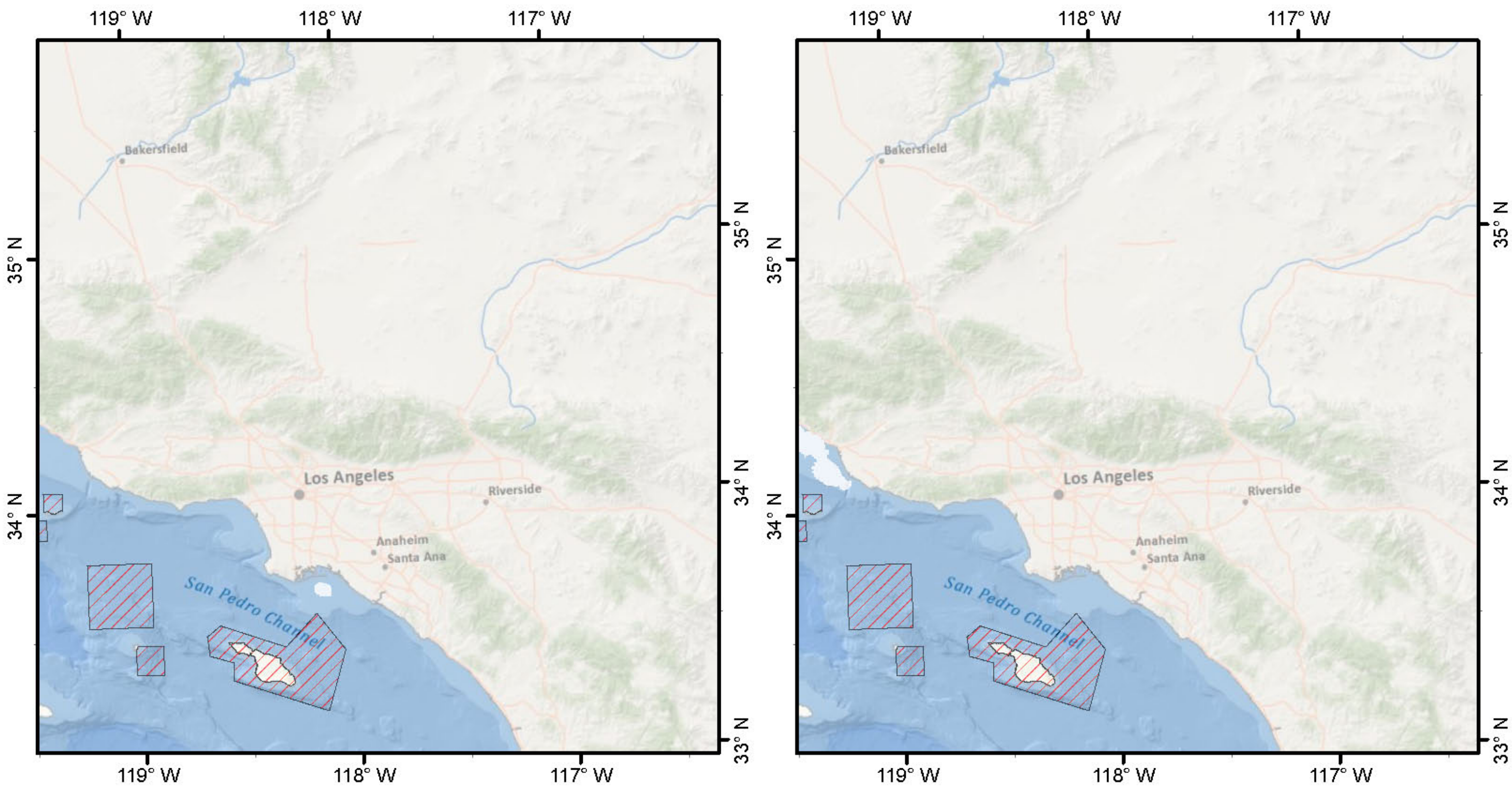
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
122° W
121° W
120° W
38° N
37° N
36° N
San Francisco
San Jose
Fresno
Canyon
E3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 0.221106
Low : 0.000867
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 6 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
122° W
121° W
120° W
35° N
34° N
Channel Islands
Rodriguez Seamount
4838
F3
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUE (lb/km)
High : 0.221106
Low : 0.000867
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)

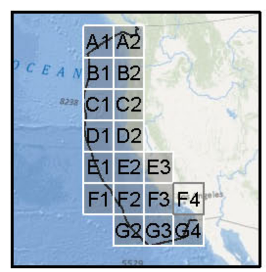
Before | After



F4

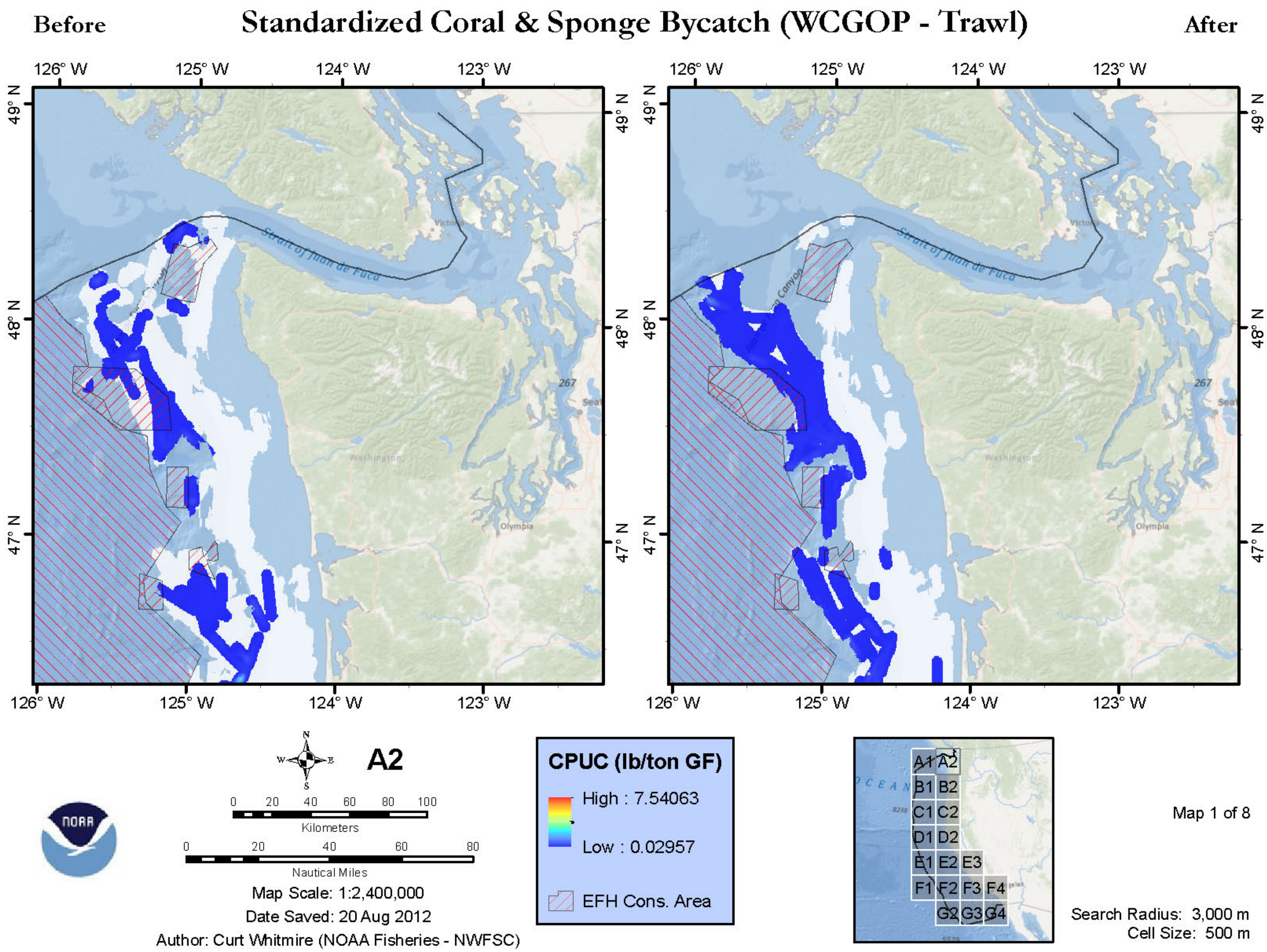
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

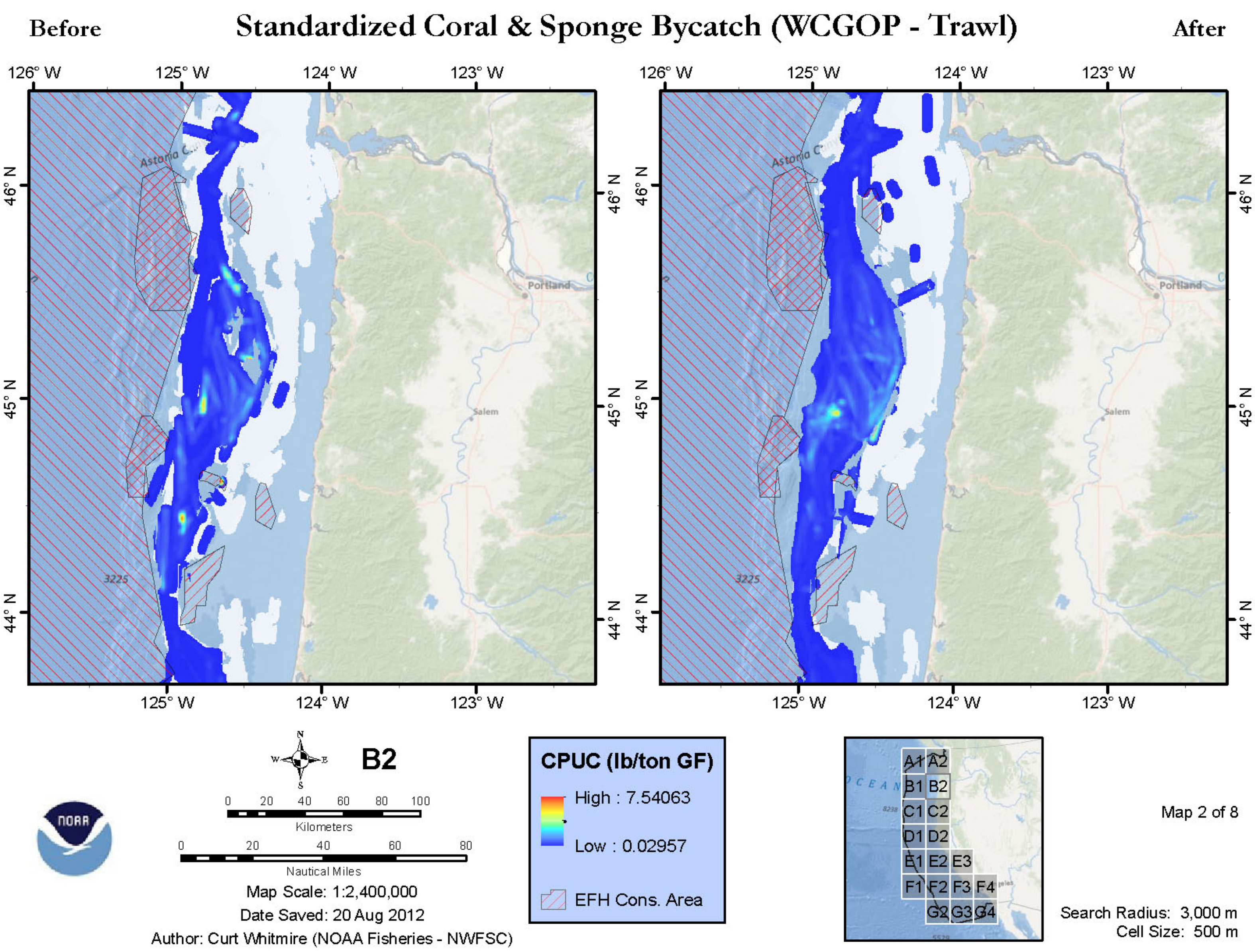
CPUE (lb/km)
High : 0.221106
Low : 0.000867
EFH Cons. Area



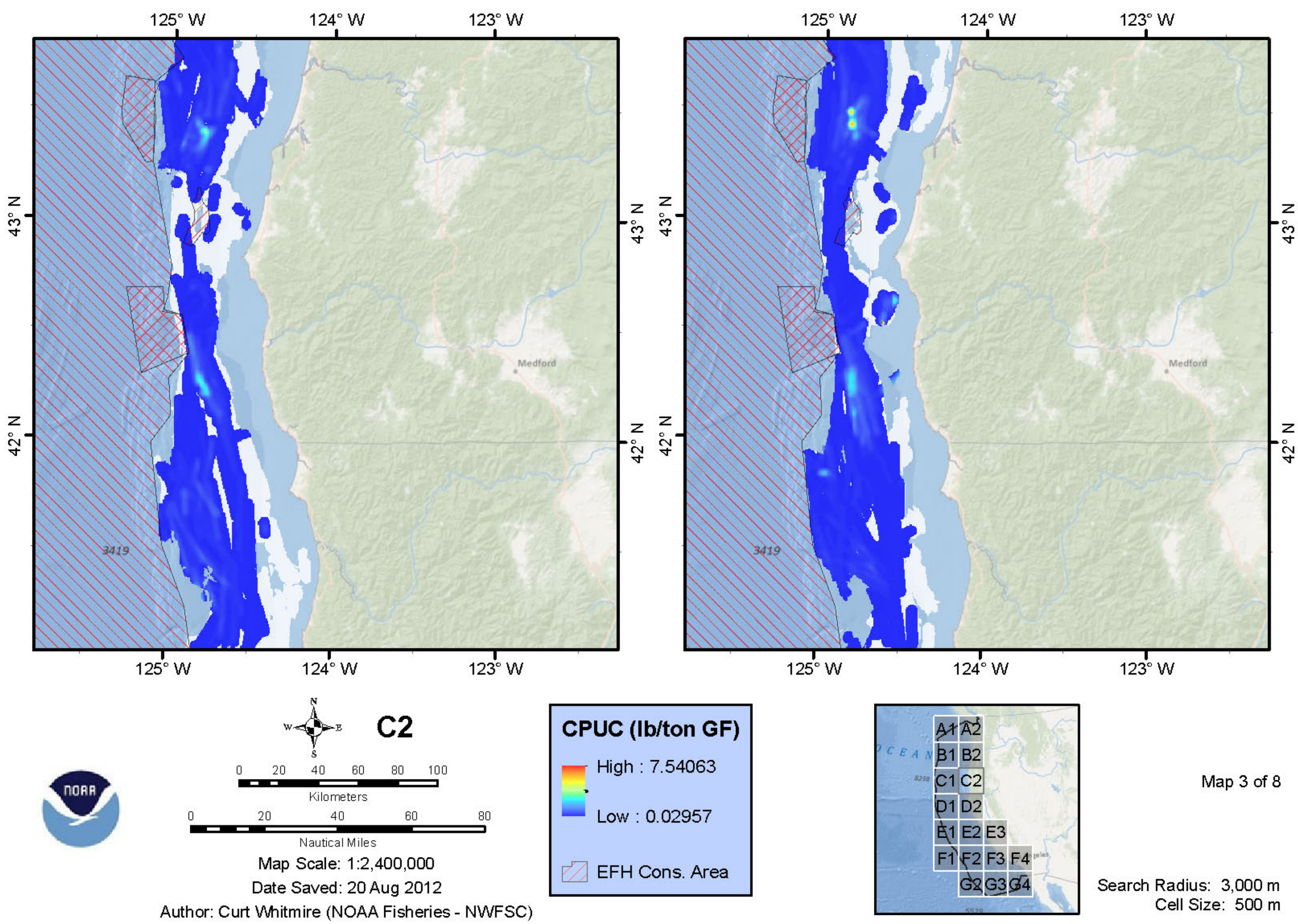
Map 8 of 8

Search Radius: 3,000 m
Cell Size: 500 m

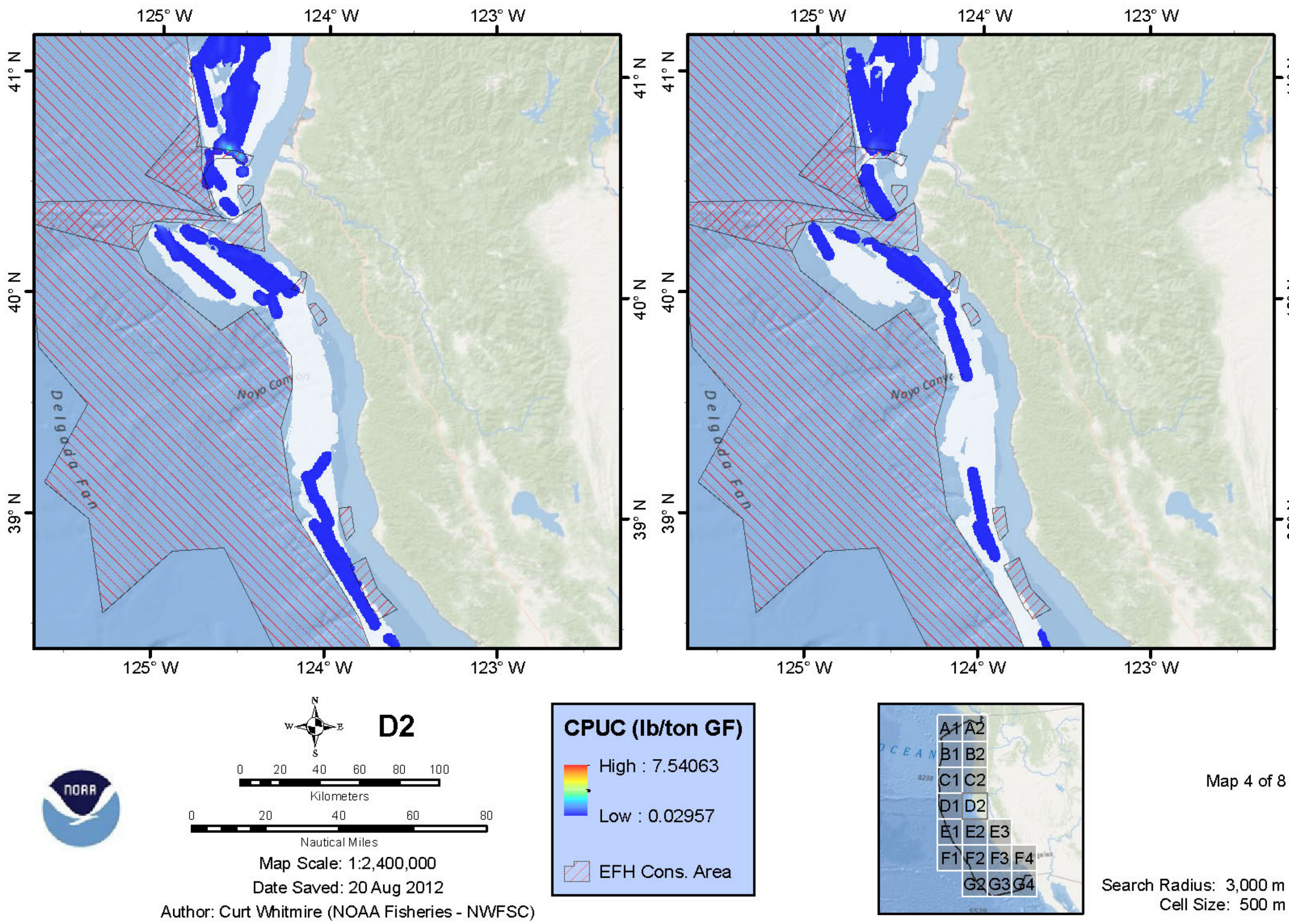

Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Victoria
Washington
Olympia
267
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 8
Search Radius: 3,000 m
Cell Size: 500 m

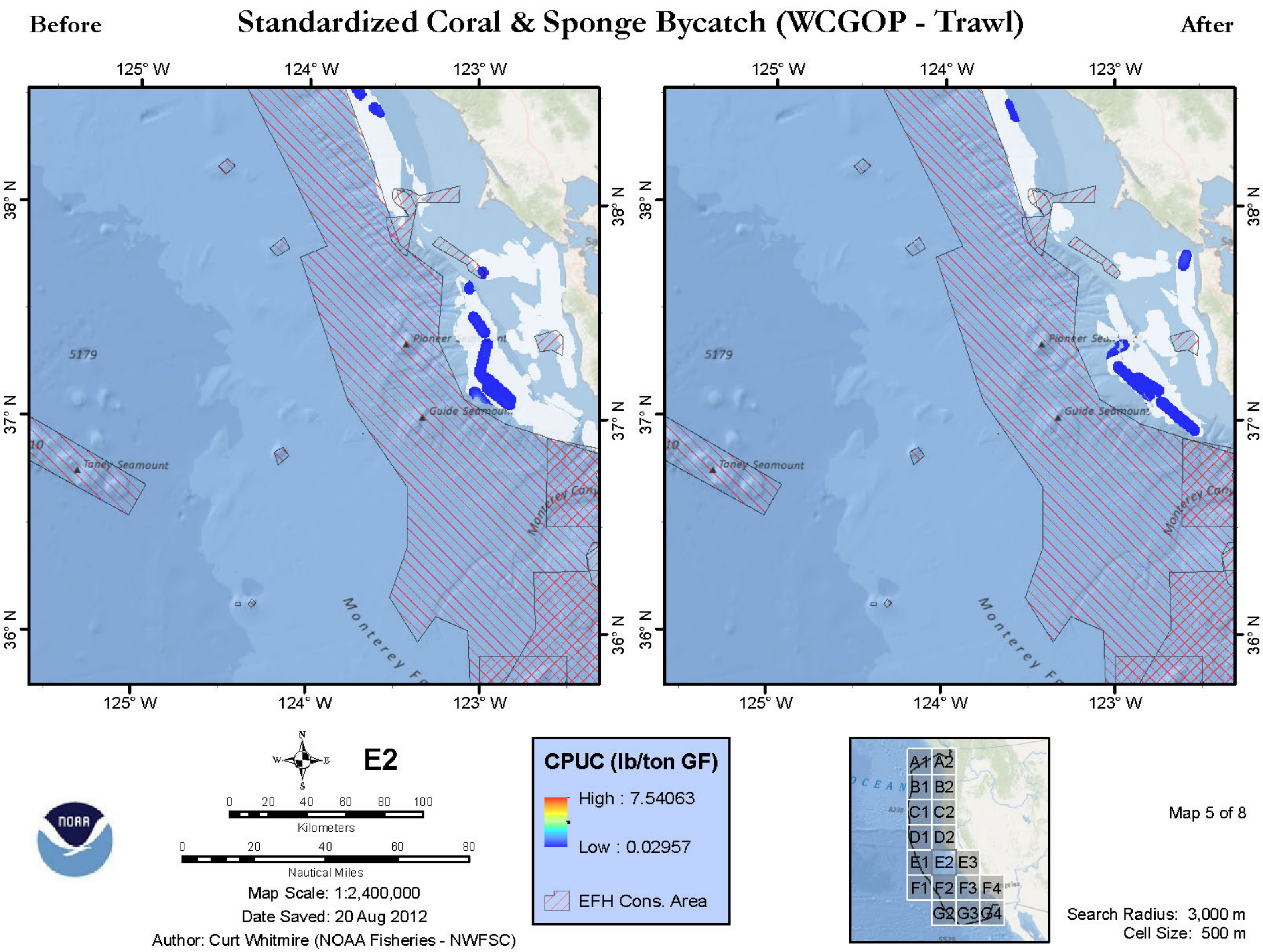

Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria C...
Portland
Salem
3225
B2
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After



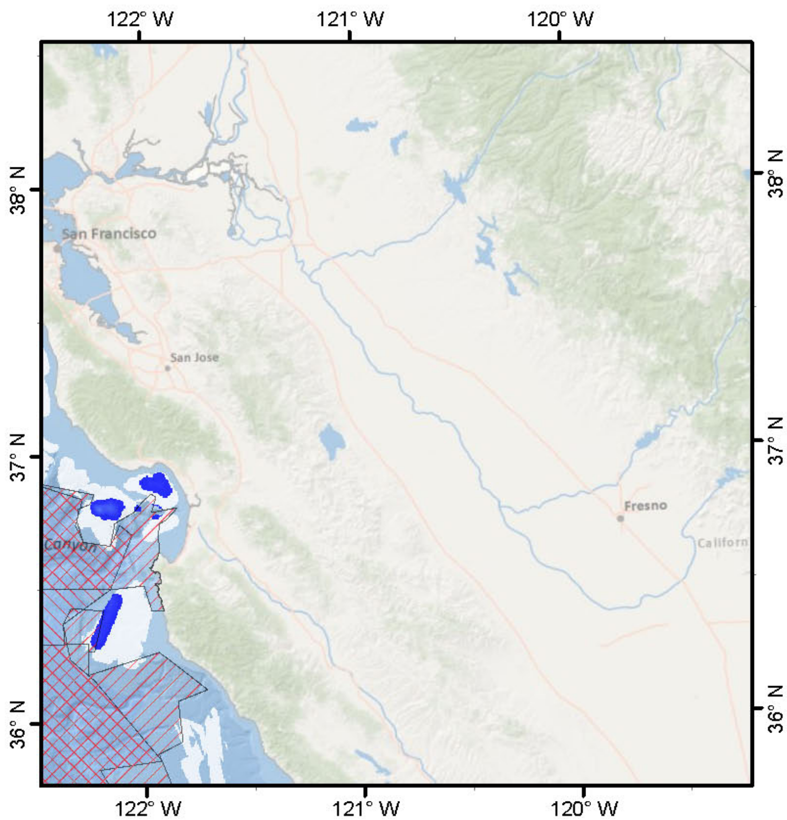
Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** **After**



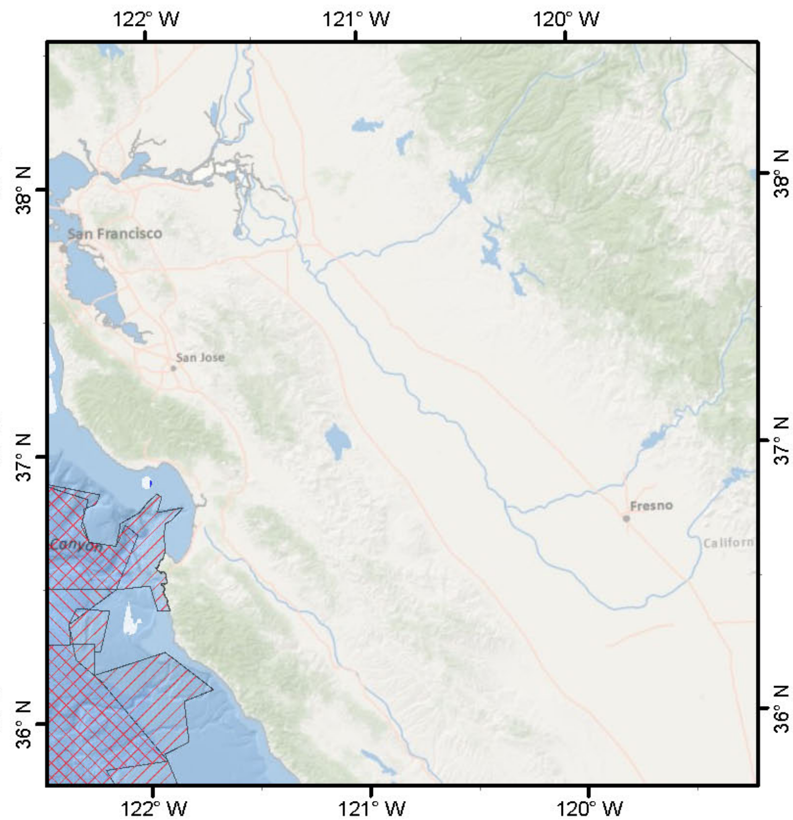

Before
Standardized Coral & Sponge Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Standardized Coral & Sponge Bycatch (WCGOP - Trawl)

Before



After



E3

Kilometers: 0 20 40 60 80 100

Nautical Miles: 0 20 40 60 80

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

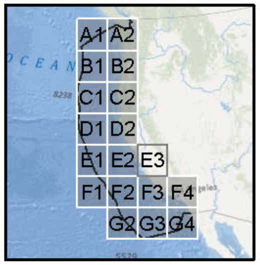
Author: Curt Whitmire (NOAA Fisheries - NWFSC)

CPUC (lb/ton GF)

High : 7.54063

Low : 0.02957

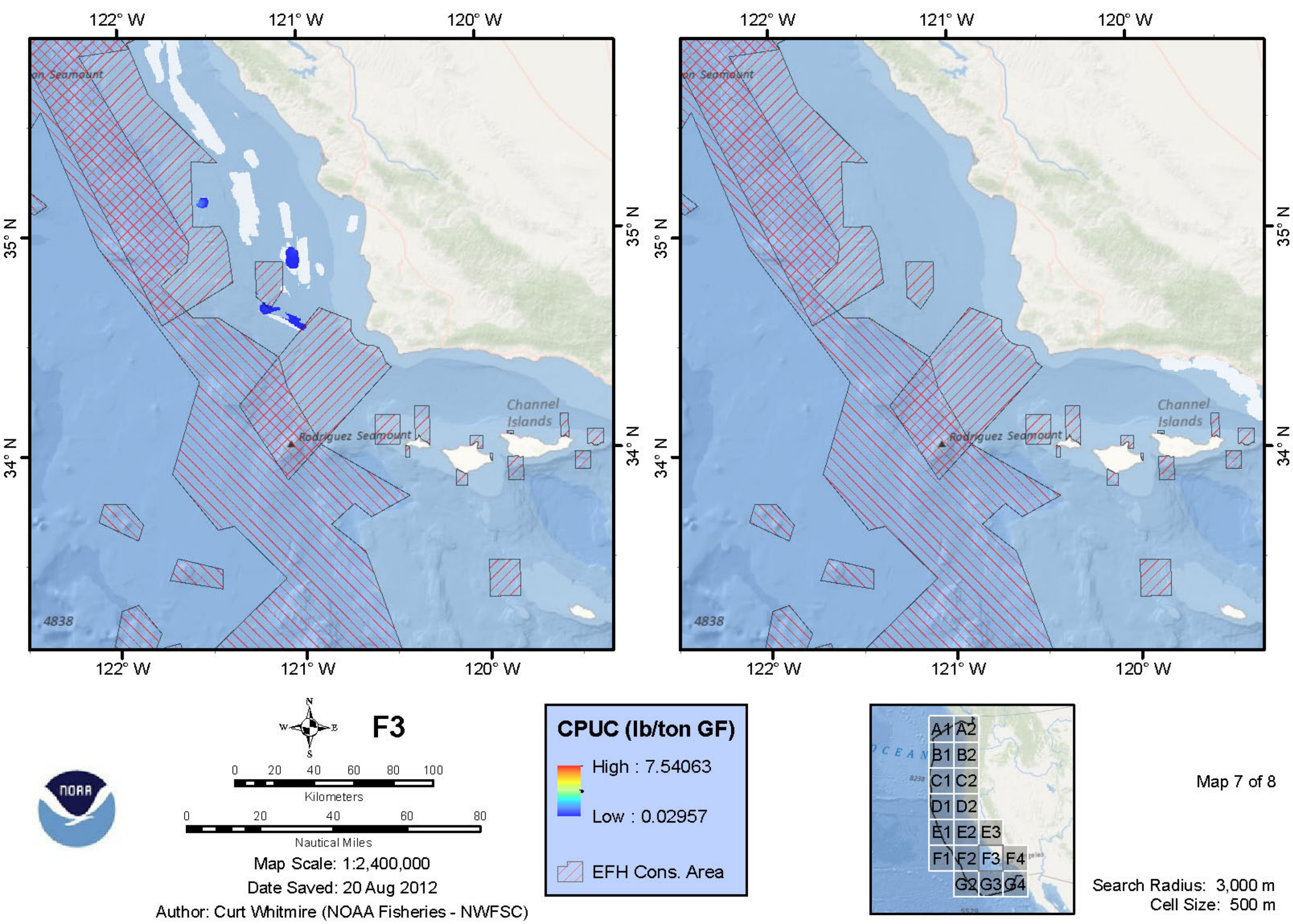
EFH Cons. Area



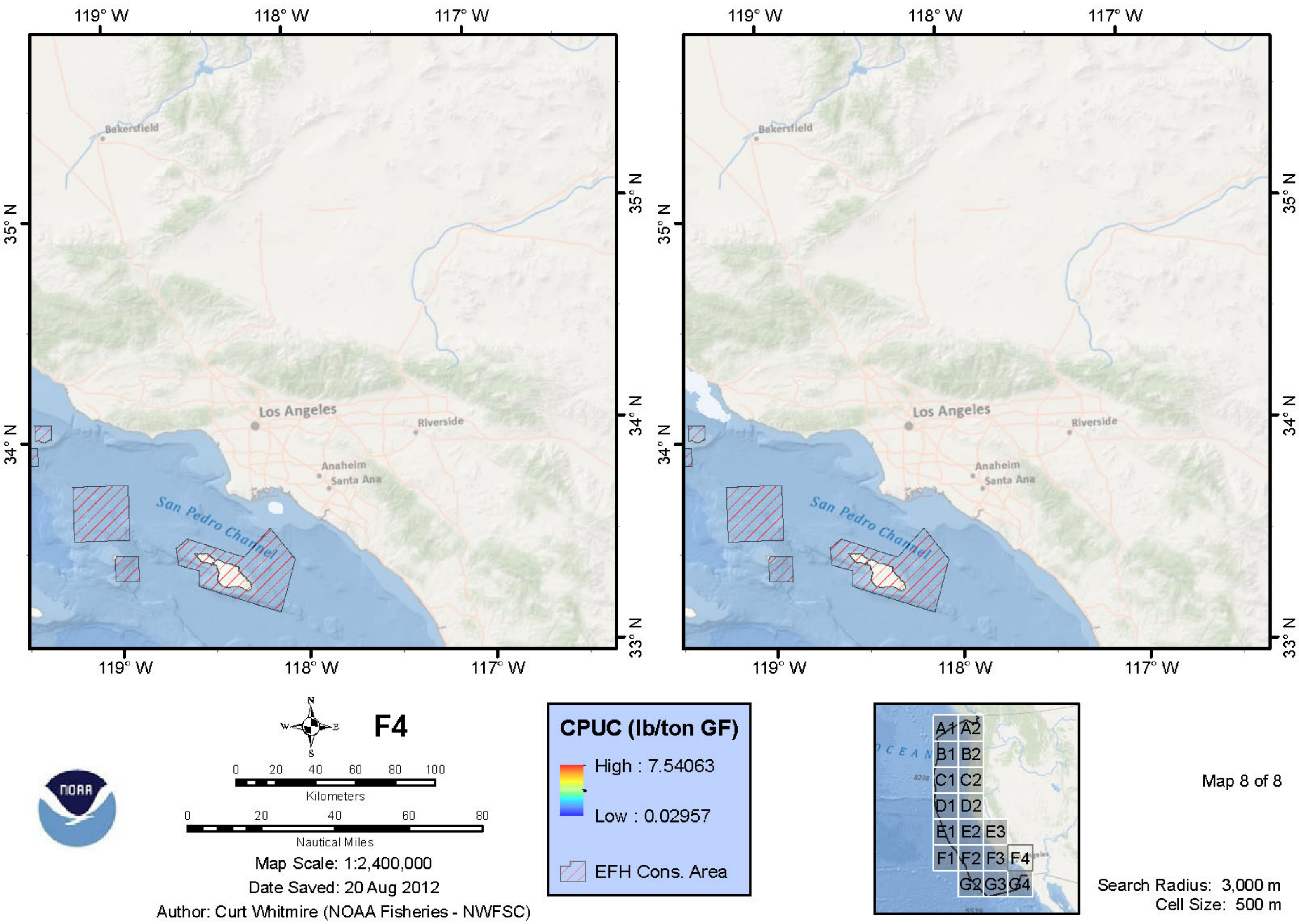
Map 6 of 8

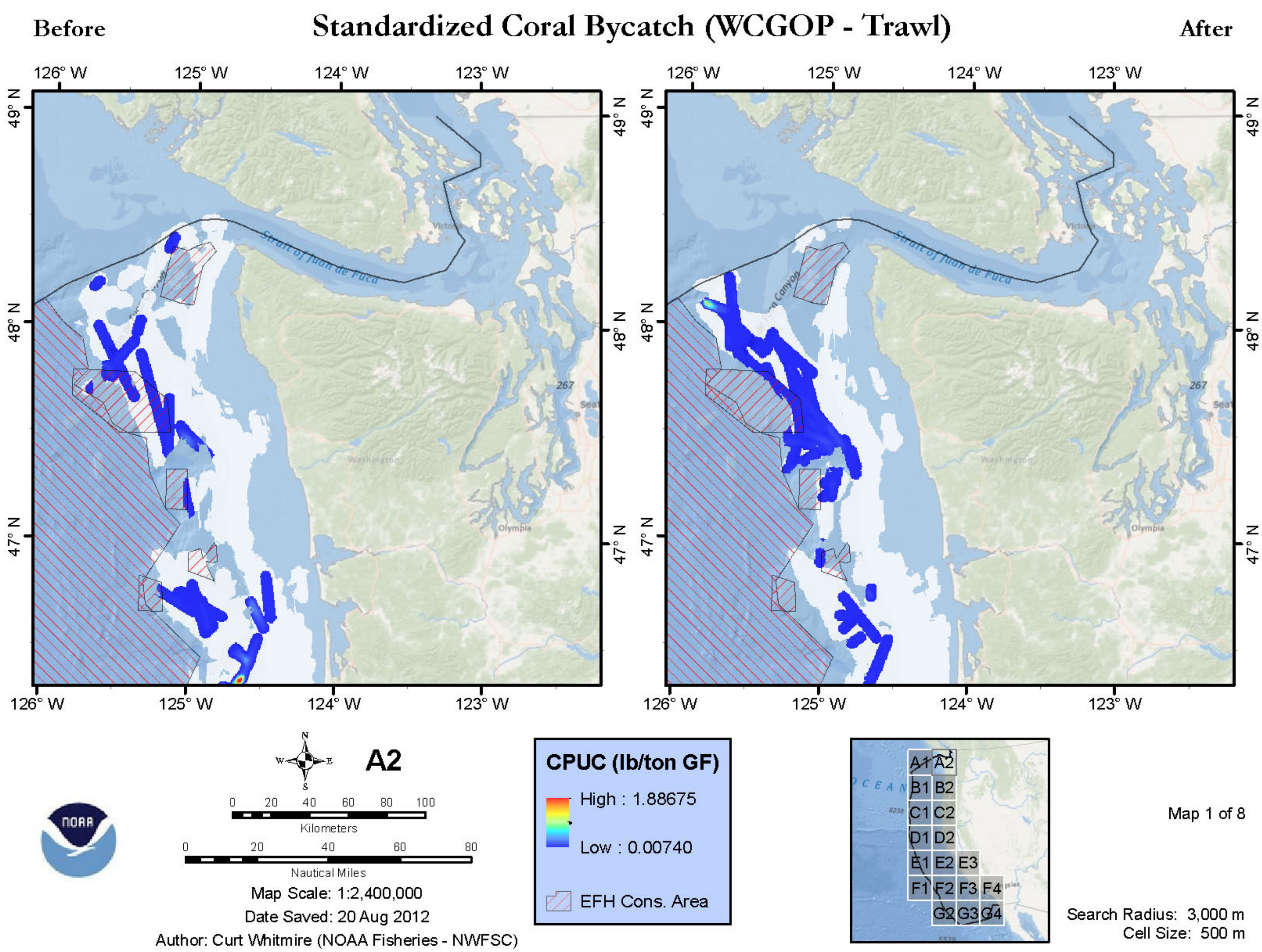
Search Radius: 3,000 m
Cell Size: 500 m

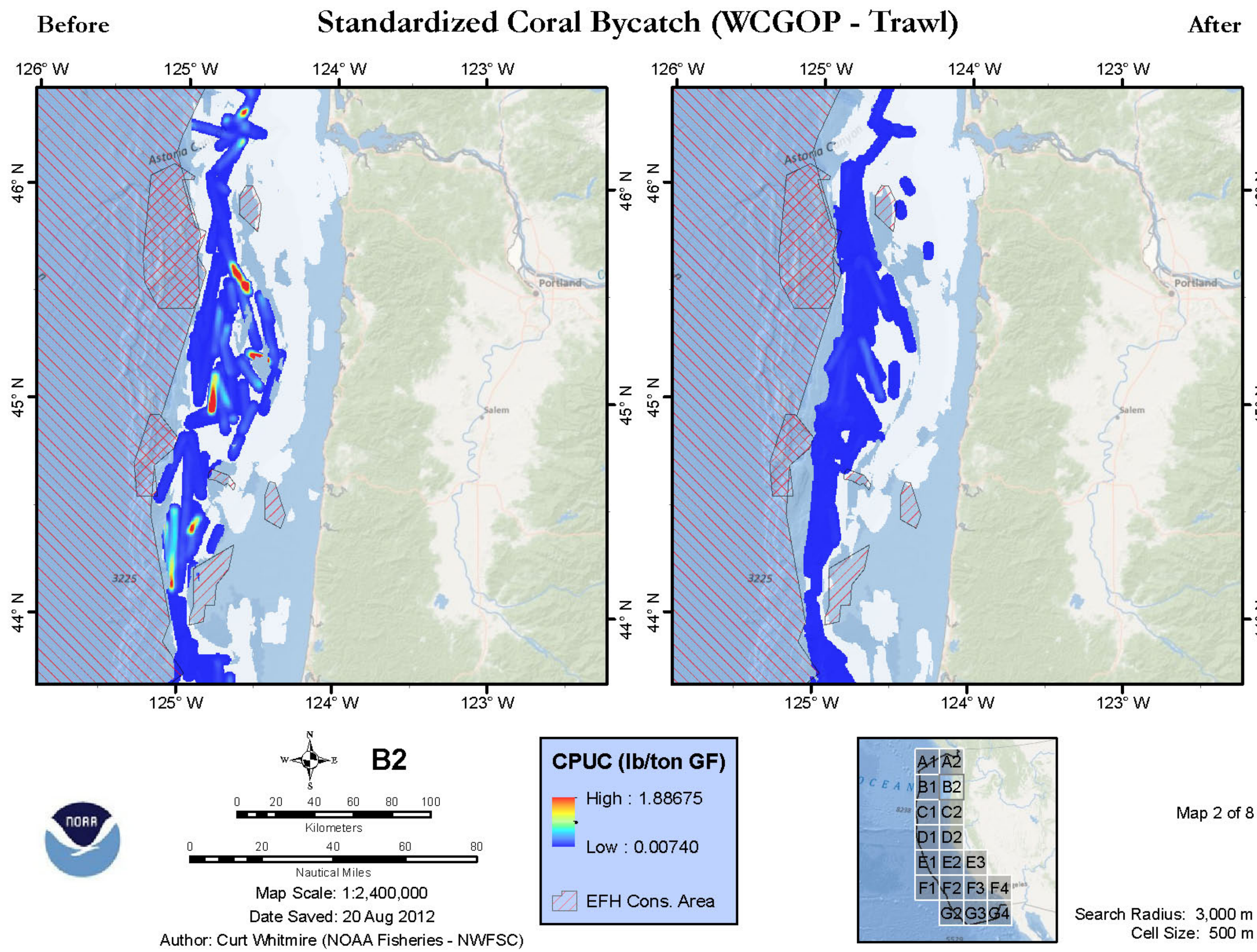
Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After



Before **Standardized Coral & Sponge Bycatch (WCGOP - Trawl)** After

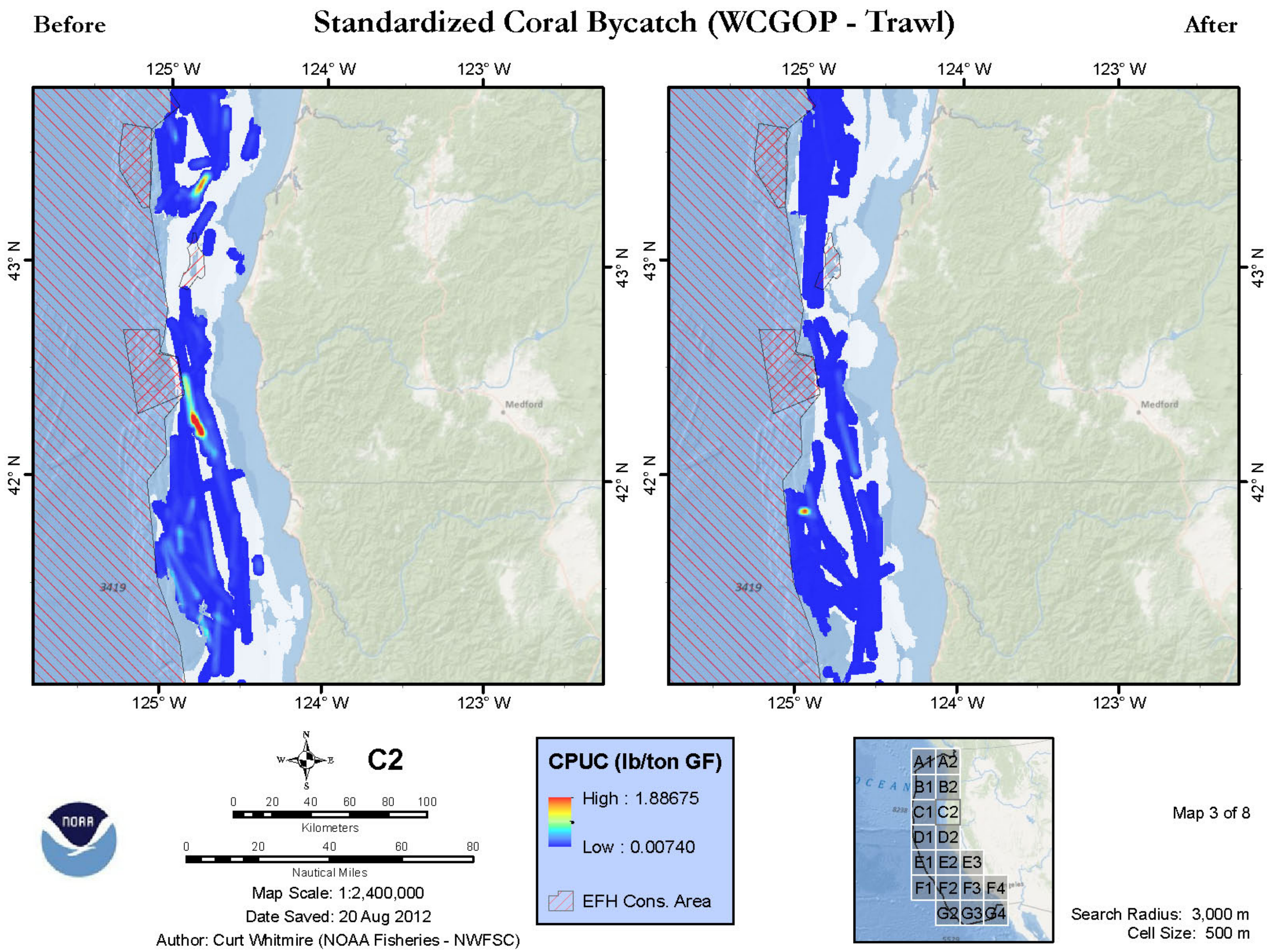


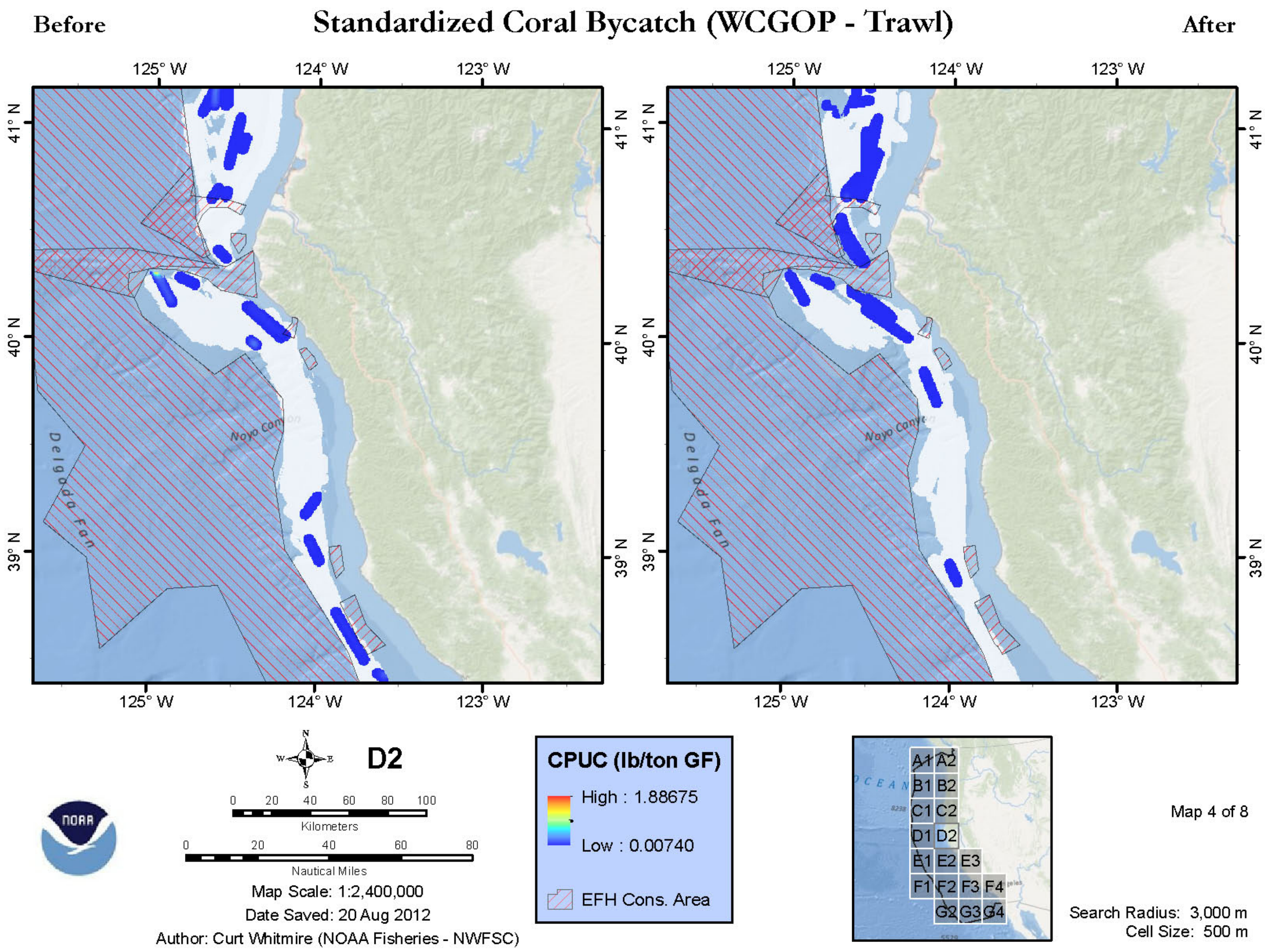

Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Washington
Olympia
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 1.88675
Low : 0.00740
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 8
Search Radius: 3,000 m
Cell Size: 500 m



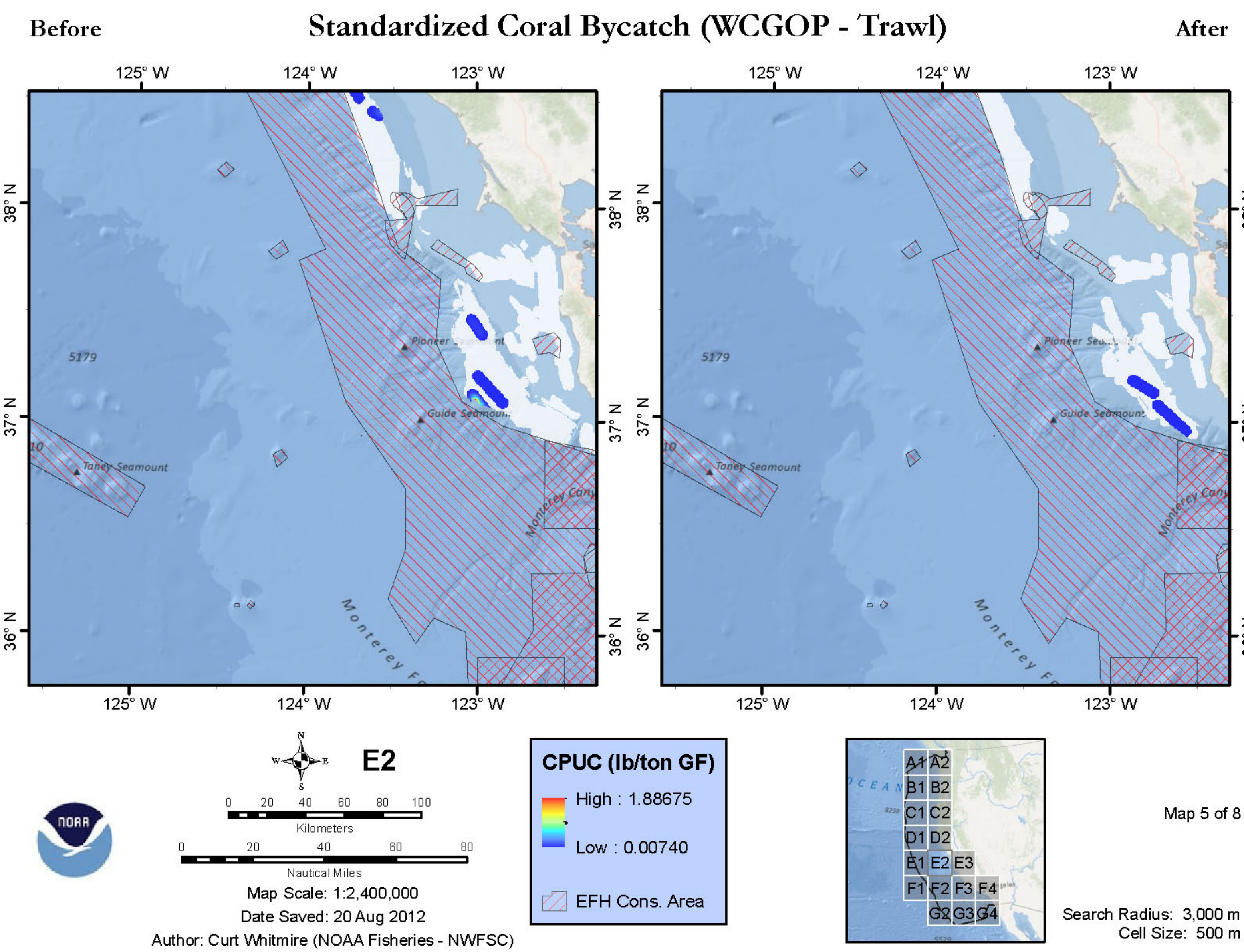
Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria C...
Astoria Canyon
Portland
Salem
3225
B2
N
S
E
W
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
NOAA
CPUC (lb/ton GF)
High : 1.88675
Low : 0.00740
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Appendix F-6

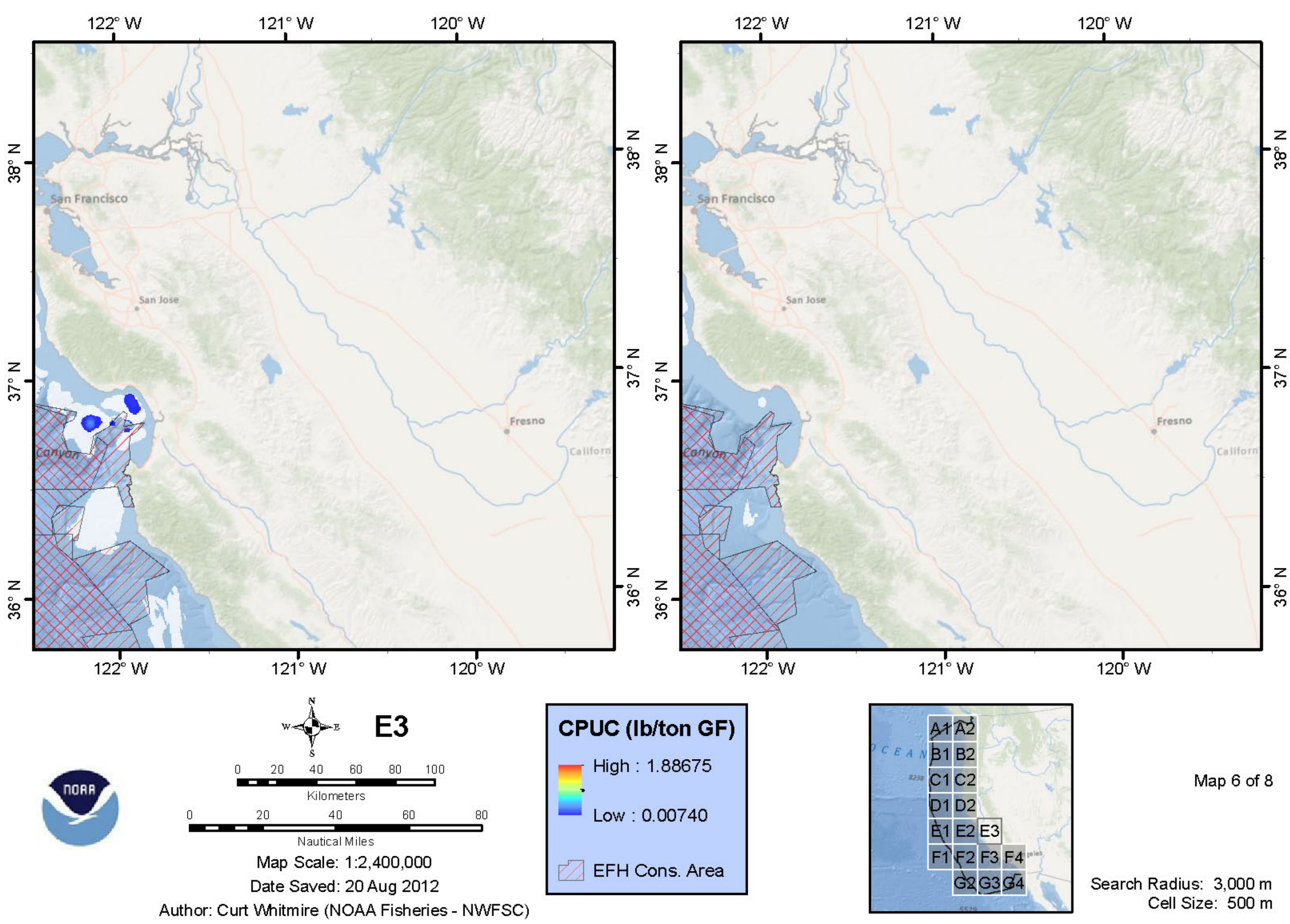

Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 1.88675
Low : 0.00740
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 8
Search Radius: 3,000 m
Cell Size: 500 m



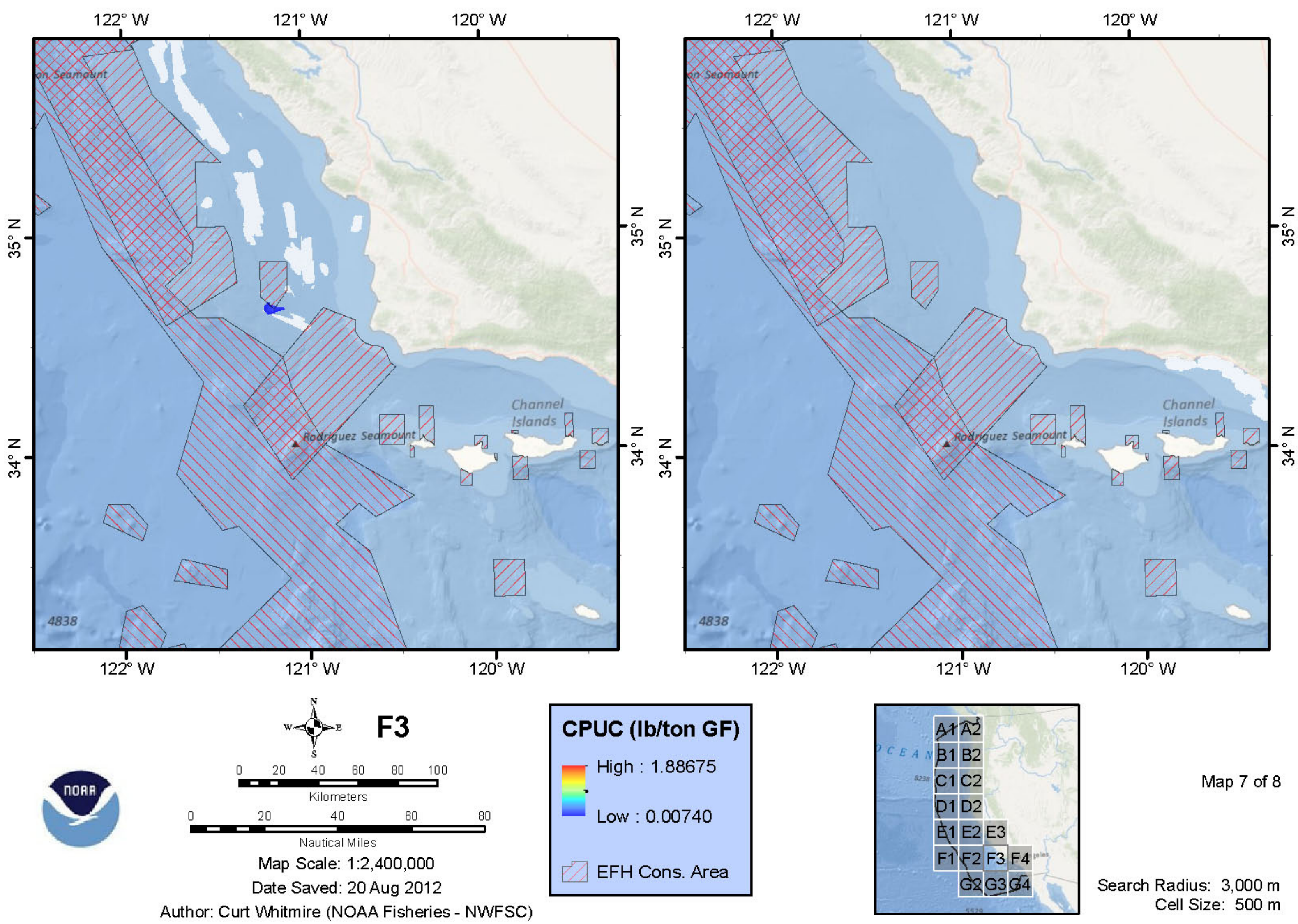
Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 1.88675
Low : 0.00740
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Coral Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 1.88675
Low : 0.00740
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Coral Bycatch (WCGOP - Trawl)** **After**

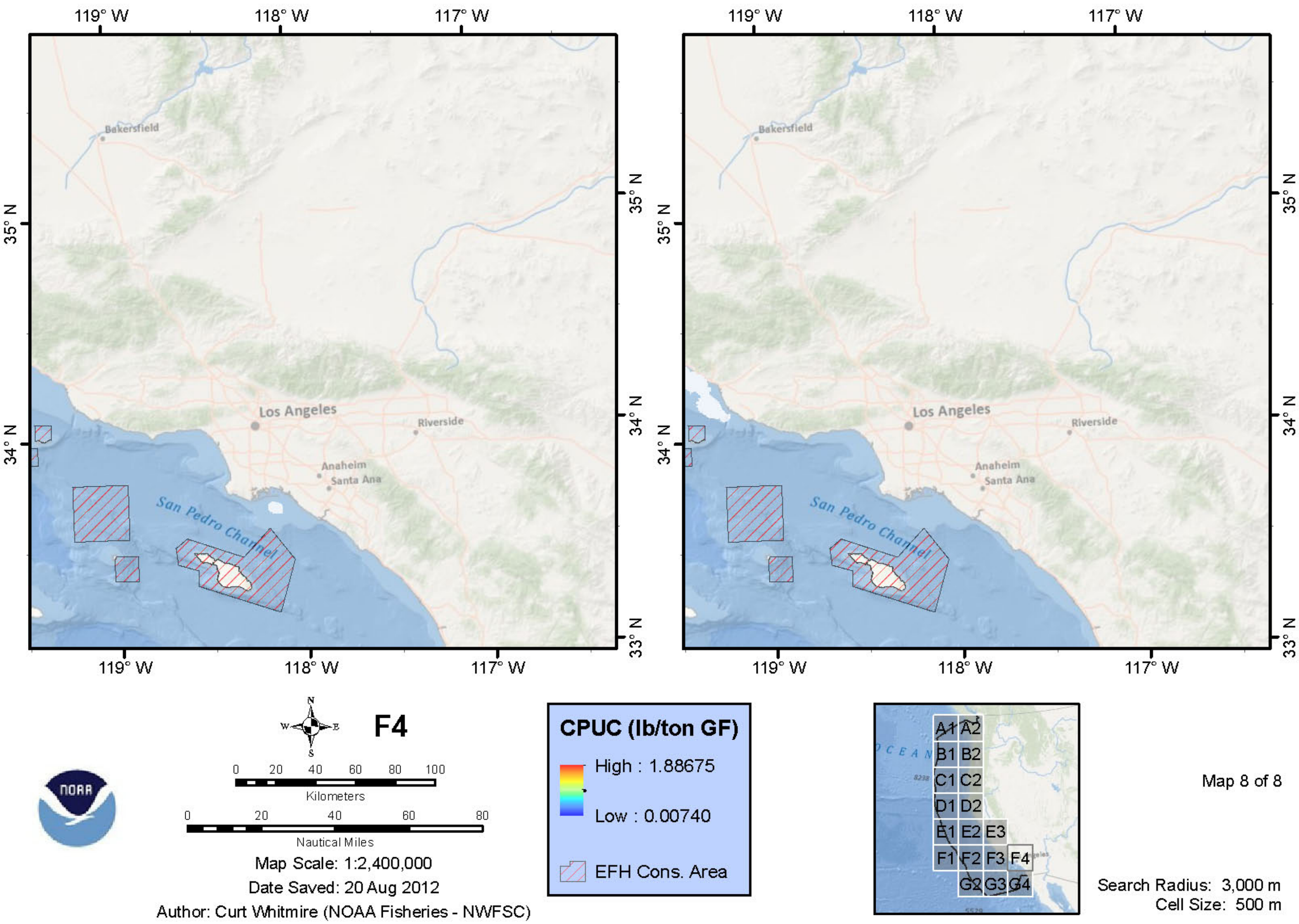


Before **Standardized Coral Bycatch (WCGOP - Trawl)** After



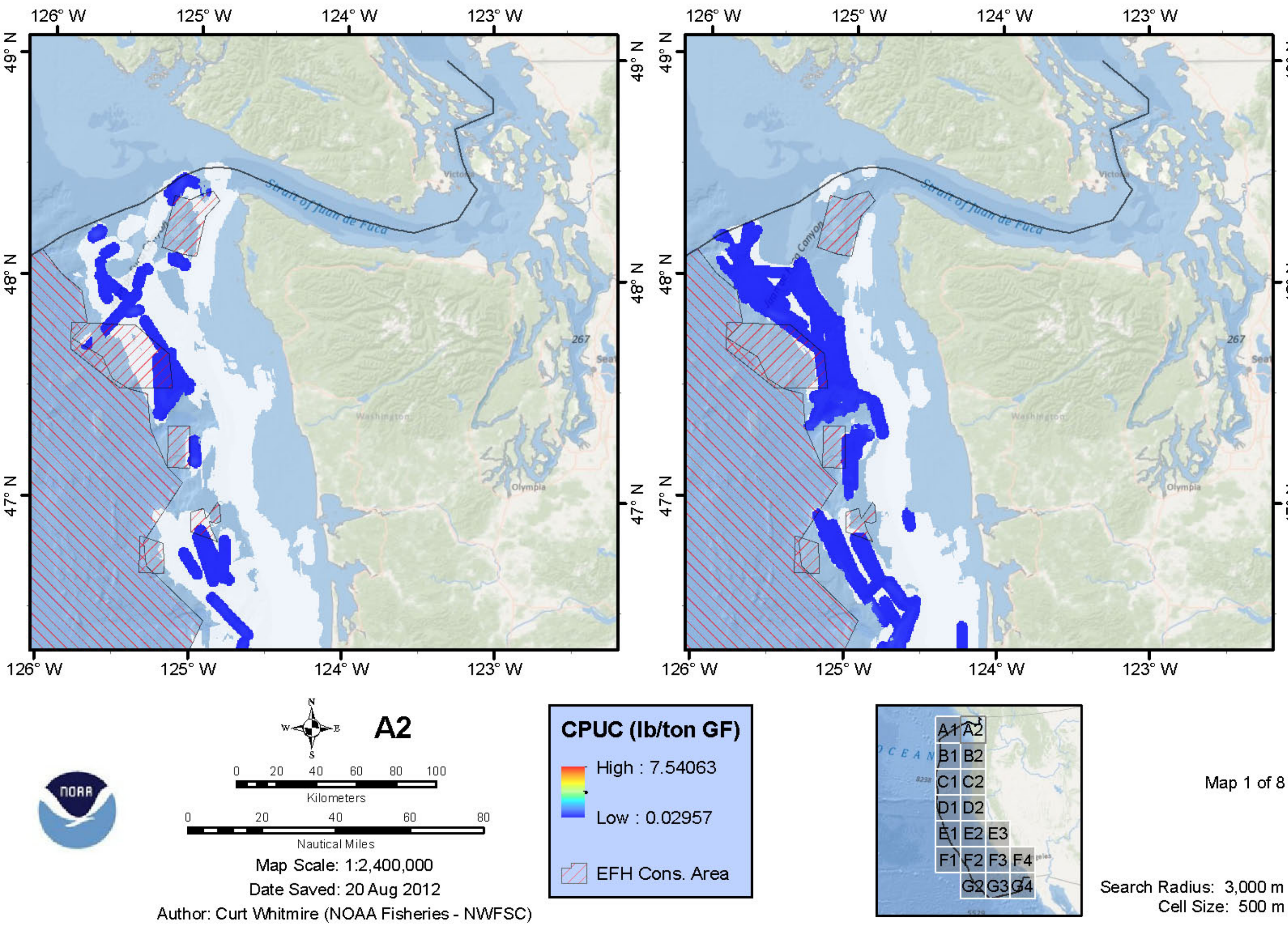
Standardized Coral Bycatch (WCGOP - Trawl)

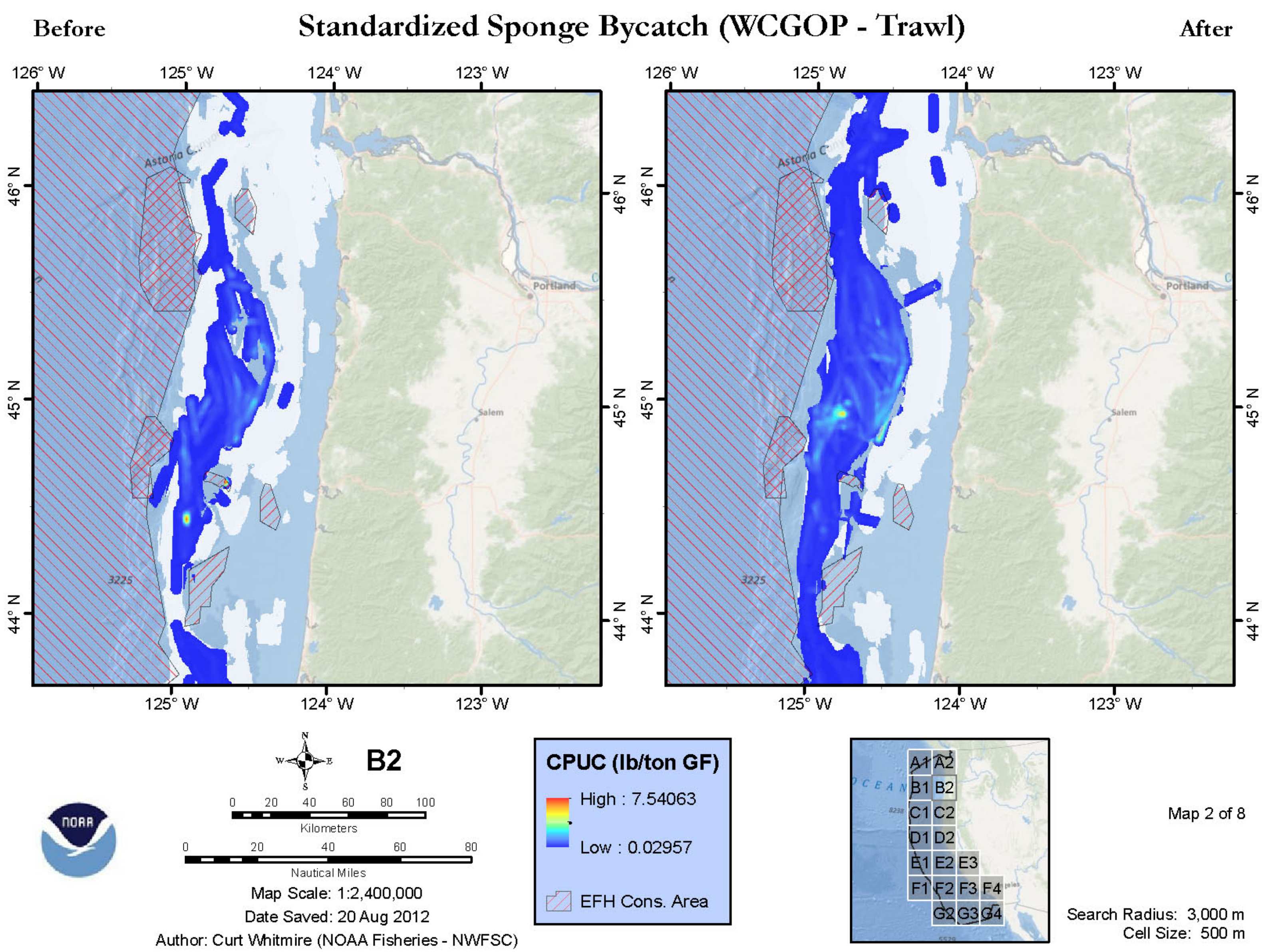
Before **After**



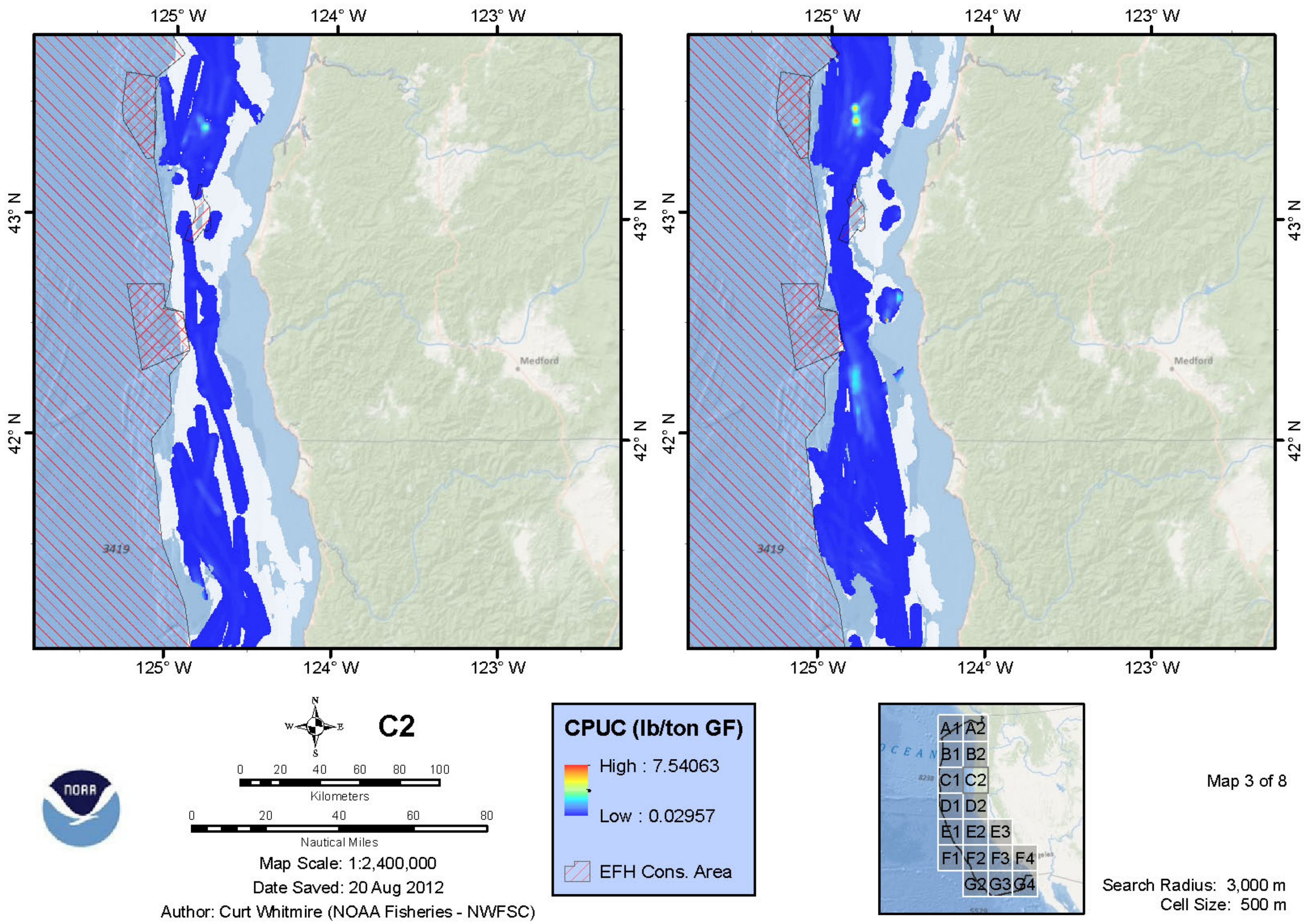
Standardized Sponge Bycatch (WCGOP - Trawl)

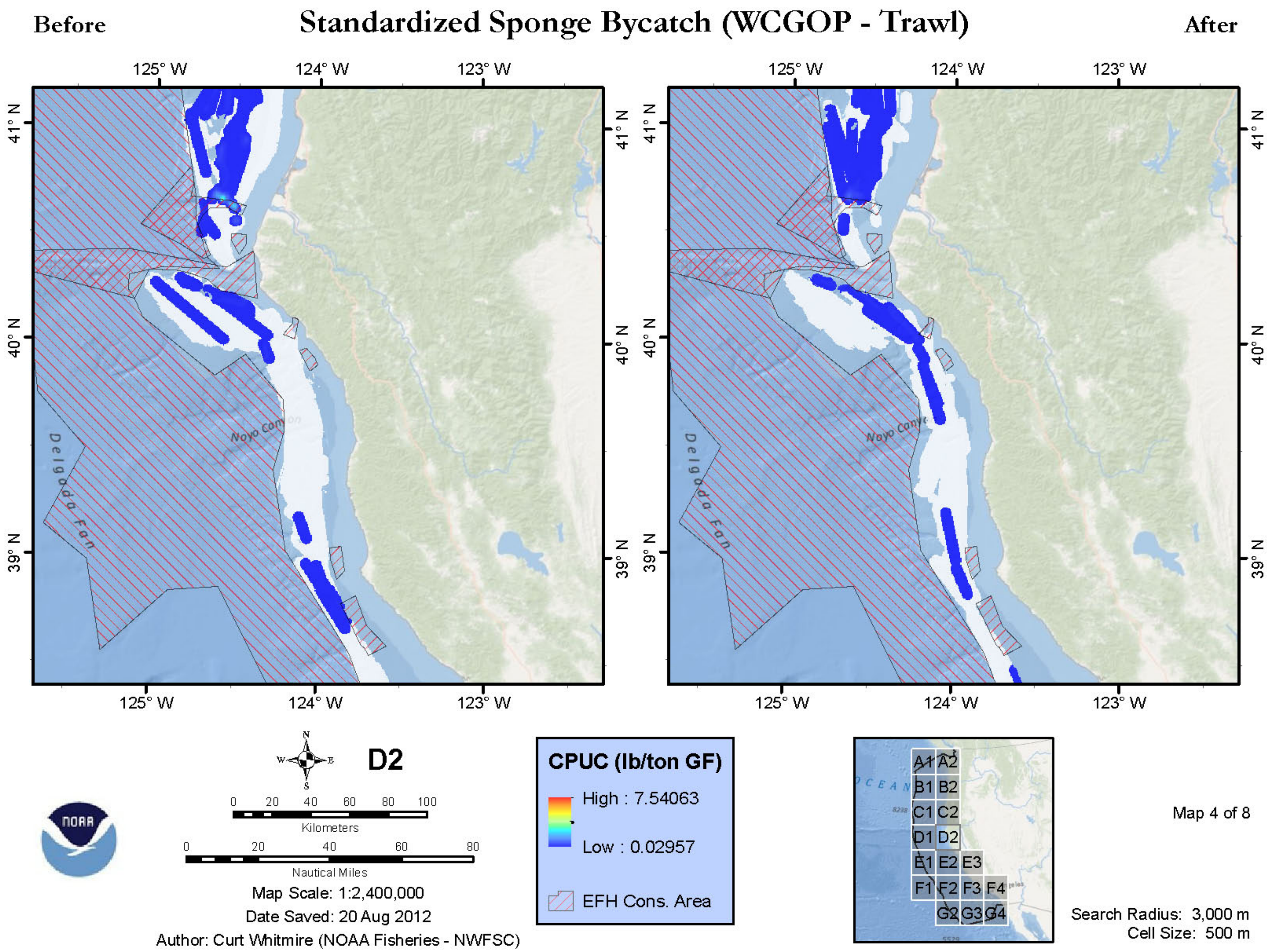
Before | After

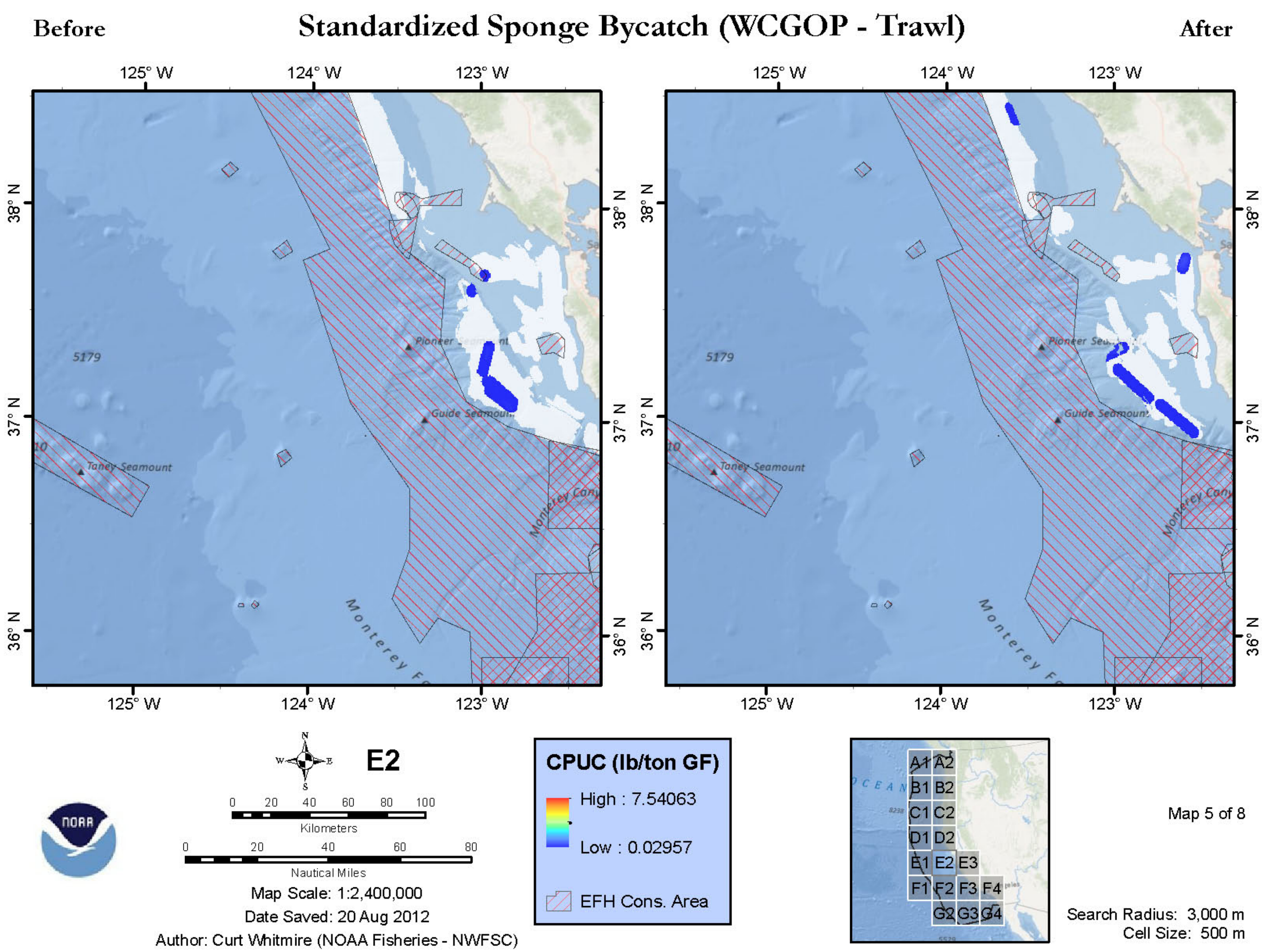



Before
Standardized Sponge Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria C.
Portland
Salem
3225
B2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 8
Search Radius: 3,000 m
Cell Size: 500 m

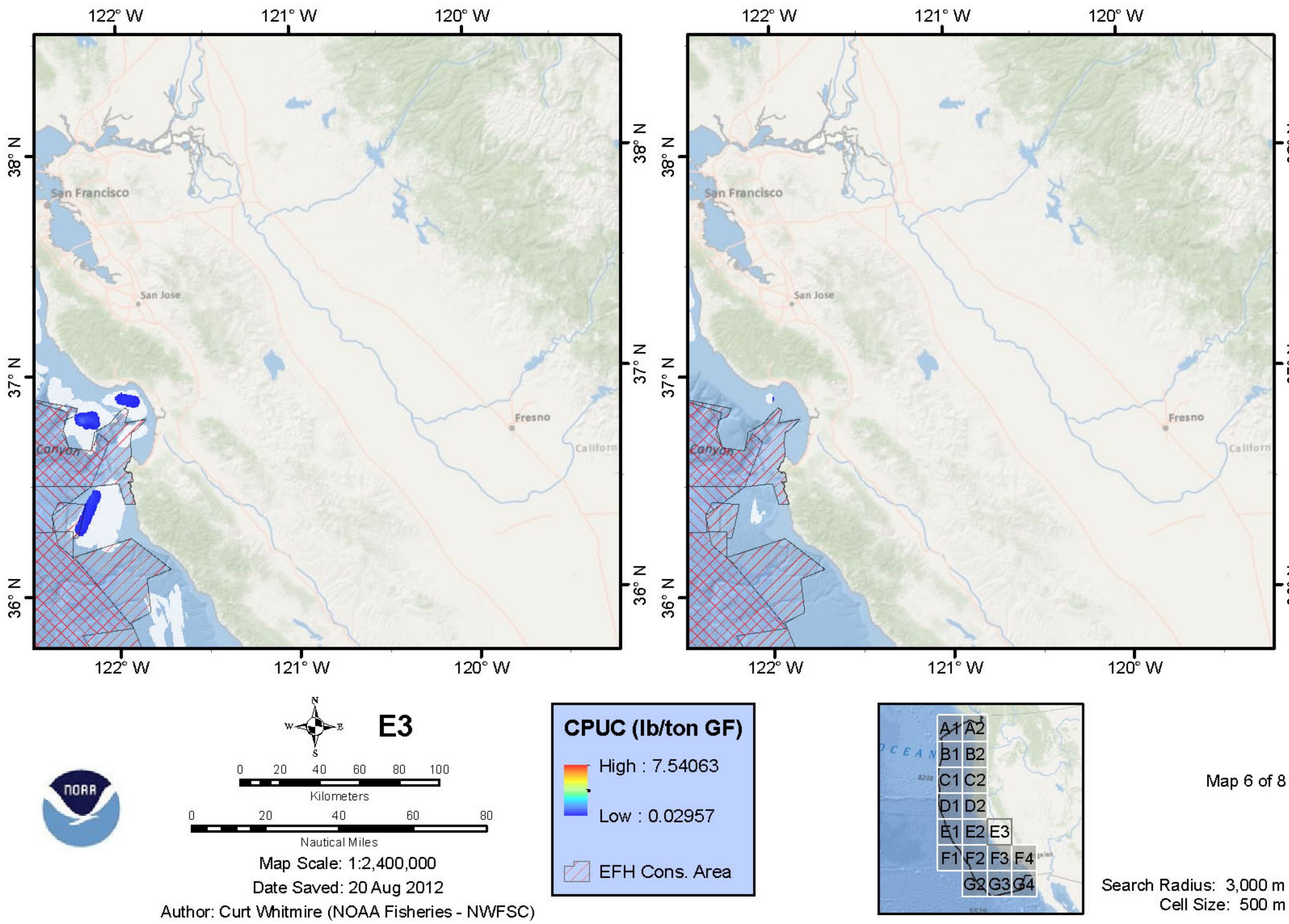
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** **After**




Before
Standardized Sponge Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 8
Search Radius: 3,000 m
Cell Size: 500 m

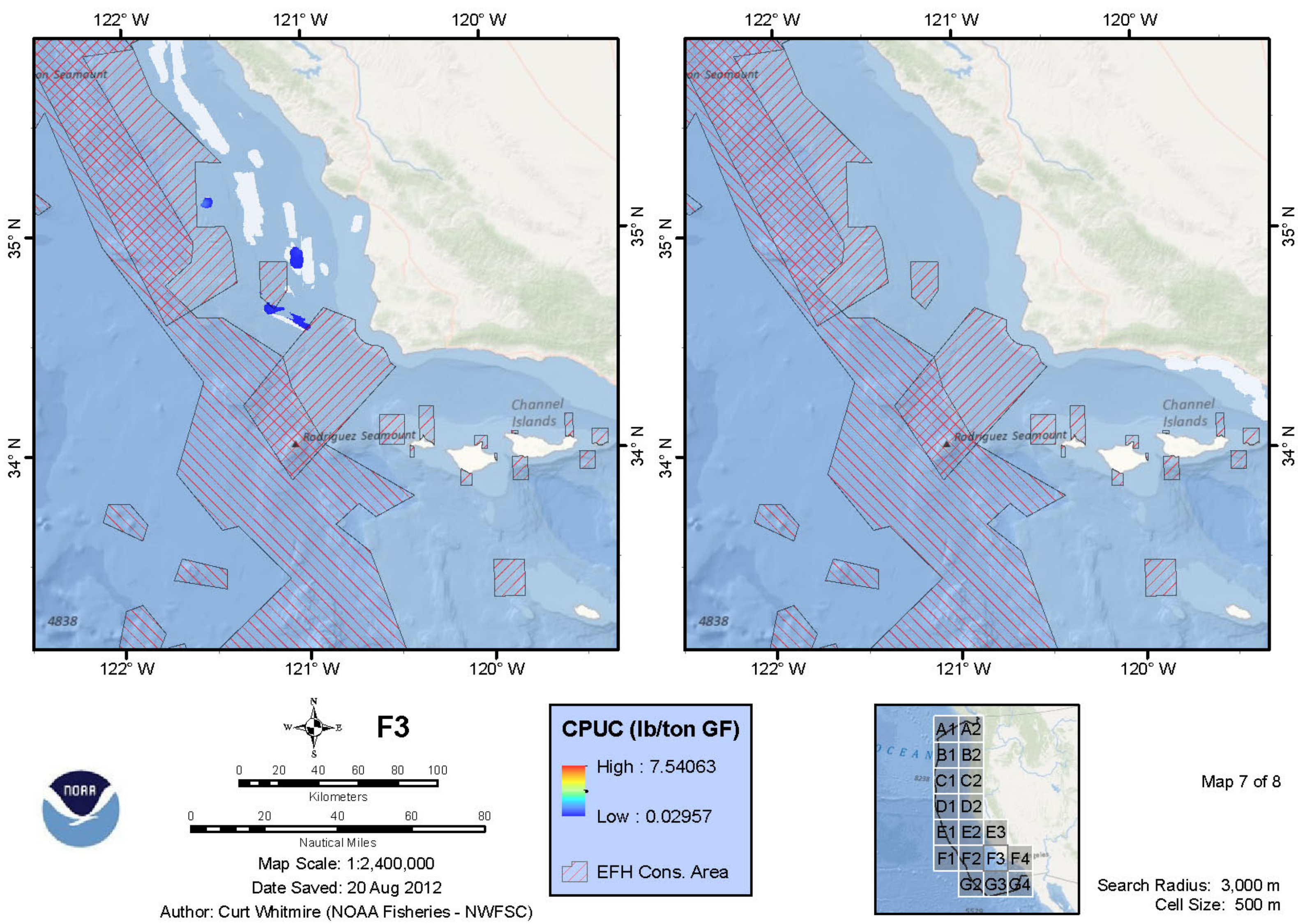

Before
Standardized Sponge Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 7.54063
Low : 0.02957
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Sponge Bycatch (WCGOP - Trawl)** After

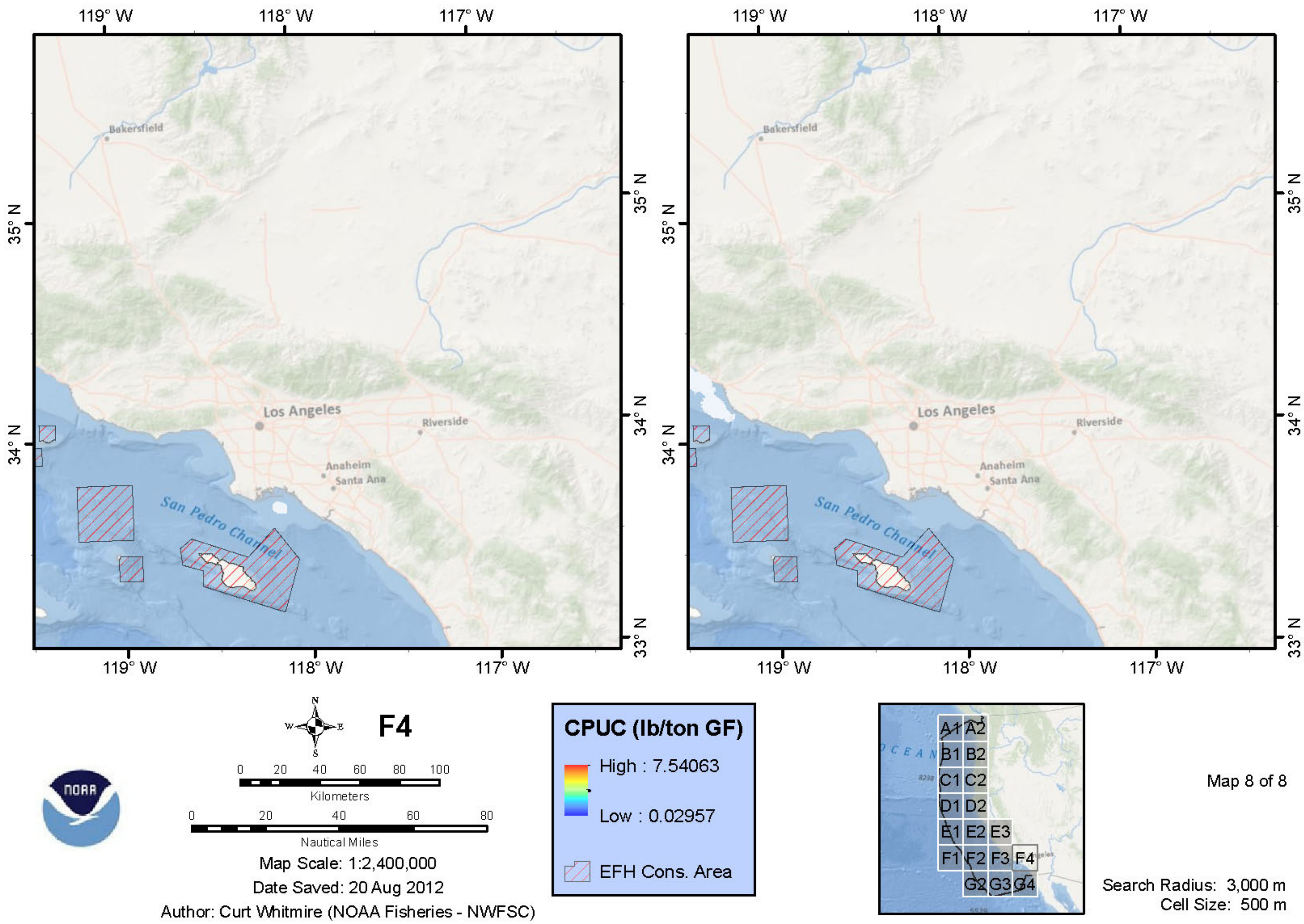


Appendix F-7

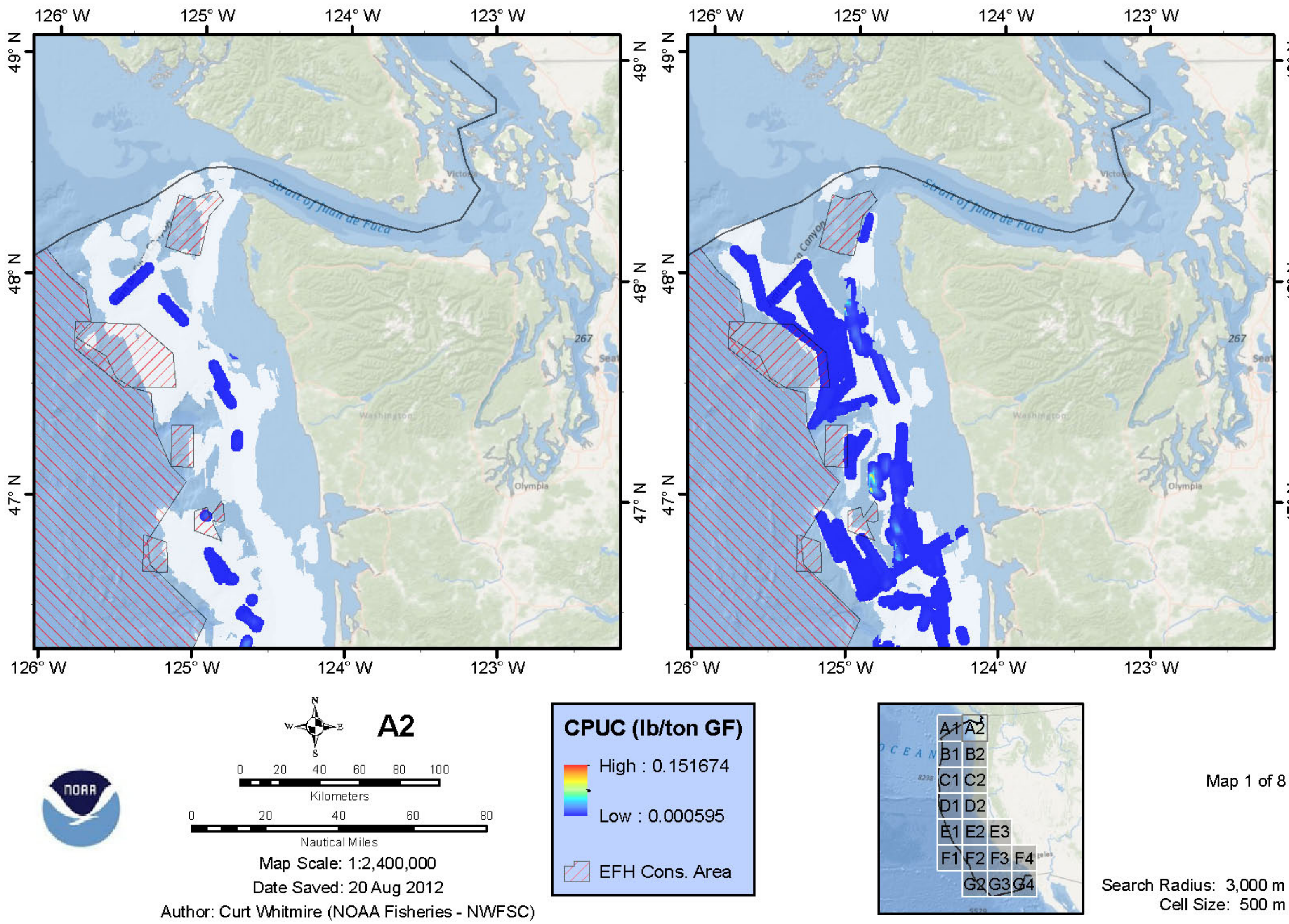
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** **After**

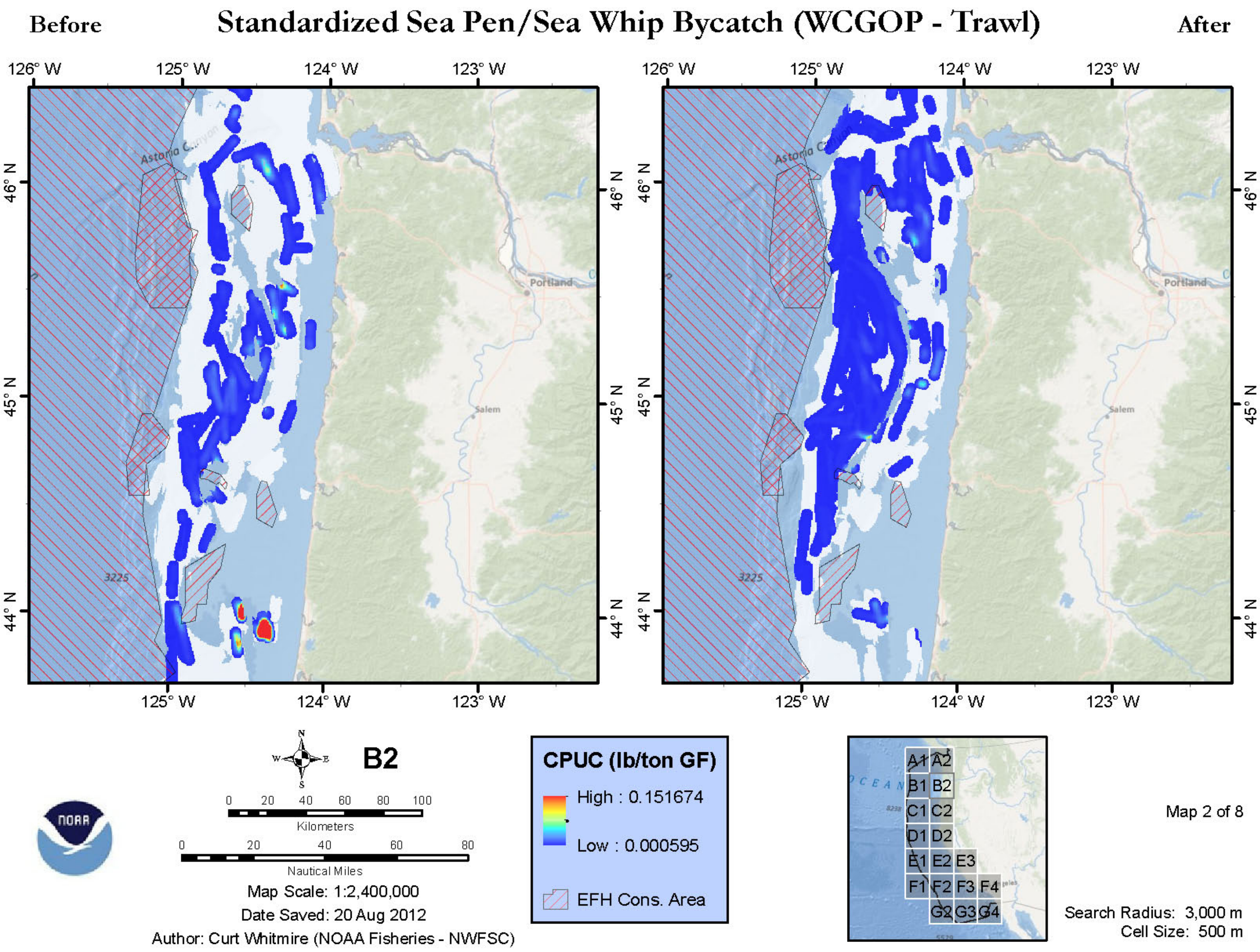


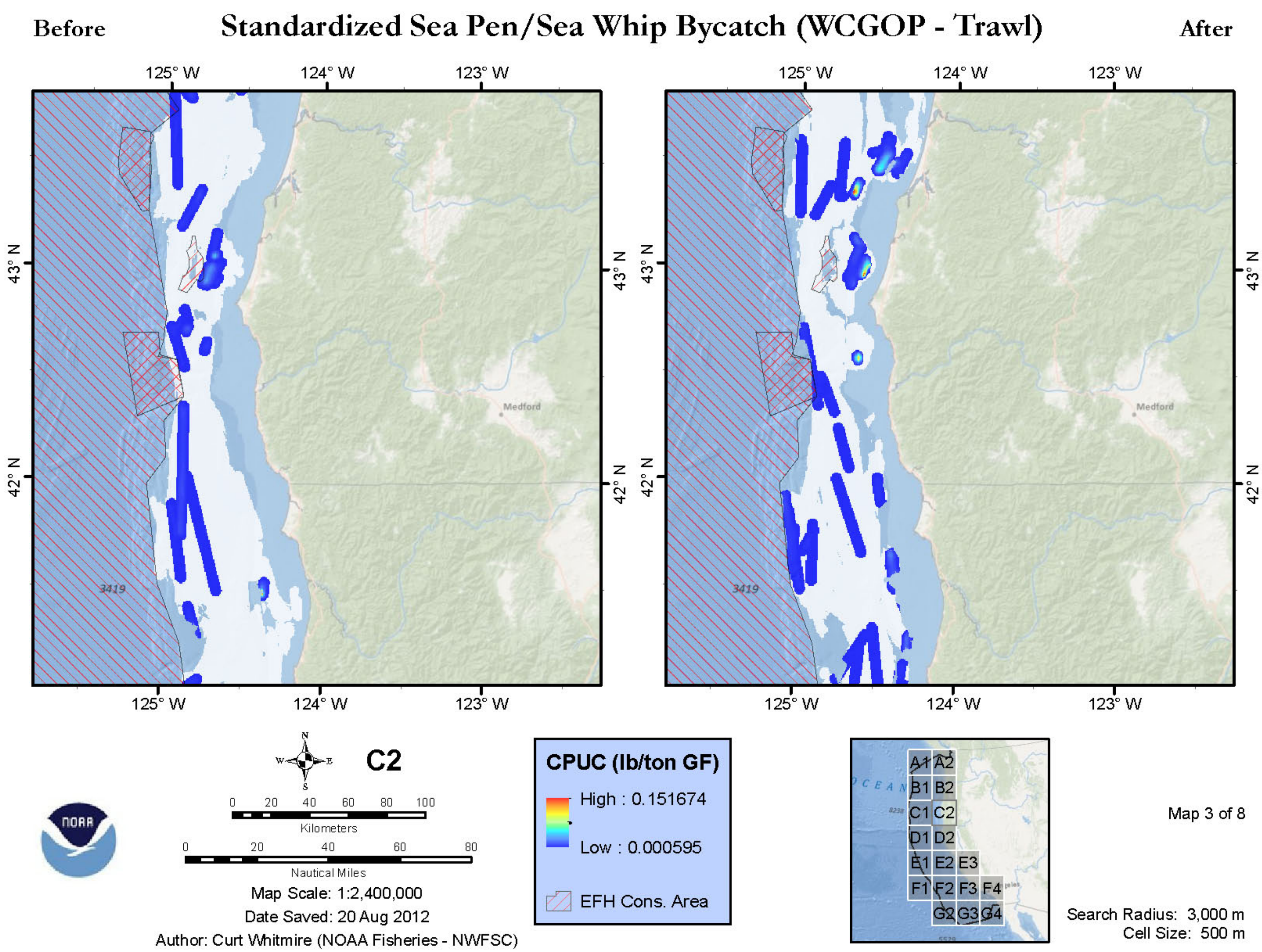
Before **Standardized Sponge Bycatch (WCGOP - Trawl)** After

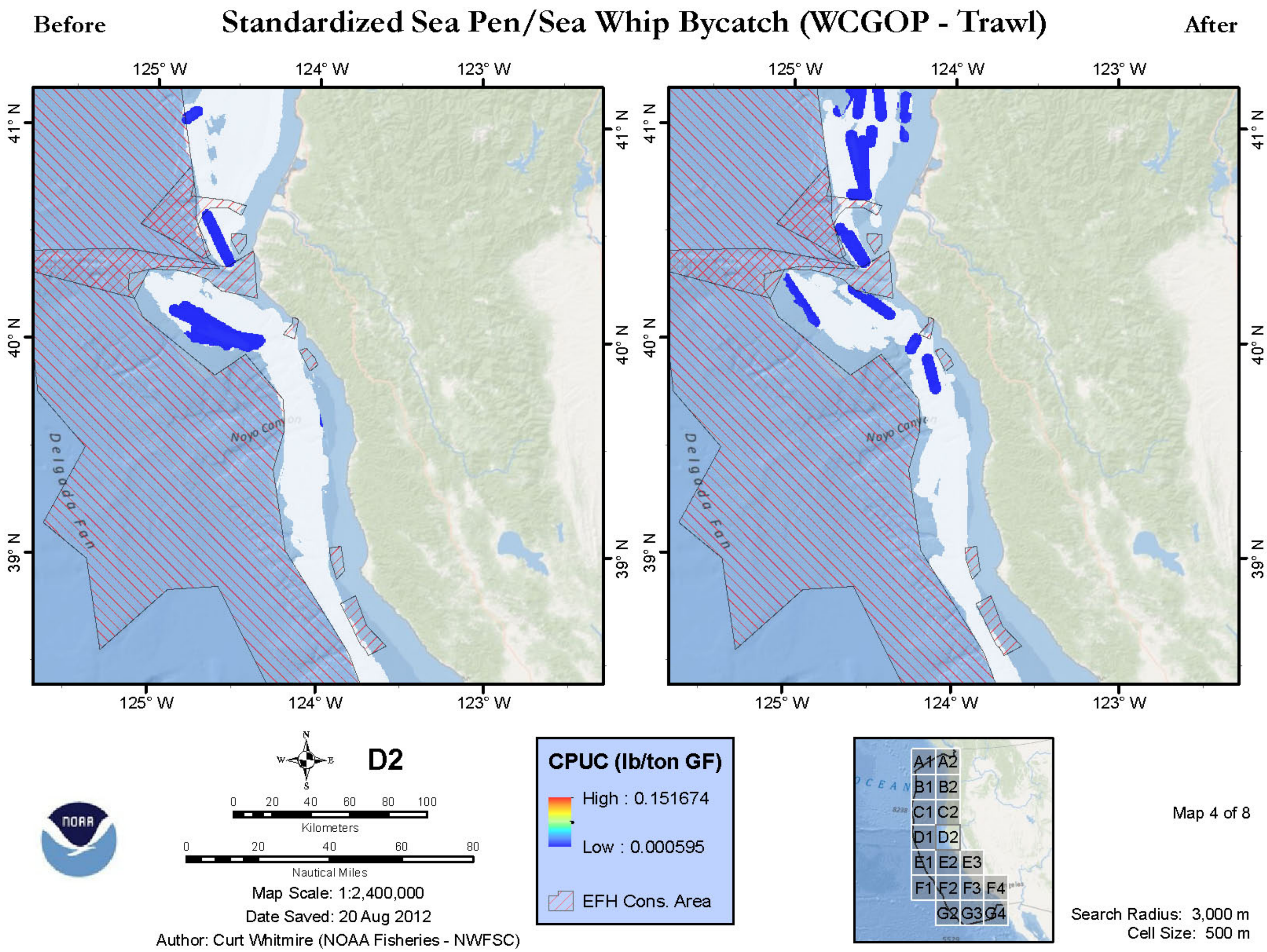


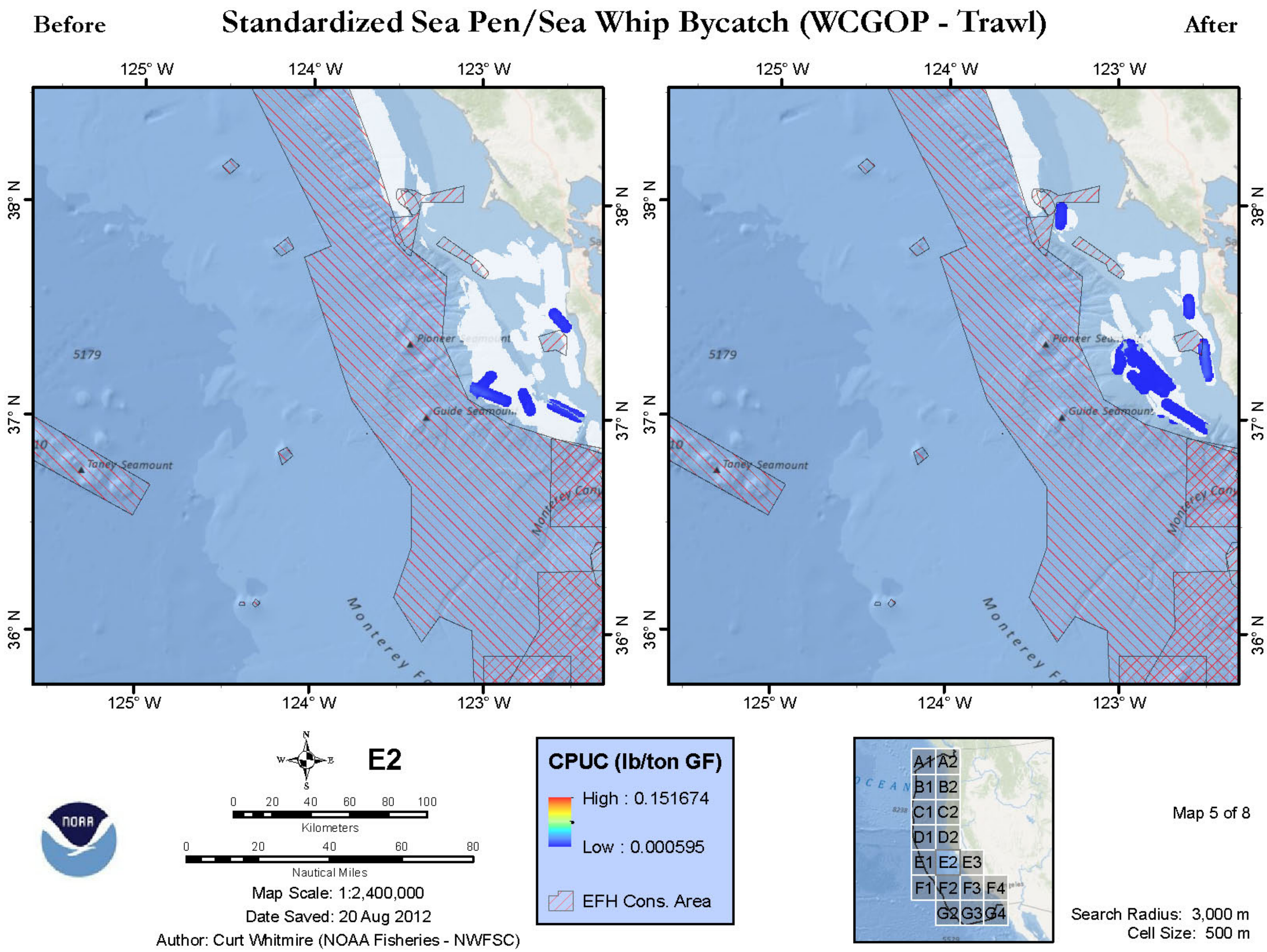
Before **Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)** **After**



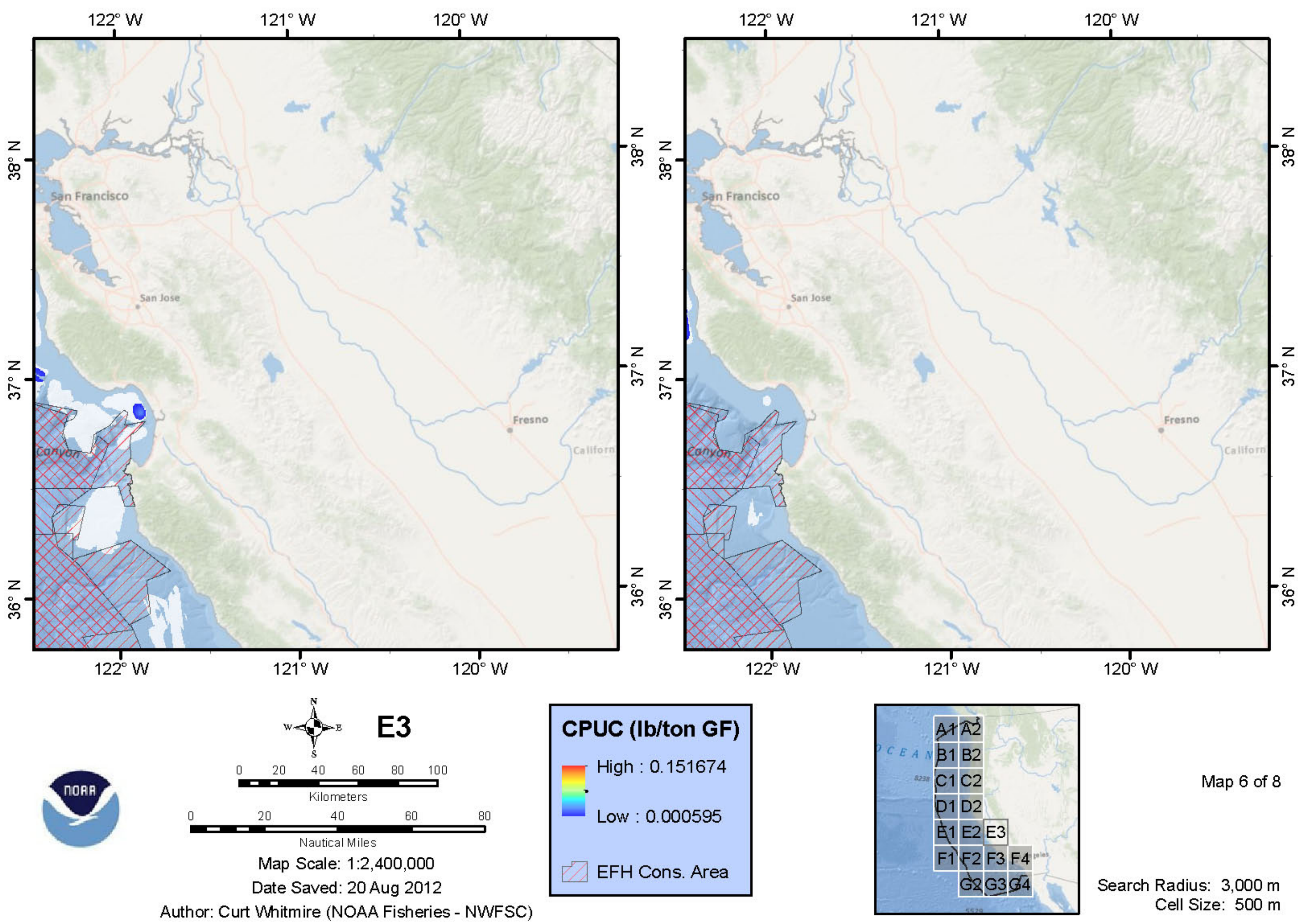

Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria Canyon
Portland
Salem
3225
B2
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 8
Search Radius: 3,000 m
Cell Size: 500 m

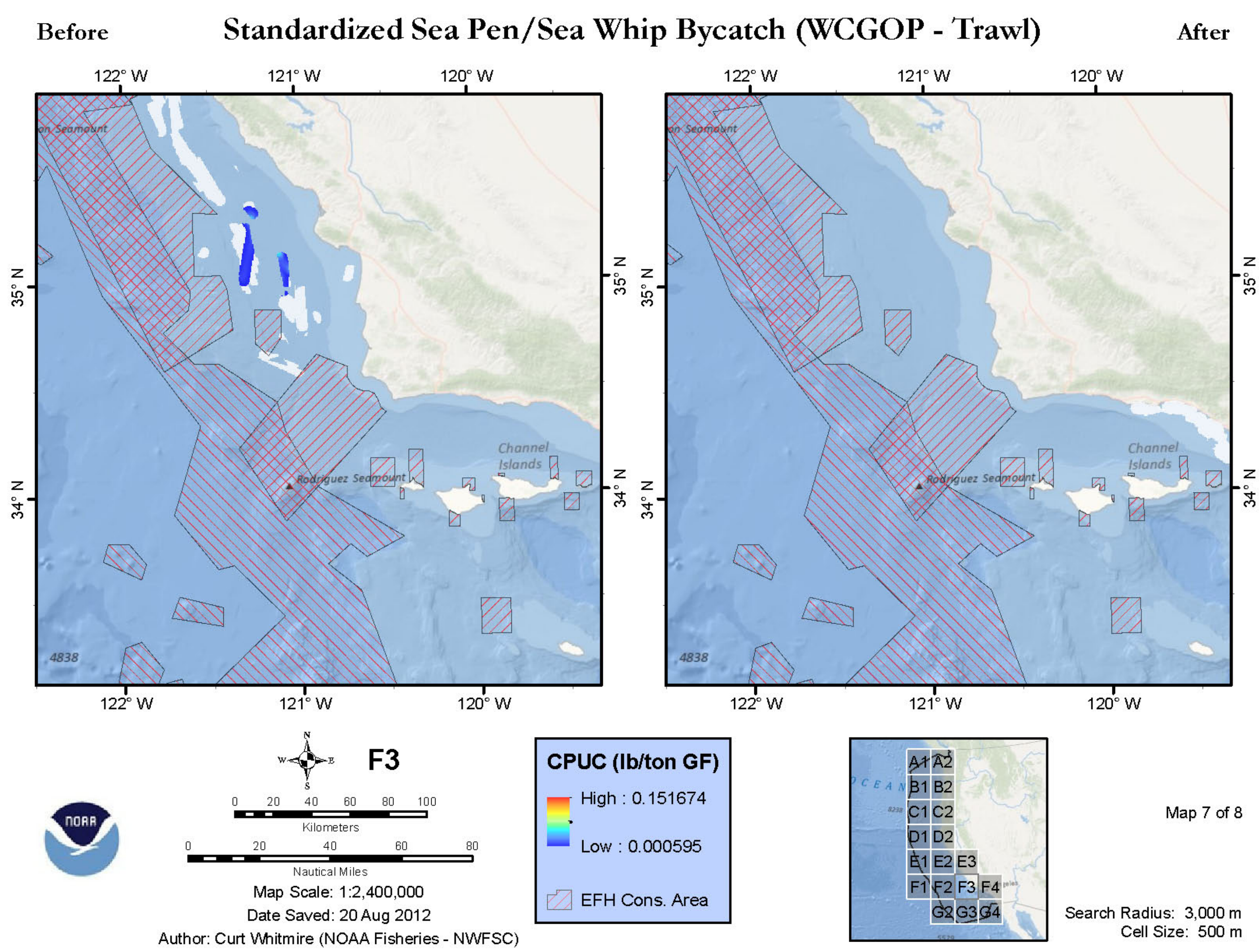

Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 8
Search Radius: 3,000 m
Cell Size: 500 m

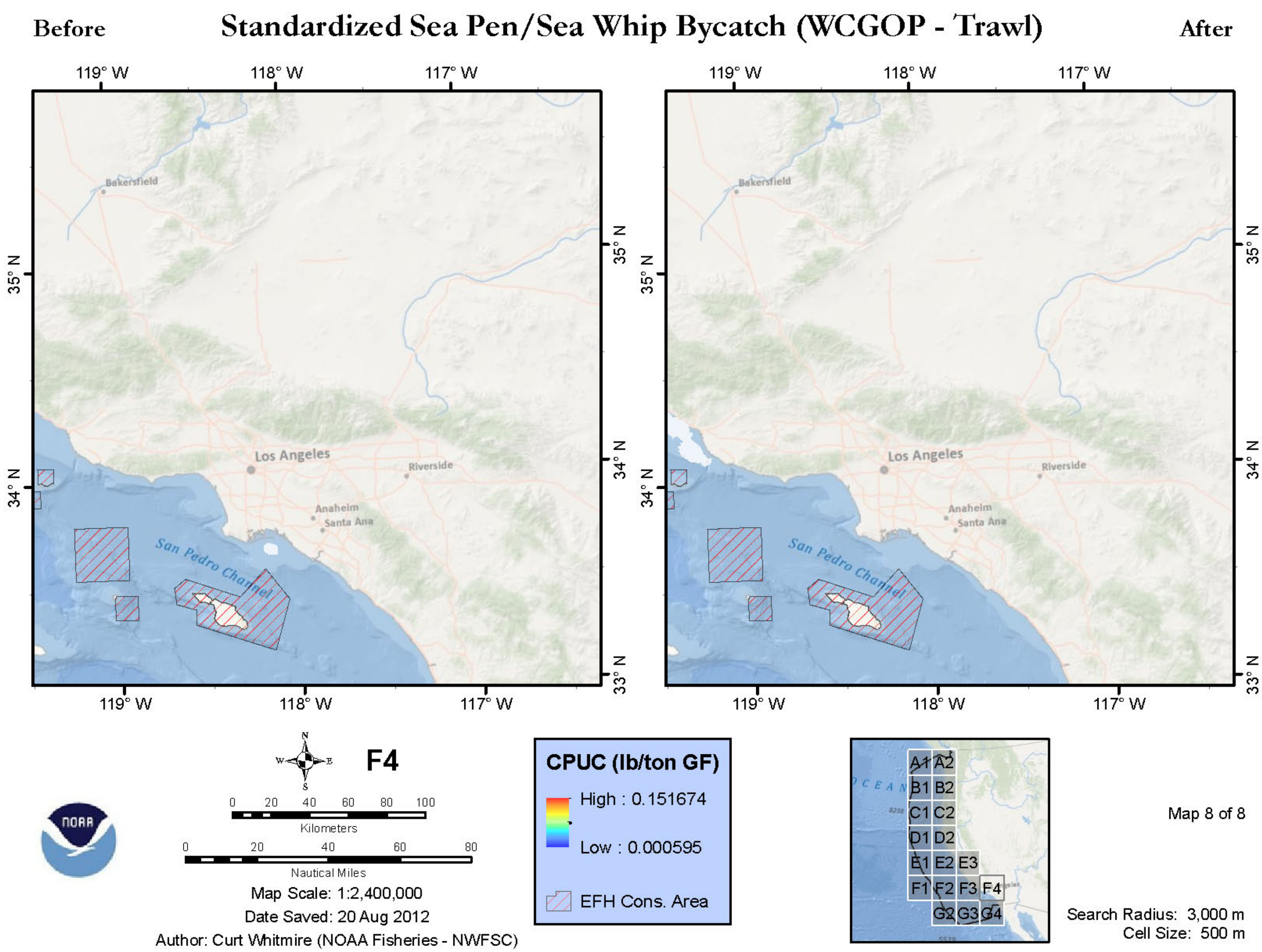

Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
Map 4 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Can
Monterey F
E2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Before **Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)** **After**




Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
Channel Islands
4838
F3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Standardized Sea Pen/Sea Whip Bycatch (WCGOP - Trawl)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Author: Curt Whitmire (NOAA Fisheries - NWFSC)
CPUC (lb/ton GF)
High : 0.151674
Low : 0.000595
EFH Cons. Area
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 8
Search Radius: 3,000 m
Cell Size: 500 m

APPENDIX G GROUNDFISH SPECIES GROUP LIFE HISTORY SUMMARIES

This appendix provides an updated review of spatial and trophic information relevant to the designation of EFH for Pacific Coast groundfishes.

Appendix G-1: Flatfish Group Species Accounts

Appendix G-2: Other Flatfish Group Summary Information

Appendix G-3: Rockfishes Group Summary Information

Appendix G-4: Other Rochfishes Group Summary Information

Appendix G-5: Other Groundfishes Group Summary Information

Appendix G-6: Bibliography of Recent Literature Relevant to EFH for Pacific Coast Groundfishes

Table G-1. List of groundfish species and stocks managed under the Pacific Coast Groundfish Fishery Management Plan (species added to the FMP since 2005 marked with **).

Flatfishes	**Other rockfishes**
Arrowtooth flounder, *Atheresthes stomias*	Aurora rockfish, *Sebastes aurora*
Dover sole, *Microstomus pacificus*	Bank rockfish, *Sebastes rufus*
English sole, *Parophrys vetulus*	Black-and-yellow rockfish, *Sebastes chrysomelas*
Petrale sole, *Eopsetta jordani*	Blue rockfish, *Sebastes mystinus*
	Bronzespotted rockfish, *Sebastes gilli*
Other flatfishes	Brown rockfish, *Sebastes auriculatus*
Butter sole, *Isopsetta isolepis*	Calico rockfish, *Sebastes dallii*
Curlfin sole, *Pleuronichthys decurrens*	California scorpionfish, *Scorpaena guttata*
Flathead sole, *Hippoglossoides elassodon*	**Chameleon rockfish, *Sebastes phillipsi*
Pacific sanddab, *Citharichthys sordidus*	China rockfish, *Sebastes nebulosus*
Rex sole, *Glyptocephalus zachirus*	Copper rockfish, *Sebastes caurinus*
Rock sole, *Lepidopsetta bilineata*	Dusky rockfish, *Sebastes ciliatus*
Sand sole, *Psettichthys melanostictus*	**Dwarf-red rockfish, *Sebastes rufinanus*
Starry flounder, *Platichthys stellatus*	Flag rockfish, *Sebastes rubrivinctus*
	**Freckled rockfish, *Sebastes lentiginosus*
Rockfishes	Gopher rockfish, *Sebastes carnatus*
Black rockfish, *Sebastes melanops*	Grass rockfish, *Sebastes rastrelliger*
Blackgill rockfish, *Sebastes melanostomus*	Greenblotched rockfish, *Sebastes rosenblatti*
Bocaccio, *Sebastes paucispinis*	Greenspotted rockfish, *Sebastes chlorostictus*
Canary rockfish, *Sebastes pinniger*	Greenstriped rockfish, *Sebastes elongates*
Chilipepper, *Sebastes goodie*	**Halfbanded rockfish, *Sebastes semicinctus*
Cowcod, *Sebastes levis*	Harlequin rockfish, *Sebastes variegatus*
Darkblotched rockfish, *Sebastes crameri*	Honeycomb rockfish, *Sebastes umbrosus*
Longspine thornyhead, *Sebastolobus altivelis*	Kelp rockfish, *Sebastes atrovirens*
Pacific ocean perch, *Sebastes alutus*	Mexican rockfish, *Sebastes macdonaldi*
Shortbelly rockfish, *Sebastes jordani*	Olive rockfish, *Sebastes serranoides*
Shortspine thornyhead, *Sebastolobus alascanus*	Pink rockfish, *Sebastes eos*
Splitnose rockfish, *Sebastes diploproa*	**Pinkrose rockfish, *Sebastes simulator*
Widow rockfish *Sebastes entomelas*	**Puget Sound rockfish, *Sebastes emphaeus*
Yelloweye rockfish, *Sebastes ruberrimus*	**Pygmy rockfish, *Sebastes wilsoni*
Yellowtail rockfish, *Sebastes flavidus*	Quillback rockfish, *Sebastes maliger*
	Redbanded rockfish, *Sebastes babcocki*
Other groundfishes	Redstripe rockfish, *Sebastes proriger*
Cabezon, *Scorpaenichthys marmoratus*	Rosethorn rockfish, *Sebastes helvomaculatus*
Lingcod, *Ophiodon elongatus*	Rosy rockfish, *Sebastes rosaceus*
Pacific cod, *Gadus macrocephalus*	Rougheye rockfish, *Sebastes aleutianus*
Pacific hake, *Merluccius productus*	**Semaphore rockfish, *Sebastes melanosema*
Sablefish, *Anoplopoma fimbria*	Sharpchin rockfish, *Sebastes zacentrus*
Big skate, *Raja binoculata*	Shortraker rockfish, *Sebastes borealis*
California skate, *Raja inornata*	Silvergray rockfish, *Sebastes brevispinis*
Kelp greenling, *Hexagrammos decagrammus*	Speckled rockfish, *Sebastes ovalis*
Leopard shark, *Triakis semifasciata*	Squarespot rockfish, *Sebastes hopkinsi*
Longnose skate, *Raja rhina*	Starry rockfish, *Sebastes constellatus*
Pacific flatnose, *Antimora microlepis*	Stripetail rockfish, *Sebastes saxicola*
Pacific grenadier, *Coryphaenoides acrolepis*	**Swordspine rockfish, *Sebastes ensifer*
Spiny dogfish, *Squalus acanthias*	Tiger rockfish, *Sebastes nigrocinctus*
Spotted ratfish, *Hydrolagus colliei*	Treefish, *Sebastes serriceps*
Tope, *Galeorhinus galeus*	Vermilion rockfish, *Sebastes miniatus*
	Yellowmouth rockfish, *Sebastes reedi*

Appendix G-1: Flatfish Group Species Accounts

Arrowtooth Flounder (*Atheresthes stomias*)

Spatial Associations:
The center of distribution for Arrowtooth Flounder is the western Gulf of Alaska and southern Bering Sea, but this species also commonly occurs along the US West Coast. The results of fishery–independent surveys conducted by the NMFS Northwest Fishery Science Center (NWFSC) between the Canadian border and southern Caliornia during May and October of 2000–2002, 2004, and 2005 were recently summarized (Keller et al. 2005, 2006a, 2006b, 2007, 2008). The 2004 and 2005 surveys captured a size range indicative of large juvenile (> 20 cm TL) and adult life stages (Keller et al. 2007, 2008). These life stages were presumably also largely taken in earlier surveys but no measurements were provided. Arrowtooth Flounder occurred in 17.3–21.5% of hauls conducted between 2000–2002 (n_{2000} = 325, n_{2001} = 334, n_{2002} = 427) at depths of 183–1280 m (Keller et al. 2005, 2006a, 2006b). Its distribution was restricted to the outer continental shelf and continental slope (186–626 m) during 2000–2002 surveys with a mean capture depth of approximately 350 m. Changes in design between 2002 and 2004 surveys (minimum target depth range reduced to 55 m, southern extent of survey expanded from 34.5° N to 32.5° N) are probably responsible for observed differences in minimum depth ranges (52–1111 m, mean ~ 200 m) and frequency of occurrence during 2004 (36.0%, n_{2004} = 505) and 2005 (32.4%, n_{2005} = 675) surveys (Keller et al. 2007, 2008). Along the West Coast, Arrowtooth Flounder abundance decreased from north to south, with the great majority of the population (> 90% of survey biomass in all survey years) located north of 43° N (Keller et al. 2005, 2006a, 2006b, 2007, 2008). Among groundfishes, Arrowtooth Flounder was typically among the top 15 most adundant species by biomass, and among the top 3 most abundant species between 47.5° N and the Canadian Border (Keller et al. 2005, 2006a, 2006b, 2007, 2008). Based on a subset of available West Coast survey information collected during 1999–2002 (n = 1159 tows), median depth of capture for Arrowtooth Flounder was 300 m, and the median latitude of capture was 45° N (Tolimieri and Levin 2006).

Arrowtooth Flounder was extremely abundant in fishery–independent surveys conducted in continental shelf waters off Hecate Strait, British Columbia, ranking first and third among groundfishes by biomass during June 2002 (n = 96 tows) and May–June 2003 (n = 94 tows) (Choromanski et al. 2004, 2005). The catch was composed of a wide range of juvenile– and adult–size individuals (male: 11–68 cm TL, n = 2623; female: 11–88 cm TL, n = 4914) (Choromanski et al. 2004, 2005). During 2003, most individuals were caught between 108–126 m (depth range of tows = 18–146 m) (Choromanski et al. 2004). Arrowtooth Flounder occupied deeper waters during the winter (mean = 257 m) than during the summer (mean = 100 m) in this region (Pearall and Fargo 2007). In continental shelf surveys (18–166 m) conducted sporadically during 1985–1987 among a variety of unconsolidated bottom types, Arrowtooth Flounder was the most abundant species by biomass on a silty sand, high current region (55–166 m) (Pearsall and Fargo 2007).

Recent fishery–independent survey results indicated that Arrowtooth Flounder was the most abundant groundfish in the Gulf of Alaska. During summer months (June–August) of 2007 (n = 820 tows) and 2009 (n = 823 tows), Arrowtooth Flounder biomass was overwhelmingly dominant among groundfishes with the highest densities occurring on the broad continental shelf of the western Gulf, especially around the Barren Islands and off northeast Kodiak Island (Von Szalay et al. 2008, 2010). Mean weight of Arrowtooth Flounder generally increased with depth and (presumably) juveniles (< 30 cm TL) were realtively rare below 300 m. Distinct size modes corresponding to large juveniles or early adults typically occurred at depths of 100–500 m (Von Szalay et al. 2008; Von Szalay et al. 2010), with males distributed deeper than females (Von Szalay et al. 2010).

High densities of large juvenile and adult Arrowtooth Flounder recently have been documented in the southern Bering Sea and eastern Aleutian Islands. Arrowtooth Flounder was the most abundant flatfish and among the ten most abundant groundfishes (by biomass) in the Aleutian Island region in fishery–independent surveys conducted between May and August of 2002 (n = 417 tows), 2004 (n = 420 tows), 2006 (n = 358 tows), and 2010 (n = 417 tows) at depths of 1–500 m (Zenger 2004; Rooper 2008; Rooper and Wilkins 2008; Von Szalay et al. 2011). Based on the combined results of these surveys, Arrowtooth Flounder was the dominant groundfish in the southern Bering Sea but catch rates were greatest in the eastern Aleutians. These results are consistent with those of Logerwell et al. (2005) using data from NMFS surveys conducted during May–September 1980–2003. Mean length and weight increased with depth and individuals were larger in the eastern Aleutians than southern Bering Sea (Zenger 2004; Rooper 2008; Rooper and Wilkins 2008). Results of eastern Bering Sea surveys indicated that greatest catch rates were located between 600–800 m during May–August 2004 (n = 231), 2008 (n = 200), and 2009 (2000) (Hoff and Britt 2005, 2009, 2011). This center of distribution is generally deeper than that reported among other regions, although Von Szalay et al. (2011) noted that Arrowtooth Flounder populations were concentrated in deeper water in the southern Bering Sea (301–500 m) than in the Aleutian Islands (201–300 m). No temperature or other information was available to explain the cause of the high observed catch rates in deep waters of the eastern Bering Sea. Based on a General Additive Model, year, depth, and bottom temperature explained 72% of variability in Arrowtooth Flounder CPUE in the eastern Bering Sea during spring and summer months of 1982–2004 (McConnaughey and Syrjala 2009). When backscatter data representing variable substrate types were included, model predictions only increased by 3.5% indicating that substrate type may not be an important predictor of Arrowtooth Flounder distribution.

Changing environmental conditions seem to be affecting the distribution and abundance of Arrowtooth Flounder in the Bering Sea. Warming temperatures have led to an overall increase in the Bering Sea Arrowooth Flounder population from 1982–2007 (Zador et al. 2011). However, abundances generally have not increased in the most densely inhabited regions, and much of the recent population expansion appears to be driven by the increase in larger (adult) individuals caught on outer continental shelf north of Zhemchug Canyon (Zador et al. 2011). Southeastern Bering Sea populations also showed a marked increase in abundance during recent warm years (2003−2005), indicating possible increased physical habitat suitability. The high numbers of small (juvenile) individuals found in the southeastern Bering Sea suggest that this region may be a nursery area (along with the outer shelf). Arrowtooth Flounder movement patterns and geographic distribution appear to be strongly driven by temperature, and specifically the location of the cold pool and 0°C water. During years of large cold pools, distribution is restricted, which may increase density–dependent effects and curtailed population growth (Zador et al. 2011). Arrowtooth Flounder populations are expected to expand their distribution and abundance as the eastern Bering Sea warms (Zador et al. 2011). This species is known to be a strong swimmer and has exhibited active migrations from the northeastern to northwestern Bering Sea (Orlov 2004). This westward movement has been attributed to a warming of the northwestern Bering Sea during the 1990s and the associted weakening of the Kamchatka Current (Orlov 2004).

Seasonal movements, spawning habitat, and distribution patterns of eggs and larvae recently have been described in the Gulf of Alaska. Arrowtooth Flounder primarily spawned along the continental slope east of Kodiak Island from late January to March (Blood et al. 2007). During peak spawning in January and February, mature–size females were concentrated along the continental slope southwest, south and east of Kodiak Island at depths of 190–340 m and as deep as 485 m (Bailey et al. 2008). In early March and in April, most individuals had migrated towards Shelikof Strait. The monthly distribution of mature–size female Arrowtooth Flounder indicated a prompt migration away from the slope once spawning was complete (Bailey et al. 2008). Early–stage eggs were found in tows that sampled to depths of ≥ 450 m. Larvae, which hatch between 3.9 and 4.8 mm standard length, increased in abundance with depth (Blood et al 2007). Larvae of increasing lengths were found inshore of eggs, demonstrating a shoreward movement with ontogeny. There also may be a downstream gradient over the shelf of increasing size, with the smallest larvae around Kodiak Island and the largest mean lengths between the Shumagin Islands and Unimak Pass. The mean depth of Arrowtooth Flounder larvae was ~30 m but there was an ontogenetic movement of larvae to the surface and early stage larvae were commonly found to 150 m (Bailey et al. 2008). Arrowtooth Flounder generally recruited to benthic environments of the inner and mid continental shelf during July–August (Bailey et al. 2008).

Recently published spatial information concerning Arrowtooth Flounder is consistent with and expands upon prior knowledge. Previous findings, such as temperature tolerances of different life stages (McCain et al. 2005), were utilized in some recent studies (e.g., Zador et al. 2011) to build a more complete picture of spatial and temporal distribution patterns and to determine the main factors driving observed patterns. Most of the recently published spatial information on Arrowtooth Flounder was derived from Alaskan waters with West Coast contributions largely limited to the results of NMFS trawl surveys. However, a substantial amount of historic information is available from directed scientific research on the spatial associations of this species along the West Coast (McCain et al. 2005).

Trophic Interactions:
Several new studies are available that detail the food habits of Arrowtooth Flounder. All of these studies used benthic trawl gear deployed during daylight hours to collect specimens and stomach samples in the Gulf of Alaska (Yang 2004; Yang et al. 2005; Yang et al. 2006; Knoth and Foy 2008), eastern Bering Sea (Yang et al. 2005; Lee et al. 2010) and Hecate Strait, British Columbia (Pearsall and Fargo 2007). Data from the Gulf of Alaska were derived from Pavlof Bay (90–123 m; Augst 5–7 1995; Yang 2004), Chiniak and Marmot Bays off Kodiak Island (mostly <100 – 200 m, May and August 2002–2004; Knoth and Foy 2008), the central and western Gulf of Alaska (1999, 2001; Yang et al. 2006) and throughout the Gulf of Alaska (May–September, 1990–2001; < 50–200 m; Yang et al. 2005). In the Gulf of Alaska, Arrowtooth Flounder ate primarily fishes, with a greater proportion fishes noted among (presumably) adults (≥ 40 cm FL; Yang et al. 2006, Knoth and Foy 2008). The dietary contribution of fishes (by weight) ranged from 43.5% (n = 465; Knoth and Foy 2008) to 73% (n = 1359; Yang et al. 2006) in studies with large sample sizes (n > 100). Walleye Pollock was the primary prey species, contributing between 13.3% (2002–2004; Knoth and Foy 2008) and 31.4% (2001; Yang et al. 2006) to diet composition by weight among identified fishes. Pacific Sand Lance and Capelin also were commonly ingested in the Gulf of Alaska (Yang et al. 2005, 2006). Crustaceans, especially pandalid shrimps (%Weight (%W) = 7–12, Yang et al. 2006) and euphausiids (%W = 17.7%; Knoth and Foy 2008), were also regularly consumed, especially by (presumably) juvenile specimens (< 40 cm FL; Yang et al. 2006). A relatively low proportion of stomachs with prey items (53.8% (n = 80; Yang 2004) to 76.2% (Yang et al. 2006)) were indicative of the episodic feeding of a piscivorous predator. In addition to the previously noted ontogenetic differences in diet composition, temporal dietary variability was documented in the Gulf of Alaska. In 2002 and 2003, Walleye Pollock was the dominant prey item of adult Arrowtooth Flounder in the western Gulf of Alaska, but its importance declined substantially in 2004 with an associated increased reliance on euphausiids and Pacific Sand Lance (Knoth and Foy 2008). The importance of euphausiids in the diet of Arrowtooth Flounder also decreased significantly from May to August, whereas the importance of capelin increased during the same time period. Temporal changes in feeding activity were more pronounced in smaller, likely juvenile, individuals (Knoth and Foy 2008). Temporal dietary variability was largely attributed to differences in local prey availability, suggesting that Arrowtooth Flounder is a generalist feeder. In addition, the prevalance of pelagic prey was interpreted to reveal that Arrowtooth Flounder feedsf mainly in the water column (Knoth and Foy 2008).

New studies conducted in the eastern Bering Sea also indicated piscivory by Arrowtooth Flounder. Fishes composed 72.2% of diet composition by weight during 1979–1985 in waters < 500 m (Lee et al. 2010). Walleye Pollock (64%) dominated diet composition, followed by large zooplankton (20.1%) and shrimp (7.1%). Forage fishes composed a smaller proportion of diet (5.9%; Lee et al. 2010) compared to the Gulf of Alaska population (Yang et al. 2006; Knoth and Foy 2008). Capelin, for instance, constituted 1.0% of Arrowtooth Flounder diet composition in the eastern Bering Sea during 1970–2001, compared to 8.8% in the Gulf of Alaska during 1990–2001 (Yang et al. 2005). Dietary overlap with Greenland Turbot was substantial during 1979–1985 (0.882) and trophic level was estimated at 3.93 (Lee et al. 2010).

In the waters of Hecate Strait, British Columbia, fishes also were the primary prey taxa, although species composition varied. Pearsall and Fargo (2007) collected a size range representative of juvenile and adult Arrowtooth Flounder in trawl surveys conducted during June and September–October 1985, January 1986, and May–June 1987. Trawls were fished during daylight hours in four distinct regions at depths of 18–166 m and bottom types ranging from sandy silt to a mixture of coarse sand, gravel, pebbles, and cobbles. The great majority of stomach samples (n = 977) contained prey items (93.1%) (Pearsall and Fargo 2007). Based on %W, Arrowtooth Flounder in Hecate Strait fed mainly on fishes, with most undentified (50.5%). Among identified prey taxa, Pacific Herring (12.9%), Pacific Sand Lance (9.8%) and lobsters (7.4%) contributed > 5% to diet composition (Pearsall and Fargo 2007). Adult–size Arrowtooth Flounder fed on a greater proportion of fishes than juvenile–size individuals and on a different species composition. Adults consumed a greater proportion of forage fish and herring whereas juveniles ate greater amounts of macrobenthos, as well as more euphausiids and shrimps (Pearsall and Fargo 2007). Pronounced temporal variability was reported in the relative contribution of prey taxa within and among regions. In general, however, a greater proportion of fishes was noted on a sand, gravel, pebbles, and cobbles habitat, whereas more shrimp and plankton were consumed on a sandy silt habitat with strong currents (Pearsall and Fargo 2007). Diet composition of juveniles and adults was similar and samples were pooled to estimate trophic level (between 3.8–4.0) and for interspecific comparisons. Arrowtooth Flounder diet composition was most similar to that of of upper trophic level species such as dogfish (0.946), adult Pacific Cod (0.919), juvenile Pacific Cod (0.873), and Lingcod (0.824) (Pearsall Fargo 2007).

Seabirds, pinnipeds, and other fishes were reported as predators of Arrowtooth Flounder in recent studies. Common Murres (n = 15), Thick–Billed Murres (n = 76), Red–Legged Kittiwakes (n = 52), and Black–Legged Kittiwakes (n = 92) sampled on St. Paul and St. George Islands (Pribilof Islands) and Bogoslof Island (Aleutian Archipelago) during 1999–2000 all consumed (presumably) juvenile Arrowtooth Flounder. The relative dietary contribution differed among species and between short–term (stomach content analysis) and long–term (fatty acid analysis) feeding trends. Dietary contributions of Arrowtooth Flounder ranged from trivial amounts to nearly 30% (Iverson et al. 2007). Based on 2760 scat samples collected on Kodiak Island during September 1999 to March 2005, juvenile and adult Arrowtooth Flounder (<16–70 cm TL) were the third most important species in the diet of Steller Sea Lions (%Number (%N) = 5.6, %Frequency of Occurrence (%FO) = 34.7). Arrowtooth Flounder was more important to Steller Sea Lions diets in the summer as compared to the winter, and increased in dietary importance during 2000–2004 when Walleye Pollock numbers declined (McKenzie and Wynne 2008). Arrowtooth Flounder also were important components of Pacific Cod diets (n = 1438) off Southeast Alaska during 1993–1999 (Trites et al. 2007). The occurrence of Arrowtooth Flounder in Pacific Cod diet was similar among seasons, ranging from 13.2% (spring) to 20.3% (winter) (Trites et al. 2007). Pacific Halibut (%W = 9.8, n = 152), Bocaccio (%W = 2.3%, n = 8), Rock Sole (%W = 0.5%, n = 347) and Pacific Sanddab (%W = 1.7%, n = 90) also consumed Arrowtooth Flounder (Pearsall and Fargo 2007).

Recent published information concerning Arrowtooth Flounder trophic interactions is consistent with and augments previous findings. A rather large body of information indicates a primarily piscivorous diet with a high proportion of Walleye Pollock in Alaskan waters. A previously reported dietary shift from crustaceans to small forage fishes between small and large juveniles (McCain et al 2005) was reinforced by recent studies (Yang et al. 2006; Knoth and Foy 2008). Newly available information on Arrowtooth Flounder predators considerably augments prior documentation (McCain et al. 2005).

DOVER SOLE (*MICROSTOMUS PACIFICUS*)

Spatial Associations:
A substantial amount of new information is available regarding the spatial associations of Dover Sole in the eastern North Pacific. Along the West Coast, this information is derived from fishery–independent surveys of NMFS–NWFSC and from directed scientific research. NMFS–NWFSC conducted surveys from the US/Canadian border to southern California between May and October of 2000–2002, 2004, and 2005 (Keller et al. 2005, 2006a, 2006b, 2007, 2008). The depth range of tows was expanded to include a shallower portion of the continental shelf during the 2004 and 2005 surveys (55–1280 m; 2000–2002: 183–1280 m) and the southern limit was extended (2000–2002: 34.5° N; 2004–2005: 32.5° N). Surveys captured a size range indicative of large juvenile (> 20 cm TL) and adult life stages. Dover Sole was caught at depths of 186–1241 m during 2000–2002 (#tows: n_{2000} = 325, n_{2001} = 334, n_{2002} = 427) with a mean capture depth of 549–581 m. A shallower depth range (52–1235 m) and mean depth of capture (359 m) observed during 2004 and 2005 (#tows: n_{2004} = 505, n_{2005} = 675) are presumably attributable to differences in survey depths. Dover Sole had the highest overall biomass among groundfish species for all surveys conducted during 2000–2005 (Keller et al. 2005, 2006a, 2006b, 2007, 2008). It was distributed throughout the survey region, but occurred in greatest abundance in cotinental slope and upper contiental shelf regions (< 550 m). Dover Sole was especially abundant between 184–549 m (Keller et al. 2007, 2008). In directed studies using NMFS trawl survey data derived from 1999–2002 (n = 1020 tows), Dover Sole was the second most common fish numerically and most common species by biomass (Tolimieri and Levin 2006; Tolimieri 2007). It numerically dominated hauls from 400–500 m (Tolimieri 2007) and inhabited progressively deeper depths on a gradient from north to south. For example, it was the most common species by biomass from 200–300 m at 40–43° N, and also the most common species at 700–900 m at 34–37° N (Tolimieri and Levin 2006). The median latitude of capture was 41° N (Tolimieri and Levin 2006). The region from central California to the Canadian border represent the center of distirbution for this species in US waters; its abundance declined in the southern portion of the survey and was considerably less in the Gulf of Alaska (Tolimieri 2007; Von Szalay et al. 2008, 2010, 2011).

Dover Sole were abundant in fishery–independent surveys conducted in continental shelf waters off Hecate Strait, British Columbia, ranking third and fourth among groundfishes by biomass during June 2002 (n = 96 tows) and May–June 2003 (n = 94 tows) (Choromanski et al. 2004; 2005). The catch was composed of a wide size range suggestive of juveniles and adults (male: 15–52 cm TL, n = 3845; female: 13–68 cm TL, n = 4643) (Choromanski et al. 2004; 2005). During 2003, most individuals were caught between 72–108 m (depth range of tows = 18–146 m) (Choromanski et al. 2004). Dover Sole occupied deeper waters during March (mean = 334 m) than during the summer (mean = 163 m) in this region (Pearall and Fargo 2007) in continental shelf trawl surveys (18–166 m) conducted sporadically during 1985–1987. These findings are consistent with those of Fargo and Westrheim (2007), who demonstrated that tagged adult Dover Sole (n = 852 recovered) migrated to deep water off the west coast of Queen Charlotte Island to spawn during witner months, with male migrations preceeding those of females. Large juvenile– and adult–size Dover Sole (21.3–61.0 cm TL, n = 1824 measures) were relatively less adundant off the West Coast of Vancouver Island than in Hecate Strait, ranking 8^{th} by biomass among groundfishes surveyed between 50–500 m (n = 165 tows) (Workman et al. 2008).

Recent studies indicated that Dover Sole was extremely resilient to disturbance and low oxygen concentrations and reinforced its association with muddy habitats. Based on sampling conducted on Hecate Bank, Oregon during September 1988–2000 (67–360 m), Dover Sole was most abundant in mud–dominated seafloors from 200–360 m (n = 42 submersible dives) that included boulders, cobbles, and pebbles (Tissot et al. 2007). Densities were ~5x greater on trawled mud seafloors of Coquille Bank, Oregon when compared to untrawled regions (Hixon and Tissot 2007). Trawling results in a general increase in sedmentation, turdity, and the suspension of epibenthic invertebrates. Since Dover Sole primarily inhabit mud bottoms and use chemoreception to forage, all of these consequences are probably beneficial (Hixon and Tissot 2007). Dover Sole also do not seem to be adversely affected by low oxygen levels. In a recent study, conducted off the Oregon coast at depths of 50 m and 70 m (n = 17 tows), Dover Sole exhibited no significant effects of hypoxia (Keller et al. 2010). Biomass of Dover Sole was not significantly related to dissolved oxygen concentration along the hypoxic gradient, and condition factors were actually somewhat higher in low oxygen waters (Keller et al. 2010).

The early life history and reproductive movements of Dover Sole were recently investigated off central Oregon and in the Gulf of Alaska. Toole et al. (2001) collected a complete size range of juveniles and adults (3–55 cm TL; mean = 13.2 cm TL) using a small–mesh shrimp trawl deployed off central Oregon (50–400 m) during 1989–1994. Dover Sole settled on the outer continental shelf and slope, moved inshore to nursery areas < 150 m and, after reaching ~20 cm TL, moved to progressively deeper water with ontogeny (Toole et al. 2011). A massive amount of historic and contemporary data (1953–2006) were synthesized in two related studies conducted in the Gulf of Alaska that provided detailed descriptions of Dover Sole distribution and movement patterns. Adults were widely distributed from the inner shelf to outer slope during non–spawning months (n = 37,752 combined tows) but aggregated almost exclusively along the slope (310–500 m) in a few specific locations (off northern and southwestern Kodiak Island) when spawning (Bailey et al. 2008; Abookire and Bailey 2008). Peak spawning season in the Gulf of Alaska was April to mid–June but extended from late January to July (Bailey et al. 2008; Abookire and Bailey 2008). Spawning and egg concentrations tended to co–occur, indicating that adults maintained a protracted occupation in outer shelf spawning habitats (Bailey et al. 2008). Eggs were mainly found from 200–1000 m (n = 10,776 tows) on the outer continental shelf and slope in accordance with spawning events (Abookire and Bailey 2008), but rose to epipelagic waters shortly thereafter (Bailey et al. 2008). Mean depth of developing eggs and larvae was about 25 m, suggesting a comparative lack of directed, onshore movement with ontogeny (Bailey et al. 2008). In accordance, all size categories of larvae (n = 10,776 tows) were distributed evenly across the shelf and into oceanic waters and data implied facultative settling of juvenile habitats (n = 13,347 combined tows) (Abookire and Bailey 2008; Bailey et al. 2008). Small juveniles were found in bays and to a lesser extent scattered over the continental shelf, possibly indicating higher post–settlement mortality in offshore regions (Bailey et al. 2008). Juveniles recruited to much shallower depths than those reported along the West Coast (Bailey et al. 2008).

Dover Sole is a rather well–studied species throughout its range, in accordance with its high relative abundance, broad distribution, and commercial importance. New information concerning Dover Sole spatial associations are consistent with and expand upon prior knowledge (McCain et al. 2005). Considerable advancements have been made in the determination of ontogenetic movements, especially as they relate to reproduction and early life history (Abookire and Bailey 2008; Bailey et al. 2008; Toole et al. 2011). New information concerning the impact of hypoxic conditions (Keller et al. 2010) and trawling disturbance (Hixon and Tissot 2007) on distribution and abundance patterns of Dover Sole represents a major advancement in understanding the habitat requirements and physiological limitations of this species.

<u>Trophic Interactions:</u>
Two studies have been recently published that describe the diet composition of Dover Sole. One of these studies provides historical information collected in Hecate Strait, British Columbia during June and September–October 1985, January 1986, and May–June 1987 (Pearsall and Fargo 2007). Trawl surveys were conducted during daylight hours in four distinct regions at depths of 18–166 m on bottom types ranging from sandy silt to a mixture of coarse sand, gravel, pebbles, and cobbles. The great majority of stomach samples (n = 305) contained prey items (98.4%). Juvenile and adults were distinguished but sample size of each group and sex were not reported. Based on pooled results using %W, Dover Sole in Hecate Strait fed mainly only benthic invertebrates, with polychaetes (54.3%) dominating diet composition. Echinoderms (18.4%), and cnidarians (11.9%) were of distant secondary importance, and

crabs (5.1%) were the only other prey taxon that contibuted more than 5% to diet composition. Fishes were not typically consumed by the study population(%W < 0.01%). Temporal and spatial results of this study were confounded by small and/or uneven sample sizes and cannot be uncoupled for comparisons. However, meiobenthos and secondarily macrobenthos constituted > 97% of the diet composition for each region and time period. Diet composition of juveniles and adults was extremely similar and samples were pooled for interspecific comparisons and to estimate trophic level (between 3.2–3.3). Dover Sole diet composition was most similar to that of adult (0.969) and juvenile (0.930). English Sole, and adult Rock Sole (0.878).

Diet composition of a small number of Dover Sole (n = 35) was estimated in the central and western Gulf of Alaska from trawl–derived samples collected during 1999 and 2001 (Yang et al. 2006). Most stomach samples (91.4%) contained prey items. Among individuals with full stomachs, the average fork length (FL) was 44.4 $\pm$ 1.7 cm (range = 34–60 cm FL), sizes that correspond to late juveniles and adults (Yang et al. 2006). Among the sampled population, polychaetes were the most abundant prey taxon, constituting 49% of prey items by weight and 27% by frequency of occurrence. Brittle stars were of secondary importance (%W = 24, %FO = 25) and echiuran worms (%W = 5, %FO 22), gammarid amphipods (%W < 1, %FO = 22), and cumaceans (%W = < 1, %FO = 17) were frequently encountered but contributed modestly to total prey weight (Yang et al. 2006).

Pinnipeds and Pacific Halibut were documented as predators of Dover Sole in recent publications. Dover Sole contributed trivially to the diet compositions of Pacific Halibut (%W = 0.01, n = 152); Pearsall et al. 2007) and Steller Sea Lions (%FO = 0.2, %N < 0.1, n = 2760; McKenzie and Wynne 2008) in Hecate Strait and off Kodiak Island, respectively. Cumulative prey curves indicated that an adequate number of samples was collected for precise dietary estimates of the Steller Sea Lion study population. Dover Sole also was reported in the diet composition of Pacific Harbor Seals (%FO = 8.8) sampled in Alesa Estuary, Oregon during 1996–2002 (n = 3370) (Riemer and Mikus 2006). Juvenile Dover Sole (%FO = 70.6%, n = 339) were mainly consumed by Pacific Harbor Seals based on aged otoliths recovered from scat samples. The greatest overall contribution of Dover Sole to diet composition of Pacific Harbor Seals and the broadest observed age range occurred during summer months, coinciding with adult migrations to estuaries for spawning (Riemer and Mikus 2006).

Recent published information concerning Dover Sole trophic interactions was generally consistent and supported prior findings. Polychaetes, bivalves, brittlestars, and small benthic crustaceans have been previously reported as the main diet items of juvenile and adult Dover Sole (McCain et al. 2005). These were also the main prey taxa reported in recent publication, although bivalves were of only minor dietary importance (Yang et al. 2006; Pearsall and Fargo 2007). Fishes were extremely rare or absent in the diet of Dover Sole by all accounts. McCain et al. (2005) reported that flatfishes, including English Sole, were among the main competitors of Dover Sole. This conclusion was supported by the results of Pearsall et al. (2007). Marine mammals, but not Pacific Halibut, were previously reported as predators of Dover Sole (McCain et al. 2005).

ENGLISH SOLE (*PAROPHRYS VETULUS*)

Spatial Associations:

Fishery independent surveys provided new information on distribution and abundance patterns of juvenile and adult English Sole along the US West Coast. NMFS–NWFSC conducted surveys from the US/Canadian border to south of Point Conception, CA between May and October of 2000–2002 (#tows: n_{2000} = 325, n_{2001} = 334, n_{2002} = 427), 2004 (n = 505), and 2005 (n = 675) (Keller et al. 2005, 2006a, 2006b, 2007, 2008). The depth range of tows was expanded to include a shallower portion of the continental shelf during the 2004 and 2005 surveys (55–1280 m; 2000–2002: 183–1280 m) and more southern coverage (from 34.5° to 32.5° N). More recent surveys and presumably older surveys captured size ranges indicative of large juvenile (> 15 cm TL) and adult life stages (Keller et al. 2007, 2008). English Sole was caught at depths of 188–382 m during 2000–2002 with a mean capture depth of 257–271 m. A shallower depth range (52–404 m), mean depth of capture (123 m), and higher frequency of occurrence (2000–2002: 11.4–21.5%; 2004–2005: 46.9–47.0%) during 2004 and 2005 surveys can be attributed to differences in survey design. English Sole did not register among the top twenty most abundant groundfish by biomass during 2000–2002 (Keller et al. 2005, 2006a, 2006b), but ranked 6th during 2004 (Keller et al. 2007) and 16th during 2005 at depths of 55–183 m (Keller et al. 2008). The bulk of English Sole biomass along the West Coast was distributed between 36–43° N (Keller et al. 2007, 2008), with a median latitude of 39° N (Tolimieri and Levin 2006). In a directed study using NMFS trawl survey data derived from 1999–2002 between 33–47° N (n = 1159 tows), English Sole was the 24th most abundant fish species by biomass and was captured at depths of 200–500 m (median depth = 300 m) (Tolimieri and Levin 2006).

English Sole was abundant in fishery–independent surveys conducted in continental shelf waters off Hecate Strait, British Columbia, ranking third and second among groundfish by biomass during June 2002 (n = 96 tows) and May–June 2003 (n = 94 tows) (Choromanski et al. 2004; 2005). The catch was composed of a wide size range of juveniles and adults (male: 11–48 cm TL, n = 6564; female: 11–53 cm TL, n = 8730) (Choromanski et al. 2004; 2005). During 2003, most individuals were caught between 54–72 m in a region of sandy silt with strong currents (depth range of tows = 18–146 m) (Choromanski et al. 2005). In continental shelf trawl surveys (18–166 m) conducted sporadically during 1985–1987, English Sole occupied similar depths during May (mean = 90 m) and December (mean = 113 m), and was most abundant on fine to coarse sand habitats (Pearall and Fargo 2007). In contrast to its high relative abundance in Hecate Strait, juvenile and adult English Sole (12.5–61.3 cm TL, n = 1334 measures) ranked only 16th among groundfishes surveyed between 50–500 m off the west coast of Vancouver Island (n = 165 tows) (Workman et al. 2008).

A considerable amount of contemporary research has been devoted to the role of estuaries in the life history of English Sole. English Sole are believed to be carried to estauries during periods of downwelling (Parnel et al. 2008). Brown (2006a) demonstrated that juveniles collected in estuaries could be distinguish from those collected in nearby coastal regions off central California using multi–elemental analysis of otoliths. Specifically, Sr was considerably higher and Li was substantially lower in estuarine fish. These differences remained consistent over a large geographic region and among three very different oceanic years (1998–2000) (Brown 2006a). A companion study estimated that 45–57% of the adult English Sole population off central California used estuaries as juvenile nursery habitat (Brown 2006b). A similar conclusion was drawn from a study conducted in Oregon and Washington estuaries during 1985–1988 and June–August 1998–2000 (n = 800 tows) (Rooper et al. 2004). Rooper et al. (2004) suggested that the English Sole population on the Oregon–Washington shelf could potentially be supported soley by estuarine production, with production stabilized by the size of available nursery areas. Within estuaries, densities of age–0 individuals were much higher and more spatially variable shortly after settlement in June than in August (Rooper et al. 2004). Spatial variability in estuary use also was reported by Chittaro et al. (2009) between June 2006 (n = 130 fish) and August 2005 (n = 99 fish) using otolith microchemistry. However, observed spatial variability could not be explained by the density of recently settled fish, the available area of nearshore habitat, or measured environmental variables (e.g., temperature, salinity, dissolved oxygen) (Chittaro et al. 2009). Based on trawl surveys (n = 431) conducted in Oregon and Washington estuaries during June and August 1998–2000, English Sole density anomalies were significantly higher at lower side channel sites (especially during June) than at other estuarine locations. Juvenile English Sole are thought to compete for space in estuaries with Pacific Sanddab, which are not as tolerant of the relatively warm water (13–17.5° C) found in side channels (Rooper et al. 2006). Despite the conspicuous feeding behavior of English Sole, low predator densities and high turbidity allow juveniles to thrive in shallow, estuarine regions (Boersma et al. 2008). Substrate type may not be an important determinant of English Sole distribution in estuaries, as a recent study conducted in Willapa Bay, WA found no statistical differences in abundance for individuals of unspecified maturity (n = 2128) among eelgrass, oyster beds, and mudflats (Hosack et al. 2007).

English Sole show enhanced tolerance to low oxygen conditions. In a recent study, conducted off the Oregon coast at depths of 50 m and 70 m (n = 17 tows), no significant effects of hypoxia were noted (Keller et al. 2010). Condition factors for English Sole was lower in low oxygen waters, but biomass was not affected (Keller et al. 2010).

Recent scientific studies have greatly expanded the available information on English Sole distribution patterns and habitat associations, especially regarding the use of estuaries and their influence on population dynamics. Some integrated studies (e.g., Tolimieri and Levin 2006; Keller et al. 2010) also have used survey data and knowledge gained from prior studies to better understand English Sole spatial associations in offshore waters. Newly acquired information, when comparable, is generally consistent with that reported by McCain et al. (2005).

Trophic Interactions:
New information concerning English Sole trophic interactions is limited to a single study, conducted in Hecate Strait, British Columbia during June and September–October 1985, January 1986, and May–June 1987 (Pearsall and Fargo 2007). Samples were collected from trawl surveys fished in four distinct regions at depths of 18–166 m on bottom types ranging from sandy silt to a mixture of coarse sand, gravel, pebbles, and cobbles. The great majority of English Sole stomach samples (n = 433) contained prey items (97.0%). Juvenile and adults were distinguished but sample size of each group and sex were not provided. Based on pooled results using %W, English Sole in Hecate Strait fed mainly on benthic invertebrates, with polychaetes (58.7%) dominating diet composition. Bivalves (10.2%), Pacific Sand Lance (8.2%), echiurans (7.1%), and echinoderms (6.2%) were of distant secondary importance, and no other prey taxon contibuted more than 5% to diet composition. Although they were a relatively minor prey item when the overall diet was considered, Pacific Sand Lance dominated diet (84.1%) of a small number of English Sole (n = 11) collected during September–October 1985 on silty sand with high current activity. Temporal and spatial results of this study are confounded by small and/or uneven sample sizes and cannot be uncoupled for most comparisons. However, diet composition of English Sole collected during September–October 1985 (n = 62) and January 1986 (n = 125) was similar, and consisted mainly of polychaetes and other meiobethos. Juveniles and adults overlapped substantially in diet composition (0.989) and had similar estimated trophic levels (between 3.2–3.4). Diets of adult and juvenile English Sole also overlapped considerably with Dover Sole (0.969 and 0.930, respectively) and adult Rock Sole (0.873 and 0.886, respectively). The following predators of English Sole were indentified: Lingcod (8.5%, n = 25), Rock Sole (0.6%, n = 350), and Spiny Dogfish (0.2%, n = 799).

Recently published information concerning English Sole diet composition generally supports previous findings. Polychaetes have been consistently reported as the primary prey taxon for large juveniles and adults, with the remainder of the diet consisting mainly of other benthic invertebrates (McCain et al. 2005; Pearsall and Fargo 2007). Amphipods and cumaceans were found to be common prey items in the diet of adult English Sole off Oregon (McCain et al. 2005), but contributed little to the diet of juvenile and adult English Sole collected in Hecate Strait (Pearsall and Fargo 2007). Fishes were not indicated as prey items by McCain et al. (2005) but Pacific Sand Lance were episodically ingested in large quantitites by some English Sole in Hecate Strait (Pearsall and Fargo 2007).

PETRALE SOLE (*EOPSETTA JORDANI*)

Spatial Associatons:
New spatial information on Petrale Sole is somewhat limited and mainly derived from fishery independent surveys. NMFS–NWFSC conducted a survey along the US West Coast between May and

October of 2000–2002, 2004, and 2005 (Keller et al. 2005, 2006a, 2006b, 2007, 2008). The 2004 and 2005 surveys (and presumably earlier surveys) captured a size range indicative of large juvenile (> 20 cm TL) and adult life stages (Keller et al. 2007, 2008). Petrale Sole was infrequently captured during 2000–2002, occurring in 3.6–7.3% of tows conducted during 2000 (n = 325 tows), 2001 (n = 334 tows), and 2002 (n = 427 hauls) at depths of 175–581 m (Keller et al. 2005, 2006a, 2006b). Shallower tows were fished (from 55 m) during 2004 (n = 505) and 2005 (n = 675), however, and the depth profile shifted (52–434 m) to reveal a greater reliance on shelf waters (mean depth of capture ~125 m) (Keller et al. 2007; 2008). Based on a directed study using 2004 NMFS–NWFSC survey data (n = 252 tows) and ocenographic data, Petrale Sole was found to be most abundant at productive, northern latitudes (median latitude 45.7° N) (Juan–Jorda et al. 2009). It was not, however, especially abundant in nearshore waters of Britisth Columbia, ranking 15th in biomass among groundfish surveyed in Hecate Strait during June 2002 (18–146 m; n = 94 tows) and 26th off Western Vancouver Isalnd during May–June 2006 (50–500 m; n = 165) (Choromanski et al. 2004; Workman et al. 2008). Petrale Sole exhibited a much wider and deeper distribution during winter months in Hecate Strait (mean = 302 m) when compared to summer moths (n = 108 m) (Pearsall and Fargo 2007). This species is negatively affected by hypoxic conditions, and abundance and physical condition declined significantly at oxygen concentrations < 1.0 ml/l (Keller et al. 2010).

Other than the results of Keller et al. (2010) concerning the effects of hypoxia, the new spatial information provided for Petrale Sole adds little to general body of knowledge regarding this species (McCain et al. 2005). It does, however, provide area–specific information on distribution and abundance patterns that is useful for monitoring purposes.

Trophic Interactions:

Recently published information concerning Petrale Sole trophic interactions is limited to a single study, conducted in Hecate Strait, British Columbia during June and September–October 1985, January 1986, and May–June 1987 (Pearsall and Fargo 2007). Samples were collected from trawl surveys fished in four distinct regions at depths of 18–166 m on bottom types ranging from sandy silt to a mixture of coarse sand, gravel, pebbles, and cobbles. The great majority of Petrale Sole stomach samples (n = 106) contained prey items (98.1%). Most samples were obtained during September–October 1985 (n = 55) and January 1986 (n = 45). No size or sex information was provided, but fishes represented a mixture of juveniles and adults. Based on pooled results using %W, Petrale Sole in Hecate Strait were largely piscivorous, with fishes accounting for 72.9% of diet composition. The primary prey taxon was Pacific Herring (47.2%). Unidentified fishes (21.1%) and mysids (19.4%) were of secondary dietary importance, and no other prey taxon contributed substantially to diet composition. Diet composition differed markedly between fish collected on fine to coarse sand in January 1986, and those collected on coarse sand, gravel, pebbles, and cobbles during September–October 1985. During the former collection, diet composition was largely composed of Pacific Herring (70.7%), whereas mysids and other epibenthic organisms (58.6%) were dominant during the latter collection. The relative weight of stomach contents also was greater during the former collection. Unfortunately, temporal and spatial results of this study cannot be uncoupled.

The prey taxa consumed by Petrale Sole in Hecate Strait were generally similar to those reported by McCain et al. (2005) from a synthesis of several studies. However, whereas McCain et al. (2005) indicated a greater reliance on shrimp and decapods, fishes and mysids were the most important prey items in Hecate Strait (Pearsall and Fargo 2007). In addition, cannibalism was not noted by Pearsall and Fargo (2007) but was indicated to be a substantial source of mortality for juvenile Petrale Sole by McCain et al. (2005). Yellowtail Rockfish was reported to be a predator of Petrale Sole in Hecate Strait, although the dietary contribution was trivial (0.25%). This interaction is noteworthy since it was not previously demonstrated (McCain et al. 2005).

Flatfishes: Relevant Literature

Abookire and Bailey 2007; Aydin and Mueter 2007; Bailey et al. 2008; Blood et al. 2007; Boersma et al. 2008; Bredeson et al. 2006; Brown 2006a, 2006b; Chittaro et al. 2009; Choromanski et al. 2004, 2005; Cloern et al. 2007; Csepp et al. 2011; Fargo and Westrheim 2007; Gaichas and Francis 2008; Gaichas et al. 2010; Hart et al. 2010; Hixon and Tissot 2007; Hoff and Britt 2005, 2009, 2011; Hosack et al. 2006; Hulbert et al. 2005; Iverson et al. 2007; Juan–Jorda et al. 2009; Keller et al. 2005, 2006a, 2006b, 2007, 2008, 2010; Knoth and Foy 2008; Lee et al. 2010; Logerwell et al. 2005; Love and York 2005; Love et al. 2009; McConnaughey and Syrjala 2009; McKenzie and Wynne 2008; Orlov 2004; Orr et al. 2004; Palsson et al. 2008; Parnel et al. 2008; Pearsall and Fargo 2007; Phillips et al. 2009; Riemer and Mikus 2006; Rooper 2008; Rooper and Wilkins 2008; Rooper et al. 2004, 2006; Speckman et al. 2005; Stewart 2007; Thedinga et al. 2008; Tissot et al. 2007; Tolimieri 2007; Tolimieri and Levin 2006; Toole et al. 2011; Trites et al. 2007; Vigilant and Silver 2007; Vollenweider et al. 2006; Von Szalay et al. 2008, 2010, 2011; Womble and Sigler 2006; Workman et al. 2008; Yamanaka et al. 2004, 2008; Yang 2004, 2007; Yang et al. 2005, 2006; Zador et al. 2011; Zenger 2004

Appendix G-2: Other Flatfish Group Summary Information

New literature on spatial associations and trophic interactions of the Other Flatfishes group consisted of 66 publications, with several publications providing information for multiple species. Most Other Flatfishes were well studied, with rex sole (41 publications), flathead sole (38 publications), and rock sole (31 publications) foremost among them. Curlfin sole (10 studies) and sand sole (12 publications) were referenced least among the accumulated literature, with most relevant information contained in survey reports. Data on Pacific and speckled sanddabs and southern and northern rock sole were occasionally pooled because of uncertain identification (e.g., Love and York 2005; McKenzie and Wynne 2008) or for convenience during multi–species analyses (e.g., Hoff 2006; Gaichas and Francis 2008). To avoid confusion, the current designation of "rock sole" should be changed to the proper common name of "southern rock sole" in accordance with American Fisheries Society guidelines. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the U.S. West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). In addition, many directed studies provided information on a wide variety of topics related to EFH (e.g., habitat associations, physiological tolerances, trophic relationships), at various levels of detail. Much more new spatial information was available when compared to trophic information, and no new diet composition information was produced along the West Coast.

Contemporary spatial information about other flatfishes was substantial and diverse. Fishery-independent surveys provided information on distribution and abundance patterns of juveniles and adults, but additional information on eggs and larvae was also available. In the Gulf of Alaska, integrated data sets were used to determine spawning locations and distribution patterns of eggs and larvae of rex sole (Abookire and Bailey 2008; Bailey et al. 2008) and flathead sole (Porter et al. 2005). In the northern California Current, Pacific sanddab was among the most abundant ichthyoplankton species surveyed, and rex sole was also commonly observed (Phillips et al. 2009). Habitat associations were determined for several species of Other Flatfishes. Pacific sanddabs were found predominantly in muddy, benthic habitats off central California (Anderson and Yoklavich 2007) but were also commonly encountered in pelagic sampling off Oregon and Washington (Brodeur et al. 2009), and in association with heavily encrusted oil platform beams off Southern California (Love and York 2006). Starry flounder exhibited no preference among mud, oyster, and eelgrass habitats in Willapa Bay, Washington (Hosack et al. 2006) and preferred sand to cobble, and cobble to bedrock (Thedinga et al. 2008); however, sample sizes were low for both studies. Patterns of estuary nursery use and evidence for habitat partitioning was provided for sand sole, starry flounder, and Pacific sanddab in the Pacific Northwest (Rooper et al. 2005). Early juvenile starry flounder typically occupy upper regions of estuaries, and this distribution pattern is facilitated by the development of a strong low-salinity tolerance during early ontogeny (Wada et al. 2007).

Contemporary information on trophic interactions was available for all members of the Other Flatfishes group but the great majority of this information was derived from Canadian and Alaskan waters. For example, diet composition studies were limited to those conducted off British Columbia (Pearsall et al. 2007) and in Alaskan waters (Yang 2004; Yang et al. 2004, 2005). In Hecate Strait, British Columbia, diet composition, seasonal and spatial dietary variability, and dietary overlap were evaluated for flathead sole, Pacific sanddab, rex sole, rock sole, and sand sole (Pearsall et al. 2007). In the Gulf of Alaska, diet composition was determined for flathead sole, rex sole, and rock sole (Yang et al. 2006) based on small sample sizes, and flathead sole and rock sole were lumped in an "other flatfish" group to investigate predation on capelin (Yang et al. 2005). Stellar sea lions were found to prey on several species of Other Flatfishes off Kodiak Island, but only rock sole (combined) contributed more than a trivial proportion to diet by percent frequency of occurrence (Trites et al. 2007; McKenzie and Wynne 2008). Similarly, harbor seals in the Umpqua River (Oregon) frequently consumed rex sole, and ate butter sole, Pacific sanddab, and starry flounder less commonly. In California waters, Pacific sanddab was a minor prey item of California sea lions (Weise and Harvey 2008; Orr et al. 2011). A large number of predator (n = 4) and prey (n = 44) linkages were determined for flathead sole based on benthic food web modeling in the Gulf of Alaska, and rex sole (1 predator link, 13 prey links) was also an importance source of energy flow in this region. The longnose skate was found to be a major predator of small flatfishes in the Gulf of Alaska, including flathead sole, rex sole, and rock sole (Gaichas et al. 2010).

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Other Flatfish: Relevant Literature

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Appendix G-3: Rockfishes Group Summary Information

From 2004–2011, 90 publications that contain information on spatial associations and/or trophic interactions were located for the Rockfishes group. Most publications reported information for multiple species and species were occasionally combined for convenience or because identification was uncertain (e.g., Lauth et al. 2004; Wilson et al. 2008; Marilave and Challenger 2009). Shortspine thornyhead (34 publications) and Pacific ocean perch (30 publications) were the most studied Rockfishes, whereas blackgill (6 publication) and chilipepper (8 publications) were the least studied. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the US West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). However, the great majority of this information was derived from trawl surveys, which are limited in their capability to sample rocky substrates and therefore under–represent the distribution and abundance patterns of most rockfishes (PFMC 2008). Results of these surveys should therefore be interpreted cautiously for the Rockfishes group. In addition, many directed studies focused on specific aspects of resource utilization (i.e., spatial associations, trophic relationships) and provided detailed information that was relevant for the description of EFH. Only 15 of the 89 contemporary publications contained trophic information, and there is a dearth of recent diet composition information for Rockfishes throughout the eastern North Pacific.

A substantial amount of new information is available concerning spatial associations of species in the Rockfishes group. Several studies used manned submersibles or, to a lesser extent, ROVs to determine habitat associations of Rockfishes (and Other Rockfishes) along the US West Coast, including southern California (e.g., Love and York 2005; Love et al. 2009), central California (e.g., Anderson and Yoklavich 2007; Laidig et al. 2009), and Oregon (Tissot et al. 2007; Hart et al. 2010). Habitat associations were typically determined for individual species and often combined to investigate co–occurrence or to create habitat guilds. In southern California, several publications determined that oil platforms serve an important function as artificial reefs for a variety of rockfishes, including bocaccio and cowcod (e.g., Love and York, 2006; Love et al. 2006). A submersible study on Coquille Bank, Oregon compared species assemblages on trawled and untrawled seafloor and found similar densities of splitnose rockfish in each habitat (Hixon and Tissot 2007). A species–specific study determined the following information for juvenile cowcod in southern California: 1) the observed depth range was 32–330 m; 2) small juveniles (5–20" TL) were associated with cobbles and cobbles/small boulders, with larger juveniles occupying higher relief rocky habitats, and 3) small juveniles were found with pygmy and swordspine rockfishes, whereas larger juveniles were associated with juvenile bocaccio and widow rockfish (Love and Yoklavich 2008). Several studies provided information on spatial associations during larval stages, especially in the California Current region (e.g., Field and Ralston 2005; Sakuma et al. 2006; Phillips et al. 2009). Field and Ralston (2005) found that 51–72% of year–to–year variability in recruitment was shared coastwide among chilipepper, widow, and yellowtail rockfishes, with a lesser fraction associated with fine scale geographic features. Off Oregon and Washington, Miller and Shanks (2004) determined that black rockfish exhibited limited larval dispersal (< 120 km). A study of black rockfish populations along the US West Coast, however, found only weak genetic differentiation among regions (Sivasundar and Palumbi 2010). By contrast, yellowtail rockfish exhibited a strong genetic break between Monterey and Oregon (Sivasundar and Palumbi 2010). Young-of-the year (YOY) Black rockfish were observed in the rocky intertidal of central California from May to August with peak abundance in May or June and interannual variability in number of recruits (Studebaker and Mulligan 2008). Telemetry studies were conducted for black (Parker et al. 2007; Green and Starr 2011; Hannah and Rankin 2011), bocaccio (Lowe et al. 2009), canary (Hannah and Rankin 2011), widow (Lowe et al. 2009), and yelloweye (Hannah and Rankin 2011) rockfish with all of these studies conducted along the US West Coast. Black rockfish exhibited medium to high site fidelity, but large vertical movements were observed (Hannah and Rankin 2011) and some individuals traveled more than 50 km from the capture site (Green and Starr 2011). Yelloweye (Hannah and Rankin 2011) and widow (Lowe et al. 2009) rockfish exhibited high site fidelity, whereas canary rockfish (Hannah and Rankin 2011) and bocaccio (Lowe et al. 2009) exhibited low site fidelity.

New information on trophic interactions was available for most members of the Rockfishes group and, although limited, covered a wide range of topics. In the Aleutian Islands, diet composition of juvenile Pacific ocean perch consisted mainly of a mixture of large copepods and euphausiids, but size–based, temporal, and spatial differences were observed (Boldt and Rooper 2009). Euphausiids were the primary prey items of larger juvenile Pacific ocean perch in the Aleutian Islands (Boldt and Rooper 2009), as well as large juveniles and adults in the Gulf of Alaska (Yang et al. 2006) and Hecate Strait, British Columbia (Pearsall and Fargo 2007). Canary and widow rockfish off Oregon exhibited high temporal dietary variability coinciding with environmental changes due to ENSO conditions (Lee and Sampson 2009). By contrast, canary rockfish in this region had a very consistent diet composed almost exclusively of euphausiids (Lee and Sampson 2009). Diet composition of juvenile canary (euphausiids, copepods), darkblotched (gelatinous zooplankton, crustaceans), widow (gelatinous zooplankton), and yellowtail (copepods) rockfish was investigated throughout the US West Coast (Miller and Brodeur 2007). In Carmel Bay, Johnson (2006) determined that juvenile bocaccio can alter patterns of density dependence in kelp, gopher, black and yellow rockfish. Several predators of species in the Rockfishes group were identified. Shortbelly rockfish were of minor importance in the diet of jumbo (or Humboldt) squid in the California Current (Field et al. 2007), and juvenile canary, darkblotched, and widow rockfish were minor prey items of Pacific hake in the same region (Harvey et al. 2008). However, at higher consumption rates, Pacific hake could considerably prolong rebuilding times of canary rockfish (Harvey et al. 2008). Shortbelly and splitnose rockfish were minor components of longnose skate diet off central California (Robinson et al. 2007), and thornyheads (combined) were eaten in trivial quantities by Stellar sea lions off Kodiak Island, Alaska (McKenzie and Wynne 2008).

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Rockfishes: Relevant Literature
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Appendix G-4: Other Rockfishes Group Summary Information

New literature on spatial associations and trophic interactions of the Other Rockfishes group consists of 85 publications, with several publications providing information for multiple species. Species were sometimes combined for convenience or because identification was uncertain (e.g., Beaudreau and Essington 2007; Wilson et al. 2008; Frid and Marliave 2010). The most studied Other Rockfishes were rougheye (26 publications), copper (25 publications), greenstriped (25 publications), and redbanded (25 publications). Many species received sparse scientific attention, and no information was available for bronzespotted, California scorpionfish, chameleon, and semaphore rockfishes. Data summaries from fishery–independent surveys provided a great deal of general information on distribution and abundance patterns along the US West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g. Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). In addition, many directed studies were published and provided information on a wide variety of topics related to EFH (e.g., habitat associations, genetics/distribution, movement patterns). Although a substantial amount new spatial information was available, trophic information was comparatively sparse, a situation that reflects the relative amount of scientific attention as well as the substantial contribution of newly published fishery–independent survey data. Nine new species were added to the Other Rockfishes group since the last EFH review was conducted (chameleon, dwarf–red, freckled, halfbanded, pinkrose, Puget Sound, pygmy, and semaphore, and swordspine rockfishes). Literature reviews for these species were performed from 2002–2011 and references published during 2002–2003 (Bernardi et al. 2009; Johnson et al. 2009) are listed below. For historic information on these species, refer to Love et al. (2002). In addition, the species name of the dusky rockfish is listed incorrectly as Sebastes ciliatus in the current list of FMP groundfish species. Sebastes ciliatus refers to the more northernly distributed dark rockfish, whereas the dusky rockfish (S. variabilis) ranges throughout most of the US West Coast (Orr and Blackburn 2004). The information and literature referenced here therefore refers to the dusky (S. variabilis), not dark (S. ciliatus), rockfish.

Contemporary spatial information is available to a highly variable degree for the many species contained in the Other Rockfishes group. Much of the information is derived from trawl surveys (e.g., Choromanski 2004; Hoff and Britt 2007; Keller et al. 2008), which are biased in their ability to accurately represent rockfish distribution and abundance patterns (PFMC, 2008) and typically do not report many additional findings that are useful for EFH determination. Depth distributions, however, are regularly reported in data summaries from surveys and present important baseline information about general occurrence patterns. These data have been used in detailed, assemblage-level analyses of groundfishes, including Other Rockfishes, throughout the US West Coast (Tolimieri and Levin 2006; Tolimieri 2007). Considerable, detailed habitat association information is available for some species, as many Other Rockfishes have been incorporated into assemblage-level studies along the West Coast (e.g., Tissot et al. 2007; Marliave and Challenger 2009; Du Preez and Tunnicliffe 2011) and especially off California (e.g., Anderson and Yoklavich 2007; Love and Schroeder 2007; Laidig et al. 2009). Anderson and Yoklavich (2007) reported habitat associations at three different scales for a groundfish assemblage that included several Other Rockfishes (e.g., greenstriped, rosy, squarespot) on the outer continental slope and upper continental shelf of central California. Laidig et al. (2009) determined that several Other Rockfishes (pygmy, rosy, squarepot, starry, vermillion) were strongly associated with boulder habitat off central California. Both of these studies grouped co-occurring species into habitat guilds. Love and York investigated the importance of oil pipelines (2005) and platforms (2006) off southern California and determined that some species (e.g., copper, greenbltoched, halfbanded, stripetail, vermillion) were found in higher locally densities in association with these structures. Off the coast of British Columbia, Marliave et al. (2009) determined that subadult and adult greenstriped and redstriped rockfishes were associated with bioherms, whereas juvenile quillback rockfish were associated with sponge gardens. On Coquille Bank, Oregon, greenstriped and sharpchin rockfish were only found on untrawled seafloor, whereas halfbanded rockfish were only found on trawled grounds (Hixon and Tissot 2007). Based on a laboratory study, Lee and Berejikian (2009) determined that juvenile china rockfish exhibited site fidelity and territoriality with size-based dominance centered on competition for structurally complex habitats. Watson et al. (2010) found a strong correspondence between realized and potential distribution patterns of larval kelp rockfish, suggesting that circulation patterns dictate spatial distribution of this species. In population genetic studies conducted primarily along the US West Coast, Buonaccorsi et al. determined that grass (2004) and brown (2005) rockfish only moved about 10 km per generation, suggesting limited larval dispersal. Movement patterns of several Other Rockfishes were studied, primarily along the US West Coast (e.g., Jorgensen et al. 2006; Lowe et al. 2009; Tolimieri et al. 2009). Off Oregon, Hannah and Rankin (2011) found high site fidelity and limited vertical movements (2-3 m) for china, quillback, tiger and vermillion rockfishes. Lowe et al. (2009) determined that some rockfishes exhibited high site fidelity to oil platforms (e.g., flag, treefish) whereas others did not (e.g, blue, Mexican, vermillion).

Contemporary information on trophic interactions was extremely limited and only available for a small proportion of the species in the Other Rockfishes group. Yang et al. (2006) provided diet composition results for 5 Other Rockfishes in the Gulf of Alaska, but sample sizes were quite low for most species (< 6 for dusky, redbanded, sharpchin, and shortraker). Based on a larger sample size (n = 25), rougheye rockfish in the Gulf of Alaska had a very diverse diet, with pandalid shrimps and euphausiids contributing most by weight (Yang et al. 2006). Diets of greenstriped (euphausiids), redbanded (shrimp, crabs, bivalves, anomurans) and silvergray rockfish (fish, euphausiids) were estimated in Hecate Strait, British Columbia (Pearsall and Fargo 2007). Diet compositions of these species exhibited little spatial variation, but silvergray exhibited temporal differences in diet and variation with size (greater proportion of fishes in larger specimens). Studebaker and Mulligan (2008) found a high degree of interannual dietary variation in juvenile blue rockfish sampled in the rocky intertidal off northern California, especially with regard to the relative proportion of gammarid amphipods, their dominant prey type. In eelgrass beds of the same region, Studebaker and Mulligan (2009) determined that the diet of YOY copper rockfish consisted largely of harpactacoid copepods, gammarid amphipods, and caprellid amphipods. The effects of predation on Other Rockfishes was the subject of some contemporary studies. One such study determined that juvenile bocaccio can alter patterns of density dependence in kelp, gopher, black and yellow rockfish in Carmel Bay, California (Johnson 2006). Frid and Marliave (2010) reported that lingcod had an indirect positive effect on pandalid shrimps by eating pygmy, copper, and quillback rockfish (which probably mediate competition between pandalid shrimps). Beaudreau and Essington (2007) determined that pygmy, copper, and quillback rockfish (mainly 4-24 cm, standard length) collectively totaled 11% of lingcod diet by weight in the San Juan Archipelago, Washington. However, consumption was 5-10 times greater in marine reserves, which apparently served as predator sinks (Beaudreau and Essington 2009). In Monterey Bay, California, stripetail rockfish were a minor prey item (1.3% of diet by weight) longnose skate diet (Robinson et al. 2007). In addition, trophic linkages, ranging from 3 in harlequin rockfish to 42 in rougheye rockfish, were determined and incorporated into a food web model for the Gulf of Alaska (Gaichas and Francis 2008).

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Other Rockfishes: Relevant Literature

Anderson and Yoklavich 2007; Beaudreau and Essington 2007, 2009, 2011; Bowles et al. 2011; Buonaccorsi et al. 2004, 2005; Burford 2009, Burford et al. 2011; Caselle et al. 2010; Choromanski et al. 2004, 2005; Clarke et al. 2009; Coates et al. 2007; Csepp et al. 2011; Du Preez and Tunnicliffe 2011; Frid and Marliave 2010; Gaichas and Francis 2008; Gharrett et al. 2007; Gray et al. 2006; Hannah and Rankin 2011; Hart et al. 2010; Hayden–Spear and Gunderson 2007; Hixon and Tissot 2007; Hoff and Britt 2005, 2009, 2011; Hyde et al. 2008; Johansson et al. 2008; Johnson 2006, 2007; Jorgensen et al. 2006; Juan–Jorda et al. 2009; Keller et al. 2005, 2006a, 2006b, 2007, 2008; Laidig et al. 2007, 2009; Lee and Berejikian 2009; Lochead and Yamanaka 2006; Logerwell et al. 2005; Love and Schroeder 2007; Love and Yoklavich 2008; Love and York 2005, 2006; Love et al. 2006, 2009; Marliave and Challenger 2009; Marliave et al. 2009; Martin and Yamanaka 2004; Miller and Brodeur 2007; Palsson et al. 2008; Pearsall and Fargo 2007; Reilly and Thompson 2007; Reum and Essington 2011; Reuter and Spencer 2007; Reynolds et al. 2010; Robinson et al. 2007; Rodríguez–Romero et al. 2008; Rooper 2008; Rooper and Wilkins 2008; Rooper et al. 2010; Sakuma et al. 2006; Sivasundar and Palumbi 2010; Standish et al. 2011; Studebaker and Mulligan 2008, 2009; Studebaker et al. 2009; Tissot et al. 2007; Tolimieri 2007; Tolimieri and Levin 2006; Tolimieri et al. 2009; Toole et al. 2011; Von Szalay et al. 2008, 2010, 2011; Watson et al. 2010; Wilson et al. 2008; Workman et al. 2008; Yamanaka et al. 2004, 2008; Yang et al. 2006; Zenger 2004.

Appendix G-5: Other Groundfishes Group Summary Information

The Other Groundfishes group contains 15 species that, unlike the other groups, are not monophyletic (i.e., derived from a single, common ancestral species). Therefore, for the purposes of this review, the following subcategories were established based on taxonomic relatedness: 1) chondrichthyan, or cartilaginous, fishes (big skate, California skate, leopard shark, longnose skate, spiny dogfish, spotted ratfish, tope), 2) gadiform fishes, or cods (Pacific cod, Pacific flatnose, Pacific grenadier, Pacific hake), and 3) scorpaeniform, or mail–cheeked, fishes (cabezon, kelp greenling, lingcod, sablefish). New literature on spatial associations and trophic interactions of Other Groundfishes consisted of 120 publications, with the designated subgroups receiving comparable scientific attention (Chondrichthyes, N = 58; Gadiformes, N = 64; Scorpaeniformes, N = 63). Among species, lingcod (N = 42), Pacific cod (N = 42), and Pacific hake (N = 34) were most studied, whereas few publications contained relevant information about cabezon (N = 2), tope (N = 5), or California skate (N = 5).Most of the available information, and certainly the most comprehensive, was obtained from directed studies. However, fishery–independent surveys provided general information on distribution and abundance patterns along the US West Coast (e.g., Keller et al. 2005, 2007, 2008) and throughout Canadian (e.g., Choromanski et al. 2004, 2005; Workman et al. 2008; Yamanaka et al. 2008) and Alaskan waters (e.g., Hoff and Britt 2005; Rooper 2008; von Szalay et al. 2010). The North Pacific spiny dogfish population was recently determined to be distinct from other global populations of spiny dogfish, Squalus acanthias, and renamed the spotted spiny dogfish, S. suckleyi (Ebert et al. 2010). This name change should be reflected in future documents. More new spatial information was available when compared to trophic information, a situation that reflects the relative amount of scientific attention as well as the substantial contribution of newly published fishery–independent survey data.

Spatial information concerning eastern North Pacific chondrichthyan fishes has increased substantially since the last EFH review. The longnose skate, spotted ratfish, and spotted spiny dogfish occur in considerable abundance throughout the West Coast and are among the most common groundfishes encountered in this region (Tolimieri and Levin 2006; Tolimieri 2007). These species are typically found on the outer continental shelf and upper continental slope, with spotted spiny dogfish occurring patchily throughout the water column in large schools (Taylor et al. 2009). The tope, whose regional population was negatively impacted by directed overfishing in the early/mid 20th century and incidental catch in nearshore gillnets until 1994, seems to be recovering in Southern California (Pondella and Allen 2008). Studies of the movement patterns of three chondrichthyan species were recently conducted. Female leopard sharks showed strong site fidelity within Elkhorn Slough and exhibited tidal movements that were probably related to foraging activity, and especially access to intertidal mudflats (Carlisle and Starr 2009, 2010). Leopard sharks also occupied relatively warm regions of southern California embayments during daylight hours, possibly to improve digestion and reproductive development (Hight and Lowe 2007). A large–scale tagging effort was conducted in British Columbia on big skate (King and McFarlane 2010) and spiny dogfish (McFarlane and King 2009). Although 75% of recaptures occurred within 21 km of the initial capture site, a small proportion of big skates (mainly females) traveled considerable distances (to 2340 km) (King and McFarlane 2010). Spiny dogfish tagged in the Strait of Georgia were largely recaptured within the same region, but a complex movement pattern and considerable exchange with North Puget Sound were evident (McFarlane and King 2009). The big skate and spotted spiny dogfish exhibited significant decreases in abundance with decreasing dissolved oxygen levels (Keller et al. 2010). Love et al. (2008) discovered a nursery area for the longnose skate between 125–151 m and 9.1–10.1° C on a high–relief rocky ridge off southern California.

Trophic studies were additionally conducted for a number of chondrichthyan species. A directed diet study in the Monterey Bay region showed that big and California skates ate similar portions of crabs, fishes, and shrimps when at similar sizes (< 60 cm TL), but that comparably sized longnose skates ate mainly shrimps and fishes, with cephalopods also taken supplementally (Bizzarro et al. 2007). By contrast, diets of large (> 60 cm TL) big and longnose skates differed substantially from those of small skates of all species, and contained a much greater proportion of fishes and marked reduction in the proportion of shrimps (Bizzarro et al. 2007). A detailed, directed study of longnose skate diet was also conducted off central California and indicated dietary variability with increasing depth (more cephalopods and euphausiids) and size (decreasing amounts of crustaceans, increasing amounts of fishes and cephalopods) (Robinson et al. 2007). Leopard sharks in Humboldt Bay ate primarily jack silverside eggs in early May, switching to cancer crabs in late May (Ebert and Ebert 2005). Several recent trophic studies suggested that spotted spiny dogfish have a diverse diet with considerable spatial and size–based variability (Miller and Brodeur 2007; Andrews and Foy 2009, Beamish and Sweeting 2009; Brodeur et al. 2009). Predators of spiny dogfish were identified, including sixgill sharks (Gallucci and Langseth 2009), salmon sharks (Hurlburt et al. 2005), Stellar sea lions (Vollenweider et al. 2006), and California sea lions (Orr et al. 2011).

Contemporary spatial information on the gadiform subgroup is largely restricted to Pacific cod and Pacific hake, with few detailed studies concerning Pacific grenadier or Pacific flatnose. Several studies concerned distribution and abundance patterns of Pacific cod and showed that new recruits occur in shallow waters (< 20 m) and move to deeper water with ontogeny (Abookire et al. 2007; Laurel et al. 2009). New recruits and early juveniles appear to prefer structured habitats (e.g., kelp, seagrass beds, sea cucumber mounds) (Abookire et al. 2007; Laurel et al. 2007; Hamilton and Konar 2007), whereas larger juveniles and adults are highly mobile and found in more open habitats (Laurel et al. 2007; Conners and Munro 2008). Agostini et al. (2006) determined that Pacific hake are associated with subsurface poleward, which defines adult habitat and migration patterns, rather than temperature. Age–0 Pacific hake are one of the most common micronekton along the West Coast (Phillips et al. 2009). Nursery areas are principally along the coastal shelf and slope of California, but shift northward during ENSO events (Phillips et al. 2007; Agostino et al. 2008; Funes–Rodriguez et al. 2009). In addition, spawning and recruitment sites of Pacific hake have expanded northward, probably in relation to increased winter/spring temperatures in the northern California Current (Phillips et al. 2007). The Pacific grenadier is among the most abundant groundfish species in continental slope waters of the West Coast (Keller et al. 2005; Tolimieri 2007), but specific patterns of distribution and abundance are not addressed in the contemporary literature. However, this species and the Pacific flatnose are commonly found at California seamounts (Lundsten et al. 2009).

Contemporary trophic information on the gadiform subgroups is also largely focused on Pacific cod and Pacific hake. Several recent diet studies were conducted on Pacific cod in British Columbia and the Gulf of Alaska. Pacific cod were found to be major predators of herring (Schweigert et al. 2010) and capelin (Yang et al. 2005). Young Pacific cod eat copepods and other small crustaceans (Abookire et al. 2007), with older, larger fishes eating larger crustaceans (e.g., shrimps, tanner crab) and other fishes (e.g., sand lance, pollock) (Yang et al. 2006). Dietary variability was noted with size and depth (Abookire et al. 2007) and, since this species feeds opportunistically, likely also includes temporal and spatial differences. Observed, long–term dietary changes in Pacific cod have been attributed to changing environmental conditions and shifting bottom–up and top–down control (Yang et al. 2004; Litzow and Ciannelli 2007). Contemporary diet studies of Pacific hake were mainly focused on commercially important prey items. Pacific hake predation was not determined to have a major effect on Columbia River salmon populations (Emmett and Krutzikowsky 2008) but could impact canary rockfish recovery in California (Harvey et al. 2008). Pacific hake were also one of the main predators of Pacific herring off British Columbia (Schweigert et al. 2010). Scavenging is an important component of diet of Pacific grenadiers and Pacific flatnose, probably as a result of low standing prey biomass in the deep ocean (Yeh and Drazen 2011). Because of their high relative abundance, Pacific cod and Pacific hake are important prey items for a wide variety of species. Pacific cod are eaten in high proportions by Stellar sea lions between Oregon and the Aleutian Islands (e.g., Bredeson et al. 2006; Csepp et al. 2011) and are also present in the diet of Aleutian skates (Yang 2007), arrowtooth flounder (Yang et al. 2006), Pacific halibut (Yang et al. 2006), and sablefish (Yang et al. 2006). Pacific hake are commonly eaten by Stellar sea lions (Bredeson et al. 2006, Csepp et al. 2011), harbor seals (Orr et al. 2004), California sea lions (Orr et al. 2011), Humboldt squid (Field et al. 2007), albacore (Glaser 2010), and thresher sharks (Preti et al. 2004).

Some contemporary spatial information is available for all of the members of the scorpaeniform subgroup, although most attention has been focused on lingcod and sablefish. Cabezon tagged at an oil platform in Southern California were rather sedentary with a strong 24–hour activity cycle, but vertical movements along the platform may have obscured residency results (Lowe et al. 2009). No significant difference in occurrence was found for kelp greenling among mud, oyster, and eel grass habitats in a Washington estuary (Hosack et al. 2006); however, this species was also reported in association with boulders (Hart et al. 2010), cobble and bedrock (Thedinga et al. 2008). Canopy and understory kelp supported year–round populations of (primarily kelp) greenlings in Cook Inlet, Alaska (Hamilton and Konar 2007). No difference in abundance of lingcod was noted between day and night surveys at Hecate Bank (Hart et al. 2010), or among mud, oyster or eelgrass habitats in a Washington estuary (Hosack et al. 2010). This species can be considered a habitat generalist but it prefers some structure to open (mud or sand) seafloors (Love and York 2005, 2006; Anderson and Yoklavich 2007), especially during the juvenile stage (Petrie and Ryer 2006). Juvenile lingcod have high site fidelity (Petrie and Ryer 2006; Reynolds et al. 2010) and variable home ranges. In the San Juan Islands, sizes corresponding to adult lingcod (70–80 cm TL) exhibited much larger home ranges (21,272 + 13,630 m2, Beaudreau and Essington 2011) than a mixture of presumably juvenile and adult lingcod (45–68 cm TL) in Puget Sound (~500–2200 m2). Starr et al. (2004, 2005) determined that larger, adult lingcod (> 80 cm TL) frequently left the boundaries of a reserve off Sitka, Alaska, but only for short periods of time and generally showed high site fidelity. In the Gulf of Alaska, twenty years of tag returns showed that sablefish move to deeper water with age, and exhibit a general, counterclockwise migration pattern (Maloney and Sigler 2008). Sablefish are highly mobile and may migrate to (and spawn in) the western Bering Sea (Orlov 2004).

Trophic information is available for lingcod, sablefish, and kelp greenling. Juvenile lingcod in the northern California Current ate primarily large copepods with small fishes also contributing substantially to diet composition (Miller and Brodeur 2007), whereas a wide size range of juvenile and adult lingcod (15–110 cm TL) were predominantly piscivorous in the San Juan Islands regardless of length. Lingcod were major predators of Pacific herring (Schweigert et al. 2010) and rockfish (Beaudreau and Essington 2007) in British Columbia and northern Washington, respectively. Rockfish consumption was estimated to be 5–10 times greater in marine reserves than non–reserves in the San Juan Island region (Beaudreau and Essington 2009). Predation on rockfish by lingcod may indirectly increase abundance of pandalid shrimps, a major prey item of rockfish, in southern British Columbia (Frid and Marliave 2010). Juvenile sablefish ate mainly euphausiids in the northern California Current, with crabs and fishes also contributing substantially to diet composition (Miller and Brodeur 2007). In the Gulf of Alaska, a mixture of juvenile and adult sablefish ate primarily pollock, with cephalopods and gammarid amphipods also important prey taxa (Yang et al. 2006). Sablefish are one of the main predators of Pacific herring off British Columbia (Schweigert et al. 2010) and predation of salmon juveniles could negatively impact returns of adults in Southeast Alaska (Sturdevant et al. 2009). Scavenging behavior was reported for sablefish (Yang et al. 2006; Yeh and Drazen 2011) and kelp greenling (Davies et al. 2006). Kelp greenling has been reported in the diets of Alaska skates (Yang 2007), Stellar sea lions (Vollenweider et al. 2006; McKenzie and Wynne 2008), California sea lions (Orr et al. 2011), and pigeon guillemots (Robinette et al. 2007). Lingcod has recently been reported in the diet of harbor seals (Orr et al. 2004) and pigeon guillemots (Robinette et al. 2007). Sablefish has been reported as common prey of Stellar sea lions off Southeast Alaska (Csepp et al. 2011) and salmon sharks in Prince William Sound (Hurlburt et al. 2005). Sperm whale depredation of sablefish from longline gear is common, especially in the central and eastern Gulf of Alaska (Sigler et al. 2008).

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Other Groundfish: Relevant Literature

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APPENDIX H DESCRIPTION OF AVAILABLE HABITAT MODELS

1. Introduction

A model is a simplified, sometimes theoretical, representation of a real–world situation. Models, by design and circumstance, lack the complexity necessary to precisely replicate ecological systems. However, models can be useful because the empirical data required to elucidate ecosystem processes are often lacking and cannot be obtained without significant expenditures over long time periods, if at all. Models typically consist of a series of linked mathematical equations or statistical functions that are either computationally analyzed or simulated. Data (e.g., species occurrence, physical and environmental variables) are entered into a model, and model outputs (e.g., predicted habitat suitability, fluctuations in biomass and species composition) are used to improve our understanding of ecosystem processes and to evaluate or formulate management decisions. In any modeling effort, there is a trade–off between simplicity and complexity that is typically contingent on the question of interest and the amount and quality of the input data. A simple model that captures the essential features of a study system is often preferable to a more complex model that uses generalized or assumed input data. To understand the utility of a model, it is important to acknowledge that a model will not fully describe the study system correctly, no matter the degree of complexity, and to accept the possibility that many presumed interactions may not represent reality (Field 2004). Consequently, model estimates are best treated in a general sense to pinpoint major findings, key processes, points, or drivers in study systems, and to direct future research needs and priorities. It is, however, important to assess the accuracy and uncertainty of model outputs whenever possible through a variety of available methods that constitute “model validation and groundtruthing.”

This section of the report summarizes the recent contributions of three general categories of models (spatially explicit, trophodynamic, and integrated ecosystem) that are relevant to the determination and designation of EFH for West Coast groundfishes. Modeling efforts off the West Coast are mainly focused on the development and application of spatially explicit models. This emphasis reflects the creation of spatial closures, such as marine protected areas (MPAs), as a primary regulatory approach by regional managers. Management efforts in Alaskan waters are instead focused on trophic interactions and fishery harvests, and therefore trophodynamic modeling is emphasized. This difference is largely attributable to variable ecological characteristics of the primary groundfish targets between the West Coast (rockfishes) and Alaskan waters (gadids, flatfishes), and the more specific habitat–associations of the targeted West Coast fauna. In addition, ecosystem–based fishery management is much more advanced in Alaskan waters, where sections and appendices on ecosystem considerations are included in management documents (SAFE reports and FMPs) and the results of mass–balance models are used in the determination of fishery quotas. Comparable efforts are at a nascent stage off the West Coast, but are advancing rapidly through the activities of the Integrated Ecosystem Assessment and Ecosystem Planning and Development teams, as directed by the PFMC.

2. Examples of Spatially Explicit Models

2.1. Habitat Suitability Probability Model

A habitat suitability probability (HSP) model, termed the "EFH Model" (PFMC 2008), was developed in 2004 by NMFS and outside contractors in order to quantitatively evaluate EFH for West Coast groundfishes (MRAG Americas Inc. et al. 2004). The model incorporates three basic variables (benthic habitat, depth, and location) to describe and identify EFH for each life stage of federally–managed groundfishes and presents this information graphically as an HSP profile (PFMC 2005). Based on the observed distribution of a groundfish species/life–stage in relation to the input variables, each location is assigned a suitability value between 0–100% in the creation of the profile. These scores and their differences among locations are then used to develop a proxy for the areas that can be regarded as "essential" (the higher the HSP score, the more likely the location is suitable habitat for a given groundfish species/life stage). HSP profiles of each groundfish species/life stages can subsequently be combined within GIS and used to predict total groundfish EFH along the West Coast (PFMC 2005). Initial EFH Modeling efforts were incorporated into the 2008 Pacific Coast Groundfish Fishery Management Plan (FMP) (PFMC 2008), and serve as the primary basis for discussion in this section.

Input data for the model are derived mainly from NMFS fishery–independent surveys and the Habitat Use Database (HUD). NMFS surveys provide a valuable source of data on the occurrence and relative density (measured as catch per area swept by the net) of groundfishes at sampled locations (i.e., stations). Depth and latitude are routinely recorded at sampling stations, but habitat information is not collected. It was therefore decided to use NMFS survey data to develop models that incorporate depth and latitude, and to add in the effect of habitat separately, based on habitat preference information recorded in the HUD, the life history appendix of the West Coast Groundfish FMP, and from consultation with scientific experts (PFMC 2005). Several GIS layers were created to facilitate modeling efforts. One such layer (termed "physical substrate") depicts lithographic and physiographic features throughout the study region using a hierarchical system that incorporates megahabitat, seafloor induration, meso/macrohabitat, and modifier(s) (Greene et al. 1999). Another layer distinguishes biogenic habitats (e.g., canopy kelp, seagrass, structure–forming invertebrates), where data were available. Estuaries were also included as a separate "benthic habitat" layer. A single West Coast bathymetry layer was synthesized from an amalgam of sources and contoured to 10 m. Latitude was grouped into 10–minute zones for analysis. Data quality layers were created for bathymetry and physical substrate to account for uncertainty in the source data (PFMC 2005).

A Bayesian Belief Network (BBN) was chosen as an appropriate analytical tool to evaluate the probability of suitable habitat for groundfish species/life stages throughout the West Coast (PFMC 2005). A BBN is a probabilistic graphical model that represents a set of random variables (e.g., benthic habitat, depth, latitude) and their conditional dependencies (e.g., fish occurrence) via a directed graphical representation. The overall HSP is calculated from separate probabilities for each variable, which can be derived from various sources. When enough survey data are available, depth and latitude information are analyzed using a General Additive Model (GAM) with binomial (presence/absence) fish occurrence data and a logit link. Because most species/life stages lack suitable survey information, depth and latitude information are alternatively approximated from the HUD index as follows: $HUD_{index} = Depth_{index} * Latitude_{index}$, where depth and latitude indices incorporate values for absolute minimum, preferred minimum, optimum, preferred maximum, and absolute maximum (PFMC 2005). Minor differences between the substrate classification system used in the HUD and the GIS physical substrate layer were reconciled prior to analysis. In order to incorporate information about substrate preferences from the HUD into the BBN model, the following substrate suitability probability scale was used: unknown = 0.33[6], weak = 0.33, medium = 0.66, and strong = 1.00 (PFMC 2005). Habitat suitability probabilities are then calculated for substrate, depth, and latitude nodes for each polygon in the GIS. Finally, the overall suitability node calculates the estimated joint HSP value of a polygon by multiplying the benthic habitat and combined latitude/depth HSPs. Polygons are uniquely identified by their habitat type, depth range (every 10 m), and latitude range (every 10 minutes). HSP values are calculated for a given species/life stage for all the habitat polygons in the GIS, stored in a database, and plotted to form a contour plot along the entire coast (PFMC 2005).

The EFH Model provided spatially explicit HSP estimates for 160 of 328 groundfish species/life stage combinations, including the adults of all federal management unit (FMU) species (PFMC 2005, 2008). The remaining 168 species/life stages were not completed because of insufficient data. All adult, and most juvenile, stages were accounted for either by the survey data or by the information in the HUD. Of the remaining life stages to be analyzed, 84% represent eggs (n = 69), 80% represent larvae (n = 66) and 40% represent juveniles (n = 33). Among the 160 completed profiles, it was only possible to produce 36 profiles from the NMFS trawl survey data (PFMC 2005). When the HSPs of all species/life stages were combined, all waters and bottom areas at depths < 3,500 m were determined to be groundfish EFH. This designation represents a precautionary approach encompassing the maximum range of all groundfishes within the management area, based on the best scientific information (PFMC 2005). In addition to describing and identifying EFH for individual species and life stages, the EFH Model and resulting HSP values can be used to support future habitat–related management decisions. Such decisions may involve considering tradeoffs between management effects on different habitats. HSP profiles for individual species/life stages also can be combined by GIS analyses into ecosystem–level fish assemblages to investigate and predict environmental consequences of proposed projects (PFMC 2008).

Designation of West Coast EFH from the combined suite of FMU species/life stages is considered precautionary because uncertainty exists about the relative value of different habitats to individual groundfish species/life stages, and thus the actual extent of overall groundfish EFH (PFMC 2005). For example, there were insufficient data to derive habitat suitability probability (HSP) values for approximately half of the FMU species/life stages. Furthermore, the data used to determine HSP values exhibit some biases and limitations, and are subject to continued refinement.

Among the primary concerns regarding the validity of model outputs are the use of disparate data sets and data of variable quality. For example, location information was grouped into 10–minute latitudinal zones because species distributions generally exhibit only gradual changes with latitude. However, this designation is rather arbitrary and may not hold true for all species and life stages, especially in regions where input variables are heterogeneous at small spatial scales.

In addition, there are a number of FMU species and life stages that occur in the water column, and have limited association with benthic habitats. Because determining pelagic habitat associations was not feasible, HSP profiles for these species and life stages were determined solely on the basis of latitude and depth variables. Using presence/absence information to infer the location of EFH habitat is also a potential limitation of the model. A species may, for instance, have a broad depth or geographic distribution, but may only reach high densities in a limited area. Interactions between variables also were not considered, but may be significant. For example, depth distributions of groundfishes are known to vary by latitude, largely as a consequence of correlated latitudinal differences in depth–specific temperature. Although data quality layers were created to account for uncertainty in depth and physical substrate information, they have yet to be applied. In addition, probabilities derived from these layers were based on expert opinion rather than empirical information. In future modeling efforts, the sensitivity of model parameters to the assumed substrate preference probability levels should be investigated, along with the possibility of including a measure of uncertainty into the model.

A particular source of concern regarding the accuracy of EFH Model outputs is the effect of bias in survey data resulting from the nonrandom coverage of substrates (PFMC 2008). Unconsolidated substrates are preferentially sampled because trawl surveys are limited in their capability to sample rocky substrates. Species and life stages that specifically associate with such substrates are therefore likely to be under–represented in the survey data that are used to model the effects of latitude and depth. Data from alternative sources that do not exhibit similar biases, such as visual surveys conducted with submersibles, should be incorporated to more accurately model EFH for FMU species and life stages. The EFH Model and its outputs would also benefit from additional focused interaction with experts for validation of model results (PFMC 2005).

It is important to remember that although the outputs of HSP maps appear similar, the type, accuracy, and precision of the input information for each species/life stage are highly variable (PFMC 2005). HSP maps for different species and life stages should therefore not be treated with the same level of confidence. For example, the GAM models using empirical data on depth and latitude estimated true probabilities of habitat suitability for species/life stages. However, the profiles based on the HUD, which comprises far less, generalized data, provide only a relative scale of likelihood at best. The data sources for each HSP profile are provided in Appendix B, Part 1 of the 2008 Pacific Coast Groundfish FMP and should be referenced to determine the type and quality of input data (PFMC 2005). For the benthic habitat component of the model, habitat association inputs were derived entirely from the HUD and are based on index values, as previously described. Because these habitat association data are combined with the depth and latitude data in the EFH Model, the HSP profiles (whether or not the depth and latitude data were derived from the survey or the HUD) cannot be regarded as true probabilities (PFMC 2005). A future expansion of the current HSP model is necessary to better quantify uncertainty associated with variable data inputs and to display this uncertainty directly in the HSP profiles.

The EFH Model has remained static since its original construction, and no additional HSP profiles have been created or updated since the completion of the 2008 West Coast Groundfish FMP. However, modification of the model is currently underway by personnel at Oregon State University's Active Tectonics and Seafloor Mapping Laboratory, Parametrix, Robust Decisions, and Aquaterra through support of the Bureau of Ocean Energy Management (C. Goldfinger, Oregon State University, pers. comm.). The updates pertain to the Bayesian portion of the model and consist of a modified system called Bayesian Analysis for Spatial Siting (BASS). BASS incorporates the Bayesian portion of the EFH Model as an element of "ecosystem services." It combines the best available scientific, economic, and social information to produce outputs that are quantified and defensible, as well as being integrated with ecosystem components that are typically difficult to quantify, such as stakeholder engagement. BASS updates to the EFH Model are likely to be completed in early 2013. In addition, updates to the HUD (see section 3.5.4 of this report) and significant amounts of new spatial and trophic information associated with West Coast groundfish species and life stages (see section 3.3 of this report) also can be used to improve the predictive capabilities of the EFH Model.

2.2. Fish–Habitat Association Models

Accurate estimates of groundfish distributions are critical for effective spatial management through improved stock assessments and the design of MPAs. Strong, consistent benthic habitat associations of many groundfishes, in conjunction with recent advances in acoustic seafloor mapping techniques, suggest that habitat determination may serve as a proxy for predicting groundfish distribution and abundance at broad regional scales (Anderson et al. 2009). Therefore, it should be possible to model and predict these spatial patterns using habitat maps and quantified habitat relationships (Iampietro et al. 2008; Young et al. 2010). The previously described EFH Model represents one such effort to model groundfish distributions based on selected habitat variables. Some additional modeling efforts that attempt to explain or predict groundfish distributions off the West Coast recently have been published.

Most recent fish–habitat association modeling efforts off the West Coast were conducted in continental shelf waters of central California using presence/absence data. On shale beds in Monterey Bay, researchers used high–resolution multibeam bathymetry and precisely geolocated ROV observations of fish distribution to produce a preliminary genus–specific habitat suitability model for eight locally abundant rockfishes (*Sebastes* spp.) (Iampietro et al. 2005). In a follow–up study, Generalized Linear Models (GLMs) incorporating rugosity, slope, aspect, depth, and topographic position index were created for two of these species (rosy rockfish, *S. rosaceous*, yellowtail rockfish, *S. flavidus*) and used to evaluate the predictability of model estimates among locations (Iampietro et al. 2008). Additional fish–habitat studies also were conducted on groundfishes of Cordell Bank, as a result of ample data inputs and the importance of the location as a National Marine Sanctuary. Anderson et al. (2009) used canonical correlation analysis to examine relationships between a suite of groundfishes and benthic habitat variables (e.g., depth, substrate type, patch size) at multiple scales based on transect data obtained from manned submersible dives. Additionally, distribution and abundance patterns of three rockfishes (rosy rockfish; yellowtail rockfish; greenstriped rockfish, *S. elongatus*) were modeled with GLMs using georeferenced submersible transect data and seafloor variables (e.g., slope, topographic position, vertical relief) obtained from autoclassification of multibeam bathymetry (Young et al. 2010). In a more expansive study, Tolimieri and Levin (2006) used canonical analysis of principal coordinates and other associated multivariate techniques (i.e., discriminant function analysis, cluster analysis) to examine composition and variation in West Coat groundfish assemblage structure on the continental slope (200–1200 m) in relation to temperature, year, depth, latitude, and longitude. Model validation was performed for all predictive studies

(Iampietro et al. 2005, 2008; Young et al. 2010), but was not directly pertinent or incorporated for explanatory studies (Tolimieri and Levin 2006; Anderson et al. 2009).

Results of recent fish–habitat modeling efforts were generally promising in their potential application to current management efforts and for the development of future studies. On a coastwide scale, assemblage structure was strongly correlated with depth and latitude, with shallower regions exhibiting more variation in assemblage structure with latitude than deeper regions (Tolimieri and Levin 2006). The accuracy of predicted rockfish distribution in Monterey Bay was generally high (~80%) at the generic level (Iampietro et al. 2005). This result is especially interesting because the habitat suitability model included only a single data type (topographic position index) and occurrence data were pooled for eight rockfish species (Iampietro et al. 2005). A model for yellowtail rockfish generated using Cordell Bank data was comparably efficient at predicting the distribution of this species on the Monterey Bay shale beds, but a companion model for rosy rockfish proved to be unreliable (Iampietro et al. 2008). The predictive models generated by Young et al. (2010) for Cordell Bank, by contrast, were extremely accurate at predicting the distributions of all study species (model accuracy: rosy rockfish (96%), yellowtail rockfish (92%), greenstriped rockfish (92%)). The probability of occurrence of yellowtail and rosy rockfish was highest in high–relief rocky areas and lowest in low–relief, soft sediment areas, whereas the model for greenstriped rockfish exhibited the opposite pattern (Young et al. 2010). Anderson et al. (2009) determined that groundfish distribution patterns on Cordell Bank were strongly correlated with spatial location and habitat composition. At broad scales, Cordell Bank (in totality) contained the highest diversity of habitats and fishes, whereas at intermediate scales, transition zones (10–100s of m wide) between the Bank and unconsolidated regions supported a diverse and characteristic suite of fish species (Anderson et al. 2009). Fish–habitat responses were taxon–specific, and often contingent on the spatial configuration of fine scale habitats (1–10s of m) within the broader–scale landscape (Anderson et al. 2009). The results of these studies indicate that site– and species–specific habitat associations and high–resolution bathymetry data can be used to accurately extrapolate results of in situ video surveys of groundfishes across broad regions.

Although recently constructed fish–habitat models generally performed well, there are several model aspects that can be improved and some caveats to consider in their usage. It is important to recognize that predictive distribution models estimate potential rather than realized habitat suitability, which represents a more limited spatial area. The difference between potential and realized habitats may be especially pronounced for species whose populations have been greatly reduced (e.g., rockfishes) and are therefore unlikely to be habitat–limited (Iampietro et al. 2005; 2008). The discrepancy between potential and realized habitat occurs because most models rely on indirect predictor variables that are derived from bathymetric data and have no direct physiological relevance to a species' fitness (Young et al. 2010). The gap between potential and realized habitats could be narrowed if more direct physical variables (e.g., substrate type, temperature, currents) were included in the models.

The portability of models is directly contingent on accounting for all variables that may drive distribution. Otherwise, fitting a model in one location and applying it in another may produce a poor result because one or more important habitat variables were not considered. In addition, an effective model should reliably predict the absence of a species as well as its presence. Models that are overly inclusive with respect to potential explanatory variables may not accurately predict absences (Iampietro et al. 2005). The spatial and temporal scales used in modeling efforts also play a major role in the accuracy of model results. For many species, the landscape setting is an important predictor of distribution and assemblage structure in addition to fine–scale habitat associations (Anderson et al. 2009). Additionally, if habitat maps are used as surrogates of species diversity and abundance, it is crucial that the scale and type of fish responses to habitat variables are reconciled with the scale of map resolution (Anderson et al. 2009).

Finally, mention also should be made of the efforts underway by NOAAs Biogeography Branch for Oregon's Territorial Sea Project and for The Nature Conservancy to model spatial distribution of groundfishes. These efforts incorporate NMFS longterm trawl survey dataset and various variables (e.g., bathymetry, distance to shore and shelf break, location, temperature) into models of predicted biomass distribution for various groundfish species. These models are still very much under development and have yet to receive any scientific review or input. One associated bias will be the limitations of the input data set from trawl surveys, which will not adequately reflect those species primarily living in untrawlable habitats.

2.3. Biogenic Habitat Modeling

Biogenic habitat modeling techniques were developed for more data–rich, terrestrial systems, but recent increases in the quality and quantity of seafloor data have supported development and application of these models in marine benthic systems. Off the West Coast, biogenic habitat modeling recently has been used to predict distribution and abundance patterns of structure–forming marine invertebrates (e.g., corals, kelps, sponges). Structure–forming marine invertebrates (SFMI) have received considerable scientific attention because of their potential role as EFH for groundfishes and general vulnerability to human impacts.

Biogenic habitat modeling efforts relevant to the West Coast are less than 10 years old, but interest is growing and the field is rapidly advancing. Most research efforts have focused on modeling predicted coral distributions on a coastwide or global scale, using coarse taxonomic categories and presence (only) data; however, regional studies incorporating presence–absence data and more specific taxonomic categories recently have been conducted (Table 1).

Table 1. Summary of biogenic habitat modeling research conducted along the West Coast of the contiguous United States, including global studies with a West Coast component. Taxonomy = level of taxonomic distinction (common name); Method = general modeling method; Validation = model validation conducted (yes or no); Abbreviations: Chl a = chlorophyll a concentration at surface, GLM = Generalized Linear Model, ENFA = Ecological Niche Factor Analysis, Maxent = Maximum Entropy Modeling, RBNM = Regression-Based Niche Model.

Biogenic Habitat(s)	Taxonomy	Study Region	Data Type	Variables	Method	Validation	Source
Stony corals	Order	Global	Presence	Several (chemical, biological, physical)	ENFA	Yes	Clark et al. 2006
Gorgonian corals	Family	West Coast	Presence	Chl a, current velocity, depth/slope, temperature	ENFA	Yes	Bryan and Metaxas 2007
White cup coral	Species	Global	Presence	Several (chemical, biological, physical)	ENFA	Yes	Davies et al. 2008
Stony corals	Order	Global	Presence	Several (chemical, biological, physical)	ENFA, maxent	Yes	Tittensor et al. 2009
Stony corals	Order, species	Global	Presence	Several (chemical, biological, physical)	Maxent	Yes	Davies and Guinotte 2011
Black corals, stony corals	Order, suborder	West Coast	Presence	Several (chemical, biological, physical)	Maxent	Yes	Guinotte and Davies, in press
Giant kelp	Species	Southern California	Presence/absence	Several (geomorphology/glacial forcing, kelp ecophysiology, oceanography)	RBNM	No	Graham et al. 2010
Hydrocorals, gorgonian corals	Genus	Cordell Bank	Presence/absence	Aspect, depth, topographic position, rugosity, substrate, slope	GLM	No	Etherington et al. 2011
Brittle stars, stony corals, hydroids, sea pens	Class, order	Santa Barbara Channel	Presence/absence	Depth, region, substrate	GLM	Yes	Krigsman et al., in press

Presence–only data have been used to model coral distributions throughout the West Coast, primarily in deep–water (> 200 m), including seamounts. The primary objectives of modeling efforts were to determine the relative importance of environmental factors on coral distributions, create habitat suitability maps, and fill sampling gaps in distribution patterns through model predictions. The overall goal of these efforts was to provide information for the assessment of potential impacts and the development of conservation measures. Two global studies have focused on predicting distributions of stony coral (Order: Scleractinia) on seamounts (Clark et al. 2006; Tittensor et al. 2009). Similar global studies were conducted at species (i.e., *Lophelia pertusa*) and ordinal (e.g., Scleratinia) levels (Davies et al. 2008; Davies and Guinotte 2011). Several studies modeled distributions of corals at regional scales that included the entire West Coast at a variety of taxonomic levels (Table 1). In these studies, physical (e.g., depth, temperature), chemical (e.g., dissolved oxygen, salinity), and biological (e.g., primary productivity, export primary productivity) oceanographic data were combined from a variety of sources. Early modeling efforts used Environmental Niche Factor Analysis (ENFA), which compares the observed distribution of a species or taxon to the background distribution of a variety of environmental factors. This type of analysis estimates the environmental niche of a taxonomic group, identifies the relative difference between the niche and the mean background environment, and reveals the environmental variables that are most important in determining distribution (Clark et al. 2006). More recent efforts, however, have used maximum entropy modeling (Maxent), because it generally outperforms ENFA and other presence–only techniques (Davies and Guinotte 2011). Maxent is derived from the principle that the best approach to approximating an unknown probability distribution is to maximize entropy, subject to constraints (e.g., presence data for the organism andassociated environmental data) representing incomplete information (Tittensor et al. 2009).

Suitable habitat for stony corals has been predicted between 750–1250 m on seamounts in the North Pacific in highly oxygenated areas with high levels of aragonite saturation (used for skeletal formation) and low levels of dissolved inorganic carbon, nitrate, phosphate and silicate (Clark et al. 2006; Tittensor et al. 2009). Although many records exist from the North Pacific, no occurrences of *L. pertusa* were predicted from modeled distribution of this species (Davies et al. 2008), probably because the great majority of occurrence records were located in the North Atlantic. Similarly, patterns of habitat suitability of stony corals on seamounts largely reflected current biogeographical knowledge (Tittensor et al. 2009). Using global data gridded at ~1 km^2, Davies and Guinotte (2011) determined that the most important factors influencing stony coral habitat suitability were depth, temperature, aragonite saturation, and salinity. The North Pacific was found to have little scleratinian coral habitat outside of seamounts (Davies and Guinotte 2011). Between British Columbia and California, depth and chlorophyll–a concentration were the best predictors of Primnoidea distribution whereas depth, temperature, slope, and water currents best predicted Paragorgiidae distribution (Bryan and Metaxas 2007). Both families were expected to occur in areas of complex topography, mainly along the shelf break and on seamounts. Slope, temperature, salinity, and depth were important predictors for most modeled distributions of antipatharian and scleratinian corals (Guinotte and Davies, 2012). All studies performed model validation (typically cross validation techniques) of habitat suitability maps, with all models reported to perform well.

Modeling efforts that used presence–only data estimated regions of greatest habitat suitability and defined important, related variables; however, results may merely represent correlations. Furthermore, such efforts are biased by a variable amount of input data among regions and the aforementioned lumping of taxa that have diverse habitat requirements. Model validation does not address these biases or the accuracy of predictions; it simply determines if the model is a good predictor given the input data. Field studies and independent data sets are necessary to groundtruth model predictions, but were not conducted for any of the referenced studies. Until results are groundtruthed through field studies, they should be interpreted cautiously, especially when used as a basis for policy decisions.

Presence–absence data of a variety of SFMI and giant kelp in California waters have been used to develop potentially more reliable biogenic habitat modeling efforts compared to those based on presence–only information. Graham et al. (2010) used a niche–based model to predict millennial–scale variability in the distribution and productivity of southern California giant kelp forests since the last glacial maximum. Etherington et al. (2011) and Krigsman et al. (2012) developed predictive models using presence/absence of corals and other SFMI on Cordell Bank and in Santa Barbara Channel, respectively, and mapped distributions of these organisms. Input data ranged in quantity and type from a relatively small number of physical variables (depth, location, and substratum type; Krigsman et al. 2012) to myriad physical, oceanographic, and physiological variables. All studies used some form of regression analysis to link independent and explanatory variables, which provided much more robust results than the previously described correlative methods. Graham et al. (2010) determined that late Quaternary climate change probably caused high millennial variability in the distribution and productivity of kelp forests. Examination of the occurrence of coral species by habitat and spatial distribution on Cordell Bank indicated that hydrocorals (*Stylaster* spp.) and gorgonians (*Swiftia* spp.) occupied different niches (Etherington et al. 2010). More specifically, hydrocorals were associated with shallow, hard substrate, high sloping habitats, whereas the more broadly distributed gorgonians had affinity to deeper, low sloping habitats and a diversity of substrate types. In the Santa Barbara Channel, cup corals (Scleratinia) and hydroids had high probabilities of occurrence in areas of hard substrate, whereas short and tall sea pens were predicted to occur on unconsolidated and mixed sediment (Krigsman et al. 2012). Brittle stars were predicted to occur throughout the Channel on a variety of substrates.

Model predictions were highly accurate for most studies based on presence–absence data, although results were not typically validated or groundtruthed. The predicted size and distribution of contemporary giant kelp forests closely matched known distributions based on remote sensing surveys (86% agreement at 10 m resolution), providing support for the accuracy of the model, although no specific validation tests were conducted (Graham et al. 2010). Although kelp forests are much more dynamic than most SFMI, this model could have applications in predicting future kelp forest distributions if accurate data inputs can be provided. Predictive accuracy and model validation were not conducted for deep–sea corals on Cordell Bank, as preference was given to creating a more robust model given data limitation in this preliminary study (Etheridge et al. 2010). The lack of these procedures does, however, mitigate the reliability of predictive results. Predictive accuracy was high (75–89%) for SFMI in Santa Barbara Channel and model performance, estimating area under the characteristic curve (AUC), ranged from acceptable (0.76) to excellent (0.91) (Krigsman et al. 2012). Results of this study should be useful for marine spatial planning and ecosystem–based management, as the authors suggest, and for assessing the effectiveness of EFH closures and other MPAs. Although presence–absence data are certainly preferred, model validation and groundtruthing of results are critical to the interpretation of these models. Where possible, model validation and groundtruthing can be accomplished by retaining some data from a particular time period or region and then comparing predicted with observed distributions.

Modeling techniques may provide the best available estimates of distribution, abundance, and habitat characteristics for SFMI. However, many limitations and challenges exist that may impact the accuracy of model results. For instance, although environmental variables are often highly correlated (e.g., temperature and depth) no method currently exists for incorporating the effects of spatial autocorrelation for presence–only models (Tittensor et al 2009). Another problem inherent to presence–only models is that occurrence data may not accurately capture the complete environmental range of the taxon being modeled. Several methods have been developed to evaluate the predictive capabilities of presence–absence models, but techniques to gauge the performance of presence–only models are largely unavailable. Presence–absence data are preferred but absence data is often unreliable because: 1) the majority of research expeditions target areas of known SFMI abundance, 2) sampling methodologies often vary between expeditions, and 3) the patchiness of deep–sea habitats limits confidence for assessing the absence of SFMI (Davies et al. 2008). In addition, the geographical coverage and resolution of taxonomic occurrence are primary constraints to both presence–only and presence–absence models.

The selection of appropriate spatial and temporal resolutions for environmental data sets is also an important factor when constructing habitat suitability models (Davies and Guinotte 2011). Coarse–resolution models can miss important features (e.g., seamounts, canyons) that may be important to SFMI, but data necessary for high–resolution models are typically unavailable. Some studies use interpolation to fill in data gaps for high–resolution models, but this process introduces an unquantifiable source of error. Different types of environmental data also typically span multiple temporal and spatial scales and are collected with varying, usually unknown, levels of accuracy (Guinotte and Davies 2012). Even when high–resolution data exist, predictive maps cannot be viewed as distribution maps since the actual presence of modeled taxa is not known and potentially important variables (e.g., substrate) may not be incorporated (Guinotte and Davies 2012). Habitat suitability models therefore generally over–predict distributions of SFMI. Groundtruthing of predictive maps through field validation is necessary to: 1) assess the accuracy of model predictions, 2) refine models by identifying false positives, and 3) gauge the utility of models for identifying SFMI in unsurveyed areas for management actions (Davies and Guinotte 2011).

Because of the noted biases, concerns, and limitations, care should be taken when using modeling results for management and conservation purposes. Presence–only models could be useful as predictive tools to plan future research, but too much uncertainty exists to rely solely on presence–only model estimates for EFH designation. Results obtained from validated presence–absence models are more useful for planning and management purposes because they provide a measure of variability and can inform decisions based on different levels of acceptable risk (Etheridge et al. 2010). Presence–only data necessitate broad–scale investigations. By contrast, model efforts that use presence–absence data are typically conducted at scales of 1s to 10s of meters (Graham et al. 2010; Etheridge et al. 2010; Krigsman et al. 2012). Therefore, although presence–absence models are more useful for planning and management purposes, such applications will be limited to specific regions until more robust, widespread data are available. Where applied, however, there are several ways that presence–absence biogenic habitat models can aid our ability to make informed management decisions. Model estimates can (and have) been used: 1) to choose a target location for the placement of an oceanographic instrument mooring that would minimize the impact to sensitive benthic communities, 2) to determine appropriate locations for monitoring or experimental work, and 3) to evaluate the importance of existing EFH conservation zones for SFMI (Etheridge et al. 2010).

3. Examples of Trophodynamic Models

3.1. Ecopath with Ecosim

Ecopath, typically coupled with the dynamic companion model Ecosim, has become the standard for trophodynamic modeling not only off the West Coast but also throughout the world's marine and freshwater regions. The initial model was developed by Polovina (1984), then expanded and provided as a software application by scientists at the University of British Columbia (Christensen and Pauly 1992). Ecopath is a static (typically steady–state) mass balance model of trophic structure that integrates information from diet composition studies, bioenergetics models, fisheries statistics, biomass surveys, and stock–assessments (Field 2004). It represents the initial or reference state of a food web. Ecosim is a dynamic model in which biomass pools and vital rates change through time in response to simulated perturbations. Different species or functional groups are represented in Ecopath as biomass pools with their relative sizes regulated by gains (consumption, production, immigration) and losses (mortality, emigration). Biomass pools are typically linked by predation, though in some cases reproduction and maturation information also is included. In this model, fisheries act as super–predators, removing biomass from the system. In terms of model structure, Ecopath is composed of a series of linear equations that describe biomass flow into and out of discrete biomass pools. In Ecosim, the biomass pools are dynamic and controlled by coupled, differential equations that stem from the general linear equations used by Ecopath. The Ecopath model framework allows investigators to evaluate how well conventional wisdom about a system of interest holds when basic bookkeeping tools are applied, to pool together species and into a coherent food web, and to evaluate trophic interactions (Field 2004). The combined model allows users to simulate ecological or management scenarios, such as the response of the system to changes in primary productivity, habitat availability, climate change, or fishing intensity (Harvey et al. 2010). Ruzicka et al. (2007), Harvey et al. (2010), and Field (2004) provided examples of the application of this model to the West Coast.

Seasonal food web models were developed within the Ecopath framework (Ruzicka et al. 2007), to investigate the trophic role of large jellyfish in the Oregon inner–shelf ecosystem. Determining the trophic role of large jellyfish within the Northern California Current (NCC) upwelling ecosystem is important because increases in jellyfish biomass have been documented in many other marine ecosystems with a typical corresponding decrease in fish biomass. Off Oregon, upwelling–favorable winds typically persist from early spring to early fall. The seasonal models therefore represented spring (April–June) and summer (July–September) during a composite time period from 2000–2002. The model domain extended from 46.0° N to 41.8° N (excluding the mouth of the Columbia River) and from the shoreline to 125 m. Information about fish and jellyfish biomass, distribution, and diet was derived from a variety of pelagic trawl surveys and the NMFS bottom–trawl survey, whereas information about lower–trophic level production was obtained from zooplankton survey data. Benthic food web information was modified from preexisting, annual–scale models of the NCC (Field 2004; Field and Francis

2005; Field et al. 2006). The pelagic food web was developed from a variety of quantitative and qualitative sources (e.g., fish and plankton surveys, fishery records, literature). Each model consisted of 48 consumer groups, two egg groups, and three detritus groups.

Model results indicated that pelagic organisms dominate energetics in the NCC system but the trophic impacts of large jellyfish appear to be slight. From spring to summer, ecosystem biomass doubles in size and total energy flow nearly triples in size. Zooplankton (e.g., copepods, euphausiids, pelagic amphipods) and benthic invertebrates (e.g., pandalid and benthic shrimp, Dungeness crab) dominate the system and account for 88% of the energy flow during both seasons. However, the pelagic subsystem was estimated to be five times larger than the benthic subsystem in terms of biomass. In the spring, jellyfish are modest consumers of zooplankton (16%) and forage fishes (e.g., anchovies, herring) dominate in terms of biomass and consumption (64%). By late summer, jellyfish become the primary zooplankton consumer (39%) with forage fishes relatively less important (27%). Jellyfish are the primary consumers of euphausiid eggs and larvae and small jellyfish, whereas fishes are the primary consumers of adult euphausiids, macro–zoolplankton, and pelagic amphipods. Jellyfish appear to divert zooplankton production away from upper trophic levels because they have few predators. However, zooplankton does not appear to be a limiting resource in this region, with approximately 40–44% of total biomass unconsumed and lost to detritus. Impacts of jellyfish predation and competition therefore appear to be slight and are probably limited to local areas of high jellyfish abundance and low zooplankton abundance. Moreover, jellyfish may provide a substantial nutrient input to the benthic food web when medusa die and sink to the benthos.

A dynamic mass–balance model was recently constructed to evaluate food web structure in the central basin of Puget Sound (Harvey et al. 2010). The model is ultimately intended to identify meaningful indicators that can be used to monitor the efficacy of management decisions, quantify risk, and generate alternative ecosystem management scenarios. The Ecopath model comprised 65 functional groups, including: primary producers, invertebrates, vertebrates, detrital groups, and fisheries. Data necessary to generate Ecopath equations for each functional group were derived from the primary literature, stock assessments, technical reports, unpublished data, and consultation with experts through a series of workshops. Data inputs were restricted to 1990–2010 so that results reflected contemporary conditions. Parameter estimates were developed for biomass, production, consumption, fishery losses, and diet composition and modified iteratively in Ecopath to achieve mass–balance. The Ecopath model provided general, descriptive information on biomass allocation, functional group diversity, energy flow, and mortality. The basic model was then evaluated on the basis of a series of scenarios using Ecosim to examine model responses to changes in the biomass of key functional groups (phytoplankton, Bald Eagles) and to changes in fishing mortality.

Model outputs indicated that the Puget Sound system is dominated by species and guilds associated with benthic habitats. Approximately 70% of standing biomass is associated with benthic regions, with benthic invertebrates (55%) and groundfishes (13%) dominant. Zooplankton functional groups represent the largest contribution to total pelagic biomass (29%), and less than 2% of total biomass is composed of species and guilds that are considered to make extensive use of benthic and pelagic regions (e.g., pinnipeds, seabirds, squids). Most (68%) living biomass is present in just seven functional groups: infaunal bivalves, soft infauna, geoducks, phytoplankton, small crustaceans, ratfish, and copepods. Throughput, the sum of all biomass or energy flows that enter and exit a functional group during a unit of time, was dominated by phytoplankton and detritus (67%). High–energy throughput in the pelagic community therefore compensates for its lower biomass. Bottom–up dynamics strongly influence trophic flows. However, there are some examples of top–down control, and bald eagles appear capable of eliciting trophic cascades by regulating populations of other upper–trophic level seabirds. Current levels of fishing mortality seem to be sustainable, in part because of contemporary declines in commercial catches. However, poor accounting of recreational harvests resulted in underestimates of fishing mortality, at least for some groups. In addition, the present composition of the Puget Sound system may have been impacted by past fishing pressure that was unaccounted for in the contemporary model.

Field (2004) developed the most comprehensive and extensive food web model off the West Coast (see also Field and Francis (2005) and Field et al. (2006)). The modeled area includes the entire region between Cape Mendocino to Vancouver Island, from 55–1280 m. Two Ecopath models of the NCC were developed, one representing a period prior to the most intensive levels of regional fishery exploitation (1960s), and the other representing a period following substantial growth in fishery effort and landings, as well as substantial environmental changes (1990s). The final Ecopath models included 63 organismal functional groups, of which 33 were commercially important fishes and invertebrates, 11 were seabirds or mammals, 4 were phytoplankton or detritus, and 15 represented broad aggregations of zooplankton, benthic fauna, and non–commercial fishes. Seven fisheries also were included. Biological and fishery model parameters were derived from a variety of groundfish, pelagic nekton, zooplankton, and benthic invertebrate surveys, peer–reviewed and grey literature, unpublished data, monitoring and prior modeling results, stock assessments, and existing biomass surplus models. Oceanographic and climate data were obtained from research surveys and monitoring programs, including GLOBEC data. Static Ecopath models were projected forward in time using Ecosim with variable estimates of fisheries effort, fishing mortality and climate characteristics, and model fitting to stock assessment results and survey information. This approach is particularly relevant to the evaluation of consistency between observed trends and results from single species assessments and commonly held notions of ecosystem abundance, productivity, interactions and behavior (Field 2004).

A variety of insights and interesting findings resulted from balancing the NCC Ecopath models and subsequent dynamic simulations. Ecopath model results suggested a shift in major sources of predation for long–lived and slow–growing fishes (e.g., rockfishes) from piscivorous fishes (e.g., sablefish, lingcod, large rockfishes) in the 1960s to fisheries (and moderate increases in marine mammal predation) in the 1990s. Much of the observed variability in existing single–species models and dynamics were replicated in Ecosim simulations, which lent validity to both efforts. Model performance was significantly improved when climate was introduced as a driving force, indicating that NCC system dynamics are mainly driven by bottom–up processes. With regard to component species, Pacific hake were determined to be of great significance as both a predator and competitor of other ecosystem components. For example, Pacific hake and salmon (combined groups) displayed highly competitive interactions with both preying heavily on euphausiids and forage fishes, although the biomass and landings of Pacific hake dwarfed those of salmon. Consequently, throughout the modeled period, there was a slight increase in salmon populations when Pacific hake fishery mortality was included. Pacific hake were determined to be the main source of mortality of the pink shrimp, accounting for ~40% of total shrimp mortality even during periods of peak Pacific hake harvests. By contrast, fisheries accounted for ~20% of pink shrimp mortality. The observation that thornyheads (esp. longspine thornyhead) are a key prey item of sablefish, as suggested by several food habit studies, was found to be inconsistent with the estimated abundance, consumption, and production data for both species and appears to be largely a consequence of net feeding and biases inherent to available dietary studies. Ecopath and Ecosim models suggested that strong interspecific interactions have not played a large role in determining the dynamics of many NCC food web components. This is to be expected in a system that is historically dominated, in part, by long–lived groundfishes that have low natural mortality rates indicative of low predation rates and weak trophic interactions (e.g., generalist diets) (Field 2004).

Although each modeling effort provided important information for an improved understanding of ecosystem dynamics, there are some significant limitations to food web modeling in general, and to these studies in particular, that must be considered. The most pervasive shortcoming of food web models is a lack of adequate data. There simply is not enough known about most ecosystems to accurately parameterize Ecopath with Ecosim models (Field 2004). Unknown parameters are fitted based on known parameters to balance equations, but this process is possible when only a single parameter is unknown. Myriad assumptions must be made simply to estimate “known” parameters in most cases because input data are often either unavailable or of variable type and quality. For example, in the Ruzicka et al. (2007) study: 1) numerical diet information was used as a proxy for weight information, which is required in Ecopath; 2) gelatinous zooplankton were underrepresented in input diet studies because they digest rapidly; 3) the nutritional value of jellyfish was assumed to be comparable to that of fishes, crustaceans, and other organisms when it is known to be substantially less; 4) catchability estimates were assumed for each functional group from survey data; 5) best guess estimates were made for several biomass, population growth, and immigration/emigration estimates; and 6) production export by Ekman transport was neglected in the model although it is known to be considerable in upwelling regions. Major data gaps in the Harvey et al. (2010) study include: lack of robust biomass estimates for most functional groups, poor evidence for interaction strengths among food web components, empirical estimates of recreational fishing mortality, and a lack of diet information for a representative range of seasons, sizes, depths, and habitats. The specified limitations are not unique to these studies but are rather typical in food web model construction. In addition, because there is no spatially explicit component to the Ecopath/Ecosim model, data are integrated across the chosen study region. The consequence of this limitation is that organisms that may not co–occur are linked in the model. Food habit information is intended to be the main source of resolution for this issue. It is therefore important that dietary information is robust. However, incongruous spatial and temporal coverage coupled with uneven and often inadequate sample sizes are common limitations of diet information. For example biases in food habitat sampling were demonstrated to overemphasize tight coupling in sablefish and thornyhead populations (Field 2004). A spatially explicit companion module, Ecospace (Christensen et al. 200), is available but has rarely been applied because adequate data are largely unavailable to accommodate this model component. In addition, ontogenetic changes in diet are almost universal in fishes and therefore different life stages should be used in modeling efforts when appropriate data are available.

3.2 Other Predator–Prey Modeling Efforts

There have been a few directed, recent modeling efforts on predator–prey interactions that are relevant to an improved understanding of Pacific groundfish EFH. As previously stated, one of the primary limitations to current fish–habitat models is a lack of ecological information that may be of considerable importance in determining distribution patterns. Predation and competition are two such processes that warrant consideration. For instance, a model including predatory and competitive interactions predicted two alternative stable states for overfished rockfishes: one in which the overfished species (in this case, yelloweye rockfish, *S. ruberrimus*) dominated, and one in which the prey (pygmy rockfish, *S. wilsoni*) dominated (Baskett et al. 2006). The model predicted that a much larger fishing closure (marine reserve) was necessary for the overfished species to recover and dominate when predatory and competitive interactions were included than when these interactions were ignored.

An evaluation of the relative magnitude of predation and habitat effects on the distribution of a common prey type, dwarf rockfishes (e.g., Pygmy Rockfish, *S. wilsoni*; Halfbanded Rockfish, *S. semcinctus*), did not show a marked predator effect (O'Farrell et al. 2009). However, this result was influenced by the contribution of southern California MPAs that had not fully recovered the biomass of predator species. A *de facto* MPA off central California exhibited high densities of large, predatory rockfishes and a paucity of dwarf species, but sample size limitations precluded a direct, quantitative assessment (O'Farrell et al. 2009).

4. An Example of an Integrated Ecosystem Model

4.1. Atlantis Model

The primary tool used in integrated ecosystem modeling (especially in Australia and the United States) is the Atlantis Model, developed by Elizabeth Fulton at Australia's Commonwealth Scientific and Industrial Research Organization (CSIRO) (Fulton et al. 2004). Although it was originally focused on biophysical and fisheries aspects of an ecosystem, Atlantis has been further developed to consider all parts of marine ecosystems (i.e., biophysical, economic and social). All integrated ecosystem models require massive data inputs and must therefore strike a balance between simplicity and complexity, or tractability and realism. The systematic exploration of the optimum level of model complexity is one of the key strengths of the Atlantis Model, and it has been consistently evaluated as the best available integrated ecosystem model (e.g., Plagányi 2007). It can be used to identify which aspects of spatial and temporal resolution, functional group aggregation, and representation of ecological processes are vital to model performance. The modeling approach primarily has been used to address fisheries management questions (e.g. appropriate strategic management options for regional fisheries), but increasingly is being implemented to consider other facets of marine ecosystem use and function (CSIRO 2011).

In terms of structure, the Atlantis Model is composed of a series of linked sub–model, or modules. It contains a deterministic biophysical sub–model, coarsely spatially–resolved in three dimensions, which tracks nutrient flows through the main biological groups in the system. The primary ecological model components are: consumption, production, waste production, migration, predation, recruitment, habitat dependency, and mortality. Trophic resolution is typically set at the functional group level. Invertebrates are usually represented as biomass pools, whereas vertebrates are represented using an explicit age–structured formulation. The physical environment is also represented explicitly, via a set of polygons matched to the major geographical and bioregional features of the simulated marine system Biological model components are replicated in each depth layer of each of these polygons. Movement between polygons is represented by advective transfer or by directed movements depending on the variable in question. Atlantis also includes a detailed industry (or exploitation) sub–model. This module addresses the impact of pollution, coastal development and broad–scale environmental change, and is also focused on the dynamics of multiple fishing fleets. Atlantis is also capable of including explicit handling of economics, compliance decisions, exploratory fishing and other complicated real world concerns such as quota trading. The exploitation model interacts with the biotic part of the ecosystem, but also supplies 'simulated data' to the sampling and assessment sub–model. This module is designed to generate sector dependent and independent data with realistic levels of measurement uncertainty evaluated as bias and variance. These simulated data are based on the outputs from the biophysical and exploitation sub–models, using a manually–specified monitoring scheme. The data are then incorporated into the same assessment models used in the real world, and the output is fed into a management sub–model. This last sub–model is typically a set of decision rules and management actions that can be drawn from an extensive list of fishery management instruments (e.g., gear restrictions, quotas, spatial and temporal zoning, bycatch mitigation) (CSIRO 2011).

The Atlantis framework was recently used to construct a preliminary spatially explicit ecosystem model of the NCC (Horne et al. 2010), and is a fundamental tool in use by the Integrated Ecosystem Assessment Team to meet the goals of the Ecosystem Plan Development Team. Field's (2004) food web model was incorporated as the foundation for model creation, building on prior results and parameterization. The addition of a spatially explicit component will allow users to test hypotheses concerning migrations, movement behavior, and spatial management options that are not possible with the original food web model. The study domain extended from the US/Canadian border to Point Conception and from nearshore waters to the 1200 m isobath. Trophic dynamics of 54 functional groups (i.e., habitat–forming species (e.g., kelp, corals, sponges), phytoplankton, detritus, zooplankton, invertebrates, and fishes) were included, using nitrogen as a common currency between groups. The model was divided into 62 three–dimensional spatial zones, with $\leq$ 7 depth layers per zone. Data for model parameters were derived from a variety of sources in addition to Field (2004), with vertebrate life history parameters drawn from the literature, fish biomass estimates taken from stock assessments and NMFS trawl surveys, and marine mammal biomass estimates incorporated from stock assessments. Initial model conditions were based on data from approximately 1995–2005. A 42–year period without fishing was then simulated forward to reach a quasi–equilibrium unfished state. The unfished scenario was used to compare predictions of the Atlantis Model with those generated by existing single–species stock assessments. The model was driven with hydrodynamic flows, salinity, and temperature outputs from a high–resolution regional ocean sub–model to allow the investigation of impacts that climate–driven changes in upwelling or coastal currents have on nutrients and primary production. Later versions of the model will incorporate fisheries and other anthropogenic effects and fitting to historical time series, and will ultimately be used to evaluate management strategies and decisions (Horne et al. 2010).

The Atlantis Model was able to recreate expected growth, abundance, and seasonal parameters for most functional groups in the NCC (Horne et al. 2010). Abundance of large and small phytoplankton fluctuated seasonally as expected, based on light intensity and nutrient availability from advection. However, seasonal mean phytoplankton abundance increased to unrealistic levels, signaling that some nutrient availability was overstated in the model. Most zooplankton groups showed similar seasonal trends, tracking fluctuations in primary production. By contrast, benthic invertebrate populations were less affected by seasonal variation in phytoplankton abundance. Amphipods, bivalves, and barnacles went extinct and shrimp and octopus declined to low levels as their predators (e.g., finfish) increased. These results were overly extreme and cannot be considered to effectively replicate the natural dynamics of these groups. Vertebrates exhibited strong seasonal changes in biomass due to annual recruitment, growth, and migration. Most vertebrate groups reached equilibrium by the end of the 42–year model run, with the exception of mid-water rockfish, which experienced an increase in predation after 25 years. A lack of fishing mortality resulted in increased biomass of vertebrates and especially rockfishes, flatfishes, and marine mammals. Recovery of depleted large rockfish was rapid (< 10 years) relative to expectations, probably as a result of excessively optimistic recruitment parameters. Trophic effects were evident for some fishes. Small planktivores (e.g., anchovies), deep vertical migrators (e.g., myctophids), and nearshore demersal fishes (e.g., white croaker) declined as a result of increasing predator populations. Large demersal fishes (e.g., lingcod) showed an increasing trend like species recovering from depletion.

The efforts of Horne et al. (2010) represent an initial effort to produce an integrated ecosystem model for the NCC. The model is currently being refined and expanded by the Integrated Ecosystem Assessment Team to address limitations and enable its use in management strategy evaluation. Ongoing work is focused several model components. Biomass of primary producers and invertebrates was difficult to regulate because good calibration targets were lacking. Macroalgae, benthic filter feeders, and benthic grazers were particularly sensitive and went extinct within a few years of simulation. Attempts to resolve these problems resulted in extinction of alternate groups. Large phytoplankton, microzooplankton, large carnivorous zooplankton, and shrimp showed large but bounded fluctuations, whereas other functional groups (e.g., large megazoobenthos) continued to increase indefinitely. Difficulties in calibrating primary producer and invertebrate biomass reflect the relative lack of data for these groups compared to the fish, mammal, and bird species that are the focus of the model and may be problematic until such data deficiencies are resolved. Large and small planktivorous fishes also were difficult to model, as their historical fluctuations likely reflect responses to large–scale climactic variation rather than fishing or direct trophic effects. Recruitment responses to climate drivers are difficult to model in Atlantis with the recruitment routines currently in use (e.g., Beverton–Holt stock recruitment relationship). Future simulations using the suite of spawning and recruitment options already implemented for Australian Atlantis models could enable a linkage between recruitment and climate and thereby model these groups more effectively. Other groups such as large demersal predators and hake did not effectively track historical fishing pressure. For large demersal predators, the very strong declines projected in the historical Atlantis Model may be tied to slight underestimates of the productivity of this stock whereas the difficulties with hake most likely stem from the large amount of time they spend outside of the model domain.

Regardless of these limitations, the Atlantis Model has considerable promise to help characterize the efficacy of management actions within the NCC ecosystem. Although no model will ever perfectly replicate ecosystem processes in nature, the NCC Atlantis Model has been calibrated and tested under a wide variety of conditions, and is believed to produce an adequate representation of ecosystem dynamics (Horne et al. 2010). Addressing the specified model limitations should considerably improve the reliability of the model. Once refined, the NCC Atlantis Model is expected to be a powerful management tool, providing a platform to address important hypotheses relating to the effects of perturbations (e.g., fisheries exploitation), characterize the potential trade–offs of alternate management actions, and test the utility of ecosystem indicators for long–term monitoring programs (Horne et al. 2010). Ultimately, the model should have substantial utility in identifying which policies and methods have the most potential to inform ecosystem–based management on the U.S. West Coast.

5. Discussion

Modeling efforts are being developed to meet NOAA's overall management goals and to specifically inform policy decisions regarding the determination and designation of EFH. These efforts have advanced substantially since the last West Coast groundfish FMP. Although the construction and application of spatially–explicit, trophodynamic, and integrated ecosystem models mainly have been prompted by management needs, recent modeling studies have been facilitated by a considerable increase in the amount of available input data. Long–term NMFS surveys are an important source of biological data on species occurrence, biomass, and population changes. However, rapid advances in the collection and quality of seafloor acoustic data are the main drivers of contemporary modeling efforts in the marine demersal environment.

Considerable progress has been made in modeling ecosystem dynamics off the West Coast, but improvements in model performance are necessary for more accurate outputs. The EFH Model that was developed for the last West Coast Groundfish FMP represents a considerable upgrade over previous qualitative evaluation efforts, but has many flaws and limitations that should be addressed prior to future modeling efforts. Incorporating the BASS system should improve some aspects of model performance. Fish–habitat association models show great promise, especially in continental shelf and upper slope regions where many submersible, ROV, and AUV studies have been conducted and widespread coverage of multibeam bathymetry and other seafloor data now exist. Biogenic habitat models lag somewhat behind fish–habitat association models, largely as a result of greater data limitations. This situation has resulted in a proliferation of modeling efforts using presence–only data and coarse taxonomic resolutions. Using low–resolution taxonomic categories theoretically enables greater predictability than results generated with smaller, high–resolution data sets. However, this is only true if habitat associations are consistent among grouped taxa; otherwise, coarse taxonomic groupings can result in the generation of an "average condition" that isn't representative for any particular taxon. The results of such modeling efforts therefore must be considered skeptically and should be groundtruthed before being used for monitoring or policy formation. Trophodymanic models have been used effectively to evaluate important processes and functional groups across multiple scales and regions but are highly contingent on the quality of diet composition data and the appropriate designation of functional groups. Future efforts should incorporate a measure of uncertainty with regard to data quality, and should consider distinct life stages to account for ontogenetic dietary differences. The development of an integrated ecosystem assessment model using the Atlantis platform has considerable promise for management strategy evaluation and policy formation; however, current model limitations must be addressed and the model must be expanded before it can be effectively used in this capacity.

The greatest limitation to the success of current and future modeling efforts is the quantity and quality of input data for the West Coast marine region. The accuracy and consistency of model outputs are directly contingent on the input data that are used. When input data are sparse, generalized, or interpolated, model results should be considered skeptically. Biogenic models using presence–only data and coarse taxonomic categories are the typical example used here, but this problem is relevant to all model types. A good example of the problematic nature of using poor data inputs is provided by a recent study that attempted to determine dietary overlap of California Current species (DuFault et al. 2009). Accurate calculations of dietary overlap are only possible it diet composition data are of adequate sample size to precisely reflect the diet of a particular species, if temporal, spatial, and ontogenetic differences in diet are accounted for, and if species being compared overlap in geographical and depth distributions. All of these qualifications were violated in the DuFault et al. (2009) study. The results are therefore unreliable at best, and highly problematic if used in future modeling efforts or to provide advice regarding trophic effects within the California Current food web, as advocated by the authors. Data limitation is an unfortunate consequence of modeling in marine environments, but its effects can be mitigated. A key element when dealing with limited data inputs is to formulate appropriate objectives and hypotheses. This practice will produce more reliable results even if the scope of the study must be limited. In addition, model construction can serve as a gap analysis to identify data limitations and inform future research needs and priorities. As data gaps are identified and filled, model results will become more robust and have increased utility for ecosystem understanding, management strategy evaluation, and policy formation.

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APPENDIX I HABITAT USE DATABASE

This section provides a review of the Habitat Use Database (HUD) used to inform EFH designations contained in Amendment 19, comparing the extent of information contained in the HUD in 2005 with its current state at the end of 2011.

Appendix I-1 Entity Relationship Diagrams

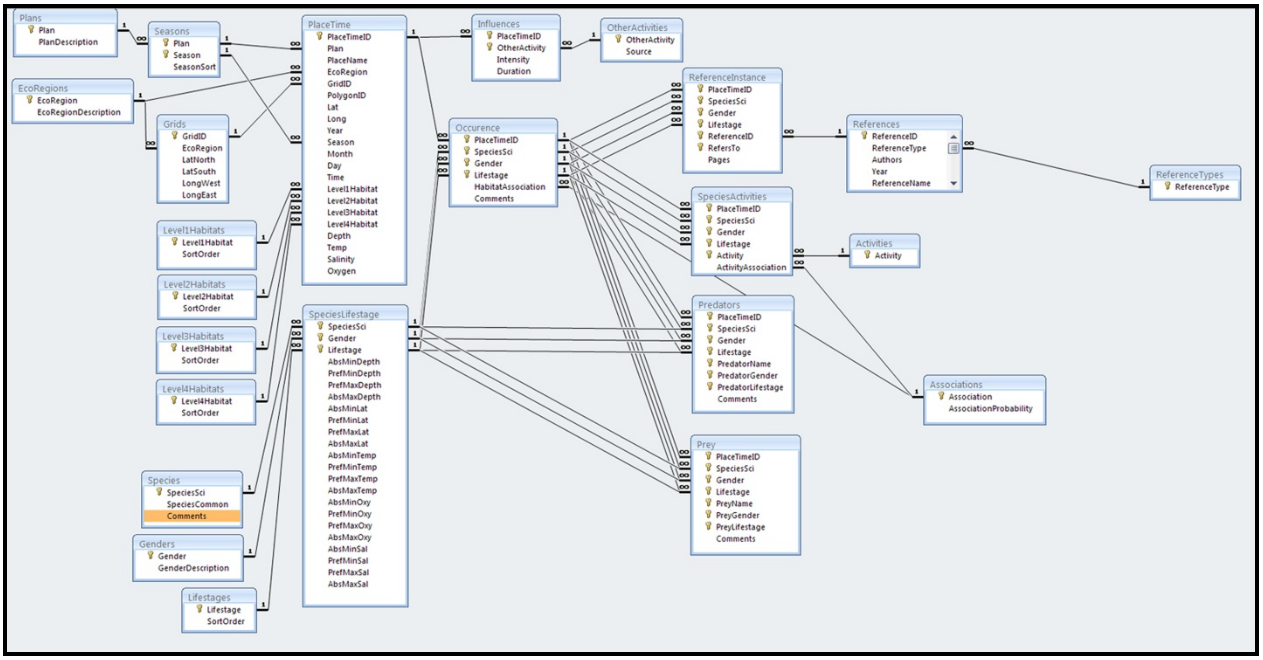

Figure I-1.1. 2005 MS Access® Habitat Use Database Entity Relationship Diagram.

Appendix I-1: Habitat Use Database-Entity Relationship Diagrams

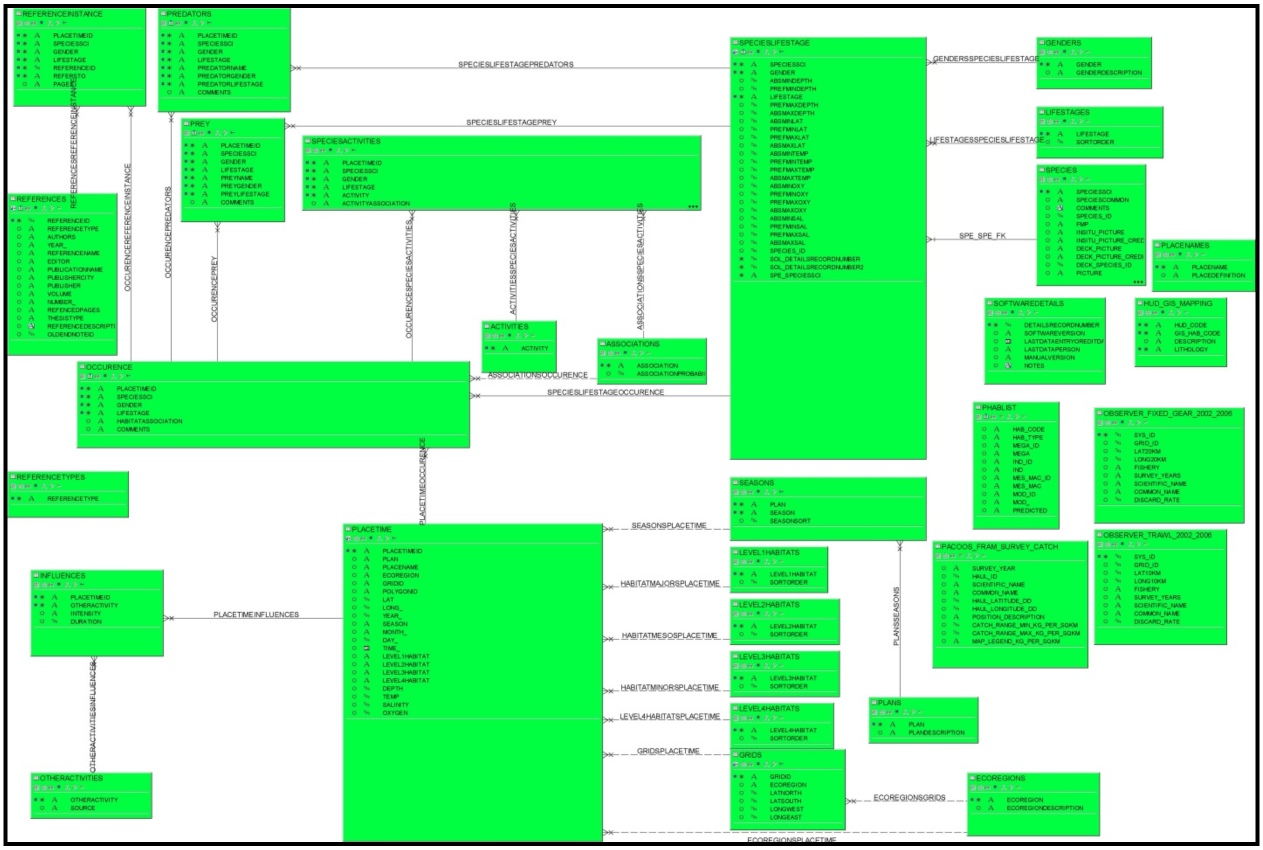

Figure I-1.2. 2011 Oracle® Habitat Use Database Entity Relationship Diagram.

Appendix I-1: Habitat Use Database-Entity Relationship Diagrams

Table I-1.1 HUD tables and a brief description of their contents.

Table Name	Contents
1. PLANS	- Management Plans (FMP, OR Nearshore Strategy, etc)
2. ECOREGIONS	- 7 West Coast Ecoregions
3. SEASONS	- 4 Seasons + All Year and Unknown
4. GRIDS	- No Description Available (appears to reference Ecoregions)
5. LEVEL1HABITATS	- Aquatic Sector
6. LEVEL2HABITATS	- Aquatic Sub Sector
7. LEVEL3HABITATS	- Sub Sector Zone
8. LEVEL4HABITATS	- General Composition
9. SPECIES	- Species (or group)
10. GENDERS	- Male, Female, Both, Unknown
11. LIFESTAGES	- Adult, Juveniles, Larvae, Eggs, Unknown
12. PLACETIME	- Unique and observed combinations of L1 – L4 Habitat including season
13. ASSOCIATIONS	- Relative strength or level of habitat preference
14. SPECIESLIFESTAGE	- Depth, Latitude, Temperature, Oxygen requirements and preferences
15. OCCURRENCE	- Record of Species & life stage by PLACETIME and Association Level
16. INFLUENCES	- No description Available
17. OTHERACTIVITIES	- Notable non-fishing activities
18. REFERENCEINSTANCE	- Relates reference to instance of species-lifestage habitat association
19. ACTIVITIES	- Activity: Spawning, breeding, feeding, or growth-to-maturity
20. SPECIESACTIVITIES	- Activity by PlaceTime, Species, Gender, Lifestage, and Association
21. PREDATORS	- Pairs a HUD species with its predator (by lifestage and gender)
22. PREY	- Pairs a HUD species with its prey (by lifestage and gender)
23. REFERENCES	- Citations
24. REFRENCETYPE	- Accounting of citation medium (book, journal, report, etc.)

In addition to the original 24 tables 4 new tables were created in the Oracle HUD instance:

1. PLACENAMES -no description available
2. PHABLIST -no description available
3. HUD_GIS_MAPPING -one-to-one crosswalk table
4. SOFTWARE_DETAILS -system metadata

Appendix I-2. 2005 & 2011 HUD Scope and Extent

Table I-2.1. Pacific Coast groundfish in the 2005 HUD.

Species Group	Species Count
Flatfishes	4
Other Flatfishes	8
Rockfishes	15
Other Rockfishes	45*
Other Groundfish	15
Total Groundfish Count	87
Predator Species/Groups	24
Prey Species/Groups	73
Predator & Prey Species/Groups	2
Ungrouped Species	7
Total 2005 HUD Species Count	193

*Other Rockfishes include 40 2005 FMP Groundfish and 5 non-FMP Groundfish (Freckled rockfish, Halfbanded rockfish, Pinkrose rockfish, Pygmy rockfish, Swordspine rockfish).

Table I-2.2. Pacific coast groundfish with habitat associations coded in the 2005 HUD.

Species Group	Species Count
Flatfishes	4
Other Flatfishes	8
Rockfishes	15
Other Rockfishes	40
Other Groundfish	14**
Total 2005 HUD Species with Habitat Associations	81

**No habitat association information was included for *Antimora microlepis* (Finescale Codling or Pacific flatnose) in the 2005 HUD.

Table I-2.3. Groundfish Prey.

Table B.3.a Adult Groundfish Prey

Prey Item	Freq.Occ.	%	cum%
Shrimp	68	9.40525588	9.405255878
Fish	49	6.77731674	16.18257261
Crabs	47	6.50069156	22.68326418
Euphausiids	41	5.67081604	28.35408022
Molluscs	38	5.25587828	33.60995851
polychaetes	37	5.1175657	38.7275242
Amphipods	33	4.56431535	43.29183956
Clupeids	32	4.42600277	47.71784232
Squids	31	4.28769018	52.0055325
Octopi	26	3.59612725	55.60165975
Small fishes	22	3.0428769	58.64453665
Copepods	20	2.76625173	61.41078838
fish juveniles	17	2.35131397	63.76210235
Mysids	16	2.21300138	65.97510373
Invertebrates	16	2.21300138	68.18810512
tunicates	16	2.21300138	70.4011065
Crustaceans	11	1.52143845	71.92254495
Pelagic fishes	11	1.52143845	73.4439834
Juvenile rockfish	10	1.38312586	74.82710927
krill	10	1.38312586	76.21023513
Brittle Stars	8	1.10650069	77.31673582
salps	8	1.10650069	78.42323651
Merluccius productus	8	1.10650069	79.52973721
Rockfish	8	1.10650069	80.6362379
Cephalopods	7	0.96818811	81.604426
Snails	6	0.82987552	82.43430152
Theragra chalcogramma	6	0.82987552	83.26417704
Fish eggs	6	0.82987552	84.09405256
Crab larvae	6	0.82987552	84.92392808
Cumaceans	5	0.69156293	85.61549101
Decapod crustaceans	5	0.69156293	86.30705394
Gadids	5	0.69156293	86.99861687
isopods	5	0.69156293	87.69017981
Nudibranchs	4	0.55325035	88.24343015
echinoderms	4	0.55325035	88.7966805
Sandlance	4	0.55325035	89.34993084
juvenile crab	4	0.55325035	89.90318119
Ophiuroids	4	0.55325035	90.45643154
Clams	3	0.41493776	90.87136929
Worms	3	0.41493776	91.28630705
Sea stars	3	0.41493776	91.70124481
Larvacea	3	0.41493776	92.11618257
Demersal fish	3	0.41493776	92.53112033
Lobsters	3	0.41493776	92.94605809
Cottids	3	0.41493776	93.36099585
algae	3	0.41493776	93.77593361
Sea Urchin	3	0.41493776	94.19087137
Echiurans	3	0.41493776	94.60580913
Urechis caupo	3	0.41493776	95.02074689
Sebastolobus alascanus	2	0.27662517	95.29737206
gastropod	2	0.27662517	95.57399723
Small Crustacea	2	0.27662517	95.85062241
Bathylagids	2	0.27662517	96.12724758
Echiurid proboscises	2	0.27662517	96.40387275
Myctophids	2	0.27662517	96.68049793
Sebastolobus altivelis	2	0.27662517	96.9571231
Crustacean eggs	2	0.27662517	97.23374827
Annelids	2	0.27662517	97.51037344
Eopsetta jordani	2	0.27662517	97.78699862
gelatinous plankton	2	0.27662517	98.06362379
Hydrolagus colliei	2	0.27662517	98.34024896
Opisthobranchs	2	0.27662517	98.61687414
Ostracods	2	0.27662517	98.89349931
Scorpaenichthys marmoratus	1	0.13831259	99.03181189
fish larvae	1	0.13831259	99.17012448
hydroids	1	0.13831259	99.30843707
Chitons	1	0.13831259	99.44674965
Salmon	1	0.13831259	99.58506224
Ophiodon elongatus	1	0.13831259	99.72337483
crab	1	0.13831259	99.86168741
jellyfish	1	0.13831259	100

Table B.3.j JuvenileGroundfish

Prey Item	Freq.Occ.	%	cum%
Copepods	54	12.8571	12.8571
Amphipods	49	11.6667	24.5238
Euphausiids	41	9.7619	34.2857
Shrimp	33	7.85714	42.1429
polychaetes	17	4.04762	46.1905
Mysids	16	3.80952	50
Crabs	13	3.09524	53.0952
Squids	12	2.85714	55.9524
Molluscs	11	2.61905	58.5714
barnacle cypriots	11	2.61905	61.1905
Small fishes	11	2.61905	63.8095
tunicates	11	2.61905	66.4286
Fish	9	2.14286	68.5714
fish larvae	9	2.14286	70.7143
krill	8	1.90476	72.619
Copepod nauplii	7	1.66667	74.2857
Small Crustacea	6	1.42857	75.7143
Cumaceans	6	1.42857	77.1429
fish juveniles	6	1.42857	78.5714
Clupeids	5	1.19048	79.7619
Brittle Stars	5	1.19048	80.9524
Copepod eggs	5	1.19048	82.1429
crustacean zoea	5	1.19048	83.3333
Pelagic fishes	4	0.95238	84.2857
Ostracods	4	0.95238	85.2381
algae	4	0.95238	86.1905
Brachyuran	4	0.95238	87.1429
Crab larvae	3	0.71429	87.8571
Ophiuroids	3	0.71429	88.5714
Octopi	3	0.71429	89.2857
Juvenile flatfish	3	0.71429	90
Invertebrates	3	0.71429	90.7143
Sculpins	3	0.71429	91.4286
salps	3	0.71429	92.1429
Crustaceans	3	0.71429	92.8571
Cladocerans	3	0.71429	93.5714
Annelids	2	0.47619	94.0476
Opisthobranchs	2	0.47619	94.5238
crab	2	0.47619	95
Hydrolagus colliei	2	0.47619	95.4762
hydroids	2	0.47619	95.9524
Theragra chalcogramma	2	0.47619	96.4286
Euphausiid eggs	2	0.47619	96.9048
Demersal fish	2	0.47619	97.381
Nudibranchs	2	0.47619	97.8571
Larvacea	2	0.47619	98.3333
Zooplankton	2	0.47619	98.8095
Gadids	2	0.47619	99.2857
Cephalopods	1	0.2381	99.5238
Juvenile rockfish	1	0.2381	99.7619
gelatinous plankton	1	0.2381	100

Table B.3.l Larval Groundfish

Prey Item	Freq.Occ.	%	cum%
Copepods	55	26.8293	26.8293
Copepod nauplii	34	16.5854	43.4146
Copepod eggs	30	14.6341	58.0488
invertebrate eggs	12	5.85366	63.9024
Invertebrate nauplii	11	5.36585	69.2683
Euphausiids	10	4.87805	74.1463
fish larvae	8	3.90244	78.0488
Amphipods	7	3.41463	81.4634
Diatoms	6	2.92683	84.3902
Barnacles	4	1.95122	86.3415
Scorpaenichthys marmoratus	4	1.95122	88.2927
Fish eggs	4	1.95122	90.2439
decapod larvae	3	1.46341	91.7073
tintinnids	3	1.46341	93.1707
barnacle cypriots	3	1.46341	94.6341
Dinoflagellates	3	1.46341	96.0976
Cladocerans	3	1.46341	97.561
Brachyuran	3	1.46341	99.0244
Zooplankton	1	0.4878	99.5122
Molluscs	1	0.4878	100

Table I-2.4. Pacific coast groundfishes and other species in the 2005 and 2011 HUD

Species Group	2005 HUD Species Count	2011 HUD Species Count
FMP Coastal Pleagics	0	4
FMP Groundfish	82 + 5 Non-FMP	91
OR Nearshore Strategy	0	35
OR Nearshore Watch	0	18
OR Nearshore Commonly Assoc.	0	73
Predator Species/Groups	24	20***
Prey Species/Groups	73	73
Predator & Prey Species/Groups	2	2
Ungrouped Species	7	7
Total HUD Species Counts	193	323

***Four predator species were removed from the 2011 HUD (Rhacochilus vacca, Lamna ditropis, Artedius harringtoni, Embiotoca lateralis).

Table I-2.5a. Pacific coast groundfish adults with habitat associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	4	0
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	49	0
-Other Groundfish	15	0
Oregon Nearshore		
-Strategy	28	7
-Watch	17	1
-Commonly Associated	72	1
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	212	111

Table I-2.5b. Pacific coast groundfish juveniles with habitat associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	39	10
-Other Groundfish	14	1
Oregon Nearshore		
-Strategy	0	35
-Watch	0	18
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	80	243

Table I-2.5c. Pacific coast groundfish larvae with habitat associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	31	18
-Other Groundfish	7	8
Oregon Nearshore		
-Strategy	0	35
-Watch	0	18
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	65	258

Table I-2.5d. Pacific coast groundfish eggs with habitat associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	2	13
-Other Rockfishes	1	48
-Other Groundfish	11	4
Oregon Nearshore		
-Strategy	0	35
-Watch	0	18
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	26	297

Table I-2.6a. Pacific coast groundfish adults with Y (Latitude) & Z(Depth) associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	4	0
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	49	0
-Other Groundfish	15	0
Oregon Nearshore		
-Strategy	35	0
-Watch	18	0
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	148	175

Table I-2.6b. Pacific coast groundfish juveniles with Y & Z associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	39	10
-Other Groundfish	14	1
Oregon Nearshore		
-Strategy	0	35
-Watch	0	18
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	80	243

Table I-2.6c. Pacific coast groundfish larvae with Y & Z associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	15	0
-Other Rockfishes	31	18
-Other Groundfish	7	8
Oregon Nearshore		
-Strategy	0	35
-Watch	0	18
-Commonly Associated	0	73
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	65	258

Table I-2.6d. Pacific coast groundfish eggs with Y & Z associations coded in the 2011 HUD.

Species Group	Species Count	Species Missing
FMP Coastal Pelagics	0	4
FMP Groundfish		
-Flatfishes	4	0
-Other Flatfishes	8	0
-Rockfishes	2	13
-Other Rockfishes	1	48
-Other Groundfish	11	4
Oregon Nearshore		
-Strategy	0	35
-Watch	0	17
-Commonly Associated	0	74
Predator Species/Groups	0	20
Prey Species/Groups	0	73
Predator & Prey Species/Groups	0	2
Ungrouped Species	0	7
Total	26	297

Appendix I-3 ODFW Nearshore Plan Species Included in the 2011 HUD

Strategy List Species

	Scientific Name	Common Name	Comments
1.	*Acipenser medirostris*	Green sturgeon	
2.	*Acipenser transmontanus*	White sturgeon	
3.	*Amphistichus rhodoterus*	Redtail surfperch	
4.	*Anarrhichthys ocellatus*	Wolf-eel	
5.	*Atherinops affinis*	Topsmelt	
6.	*Cancer magister*	Dungeness crab	
7.	*Cymatogaster aggregate*	Shiner perch	
8.	*Embiotoca lateralis*	Striped perch	
9.	*Eschrichtius robustus*	Gray whale	(No Life History Information)
10.	*Eumetopias jubatus*	Steller sea lion	(No Life History Information)
11.	*Haliotis rufescens*	Red abalone	
12.	*Haliotis walallensis*	Flat abalone	
13.	*Hexagrammos lagocephalus*	Rock greenling	
14.	*Hinnites giganteus*	Rock scallop	
15.	*Hypomesus pretiosus*	Surf smelt	
16.	*Mirounga angustirostris*	Northern elephant seal	
17.	*Mytilus californianus*	California mussel	
18.	*Nereocystis luetkeana*	Bull kelp	
19.	*Octopus dofleini*	Giant octopus	
20.	*Phoca vitulina*	Pacific harbor seal	(No Life History Information)
21.	*Phocoena phocoena*	Harbour porpoise	(No Life History Information)
22.	*Phyllospadix spp.*	Surf grass	
23.	*Pisaster ochraceus*	Ochre sea star	
24.	*Postelsia palmaeformis*	Sea palm	
25.	*Rhacochilus vacca*	Pile perch	
26.	*Siliqua patula*	Razor clam	
27.	*Strongylocentrotus franciscanus*	Red sea urchin	
28.	*Strongylocentrotus purpuratus*	Purple sea urchin	
29.	*Thaleichthys pacificus*	Eulachon	
30.	*Zalophus califonianus*	California sea lion	(No Life History Information)
31.	*Haliotis cracherodii*	Black abalone	
32.	*Prionace glauca*	Blue Shark	
33.	*Mustelus henlei*	Brown smoothhound	
34.	*Enophrys bison*	Buffalo sculpin	
35.	*Hemilepidotus spinosus*	Brown Irish Lord	

Appendix I-3: Habitat Use Database-ODFW Nearshore Plan Species

Watch List Species

Scientific Name	Common Name	Comments
1. *Alopias vulpinus*	Common thresher	
2. *Ammodytes hexapterus*	Pacific sand lance	
3. *Cancer productus*	Red rock crab	
4. *Carcharodon carcharias*	White shark	
5. *Cebidichthys violaceus*	Monkeyface prickleback	
6. *Delolepis gigantean*	Giant wrymouth	
7. *Emerita analoga*	Sand (Mole) crab	
8. *Fusitriton oregonensis*	Oregon triton	
9. *Hemilepidotus hemilepidotus*	Red Irish Lord	
10. *Isurus oxyrinchus*	Shortfin mako shark (Bonito shark)	
11. *Leptocottus armatus*	Pacific staghorn sculpin	
12. *Pandalus danae*	Coonstripe or Dock shrimp	
13. *Paralichthys californicus*	California halibut	
14. *Parastichopus californicus*	California Sea Cucumber	
15. *Penitella penita*	Flap-tipped piddock	
16. *Squatina californica*	Pacific angel shark	
17. *Trichodon trichodon*	Pacific sandfish	
18. Lamna ditropis	Salmon Shark	

Commonly Associated Species

Scientific Name	Common Name	Comments
1. *Agonomalus mozinoi*	Kelp poacher	
2. *Alaria marginata*	Winged kelp	
3. *Allosmerus elongatus*	Whitebait smelt	
4. *Amphistichus koelzi*	Calico surfperch	
5. *Anoplagonus inermis*	Smooth alligatorfish	
6. *Anoplarchus insignis*	Slender cockscomb	
7. *Anoplarchus pupurescens*	High cockscomb	
8. *Anthopleura elegantissima*	Aggregating anemone	
9. *Apodichthys flavidus*	Penpoint gunnel	
10. *Artediellus pacificus*	Pacific hookhorn sculpin	
11. *Artedius corallinus*	Coralline sculpin	
12. *Artedius fenestralis*	Padded sculpin	
13. *Artedius harringtoni*	Scalyhead Sculpin	
14. *Artedius lateralis*	Smoothhead sculpin	
15. *Artedius notospilotus*	Bonehead sculpin	
16. *Ascelichthys rhodorus*	Rosylip sculpin	
17. *Atherinopsis californiensis*	Jacksmelt	
18. *Aulorhyncus flavidus*	Tubesnout	
19. *Balanus nubilis*	Giant acorn barnacle	
20. *Blepsias cirrhosus*	Silverspotted sculpin	
21. *Bothragonus swanii*	Rockhead	
22. *Brachyistius frenatus*	Kelp surfperch	(No Life History Information)
23. *Brosmophycis marginata*	Red brotula	
24. *Cancer antennarius*	Brown rock crab	
25. *Chirolophis decoratus*	Decorated warbonnet	
26. *Chirolophis nugator*	Mosshead warbonnet	
27. *Chitonotus pugetensis*	Roughback sculpin	
28. *Citharichthys stigmaeus*	Speckled sanddab	
29. *Clinocardium nuttallii*	Cockle clam	
30. *Clinocottus acuticeps*	Sharpnose sculpin	

31. *Clinocottus embryum*	Calico sculpin	
32. *Clinocottus globiceps*	Mosshead sculpin	
33. *Clinocottus recalvus*	Bald sculpin	
34. *Cryptochiton stelleri*	Gumboot chiton	
35. *Dendraster excentricus*	Sand dollar	
36. *Egregia menziesii*	Egregia	
37. *Fucus distichus*	Rockweed	
38. *Gobiesox maeandricus*	Northern clingfish	
39. *Haliotis kamtschatkana*	Pinto (Northern) abalone	
40. *Hyperprosopon anale*	Spotfin surfperch	
41. *Hyperprosopon argenteum*	Walleye surfperch	
42. *Hyperprosopon ellipticum*	Silver surfperch	
43. *Jordania zonope*	Longfin sculpin	
44. *Lumpenopsis hypochroma*	Y-prickleback	
45. *Lumpenus sagitta*	Snake prickleback	
46. *Macrocystis pyrifera*	Giant kelp	
47. *Myliobatis californica*	Bat ray	
48. *Nautichthys oculofasciatus*	Sailfin sculpin	
49. *Odontopyxis trispinosa*	Pygmy poacher	
50. *Oligocottus maculosus*	Tidepool sculpin	
51. *Oligocottus rimensis*	Saddleback sculpin	
52. *Oligocottus snyderi*	Fluffy sculpin	
53. *Oxylebius pictus*	Painted greenling	
54. *Pallasina barbata*	Tubenose poacher	
55. *Pandalus platyceros*	Spot prawn	
56. *Phanerodon furcatus*	White surfperch	
57. *Pholis clemensi*	Longfin gunnel	
58. *Pholis laeta*	Cresent gunnel	
59. *Pholis* ornata	Saddleback gunnel	
60. *Pholis schultzi*	Red gunnel	(No Life History Information)
61. *Phytichthys chirus*	Ribbon prickleback	
62. *Podothecus accipenserinus*	Sturgeon poacher	
63. *Prionotus stephanophrys*	Lumptail searobin	
64. *Pugettia producta*	Kelp crab	
65. *Rhamphocottus richardsonii*	Grunt sculpin	
66. *Ruscarius meanyi*	Puget Sound sculpin	
67. *Spirinchus starksi*	Night smelt	
68. *Spirinchus thaleichthys*	Longfin smelt	
69. *Stellerina xyosterna*	Pricklebreast poacher	
70. *Synchirus gilli*	Manacled sculpin	
71. *Torpedo californica*	Pacific electric ray	
72. *Xiphister atropurpureus*	Black prickleback	
73. *Xiphister mucosus*	Rock prickleback	

Appendix I-4 2005 Crosswalk Table

GIS hab_code	Description	Lithology	HUD Code
Ahc	Rocky Apron Canyon Wall	Any	Fshn
Ahe	Rocky Apron	Any	Fbhn
As_u	Sedimentary Apron	Any	Fbun
Asc/f	Sedimentary Apron Canyon Floor	Any	Fsun
Asc_u	Sedimentary Apron Canyon Wall	Any	Fsun
Asg	Sedimentary Apron Gully	Any	Fbun
Asl	Sedimentary Apron Landslide	Any	Fbun
Bhe	Rocky Basin	Any	Fahn
Bs_u	Sedimentary Basin	Any	Faun
Bsc/f_u	Sedimentary Basin Canyon Floor	Any	Fsun
Bsc_u	Sedimentary Basin Canyon Wall	Any	Fsun
Bsg	Sedimentary Basin Gully	Any	Faun
Bsg/f_u	Sedimentary Basin Gully Floor	Any	Faun
Fhc	Rocky Slope Canyon Wall	Any	Fshn
Fhc/f	Rocky Slope Canyon Floor	Any	Fshn
Fhe	Rocky Slope	Any	Fbhn
Fhg	Rocky Slope Gully	Any	Fbhn
Fhl	Rocky Slope Landslide	Any	Fbhn
Fhl	Rocky Slope Landslide	ROCK	Fbhn
Fs_u	Sedimentary Slope	Unknown	Fbun
Fs_u	Sedimentary Slope	CLAY	Fbuv
Fs_u	Sedimentary Slope	MUD	Fbum
Fs_u	Sedimentary Slope	SAND	Fbus
Fs_u	Sedimentary Slope	SAND/MUD	Fbub
Fsc/f_u	Sedimentary Slope Canyon Floor	Any	Fsun
Fsc_u	Sedimentary Slope Canyon Wall	Any	Fsun
Fsg	Sedimentary Slope Gully	Unknown	Fbun
Fsg	Sedimentary Slope Gully	MUD	Fbum
Fsg/f	Sedimentary Slope Gully Floor	Any	Fbun
Fsl	Sedimentary Slope Landslide	Unknown	Fbun
Fsl	Sedimentary Slope Landslide	MUD	Fbum
Rhe	Rocky Ridge	Any	Fbhn
Rs_u	Sedimentary Ridge	Unknown	Fbun
Rs_u	Sedimentary Ridge	CLAY	Fbuv
Rs_u	Sedimentary Ridge	MUD	Fbum
Rs_u	Sedimentary Ridge	SAND	Fbus
Shc	Rocky Shelf Canyon Wall	Any	Sshn
She	Rocky Shelf	Any	Sbhn
Shi_b/p	Rocky Glacial Shelf Deposit	Any	Sbhn
Ss_u	Sedimentary Shelf	Unknown	Sbun

Appendix I-4: Habitat Use Database-2005 Crosswalk Table

GIS hab_code	Description	Lithology	HUD Code
Ss_u	Sedimentary Shelf	CLAY	Sbuv
Ss_u	Sedimentary Shelf	GRAVEL	Sbuh
Ss_u	Sedimentary Shelf	MIX SAND/GRAVEL	Sbcs
Ss_u	Sedimentary Shelf	MUD	Sbum
Ss_u	Sedimentary Shelf	ROCK/SAND	Sbcw
Ss_u	Sedimentary Shelf	SAND	Sbus
Ss_u	Sedimentary Shelf	SAND/MUD	Sbub
Ssc/f_u	Sedimentary Shelf Canyon Floor	Any	Ssun
Ssc_u	Sedimentary Shelf Canyon Wall	Any	Ssun
Ssg	Sedimentary Shelf Gully	Unknown	Sbun
Ssg	Sedimentary Shelf Gully	MUD	Sbum
Ssg	Sedimentary Shelf Gully	SAND	Sbus
Ssg/f	Sedimentary Shelf Gully Floor	Any	Sbun
Ssi_o	Sedimentary Glacial Shelf Deposit	GRAVEL	Sbuh
Ssi_o	Sedimentary Glacial Shelf Deposit	MUD	Sbum
Ssi_o	Sedimentary Glacial Shelf Deposit	SAND	Sbus
Estuary	Estuary	Unknown	Ennn
Estuary	Estuary	SAND	Ebun
Estuary	Estuary	ROCK	Ebhn

Appendix I-5. 2011 HUD Crosswalk Table, one SGH (habitat code) to many HUD Codes.

(yellow)	=	shelf codes, shouldn't find these in Apron, Basin or Slope habitats
(orange)	=	slope codes, shouldn't find these in Shelf or Nearshore habitats
(light green)	=	[illegible]

			HUD Wildcard Codes				HUD Codes													
Mega_Habitat	**SGH_Prefix**	**Lith_Combo**	**Slope***	**Shelf***	**Nearsh***	**Estuary***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Apron	Ah	hard	**Fnnn**	x	x	x	**Fbhb**	**Fbhg**	**Fbhn**	**Fbhq**	**Fbhr**	**Fbnn**								
Apron	As	soft	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbuh**	**Fbuh_w**	**Fbum**	**Fbun**	**Fbus**	**Fbut**						
Basin	Bh	hard	**Fnnn**	x	x	x	**Fann**	**Fbnn**	**Fahr**											
Basin	Bh	ROCK	**Fnnn**	x	x	x	**Fann**	**Fbhn**	**Fbhr**	**Fbnn**	**Fahr**									
Basin	Bm	MUD/ROCK	**Fnnn**	x	x	x	**Facx**	**Fann**	**Fbcr**	**Fbcu**	**Fbcx**	**Fbnn**								
Basin	Bm	ROCK/MUD	**Fnnn**	x	x	x	**Facx**	**Fann**	**Fbcr**	**Fbcu**	**Fbcx**	**Fbnn**								
Basin	Bs	MUD	**Fnnn**	x	x	x	**Fann**	**Faum**	**Faun**	**Fbcu**	**Fbnn**	**Fbub**	**Fbum**	**Fbun**	**Fbut**					
Basin	Bs	soft	**Fnnn**	x	x	x	**Fann**	**Faum**	**Faun**	**Faus**										
Canyon	Ch	BOULDER	**Fnnn**	**Snnn**	x	x	**Fshb**	**Fsnn**	**Ssnn**	**Sshb**										
Canyon	Ch	hard	**Fnnn**	**Snnn**	x	x	**Fshb**	**Fshg**	**Fshn**	**Fshr**	**Fsnn**	**Ssnn**	**Sshb**	**Sshg**	**Sshn**	**Sshr**	**Nshr**			
Canyon	Ch	ROCK	**Fnnn**	**Snnn**	x	x	**Fshn**	**Fshr**	**Fsnn**	**Sshr**	**Ssnn**	**Nshr**								
Canyon	Cm	boulder/sand	**Fnnn**	**Snnn**	x	x	**Fsnn**	**Fsun**	**Fshb**	**Fshn**	**Sscy**	**Ssnn**	**Ssun**							
Canyon	Cm	SAND/MUD	**Fnnn**	**Snnn**	x	x	**Fsnn**	**Ssnn**	**Ssun**											
Canyon	Cs	MUD	**Fnnn**	**Snnn**	x	x	**Fsnn**	**Fsum**	**Fsun**	**Fsut**	**Ssum**	**Ssut**	**Ssun**	**Ssnn**						
Canyon	Cs	SAND	**Fnnn**	**Snnn**	x	x	**Fsun**	**Fsnn**	**Ssnn**	**Ssun**										
Canyon	Cs	soft	**Fnnn**	**Snnn**	x	x	**Fsnn**	**Fsum**	**Fsun**	**Fsut**	**Ssnn**	**Ssum**	**Ssun**	**Ssut**						
Estuary	Eb_i	Algal	x	x	x		Eivk													
Estuary	Eb_i	Seagrass		**Ennn** x	x	x	Eivr													
Estuary	Eb_s	Algal		**Ennn** x	x	x	Ebvk													
Estuary	Eb_s	Seagrass		**Ennn** x	x	x	Ebvr													
Estuary	Eh_i			**Ennn** x	x	x	Eihb													
Estuary	Eh_i	hard	x	x	x	**Ennn**	Eihr	Eihb	Eihq	Eihg	Eihn									
Estuary	Eh_i	ROCK	x	x	x	**Ennn**	Eihr													
Estuary	Eh_s	BOULDER	x	x	x	**Ennn**	Ebhb													
Estuary	Eh_s	hard	x	x	x	**Ennn**	Ebhr_a	Ebhr_p	Ebhr_s	Ebhr_w	Ebhb	Ebhn								
Estuary	Eh_s	ROCK	x	x	x	**Ennn**	Ebhr_a	Ebhr_p	Ebhr_s	Ebhr_w										
Estuary	Es_i	COBBLE/GRAVEL	x	x	x	**Ennn**	Eiuh													
Estuary	Es_i	MUD	x	x	x	**Ennn**	Eium													
Estuary	Es_i	soft	x	x	x	**Ennn**	Eiuh	Eium	Eiun	Einn										
Estuary	Es_s	COBBLE/GRAVEL	x	x	x	**Ennn**	Ebhg_a	Ebhg_p	Ebhg_s	Ebhg_w	Ebhq	Ebuh								
Estuary	Es_s	MUD	x	x	x	**Ennn**	Ebum	Ebum_a	Ebum_p	Ebum_s	Ebum_w									
Estuary	Es_s	SAND	x	x	x	**Ennn**	Ebus													
Estuary	Es_s	soft	x	x	x	**Ennn**	Ebhg_a	Ebhg_p	Ebhg_s	Ebhg_w	Ebhq	Ebuh	Ebum	Ebum_a	Ebum_p	Ebum_s	Ebum_w	Ebus	Ebut	Ebun
Flank (Slope)	Fh	hard	**Fnnn**	x	x	x	**Fbhb**	**Fbhg**	**Fbhn**	**Fbhq**	**Fbhr**	**Fbnn**								
Flank (Slope)	Fh	ROCK	**Fnnn**	x	x	x	**Fbhn**	**Fbhr**	**Fbnn**											
Flank (Slope)	Fm	GRAVEL/ROCK	**Fnnn**	x	x	x	**Fbcr**	**Fbcu**	**Fbch**	**Fbhg**	**Fbnn**									
Flank (Slope)	Fm	MUD/ROCK	**Fnnn**	x	x	x	**Fbcr**	**Fbcu**	**Fbcx**	**Fbnn**										
Flank (Slope)	Fm	ROCK/MUD	**Fnnn**	x	x	x	**Fbcr**	**Fbcu**	**Fbcx**	**Fbnn**										
Flank (Slope)	Fm	rock/sand	**Fnnn**	x	x	x	**Fbcw**	**Fbcu**	**Fbnn**											
Flank (Slope)	Fm	SAND/MUD	**Fnnn**	x	x	x	**Fbcu**	**Fbnn**												
Flank (Slope)	Fs	MUD	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbum**	**Fbun**	**Fbut**									
Flank (Slope)	Fs	SAND	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbun**	**Fbus**										
Flank (Slope)	Fs	soft	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbuh**	**Fbuh_w**	**Fbum**	**Fbun**	**Fbus**	**Fbut**						
Ridge	Rh	hard	**Fnnn**	x	x	x	**Fbhn**	**Fbhr**	**Fbnn**	**Fbhb**	**Fbhg**	**Fbhq**	**Fbhr**							
Ridge	Rh	ROCK	**Fnnn**	x	x	x	**Fbhn**	**Fbhr**	**Fbnn**											
Ridge	Rm	ROCK/MUD	**Fnnn**	x	x	x	**Fbcr**	**Fbcu**	**Fbcx**	**Fbnn**										
Ridge	Rm	ROCK/SAND	**Fnnn**	x	x	x	**Fbcr**	**Fbcu**	**Fbcw**	**Fbnn**										
Ridge	Rs	MUD	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbum**	**Fbun**	**Fbut**									
Ridge	Rs	sand	**Fnnn**	x	x	x	**Fbus**	**Fbun**												
Ridge	Rs	soft	**Fnnn**	x	x	x	**Fbnn**	**Fbub**	**Fbuh**	**Fbuh_w**	**Fbum**	**Fbun**	**Fbus**	**Fbut**						
Shelf	Sh	boulder	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbhn**	**Sbhb**	**Nbhn**	**Nbhb**									
Shelf	Sh	hard	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbhn**	**Sbhb**	**Sbhq**	**Sbhr**	**Sbhr_a**	**Sbhr_s**	**Nbhn**	**Nbhr**					
Shelf	Sh	ROCK	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbhn**	**Sbhr_a**	**Sbhr_s**	**Sbhr**	**Nbhn**	**Nbhr**							
Shelf	Sm	boulder/cobble	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbcu**	**Nbun**											
Shelf	Sm	boulder/gravel	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbcu**	**Nbun**											
Shelf	Sm	boulder/mud	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbcu**	**Sbcy**	**Nbun**										
Shelf	Sm	boulder/rock	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Nbun**												
Shelf	Sm	boulder/sand	x	**Snnn**	**Nnnn**	x	**Sbnn**	**Sbcu**	**Sbcl**	**Nbun**										

Appendix I-5: Habitat Use Database-2011 HUD Crosswalk Table

			HUD Wildcard Codes				HUD Codes													
Mega_Habitat	SGH_Prefix	Lith_Combo	Slope*	Shelf*	Nearsh*	Estuary*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Shelf	Sm	boulder/sand/gravel	x	Snnn	Nnnn	x	Sbnn	Sbcs	Sbcu	Sbcl	Nbun									
Shelf	Sm	boulder/shell	x	Snnn	Nnnn	x	Sbnn	Sbcu	Nbun											
Shelf	Sm	cobble/boulder	x	Snnn	Nnnn	x	Sbnn	Sbcu	Nbhq	Nbun										
Shelf	Sm	cobble/gravel	x	Snnn	Nnnn	x	Sbnn	Sbhg	Sbhg_a	Sbhg_s	Nbhq	Nbun								
Shelf	Sm	cobble/mud	x	Snnn	Nnnn	x	Sbnn	Sbcz	Nbhq	Nbun										
Shelf	Sm	cobble/rock	x	Snnn	Nnnn	x	Sbnn	Sbcr	Nbhq	Nbhr	Nbun									
Shelf	Sm	cobble/sand	x	Snnn	Nnnn	x	Sbnn	Sbci	Nbhq	Nbun										
Shelf	Sm	cobble/shell	x	Snnn	Nnnn	x	Sbnn	Nbhq	Nbun											
Shelf	Sm	gravel/boulder	x	Snnn	Nnnn	x	Sbnn	Sbcu	Nbun											
Shelf	Sm	gravel/cobble	x	Snnn	Nnnn	x	Sbnn	Sbhg	Sbhg_a	Sbhg_s	Nbun									
Shelf	Sm	gravel/mud	x	Snnn	Nnnn	x	Sbnn	Sbcg	Nbun											
Shelf	Sm	GRAVEL/ROCK	x	Snnn	Nnnn	x	Sbnn	Sbch	Sbcr	Nbun										
Shelf	Sm	GRAVEL/SAND	x	Snnn	Nnnn	x	Sbnn	Sbcs	Nbun											
Shelf	Sm	gravel/sand/mud	x	Snnn	Nnnn	x	Sbcg	Sbcs	Sbnn	Nbun										
Shelf	Sm	gravel/shell	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	mud/boulder	x	Snnn	Nnnn	x	Sbnn	Sbcy	Sbcu	Nbun										
Shelf	Sm	mud/cobble	x	Snnn	Nnnn	x	Sbnn	Sbcz	Nbun											
Shelf	Sm	mud/gravel	x	Snnn	Nnnn	x	Sbnn	Sbcg	Nbun											
Shelf	Sm	mud/rock	x	Snnn	Nnnn	x	Sbnn	Sbcx	Sbcr	Nbcx	Nbun									
Shelf	Sm	MUD/SAND	x	Snnn	Nnnn	x	Sbnn	Sbub	Sbct	Nbun	Nbub									
Shelf	Sm	mud/shell	x	Snnn	Nnnn	x	Sbnn	Sbub	Nbun											
Shelf	Sm	rock/boulder	x	Snnn	Nnnn	x	Sbnn	Sbhb	Sbhr	Sbhr_a	Sbhr_s	Nbun								
Shelf	Sm	rock/boulder/sand	x	Snnn	Nnnn	x	Sbnn	Sbcl	Sbcr	Sbcu	Sbcw	Nbun								
Shelf	Sm	rock/cobble	x	Snnn	Nnnn	x	Sbnn	Sbcr	Nbun											
Shelf	Sm	ROCK/GRAVEL	x	Snnn	Nnnn	x	Sbnn	Sbch	Sbcr	Nbun										
Shelf	Sm	ROCK/MUD	x	Snnn	Nnnn	x	Sbnn	Sbcr	Sbcx	Nbcx	Nbun									
Shelf	Sm	rock/mud/sand	x	Snnn	Nnnn	x	Sbnn	Sbcr	Sbcw	Sbcx	Nbun									
Shelf	Sm	ROCK/SAND	x	Snnn	Nnnn	x	Sbnn	Sbcr	Sbcw	Nbcw	Nbun									
Shelf	Sm	ROCK/SAND/MUD	x	Snnn	Nnnn	x	Sbnn	Sbcr	Sbcw	Sbcx	Nbun									
Shelf	Sm	rock/shell	x	Snnn	Nnnn	x	Sbnn	Sbcr	Nbun											
Shelf	Sm		x	Snnn	Nnnn	x	Sbnn	Sbch	Sbcr	Nbun										
Shelf	Sm	ROCK/SILT/SAND	x	Snnn	Nnnn	x	Sbnn	Sbcr	Nbun											
Shelf	Sm	sand/boulder	x	Snnn	Nnnn	x	Sbnn	Sbcl	Nbun	Sbcu										
Shelf	Sm	sand/cobble	x	Snnn	Nnnn	x	Sbnn	Sbci	Nbun											
Shelf	Sm	SAND/GRAVEL	x	Snnn	Nnnn	x	Sbnn	Sbcs	Nbun											
Shelf	Sm	SAND/MUD	x	Snnn	Nnnn	x	Sbnn	Sbub	Nbun	Nbub	Sbct									
Shelf	Sm	SAND/MUD/SHELL	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	sand/rock	x	Snnn	Nnnn	x	Sbnn	Sbcr	Sbcw	Nbcw	Nbun									
Shelf	Sm	SAND/SHELL	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	shell/boulder	x	Snnn	Nnnn	x	Sbnn	Sbcu	Nbun											
Shelf	Sm	shell/cobble	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	SHELL/GRAVEL	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	shell/mud	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Sm	shell/rock	x	Snnn	Nnnn	x	Sbnn	Sbcr	Nbun											
Shelf	Sm	shell/sand	x	Snnn	Nnnn	x	Sbnn	Nbun												
Shelf	Ss	cobble	x	Snnn	Nnnn	x	Sbnn	Sbhn	Sbhq	Nbhq	Nbun									
Shelf	Ss	GRAVEL	x	Snnn	Nnnn	x	Sbnn	Sbun	Sbuh	Nbun										
Shelf	Ss	MUD	x	Snnn	Nnnn	x	Sbnn	Sbun	Sbum	Sbum_a	Sbum_s	Sbut	Nbun	Nbum						
Shelf	Ss	SAND	x	Snnn	Nnnn	x	Sbnn	Sbun	Sbus	Nbun	Nbus									
Shelf	Ss	SHELL	x	Snnn	Nnnn	x	Sbnn	Sbun	Nbun											
Shelf	Ss	soft	x	Snnn	Nnnn	x	Sbnn	Sbun	Sbuh	Sbum	Sbum_a	Sbum_s	Sbub	Sbus	Sbut	Nbun	Nbus	Nbum		

APPENDIX I-6 INVERTEBRATE UPDATES

HUD Workshop: Species to add
Alan Shanks & Brian Tissot
(1/6/2010)

*Indicators
&Structure-forming
% Ecologically important
@Economically important

Need depth range, preferred depth range (if available), and geographic range.

<u>Cnidarians</u>
*Stylaster*californicus* (high relief hard substrate)
    Subtidal zone to 55m. Northern California to Southern California

Sea pens:
    Sea Whip (*Halipterus willeomoesi)* spp. **& (soft sediments)*
        Subtidal, below 20m. Southern Alaska to northern Washington, perhaps southern California.

    Orange sea pen *(Ptilosarcus gurneyi)*& (soft sediments)*
        Subtidal to 135m. On sand bottoms/soft sediments. Northern Alaska to northern Mexico.

    Stylatula elongata *& (soft sediments)
        Subtidal to below 10m. On sandy or mud bottoms. Southern Alaska to California.

Sea pansies *(Renilla koellikeri)**& (soft sediments)
    On sand, in shallow waters. Southern California to Cedros Island, Baja California.

Gorgonians %&*

- Purple (heavily branched) Gorgonian *(Eugorgia rubens)*
    Found in depths of 24 to 30m. Attached to rocks. Southern California to Baja. Common around the San Benito Islands off Baja.

- Red (branching) Gorgonian *(Lophogorgia chilensis)*
    Depths of about 15 to 60m. Monterey bay to Isla Cedros, Baja California.

-Short Red (branching) Gorgonian *(Swiftia spauldingi)*
    Subtidal to below 15m. Northern Washington to southern California. (Prefers habitat with strong current and ocean surge).

Anemones
    Pink-Tipped Anemone (*Anthropleura elegantissima)*
        Intertidal to about 18m. Abundant on rock faces or boulders, in tidepools or crevices, on wharf pilings. Alaska to central Baja.

    Green Surf Anemone *(Anthropleura anthogrammacus)*
        Low intertidal to about 30m. On rocks in tidepools and deep channels on exposed rocky shores, and on concrete pilings in open bays and harbors. Alaska to Panama.

Swimming Anemone *(Stomphia coccinea)*

Subtidal, below 10m. In very deep water on rocks. Circumpolar on this coast from northern Alaska to southern California.

Short Plumose anemone (*Metridium senile)*

Intertidal to 300m. On rocks warf pilings and other man-made structures, particularly in bays. Circumpolar; on our coast, from northern Alaska to Southern California.

Giant Plumose Anemone *(M. giganteum) (Metridium farcimen)*

Subtidal to 300m. On reefs, wrecks, and other structures. Northern Alaska to northern Mexico.

(*Utricina* spp.)

- Fish-eating Urticina (*Urticina piscivora*)

  From low intertidal to about 48m. On sides of rocks. Northern Alaska to southern California.

- Stubby rose anemone (*Urticina coriacea*)

  Intertidal to 45m. Attached to rocks, but usually buried partially in sand or shell debris. Alaska to southern California.

- Sand-rose anemone (*Urticina columbiana*)

  Subtidal, from 3 to 45m. Buried in sand and mud bottoms. Southern British Columbia to northern Mexico.

Orange cup coral (*Balanophyllia)* (high relief hard substrate)

Low intertidal to at least 48m. Attached to rocks. Southern Alaska to northern Mexico.

Pom-Pom Anemone (*Liponema brevicornis)*

Habitat: Deep sea. Range: soft, muddy seafloor at depths of 100-1,000m. <montereybayaquarium.org>

Dog-Toy Anemone (*Anthomastus ritteri*) (deep soft sediments)

Habitat: Deep sea. Range: on rocky surfaces at depths of 213-1,243m. <montereybayaquarium.org>

<u>Mollusks</u>

Purple Olivella (*Olivella biplicata*)

Low intertidal to shallow subtidal (preferred) to 50 m. Sandy bottoms in lagoons, bays and the open coast. British Columbia to Baja.

Black Turban snails (*Tegula funebralis)*

Intertidal rocks in protected coastal areas. British Columbia to Baja.

Brown Turban Snail (*T. brunnea*)*

Low intertidal & kelp forest. On blades and stipes of brown algae. Channel Islands to Cape Arage (rare).

Moon snail (*Polinices lewisii*)*& (shallow sand & mud, top predators)

Low intertidal to subtidal 150 m. Soft substrata off open coast. British Columbia to Baja.

Rock Scallop (*Hinnites giganteus*)

Low intertidal to 50 m. Cemeted to rocks. British Columbia to Baja California.
Geoduck

(*Panope generosa)*
Low intertidal to subtidal (no depth range given) in sandy mud of protected waters and bays. Common Alaska to Baja.

Northern Razor clam (*Siliqua patul)*
Common in sand on open flat beaches (dissipative beaches) receiving strong wave action. Low intertidal to shallow subtidal. Alaska to Pismo beach.

Native oyster (*Ostrea lurida*)@
Attached to rocks and shells in low intertidal in quite bays and estuaries. Alaska to Baja California

Swimming scallop (*Chlamys hastata*)@
On rocks, sand, or mud, from low-tide line to 152 m deep. Southern Alaska to Santa Barbara, California.

Giant Pacific Octopus (*Octopus dofleini*)%
Smaller individuals in low intertidal on rocky shores, Larger individuals subtidal to 100 m. Found around the north Pacific rim from Northern Asia to California. There is a subspecies (*O. dofleini martinis*) off British Columbia.

Humboldt squid@ (*Dosidicus gigas*)
Epipelagic to several hundred meters, common South America to Baja, in some years abundant off California and Oregon.

Gumboot chiton (*Crytochiton stelleri*)* (intertidal)
Intertidal rocky shores. Subtidal in kelp beds. Aleutian Islands to San Nicolas in southern California.

<u>Branchiopods</u>
Terebratalia transversa (no common name)
Low intertidal (rare) more common subtidal to at least 1,800 m. On hard surfaces. Alaska to Baja.
<u>Arthropods</u>
Sand Crab (*Emerita analoga*)
On sandy beaches in the intertidal. Chile to Oregon. Populations in Oregon are dependent on larvae carried from California by currents.

Blueband, Grainyhand, Hairy Hermit crabs* (*Pagurus samuelis, P. granosimanus,* and *P. hirsutiusculus*)
Common intertidal, rare subtidal to 30m. Alaska to central California or Baja.

Blackeyed and Alaskan hermits (*Pagurus armatus* and *P. ochotensi*)
P. armatus – low intertidal to 146 m. On sandy bottoms in sheltered areas. Common in sea pen beds. Alaska to Southern California
P. ochotensis – low intertidal to 400 m. Sand or muddy sand. Alaska to Pt. Arena, California.

Brown Box crabs (*Lopholithodes foraminatus*)@
Low intertidal to 550 m Typically on muddy bottoms below 18 m. Alaska to San Diego.

Appendix I-6: Habitat Use Database-Invertebrate Updates

Flat Porcelain crab (*Petrolisthes cinctipes and P. eriomerus*)
Intertidal on rocky shores. British Columbia to Santa Barbara

Flattop Porcelain crab (*Petrolisthes eriomerus*)
Under rocks low intertidal to 85 m. Alaska to San Diego.

Snow/tanner crab (*Chinoecetes bairdi*)@
Open mud or sand bottoms from 6 to 500 m. Juveniles at shallower depths, adults deeper. Bering Sea to Winchester Bay, Oregon.

Oregon cancer crab (*Cancer oregoensis*)@
Intertidal to 436 m depth. On rocky substrates. Alaska to Southern California Bight.

Red rock crab (*Cancer productus*)
Intertidal to 79 m. Younger crabs in shallow, older deeper. Occurs on a wide range of substrates, but most common in gravelly areas and on well-protected boulder beaches. Common in estuaries. Alaska to Baja.

Northern Kelp Crab (*Pugettia producta*)
Juveniles in the intertidal zone under rocks or in algae. Adults in kelp beds often in canopy. Alaska to Baja.

Bay ghost shrimp (*Neotrypea californiensis*)*
Sand and muddy sand in bays and estuaries. Alaska to Baja

Blue mud shrimp (*Upogebia pugettensis*)*
In estuarine mud in low intertidal. Alaska to Morro Bay, California.

Shore crabs (*Hemigrapsus nuda* & *H. oregonensis*)* (intertidal)
(*H. nuda*) Intertidal on rocky shores. Mostly open coast. Alaska to Baja.
(*H. oregonensis*) Intertidal under rocks on muddy or gravel beaches. Common in estuaries. Alaska to Baja.

Striped shore crabs (*Pachygrapsus crassipes*)* (El Nino in Oregon)
Rocky intertidal. Ecola State Park, Oregon to Baja. Present following El Ninos then slowly dies out.

Giant acorn barnacle (*Balanus nubilus*)
On hard surfaces low intertidal to 90 m. Alaska to La Jolla.

Gooseneck barnacles (Pollicipes polymerus)
Middle intertidal on rocks. British Columbia to Baja.

Smooth Bay Shrimp. (*Lissocrangon stylirostris*)
Common. Found intertidally on high energy sandy beaches and subtidally to 80 m. Alaska to central California.

Pink shrimp (*Pandalus jordani*)*@ (soft sediments)
Depth 45 to 370 m. Important commercial species. Alaska to Baja.

Sidestriped shrimp (*Pandalopsis dispar*)
Found on soft bottoms in deep water from 46 to 650 m. Fished commercially. Alaska to Manhattan beach, Oregon.

Spot prawn (*Pandalus platyceros*)*@

On rocky bottoms and vertical rock faces from very low intertidal to 500 m. Commercial and sport fishery. Alaska to Baja.

<u>Echinoderms</u>

Feather Star Crinoid (*Florometra serritissima*)&

Shallow subtidal to 1252m. On soft and hard bottoms. Alaska to Baja.

Sunflower star (*Pycnopodia/Rathbunaster*)%& (top predator)

Low intertidal to about 435m. On rocky as well as soft bottoms. Northern Alaska to northern Mexico.

Leather star (*Dermastaerias imbricata*) (rock)

Very low intertidal to 91m. On rocks, occasionally on sand. Central Alaska to northern Mexico.

Sand star (*Luidia foliolata*)* (deep mud/sand)

Intertidal to 613m. On soft bottoms. Central Alaska to Nicaragua, Galapagos Islands.

Pisaster spp. (giganteus) brevispinus)& (top predators)

-Giant Spined Star (Pisaster giganteus)& (top predators)

Very low intertidal to about 90m. On rocky as well as sand bottoms. Vancouver Island, British Columbia to Isla Cedros, Baja California.

-Short Spined Sea Star (Pisaster brevispinus)& (top predators)

Low intertidal to 182m. On rocky and soft bottoms. Southern Alaska to southern California.

Fragile Pink Urchin *(Allocentrotus fragilis)** (deep mud)

Found at depths of 50-1260m. On soft as well as rocky substrate. Queen Charlotte Islands to Baja California.

White sea urchin (*Lytechinus anamesus*)* (mid-depth sand)

Shallow subtidal to about 300m. On soft as well as rocky bottoms. Channel Islands, California to Gulf of California.

Sand dollar (*Dendraster excentricus*)* (nearshore sand)

Low intertidal to 90m. Soft substrate. Alaska to the central west coast of Baja California.

Burrowing sea cucumbers (*Psolus* spp). * (soft mud)

-Creeping Pedal Sea Cucumber or Slipper Sea Cucumber *(Psolus chitonoides)* * (soft mud)

Intertidal to 250m. Common in shallow subtidal areas. On rocks. Northern Alaska to northern Mexico.

-White Creeping Pedal Sea Cucumber *(Psolus squamatus)* * (soft mud)

Subtidal, between 37-1,061m. Northern Alaska to southern Chile.

Basketstar (*Gorgonocephalus eucnemis*)%& (high relief hard substrate)

Subtidal, between 10-1,850m. Typically from 15-150m. Sometimes abundant on rocky bottoms with moderate to strong water currents, or on mud and sand bottoms with projecting boulders, sea fans, and sea pens. Circumpolar; On our coast, from the Bering Sea (Northern Alaska) to southern California.

Appendix I-6: Habitat Use Database-Invertebrate Updates

Fishes

Intertidal fish

High Cockscomb (*Anoplarchus purperescens*)

Rocky intertidal. Alaska to southern California

Rock prickleback (*Xiphister mucosus*)

Rocky intertidal and subtidal to 18m. Alaska to southern California

Penpoint Gunnel (*Apodicththys flavidus*)

Rocky intertidal. Alaska to southern California

Tidepool sculpin (*Oligocottus maculosus*)

Tidepools on rocky shores. Bering sea to northern California.

Calico and mosshead sculpins (*Clinocottus embryum* and *C. globiceps*)

Intertidal rocky shores. In tidepools and under rocks. Alaska to southern California

Buffalo sculpin (*Enophrys bison*)

Intertidal to shallow subtidal (0 to 20 m) on rocky and sandy substrates. Alaska to central California.

Northern Clingfish (*Gobiesox maeandricus*)

Intertidal rocky shores. Alaska to southern California.

Surf smelt (*Hypomesus pretiosus pretiosus*)

Adults in nearshore waters. Spawn in course sand or fine gravel beaches in the high intertidal. Popular recreational fishery.

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APPENDIX J: FISHING GEAR IMPACTS FINDINGS FROM AMENDMENT 19 (EFH) TO THE GROUNDFISH FMP AS COMPARED TO CURRENT INFORMATION

2005 Findings Summary

As part of the initial EFH process, the Council issued an Impacts Model for Groundfish Essential Fish Habitat in 2005, which was adapted from the *Risk Assessment for the Pacific Groundfish FMP*. The Risk Assessment describes the EFH Model used to identify and describe EFH, an Impacts Model developed to evaluate anthropogenic impacts to EFH, and a data gaps analysis.

In 2005, there were several literature reviews on the effects of fishing gears on habitat, containing some studies specific to the West Coast. Only two studies from the Pacific were found that had useful information for the analysis. In order to develop a more complete picture of potential impacts, and following the recommendations of the NRC 2002 report on the Effects of Trawling and Dredging on Seafloor Habitat, the review relied on studies from the global literature. It was determined reasonable to infer impacts from studies in other areas so long as they are based on similar gear x habitat combinations, so the analysis was limited to only studies that involved gear types used on the west coast and the major habitat types that occur there. Hence, research from areas other than the Pacific coast provided most of the information on which the analysis was based.

In an effort to provide a quantitative measure of the degree of habitat modification resulting from a unit of fishing effort, two notional indices were developed: the Sensitivity Index and the Recovery Index. The Sensitivity Index provided a relative measure of the sensitivity of habitats to the action of fishing gears. The Recovery Index provided a measure of the time taken for a habitat to recover to a pre-impacted state.

The analysis suggested the following relative rankings of gear from highest to lowest impact: dredges > bottom trawls > pots & traps (no empirical data available for nets and hook & line gears). Although relatively less research existed on fixed gears, the various types of nets (gillnets, seines) were generally considered to have much less impact on the seabed than dredges and trawls, and hook & line methods had the least impact. Hence, the derived values reflect this relative ranking of impacts: dredges > trawls > nets > pots and traps > hook and line. These relative rankings corroborated those provided in Chuenpagdee et al.'s (2003) evaluation of U.S. fishing gears on seafloor habitat.

In addition to the relative gear rankings, the analysis of empirical research also showed a nearly consistent sensitivity ranking by substrate/macrohabitat type almost regardless of gear type from most adversely impacted to least: biogenic > hard bottom > soft sediment.

The 2005 analysis emphasized they only had a preliminary understanding of how fishing gear impacts biogenic habitats. Recovery times ranged mainly from zero to five years, although these were thought to be much longer for slow growing biogenic habitat such as corals and sponges, and the overall trends by gear and habitat types were similar to the trends indicated by sensitivity levels.

The general trends shown by the analysis when organizing habitats from most to least sensitive, and gears from most to least impacting, were similar to previous assessments. In terms of major habitats, biogenic habitats were found to be more sensitive than hard bottoms (although the former may occur on the latter) and these were found to be much more sensitive than soft bottoms.

There was very little research useful for the analysis on gear impacts in water depths exceeding 200 m. It should be noted, however, that there are theoretical bases for adjusting values from these deeper habitats. Benthic communities in deeper waters where wind and waves do not disturb the seabed were found to be probably less adapted to resisting and recovering from physical disturbances generally (Watling and Norse 1998). No such adjustments, however, were attempted for the analysis. Hence, the analysis should not be interpreted as a direct quantification of gear impacts that can be used to infer, for example, functional habitat characteristics related to EFH.

A related topic that was not considered in the analysis was the issue of fishing intensity, or frequency of disturbance of the bottom by fishing gear. In particular, if the period between successive trawl tows in a specific habitat is less than the recovery time, the habitat will remain in a chronically impacted state.

There was very little quantitative information describing the relationship between habitat type, structure, and function and the productivity of managed fish species. In particular, the level of information for most species x habitat associations remained at Level 1 as defined in the NMFS EFH Final Rule Guidance (i.e., presence-absence only), requiring a precautionary approach to the determination of potential adverse impacts.

Summary of Changes since the 2005 Findings

Since 2005, there are been several new publications including peer-reviewed literature, white papers and technical memorandums relevant to West Coast groundfish fisheries that have studied: 1) the effects of fishing gear on benthic habitats; 2) the status of biogenic habitat (corals and sponges); 3) predictive modeling of biogenic habitats; and 4) the effects of fishing gear-related marine debris on habitats.

The Effects of Fishing Gear on Benthic Habitats

The recent studies on the effects of fishing gear on benthic habitats are primarily focused on the effects of trawling. However, there is at least one publication that discusses the effects of bottom longlines. There have been several new studies the west coast of the contiguous US, Canada and Alaska that have focused on otter trawls in unconsolidated substrate including sand and mud that contain biogenic habitat on the seafloor. Additionally since 2005, general effects of fishing with mobile, bottom-contact fishing gear (such as otter trawls) are increasingly well established through studies worldwide. Relative to the information available in 2005, the new studies including those performed on the U.S. west coast, found significant impacts of trawling on soft sediment habitats. The following are summaries of the most recent and relevant findings that highlight new information to be considered when determining if there is a need to alter current EFH designations:

- Kaiser et al. (2006) conducted a meta-analysis of 101 different fishing impact manipulations and found that the direct effects of different types of fishing gear were strongly habitat-specific. The biota of soft-sediment habitats, in particular muddy sands, were surprisingly vulnerable, with predicted recovery times measured in years. Slow-growing large-biomass biota such as sponges and soft corals took much longer to recover (up to 8 yr) than biota with shorter life-spans such as polychaetes (<1 yr). Otter Trawls had a significant initial effect on muddy-sand and mud habitats and this could reflect the great depth to which otter doors penetrate this soft sediment habitat, but on the latter these effects were short-lived with an apparent long-term, positive, post-trawl, disturbance response (there were no recovery data for muddy-sand). This positive response may represent an increase in the abundance of smaller-bodied fauna, but a possible overall decrease in biomass in response to trawling. In muddy sand, crustaceans appear more strongly impacted by otter trawls than annelids and mollusks. The effect of otter trawls in biogenic habitats was less severe than for scallop dredges, but there was insufficient data to deduce an accurate recovery time based on published experimental manipulations.
- Baer et al. (2010) found that bottom longlines can cause significant damage to sensitive habitats through entanglement and concluded that management of areas to be fished appear to be the main mitigative strategy for this problem.
- Brown et al. (2005) studied the effects of commercial otter trawling on benthic communities in

the southeastern Bering Sea and documented that mobile invertebrate scavengers were more abundant in chronically trawled areas.

- De Marignac et al. (2008) conducted an analysis of videographic data on unconsolidated substrates in areas opened and closed to trawling on the central California coast and found that significant differences existed between an actively trawled area and an area that had been recovering from trawling impacts for three years at the time of sampling. Findings indicated that biogenic mound and biogenic depression microhabitats were significantly less abundant at trawled sites. Epifaunal macro-invertebrates were sparsely distributed and occurred in low numbers in both treatments. However, their total abundance was significantly different between treatments, which was attributable to lower densities at trawled sites. These differences were manifest in the micro-topographic structure that fish utilize for protection from predation and as refugia from currents, as well as in invertebrate epifaunal and infaunal communities. Each of the differences was found to be consistent with the literature dealing with gear impacts to seafloor communities.
- Lindholm et al. (2008) studied Patterns in the distribution of the sea whip in an area impacted by mobile fishing gear off the central California coast and found that the marked difference in the occurrence of upright sea whips among video transects was un-anticipated and may be attributable to two primary factors: water depth and/or impacts from otter trawling.
- Hixon and Tissot (2007) compared trawled versus untrawled mud seafloor assemblages of fishes and macroinvertebrates at Coquille Bank, Oregon and concluded that the observed differences between trawled and untrawled demersal fish and epibenthic macroinvertebrate communities on deep mud seafloors adjacent to Coquille Bank were the result of gear impacts of groundfishing activities, particularly trawling, rather than local environmental differences. These differences suggest that the effects of bottom trawling along the west coast of North America are similar to those documented on deep soft-sediment seafloors elsewhere in the world. Furthermore they point out that it seems prudent to consider the adverse impacts of bottom trawling on mud-seafloor ecosystems of the continental shelf and slope and that their results are best examined in the context of the many rigorous studies worldwide demonstrating that bottom trawling clearly alters communities of seafloor species.
- Interpretation of the Hixon and Tissot study is complicated by the fact that the sites they compared had nonoverlapping depth ranges, confounding depth and trawling-related effects on the biota (Hannah et al. 2010). However, Hannah et al. 2010 studied the effects of trawling for ocean shrimp on macroinvertebrate abundance and diversity near Nehalem Bank, Oregon at shallower depths and found comparable results: that densities of the sea whip, the flat mud star, unidentified Asteroidea, and squat lobsters were lower at heavily trawled sites, as was invertebrate diversity based on the Shannon-Wiener index. Sea cucumbers and unidentified corals were observed at lightly trawled sites but not at heavily trawled sites.

Several papers have underscored the fact that little has been written about recovery of seafloor habitat from the effects of fishing and that there is a lack of long-term studies, control sites or research closures, which hinder the ability to fully evaluate impacts. ODFW Marine Resources Program Staff also highlighted this issue during a technical review and discussion of the Hixon and Tissot paper where concerns were raised about the designated ‘untrawled’ area as an area that was part of historical shrimp and groundfish trawling grounds, which could hinder an accurate evaluation of impacts and recovery. They stated: "This is an analysis of data collected during a 1990 survey in response to proposals for oil drilling off of the west coast. The result was a comparison that was not adequately controlled for differences between sites. In addition MRP data shows that both sites had been trawled by bottom trawl gear." In response to this critique and other concerns raised, the authors responded that these critiques did not affect the general result of documented trawl impacts to soft sediment.

Predictive Modeling of Biogenic Habitats

Subsequent to the EFH Final Action in 2005, Fujioka (2006) documented the impacts model used in the

Alaska EFH process. This model offered several advantages over the impacts model used in the West Coast EFH process. In particular the model addressed:
Spatial heterogeneity in trawl effort and habitat types;

- Trawl intensity, using empirical trawl effort data from the region;
- More realistic estimates of recovery time for hard corals on the order of 100 years;
- Development of a Long-term Effect Index (LEI), which calculated an estimate of the proportion of each habitat type in each cell impacted over the long-term under current levels of effort.

Key outcomes of the analysis were that the LEI results for hard corals were typically greater than 50% even under low levels of trawl effort and that substantial long-term impacts could occur to soft sediment habitats depending on trawl intensity. While this approach employs a model with several underlying assumptions, it provides for quantitative estimates of fishing impacts in a spatially explicit manner, which is a significant improvement over the qualitative nature of the impacts model used in the west coast Pacific EFH process that concluded in 2005.

The Effects of Marine Debris on Benthic Habitats

Watters et al (2010). provided the first quantitative assessment of marine debris and its impacts to the seafloor in deep submarine canyons and continental shelf locations off California and the US. They discerned only a few negative impacts to benthic organisms. Two incidents of ghost fishing by derelict gear were observed over 189 km of surveyed seafloor and a variety of habitats; however, several gear items could not be evaluated for ghost fishing due to limited viewing from the videotape. Entanglement of fishes in other types of debris was not witnessed. Some physical disturbance to habitats (including common structure-forming macroinvertebrates) was observed, which was caused by debris. It is possible that there was limited ability to see disturbance from the videotape, especially when caused by monofilament line. However, from scuba surveys conducted in shallow reefs (which provide direct viewing of marine debris), Chiappone et al. (2005) found that less than 0.2% of the available invertebrates were affected by lost hook-and-line fishing gear, even though this gear caused 84% of the documented impacts (primarily tissue abrasion) to sponges and cnidarians. Debris was found to alter the seafloor, by providing artificial habitat to demersal organisms. The majority of the debris was colonized, sometimes quite heavily, by encrusting invertebrates.

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APPENDIX K COMMERCIAL FISHING EFFORT

Appendix K-1 Bottom Trawl Effort

Appendix K-2 Mid-Water Trawl Effort

Appendix K-3 Fixed Gear Effort

Appendix K-1 Bottom Trawl Effort

Figures in Appendix K-1 depict the spatial distribution of commercial bottom trawl effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Each of the three coastal states administers a commercial logbook program, for which records are uploaded to the PacFIN regional database. Database records were utilized for commercial trips using bottom trawl gear types (e.g., "small" footrope, "large" footrope, flatfish, selective flatfish, and roller trawl) regardless of fishery sector (e.g., limited entry, open access). Records from the majority of state-managed trawl fisheries (e.g., pink shrimp, ridgeback prawn, sea urchin) are not included in PacFIN and thus are not represented in the figures. Tows targeting one state-managed trawl fishery – California halibut – are submitted to PacFIN and thus are included in the bottom trawl effort summaries.

In order to analyze the effort data spatially, a straight line connecting the start and end points was used to represent each tow event. Towlines intersecting land, outside the U.S. EEZ, deeper than 2,000 m, or with a calculated straight-line speed greater than five knots were removed from the spatial analysis. Two complimentary data products were created with these records: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than three vessels were operating, and 2) an extent polygon that shows the gross spatial extent of effort.

The first data product, intensity, was calculated as the total length of all towlines intersecting a standardized area. To calculate this metric, a line density algorithm in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) was used. The line density algorithm calculates density within a circular search area (radius = 3 km) centered at a grid cell (size 500 m x 500 m). The value (units: km/km^2) for each grid cell is the quotient of total towline portions intersecting the circular area per grid cell area. Since density outputs are highly sensitive to the specified radius and cell size, the absolute values are less important than the relative nature of them. The benefit of this output over depicting towlines themselves is that the density output better identifies areas where fishing effort is concentrated, while still ensuring confidentiality of individual fishing locations. The initial density output was more spatially extensive than the one shown in Appendix K-1, because it included cells with density values calculated from tows made by less than three vessels. Those "confidential" cells were removed for the final published data product. Density parameters were chosen in order to minimize data exclusion (due to confidentiality mandates) while still providing a fairly high spatial resolution (500 x 500 m). For the bottom trawl effort maps, only 1.1 and 1.8 percent of all effort (i.e., length of towlines) was excluded within a given time period, although the proportion varies considerably in certain areas along the coast.

The second data product, the extent polygon, was created using an algorithm known as a convex hull. Convex hulls are a type of minimum extent polygon that forms an "envelope" around a group of points, or in this case, straight lines representing tows. The algorithm can be applied at various spatial scales. In this case, we grouped towlines into 0.5° latitude x 0.5° longitude blocks. The algorithm was then applied to each set of towlines within each block. Finally, all convex hull polygons were merged together for each time period. The resulting polygon encloses all towlines within each time period (e.g., Figure 15). The best way to interpret this data product is that no bottom trawling occurred outside of the extent polygon within a particular time period. In order to ensure that each extent polygon encompasses towlines from at least three vessels, the result is an overestimation of the areas of seafloor actually contacted by trawl gear. In fact, there are many areas within the extent polygon where no trawling occurred; hence this product is only intended to represent the gross "footprint" of trawling for each time period. However, there are several alternative approaches to determining the "footprint" of fishing effort resulting in very different spatial extents and interpretations, such as identifying the minimum area encompassing a certain percentage of all tows (e.g., Ban and Vincent 2009).

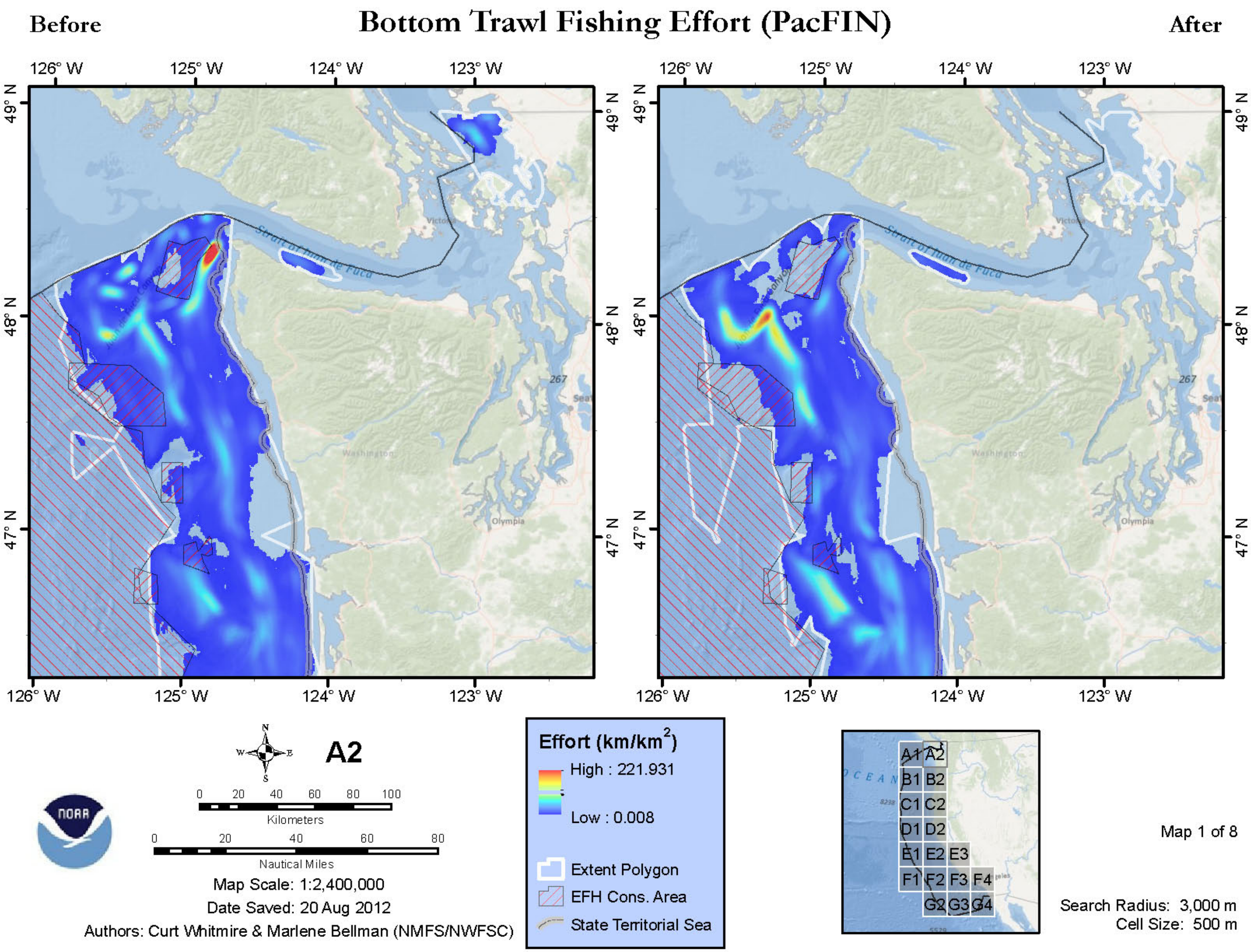
Appendix K-1: Bottom Trawl Effort

These spatial summaries of bottom trawl effort were developed from data represented only by start and end points of tows. It is recognized that tows rarely follow straight-line paths; however, this was the best information available on the spatial distribution of effort for vessels using bottom trawl gears. Because of this limitation and due to prohibitions of trawling within state waters, representatives of the states of Washington and California requested that any portions of the spatial summaries that intersect prohibited state waters be removed. In addition, Washington requested that effort occurring within both state and federal waters of the Salish Sea be removed since they felt that this information was incomplete and may not be representative of fishing effort within those areas. However, NMFS General Counsel has advised the EFHRC that there is not justification to limit access/display of these data from state waters so they are included in the map products.

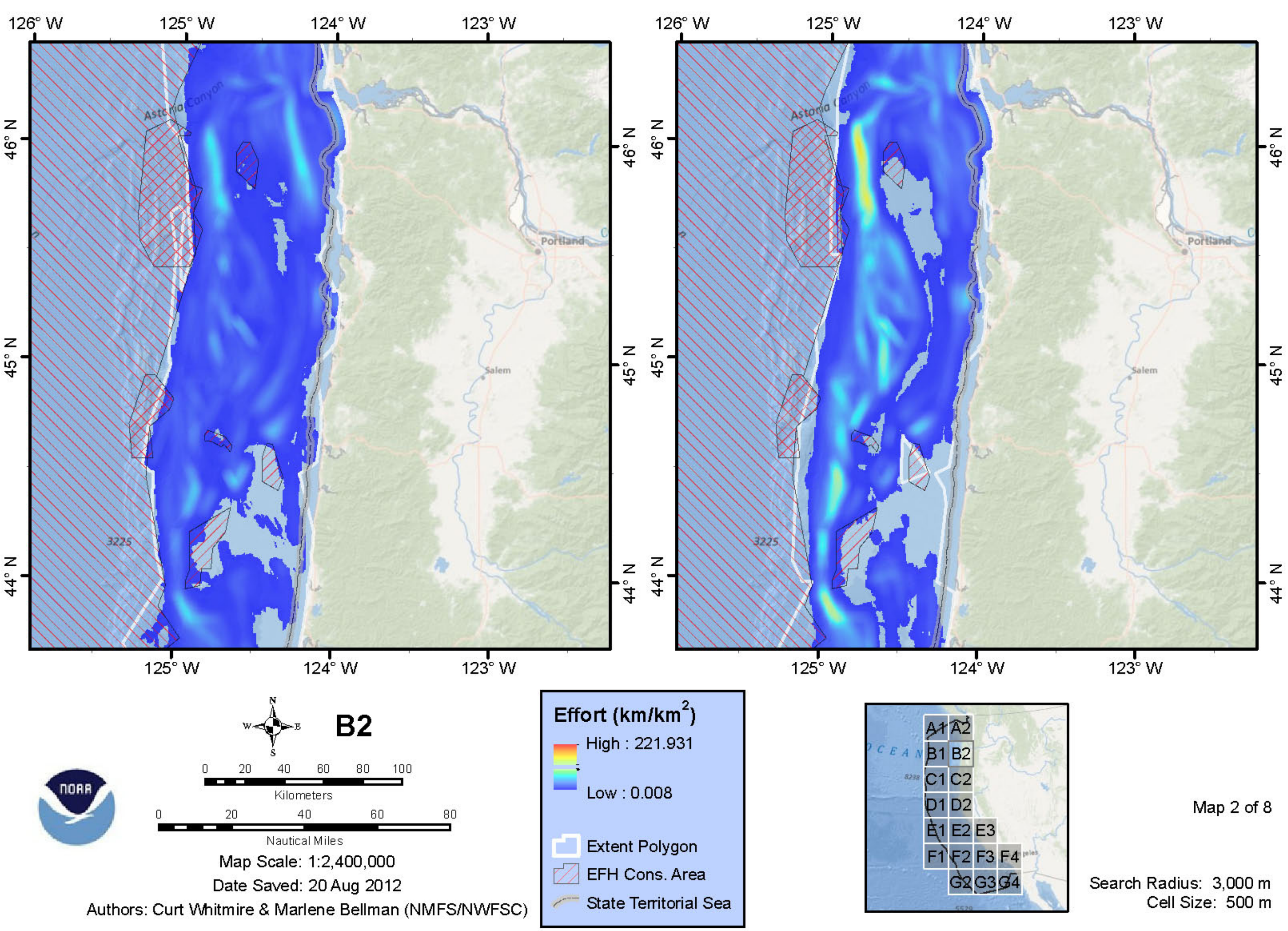
In order to evaluate how fishing effort has changed between the two time periods, the color ramps for the intensity layers are scaled to the same range of values in each panel (see Appendix K-1 figures). Blue- (red-) shaded areas represent the lowest (highest) relative effort in both time periods. The upper value in the map legends is the lowest "high" value between the time periods. It was necessary to set the color ramp to the lowest "high" value in order for the colors in each panel to perfectly match and therefore be comparative.

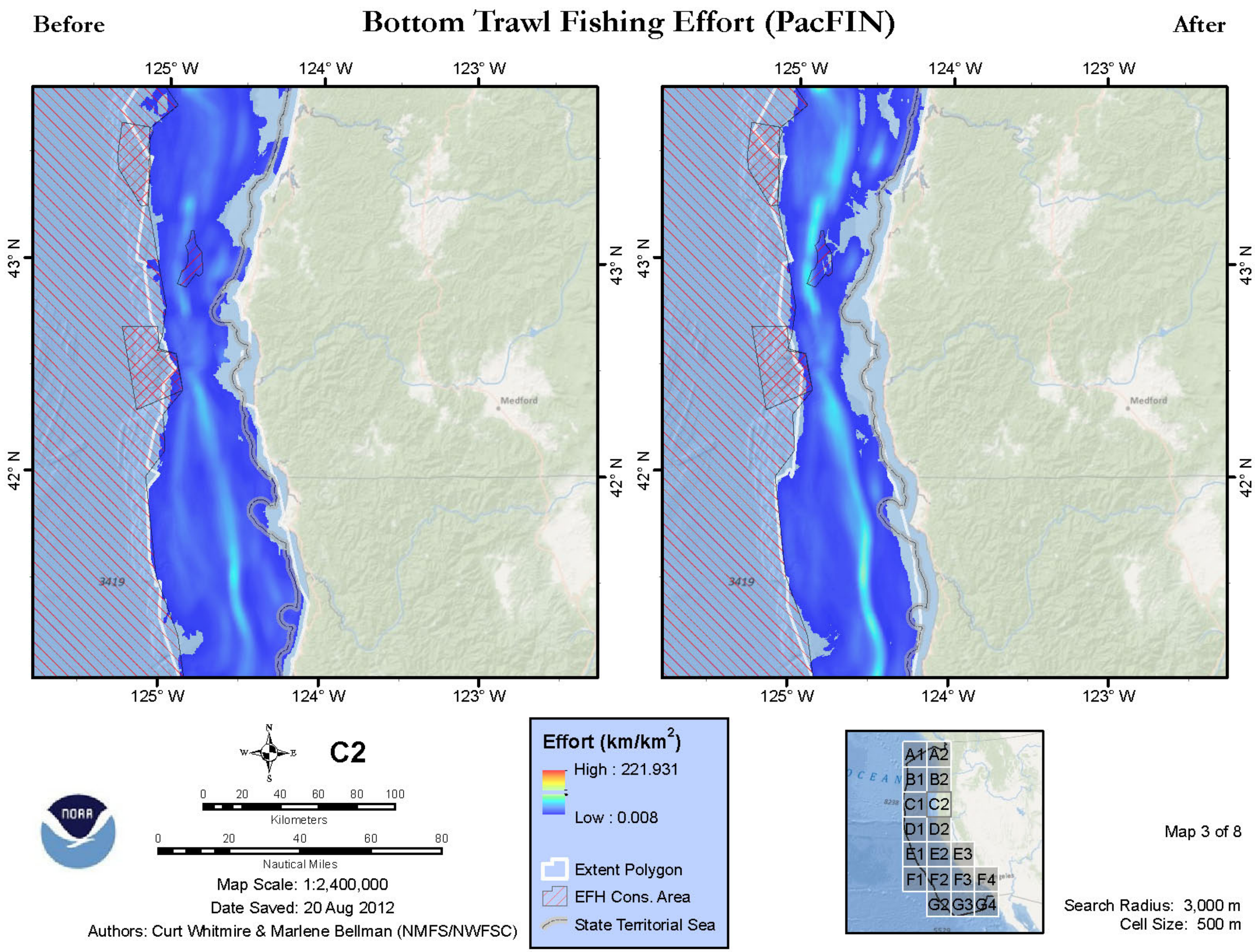
Areas of high relative effort in the former time period are apparent off northern Washington (Plate A2), in Monterey Bay, CA (Plate E3) and south of Los Angeles, CA (Plate F4). In the recent time period, only one area in deeper waters off northern Washington (Plate A2) shows up with relatively high bottom trawl effort. There are a number of areas of medium to medium-high relative effort that show up in the map panels for both time periods. They are distributed throughout the region over both the shelf and slope, often showing some persistence between the two time periods.

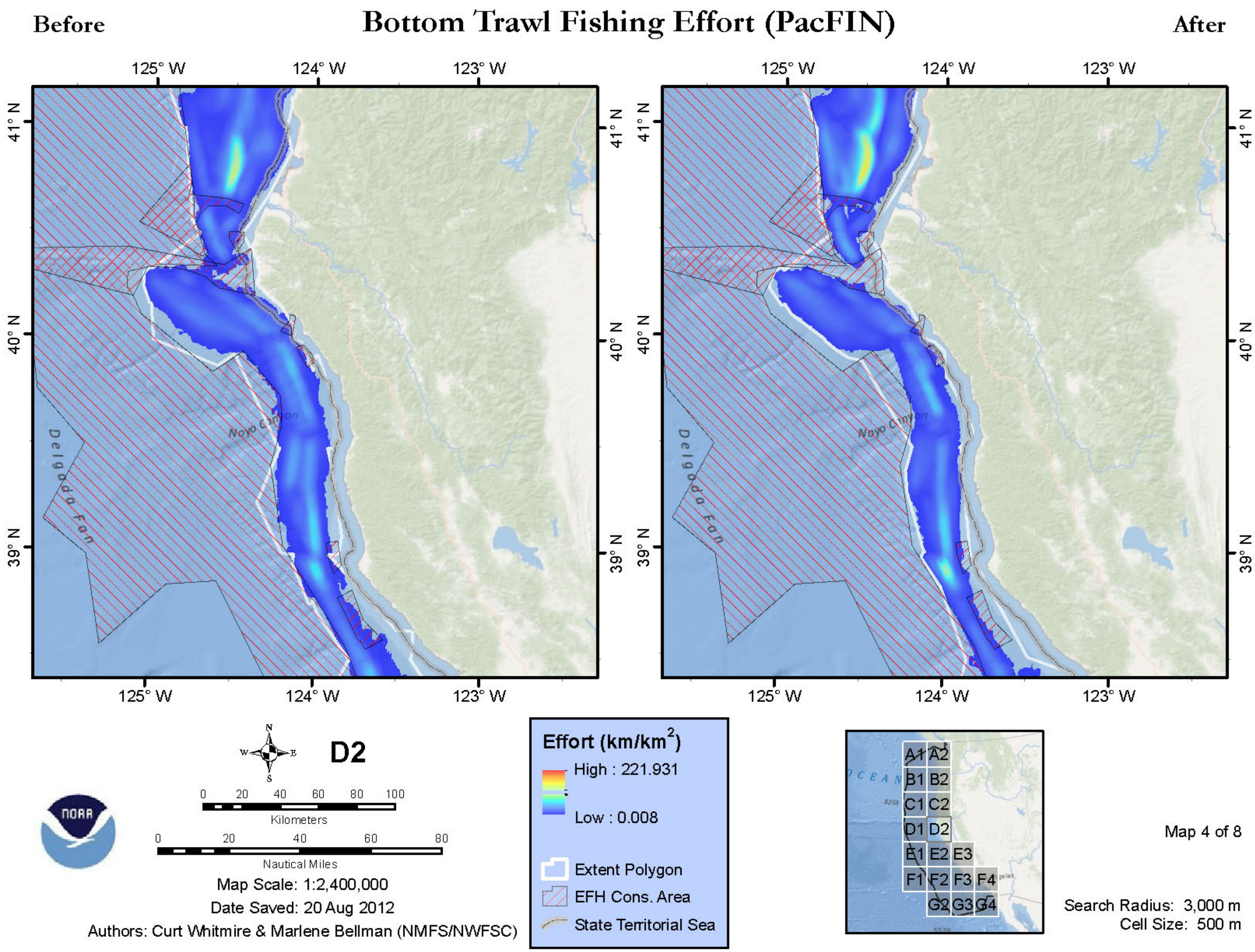
To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.


Before
Bottom Trawl Fishing Effort (PacFIN)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
Washington
Olympia
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km2)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Bottom Trawl Fishing Effort (PacFIN)

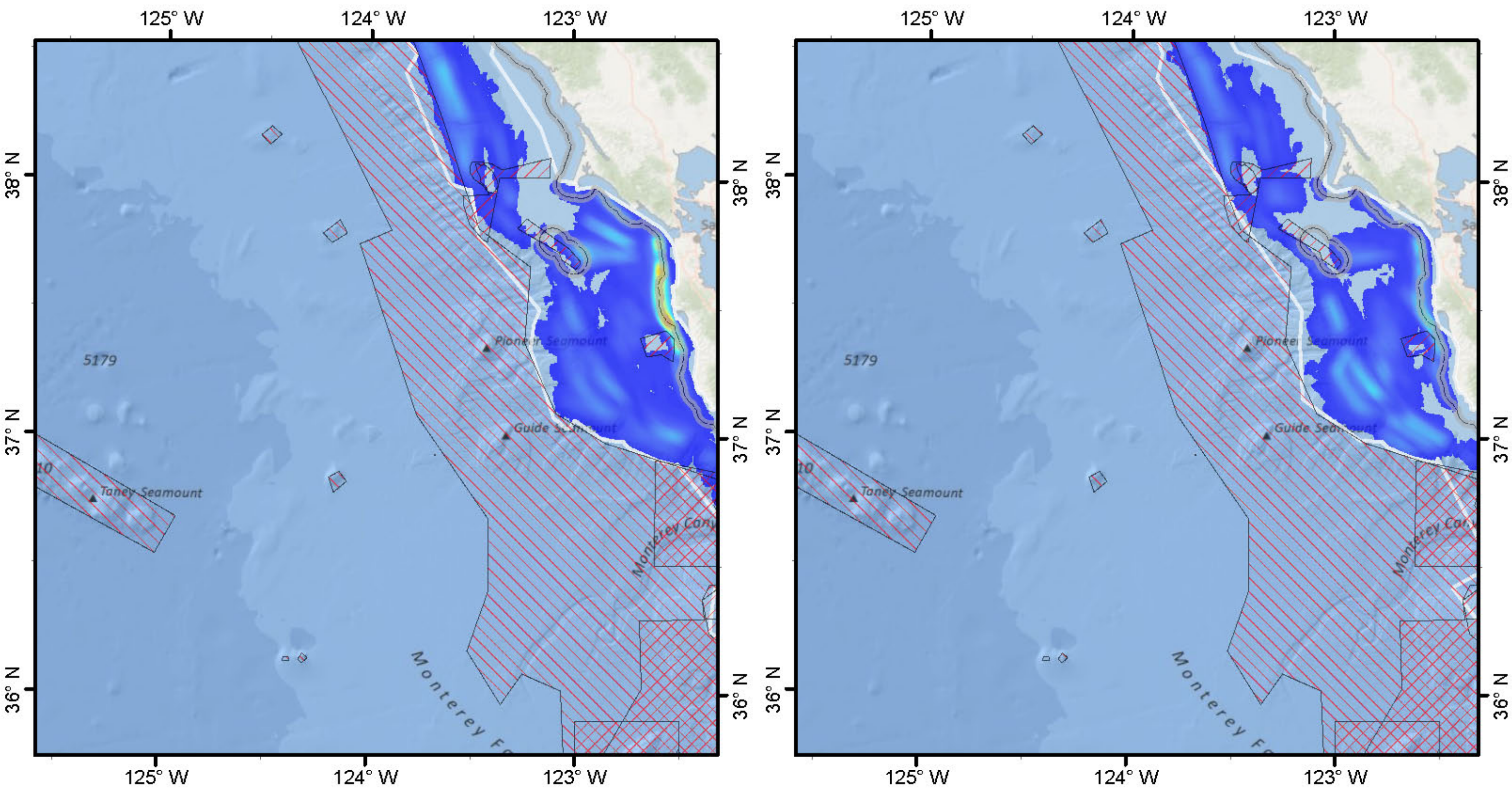



Before
Bottom Trawl Fishing Effort (PacFIN)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Bottom Trawl Fishing Effort (PacFIN)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Bottom Trawl Fishing Effort (PacFIN)

Before | **After**



E2

0 20 40 60 80 100
Kilometers

0 20 40 60 80
Nautical Miles

Map Scale: 1:2,400,000

Date Saved: 20 Aug 2012

Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)

Effort (km/km^2)

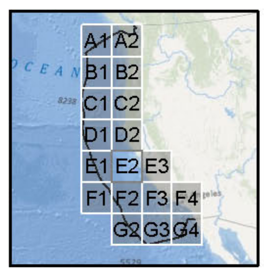
High : 221.931

Low : 0.008

Extent Polygon

EFH Cons. Area

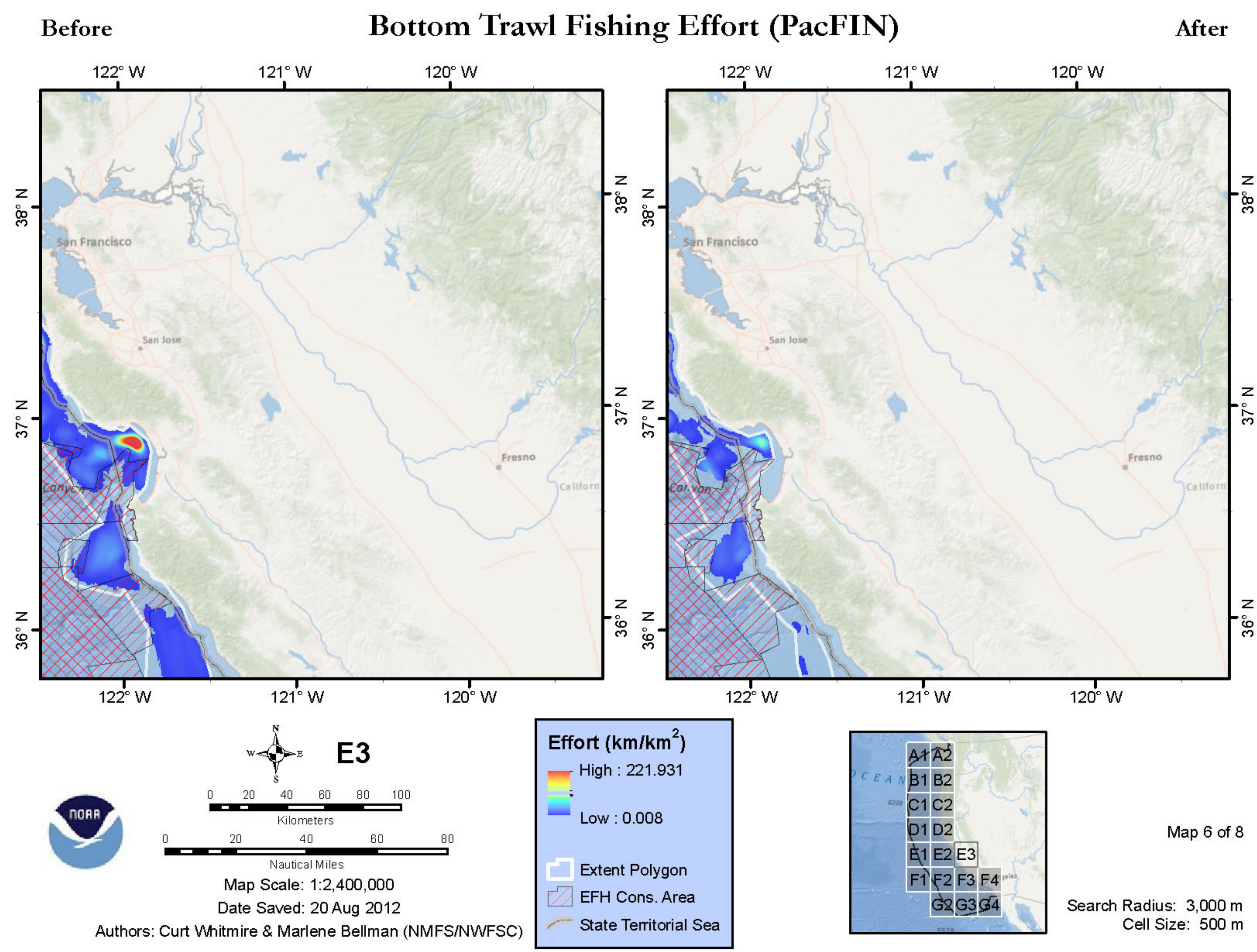
State Territorial Sea



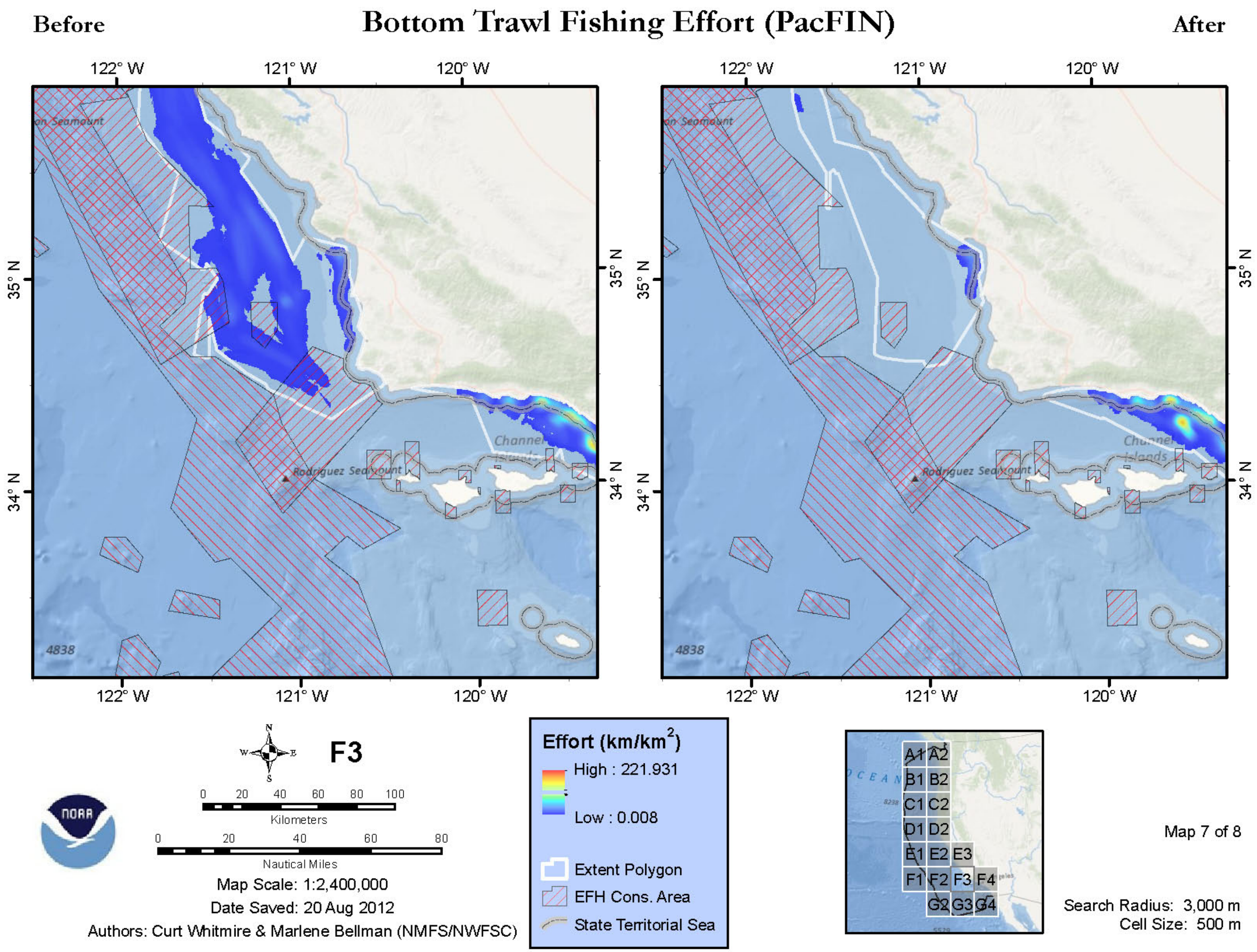
Map 5 of 8

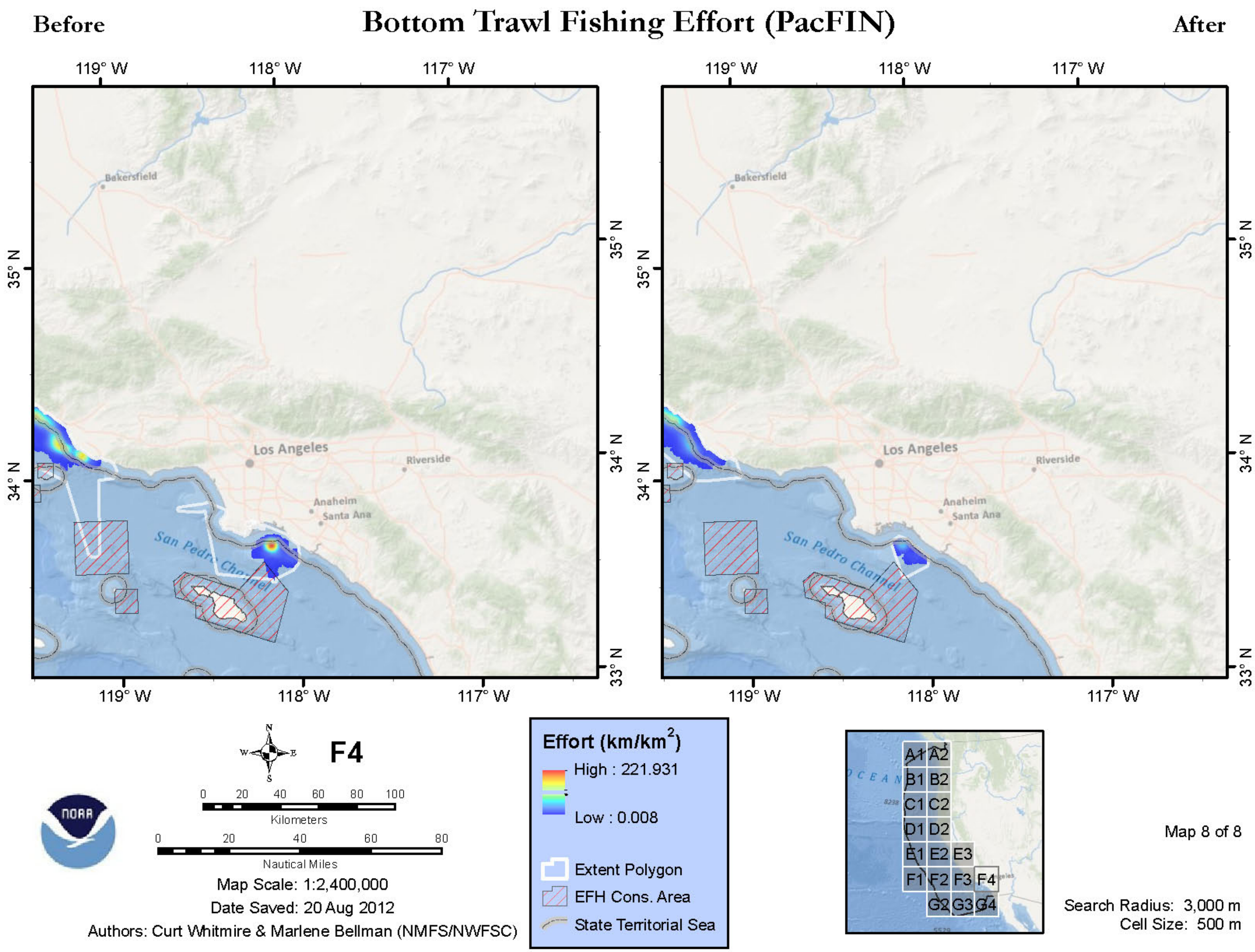
Search Radius: 3,000 m

Cell Size: 500 m



Before
Bottom Trawl Fishing Effort (PacFIN)
After
122° W
121° W
120° W
38° N
37° N
36° N
San Francisco
San Jose
Fresno
E3
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km2)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 6 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Bottom Trawl Fishing Effort (PacFIN)
After
122° W
121° W
120° W
35° N
34° N
Rodriguez Seamount
Channel Islands
4838
F3
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 8
Search Radius: 3,000 m
Cell Size: 500 m


Before
Bottom Trawl Fishing Effort (PacFIN)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 221.931
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 8
Search Radius: 3,000 m
Cell Size: 500 m

Appendix K-2 Mid-Water Trawl Effort

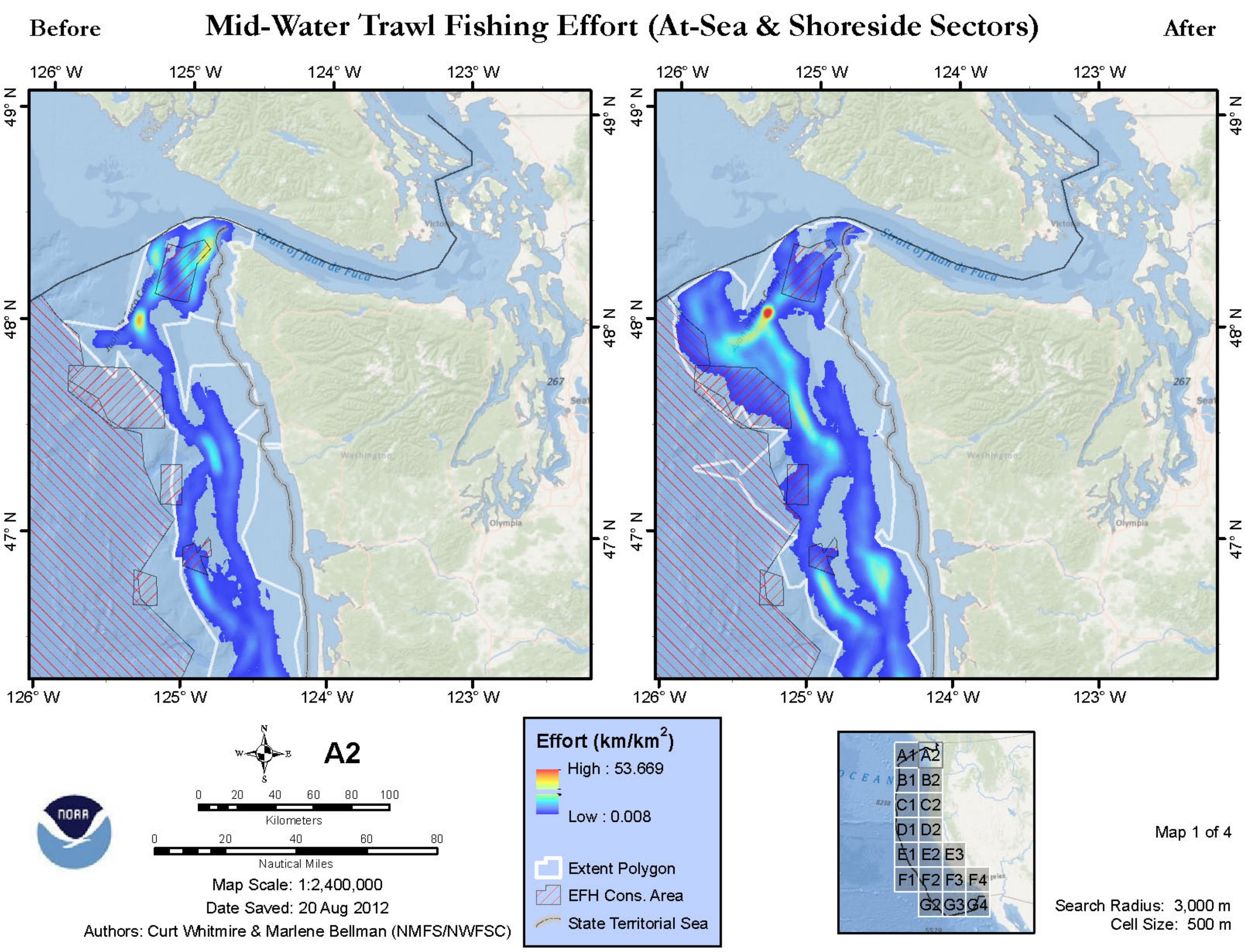
Appendix K-2 Plates depict the spatial distribution of mid-water trawl effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of mid-water trawl tows were compiled from two data sources: 1) Logbook data originating from the state logbook programs and uploaded to the PacFIN regional database, and 2) observer records from the ASHOP. These two data sources represent the shoreside and at-sea hake fleets, respectively. Included in the ASHOP data are observations of tribal fishing in the at-sea hake sector.

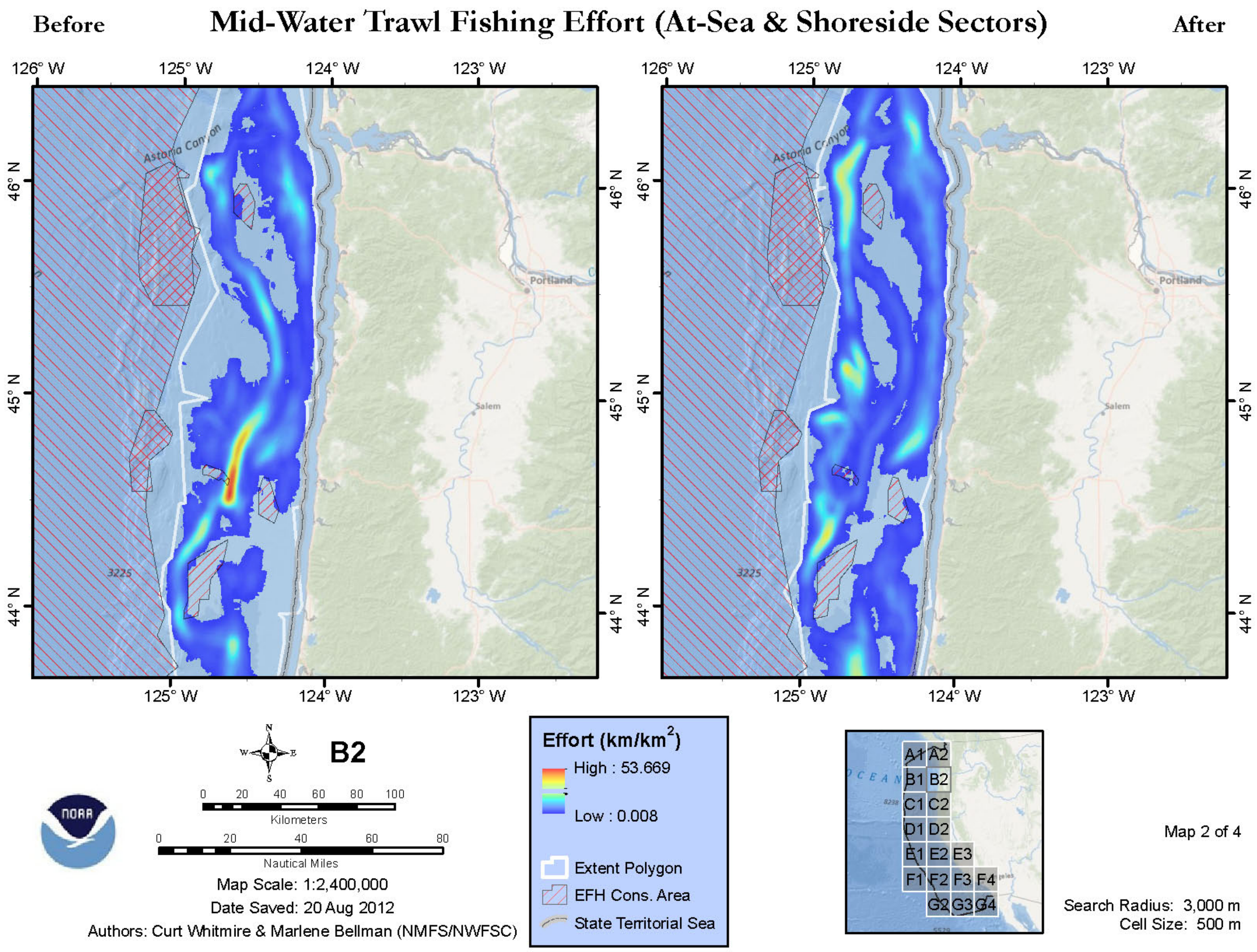
In order to analyze the effort data spatially, a straight line connecting the start and end points was used to represent each tow event. Towlines intersecting land, outside the EEZ, deeper than 2,000 m, or with a calculated straight-line distance greater than 20 km were removed from the spatial analysis. Because of their patchy spatial distributions, towlines for mid-water trawls occurring south of Cape Mendocino were removed from the analysis at the request of the state of California. Similar to the bottom trawl effort maps, two complimentary data products were created with these towlines: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than three vessels were operating, and 2) an extent polygon that shows the gross extent of effort. Please refer to the description of methods used to create the bottom trawl effort plates (see Appendix K-1 above), as they were very similar to the methods used for the mid-water trawl plates. The initial density output was more spatially extensive than the one shown in the plates because it included cells with density values calculated from tows made by less than three vessels. For the published layer, grid cells were removed where tows from less than three vessels intersected the circular search area. These "confidential" cells only represent 1.6 and 3.1 percent of all towlines within a given time period, although the proportion varies considerably in certain areas along the coast.

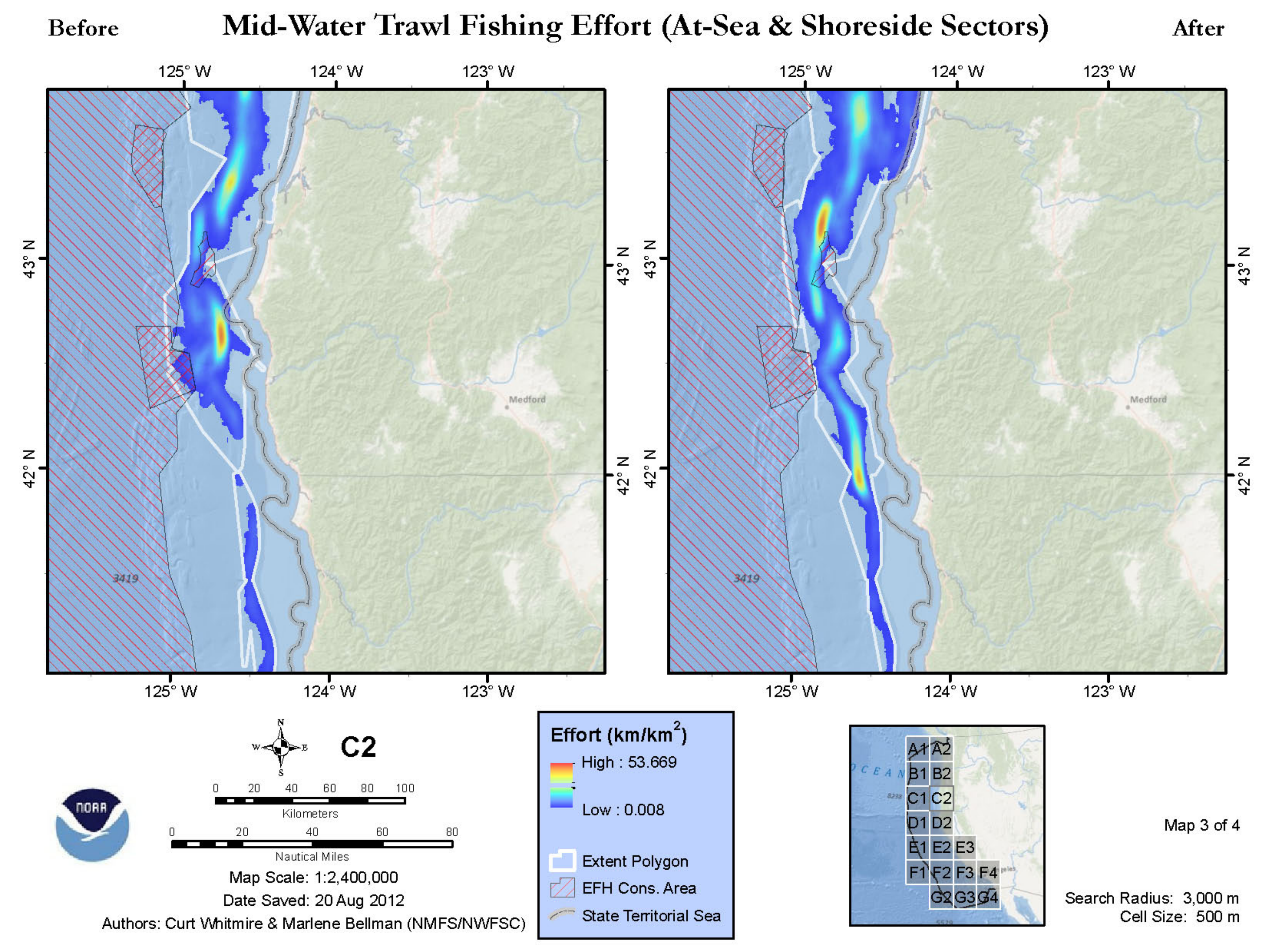
Similar to the bottom trawl effort figures, these spatial summaries of mid-water trawl effort were developed from data represented only by start and end points of tows. It is recognized that tows rarely follow straight-line paths; however, this was the best information available on the spatial distribution of effort for vessels using mid-water trawl gears. Because of their patchy spatial distributions, towlines for mid-water trawls occurring south of Cape Mendocino were removed from the analysis at the request of the state of California.

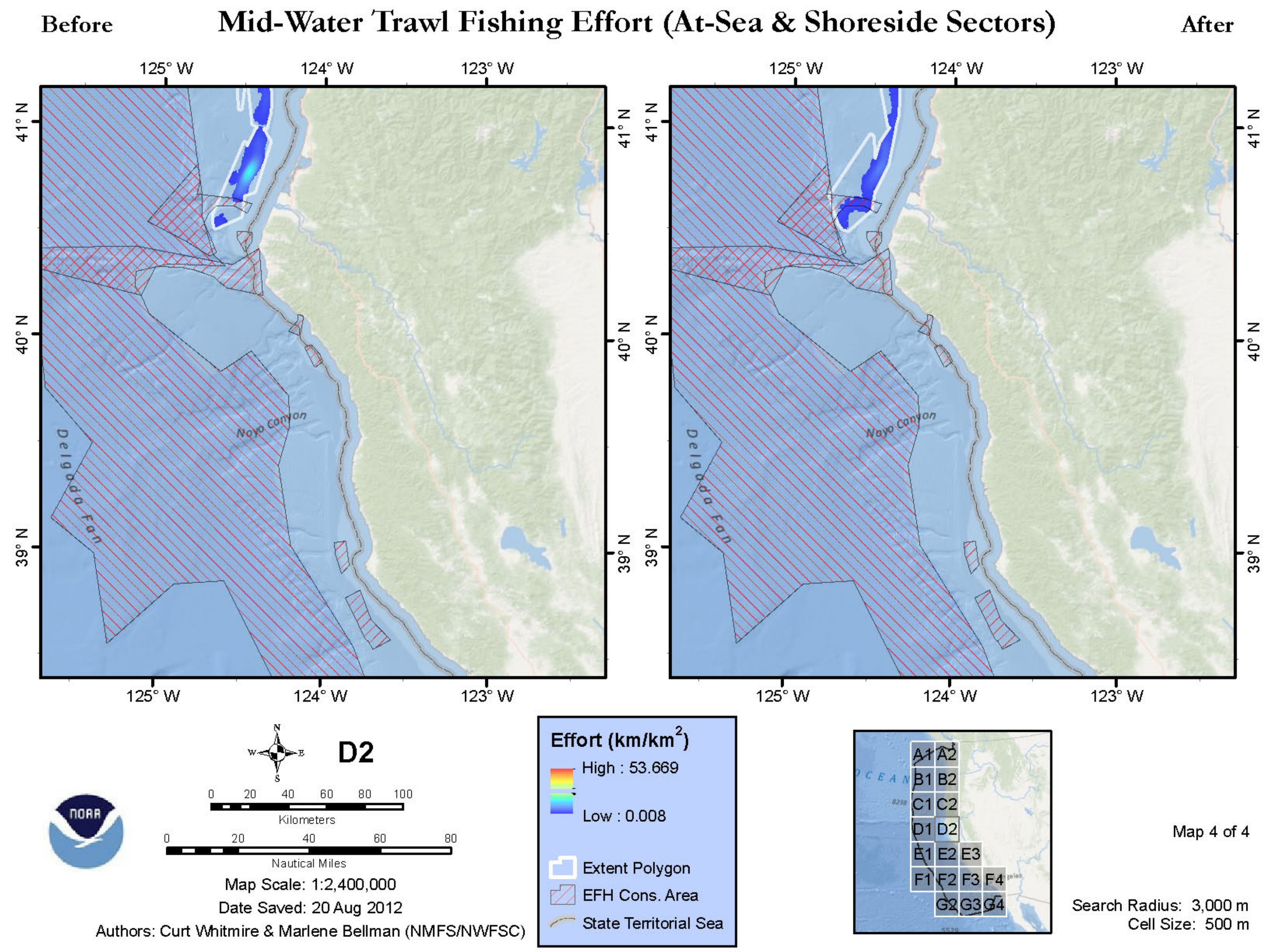
AppendixK-2 Plates show areas of high relative effort in the before time period are apparent off northern Washington and central and southern Oregon. In the after time period, areas of high relative effort show up again off northern Washington, off south-central Oregon, and near the Oregon-California maritime border (Plate A2). There are a number of areas of medium to medium-high relative effort that show up in the map plates for both time periods, but appear more widespread in the recent period. Those areas show little spatial consistency between the two time periods, possibly due to the migratory nature of the target species.

To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.


Before
Mid-Water Trawl Fishing Effort (At-Sea & Shoreside Sectors)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
A2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 53.669
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
Map 1 of 4
Search Radius: 3,000 m
Cell Size: 500 m


Before
Mid-Water Trawl Fishing Effort (At-Sea & Shoreside Sectors)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria Canyon
Portland
Salem
3225
B2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 53.669
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 4
Search Radius: 3,000 m
Cell Size: 500 m


Before
Mid-Water Trawl Fishing Effort (At-Sea & Shoreside Sectors)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 53.669
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 4
Search Radius: 3,000 m
Cell Size: 500 m



Before
Mid-Water Trawl Fishing Effort (At-Sea & Shoreside Sectors)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (km/km²)
High : 53.669
Low : 0.008
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 4
Search Radius: 3,000 m
Cell Size: 500 m

Appendix K-3 Fixed Gear Effort

Appendix K-3 figures depict the spatial distribution of observed fixed gear effort within two time periods: "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations. Records of fixed gear fishing locations were compiled from one source: observer records from the West Coast Groundfish Observer Program (WCGOP) database. The WCGOP database includes records of trips for vessels participating in the following sectors: limited entry sablefish-endorsed primary season, limited entry non-sablefish endorsed, open access fixed gear, Oregon and California nearshore. Annual WCGOP coverage of fixed gear sectors can be found online at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/sector_products.cfm. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely. We urge caution when utilizing these data due to the complexity of groundfish management and fleet harvest dynamics.

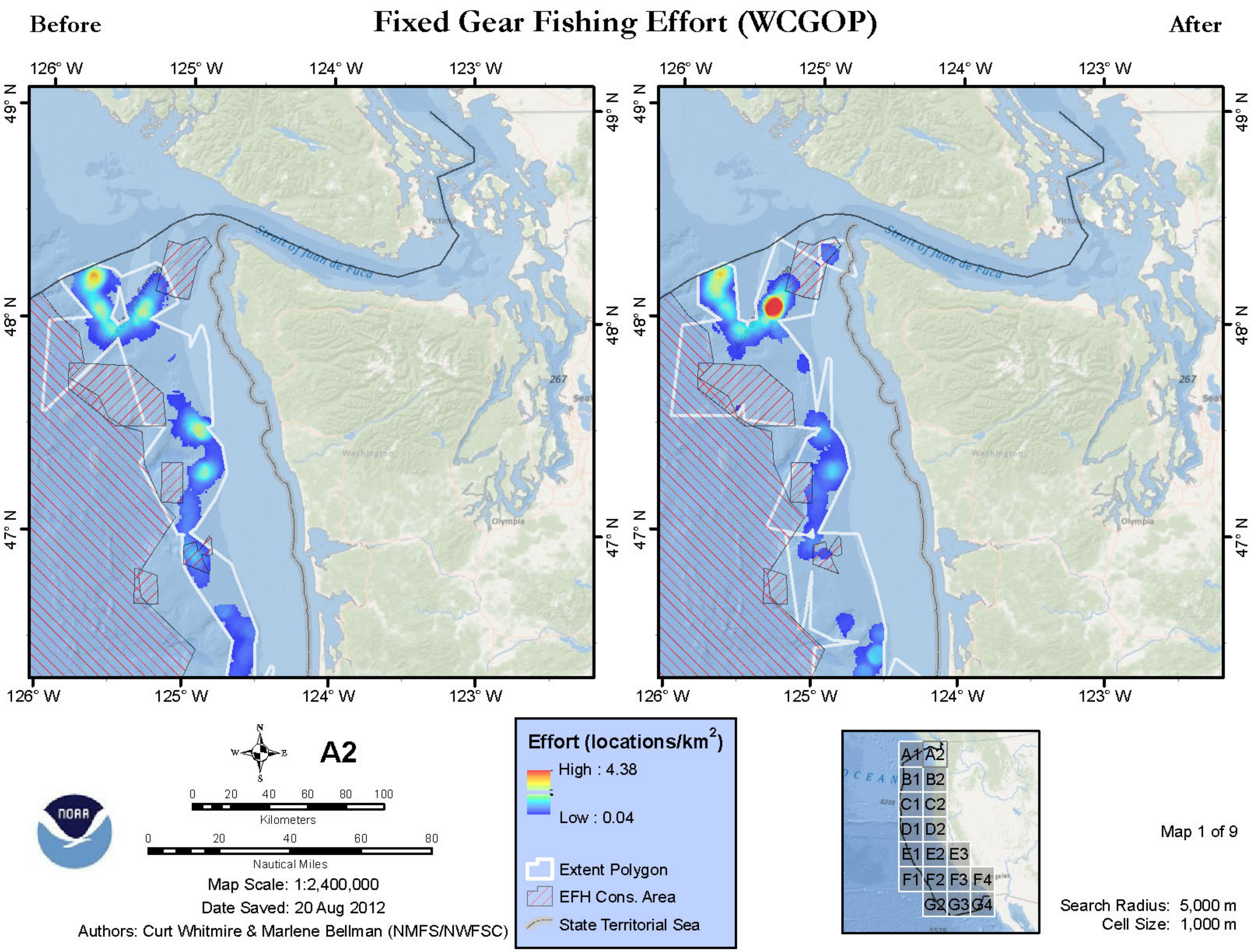
Since fishing does not occur continuously between set and haul points for fixed gears, the WCGOP fixed gear data products are based on spatial locations of both set and haul coordinates (referred to as "fishing locations"). This is in contrast to the trawl effort data products, where a straight line connecting the start and end points was used to represent each tow event. Fishing locations where either set or haul points were either on land, outside the EEZ, or deeper than 2,000 m were removed from the spatial analysis. Similar to the bottom trawl effort maps, two complimentary data products were created with these fishing locations: 1) an effort density layer that depicts the relative intensity of fishing effort within each time period, except areas where less than 3 vessels were operating, and 2) an extent polygon that shows the gross extent of effort. Please refer to the description of methods used to create the bottom trawl effort maps, as they were very similar to the methods used for the bottom trawl and mid-water trawl figures. The main difference for the fixed gear data is that a point density, rather than a line density, algorithm was used to quantify density of effort (units: locations/km^2). The density parameters used for calculating standardized effort for observed fixed gear fishing locations was a 5-km search radius and a 1,000x1,000 m cell size. As with the two trawl data products, the initial density output was more spatially extensive than the one shown in the figures, because it included cells with density values calculated from fishing locations of less than three vessels. For the published layer, we removed those grid cells where fishing locations from less than 3 vessels intersected the circular search area. These "confidential" cells represent 15.3 and 22.4 percent of all fishing locations within a given time period, although the proportion varies considerably in certain areas along the coast.

As with the two trawl effort maps, the color ramps for the intensity layers are scaled to the same range of values in each panel

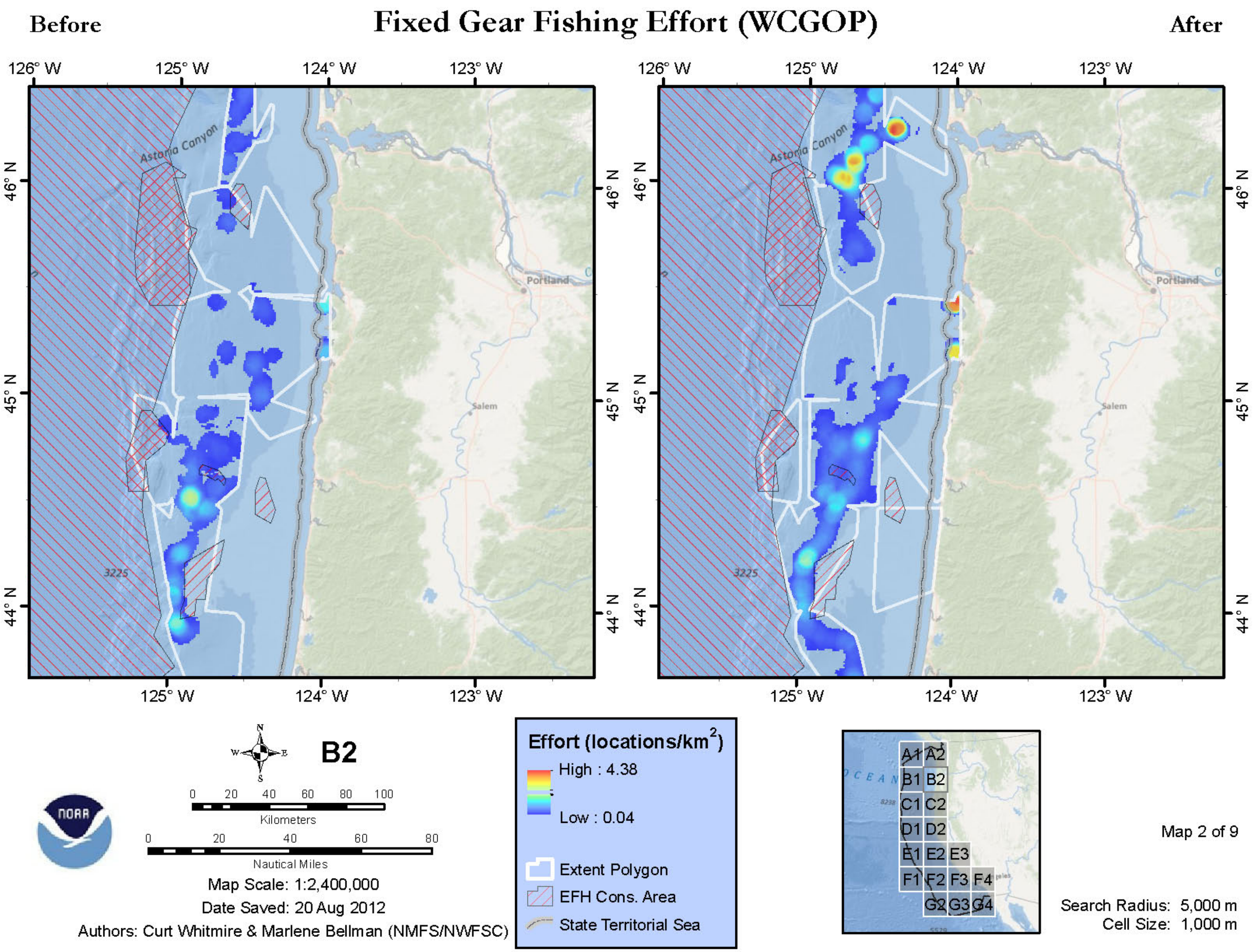
Appendix K-3 map plates show areas of high relative effort in the before time period are apparent off northern Washington, Cape Blanco, OR, and Crescent City, CA. In the after time period, areas of high relative effort show up again off northern Washington, off the Columbia River mouth, and off Cape Blanco, OR (Plates B2 and C2). There are a number of areas of medium to medium-high relative effort that show up in the map plates for both time periods; however, compared to the two sets of trawl figures, there appear to be little spatial consistency between the two periods.

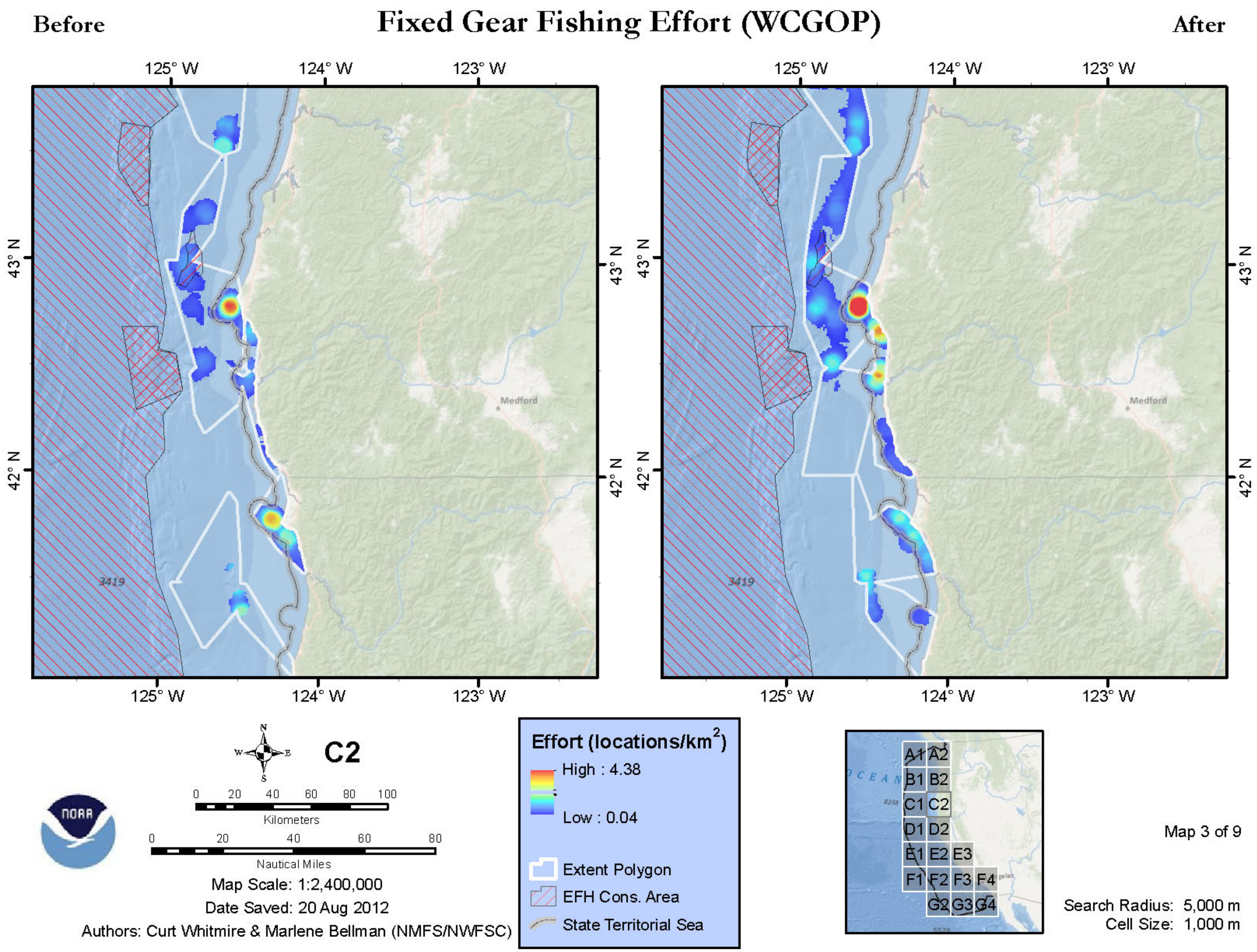
Another stark contrast between the fixed gear figures and the two trawl figures is the characteristic of the extent polygons. The extent polygons for fixed gear effort extend greater distances from the intensity layers than trawl effort. There are a couple probable explanations for this phenomenon. First, the fixed gear data comes from observers who are present only on a subset of all fixed gear trips, in contrast to the bottom trawl and mid-water trawl data sources which are a mostly complete record of all trips using those gear types. Second, due to a more patchy nature of the spatial distribution of effort, the fixed gear intensity layer represents a smaller portion of locations within the extent polygon. In other words, a higher proportion of density cells were considered confidential because the values for those cells were calculated from only one or two vessels. The overall objective of the fixed gear intensity layer development was to ensure adequate coastwide representation (in which over 80 percent or more of the data are represented). Compared to the bottom and mid-water trawl summaries, the extent polygon for observed fixed gear effort encompasses a large majority of observed fishing locations; however, some points were excluded due to confidentiality considerations.

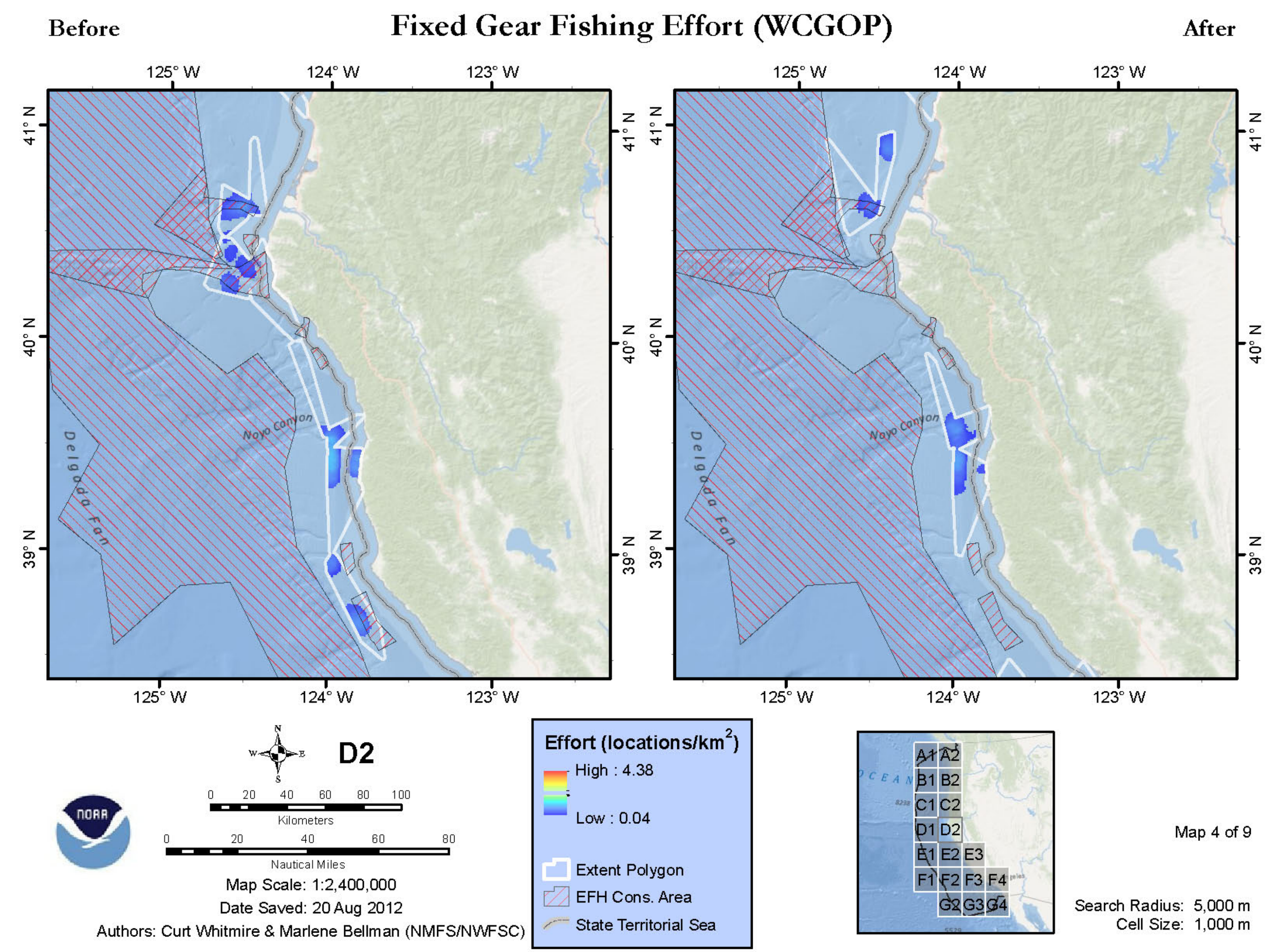
To access full resolution images, follow this link: http://efh-catalog.coas.oregonstate.edu/overview/
A GIS project was constructed in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California) in order to archive and display the collected data files, and to create the map layouts from which the comparative maps were derived. This project is currently available online at: http://efh-catalog.coas.oregonstate.edu/overview/.



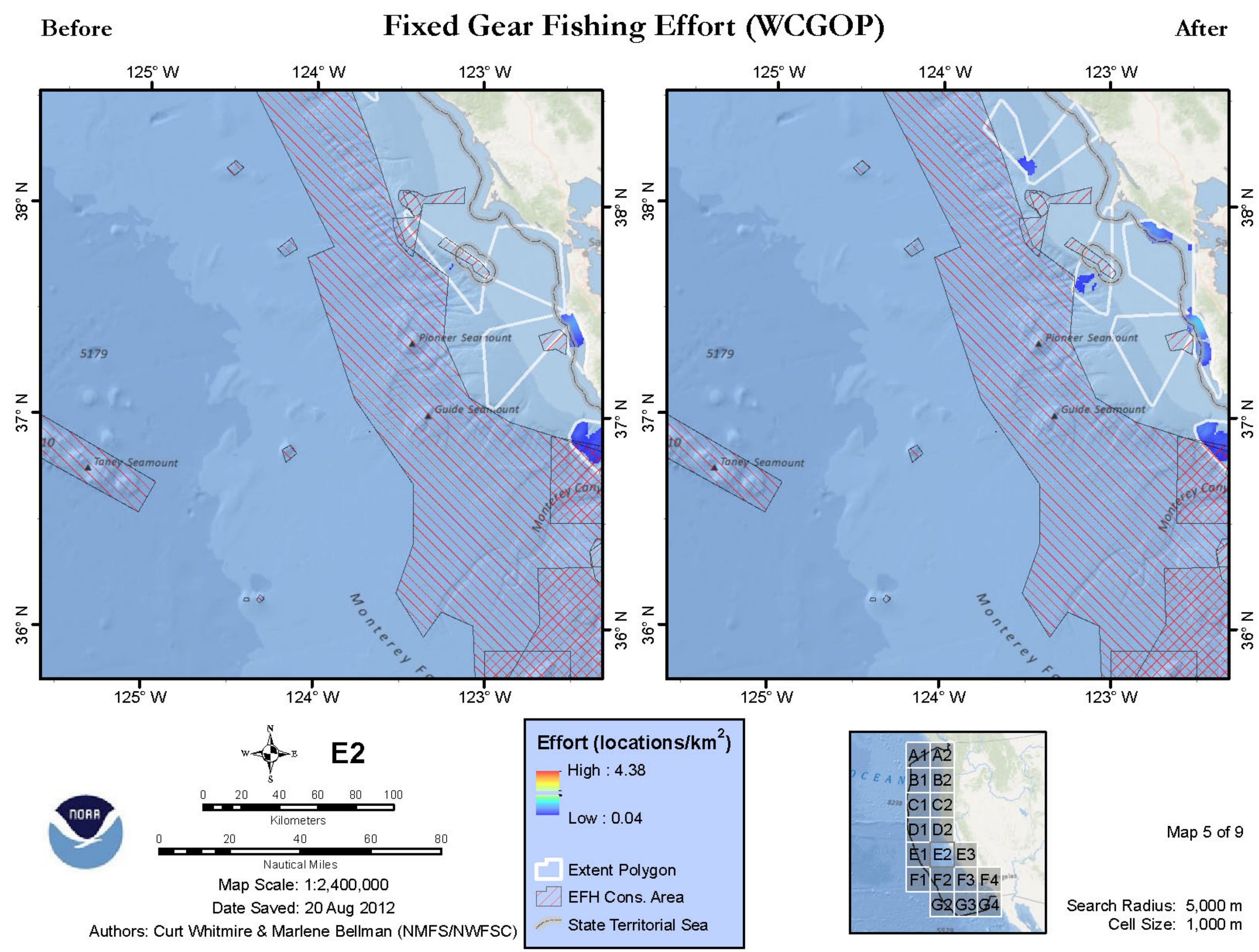
Before
Fixed Gear Fishing Effort (WCGOP)
After
126° W
125° W
124° W
123° W
49° N
48° N
47° N
Strait of Juan de Fuca
A2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km2)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 1 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m


Before
Fixed Gear Fishing Effort (WCGOP)
After
126° W
125° W
124° W
123° W
46° N
45° N
44° N
Astoria Canyon
Portland
Salem
3225
B2
Kilometers
0 20 40 60 80 100
Nautical Miles
0 20 40 60 80
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km2)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 2 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m


Before
Fixed Gear Fishing Effort (WCGOP)
After
125° W
124° W
123° W
43° N
42° N
Medford
3419
C2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km²)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 3 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m

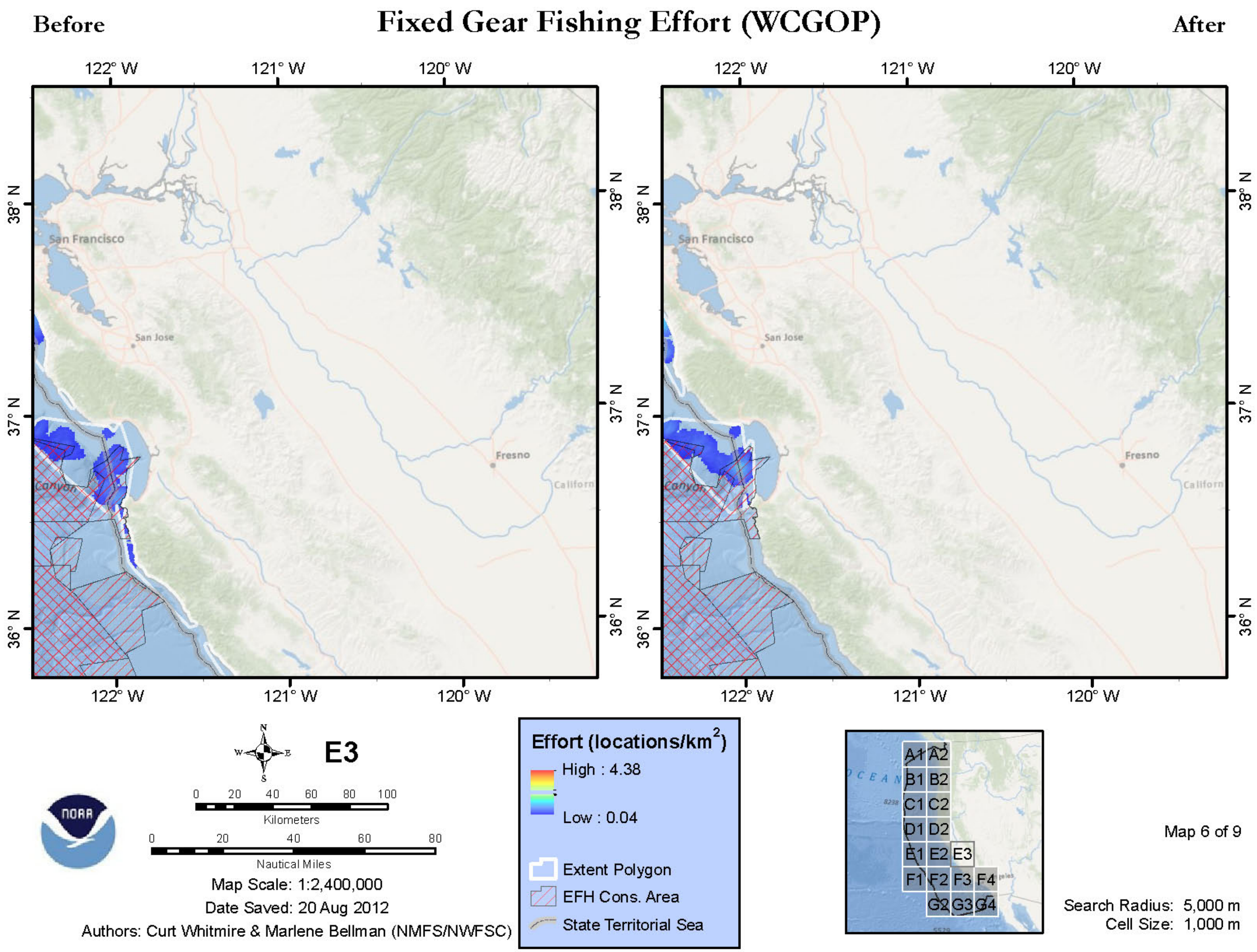


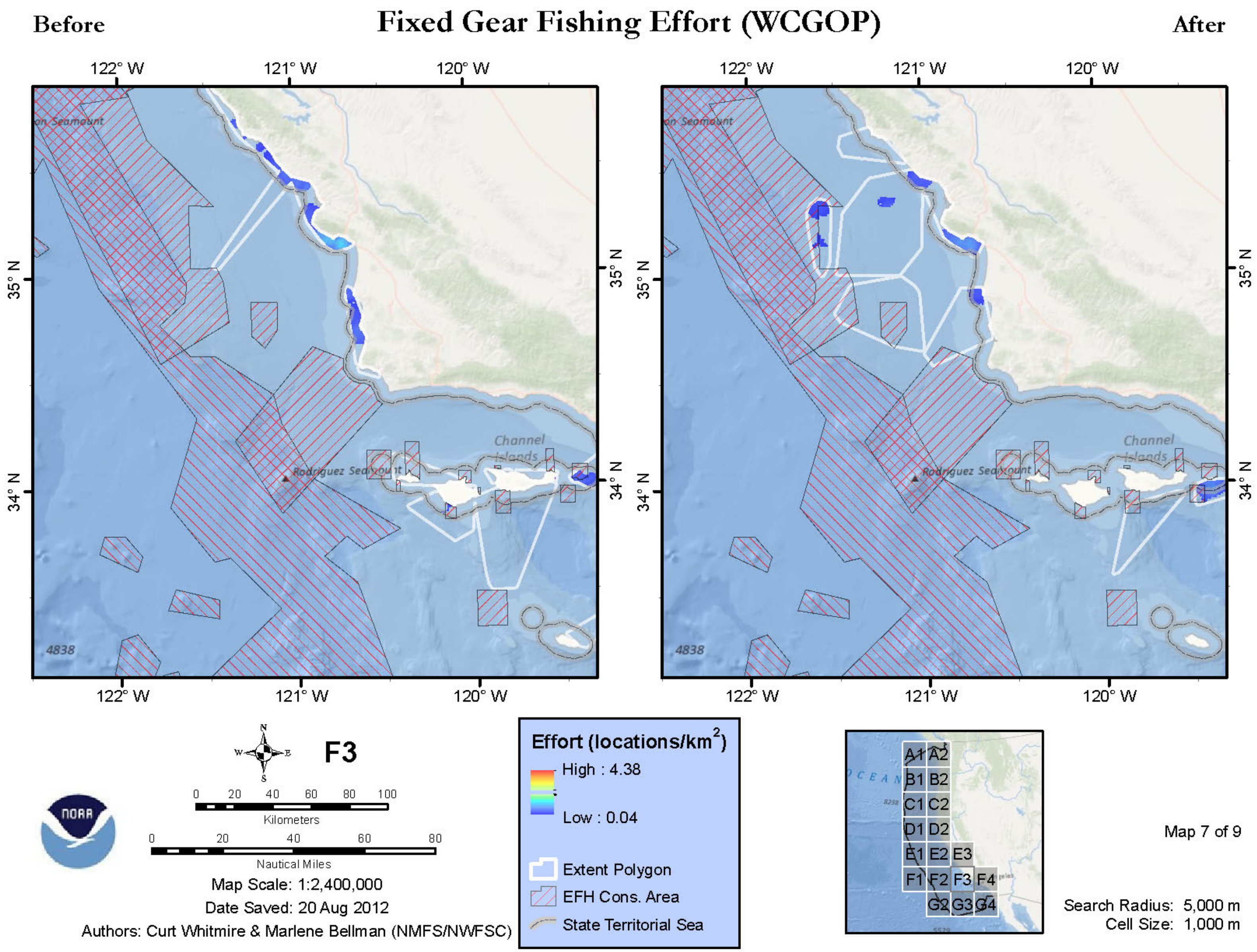
Before
Fixed Gear Fishing Effort (WCGOP)
After
125° W
124° W
123° W
41° N
40° N
39° N
Noyo Canyon
Delgada Fan
D2
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km2)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 4 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m



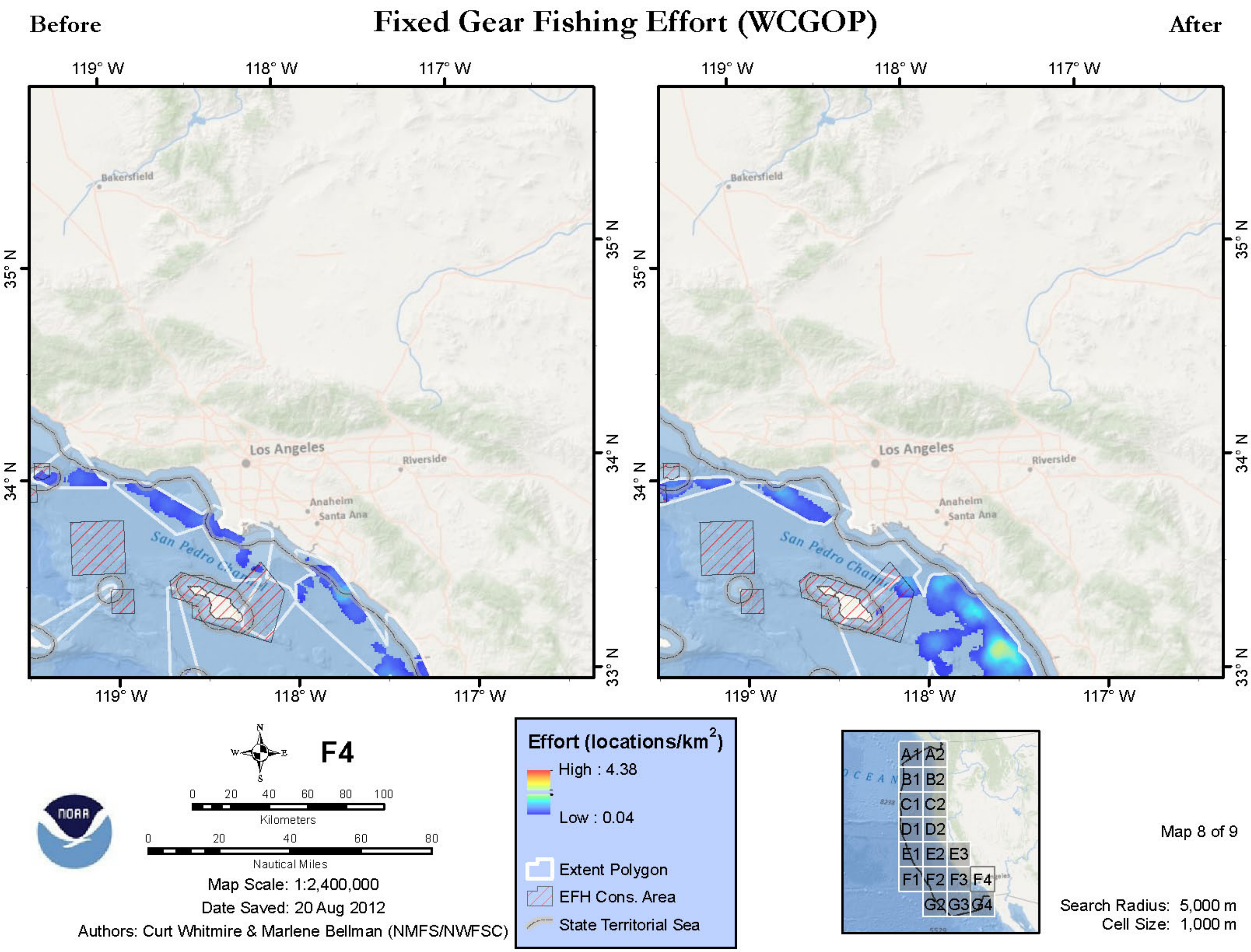
Before
Fixed Gear Fishing Effort (WCGOP)
After
125° W
124° W
123° W
38° N
37° N
36° N
5179
Pioneer Seamount
Guide Seamount
Taney Seamount
Monterey Canyon
Monterey Fan
E2
0 20 40 60 80 100
Kilometers
0 20 40 60 80
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km2)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 5 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m

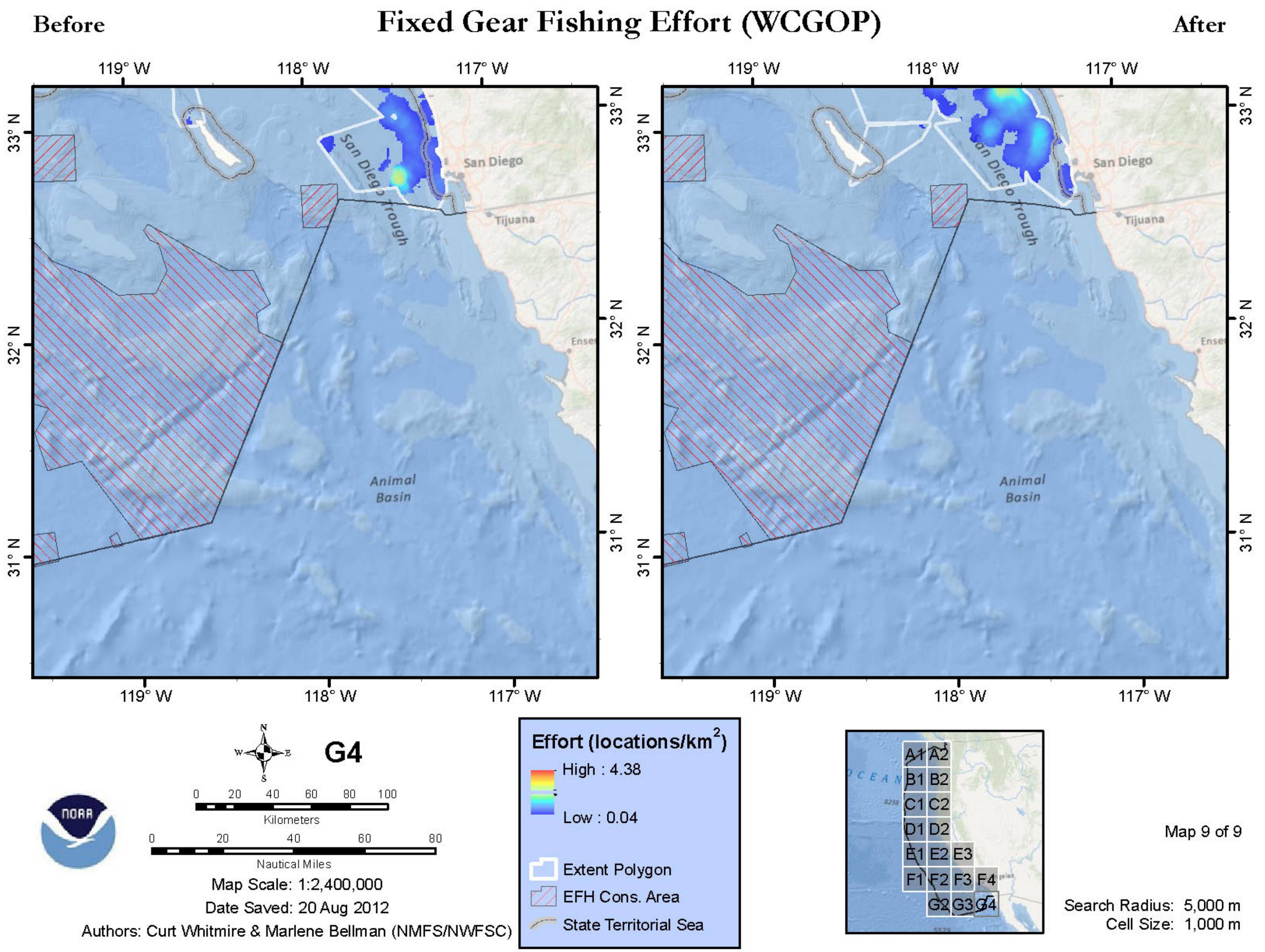
Appendix K-3: Fixed Gear Effort





Before
Fixed Gear Fishing Effort (WCGOP)
After
122° W
121° W
120° W
35° N
34° N
Channel Islands
Rodriguez Seamount
4838
F3
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km²)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 7 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m


Before
Fixed Gear Fishing Effort (WCGOP)
After
119° W
118° W
117° W
35° N
34° N
33° N
Bakersfield
Los Angeles
Riverside
Anaheim
Santa Ana
San Pedro Channel
F4
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km²)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 8 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m


Before
Fixed Gear Fishing Effort (WCGOP)
After
119° W
118° W
117° W
33° N
32° N
31° N
San Diego
Tijuana
San Diego Trough
Animal Basin
G4
Kilometers
Nautical Miles
Map Scale: 1:2,400,000
Date Saved: 20 Aug 2012
Authors: Curt Whitmire & Marlene Bellman (NMFS/NWFSC)
Effort (locations/km2)
High : 4.38
Low : 0.04
Extent Polygon
EFH Cons. Area
State Territorial Sea
A1 A2
B1 B2
C1 C2
D1 D2
E1 E2 E3
F1 F2 F3 F4
G2 G3 G4
Map 9 of 9
Search Radius: 5,000 m
Cell Size: 1,000 m

NMFS Science Center Synthesis Outline:
NMFS Science Center Analysis of the Council's EFHRC Groundfish EFH Phase 1 Report

August 22, 2012

Goal: To provide a synthesis of information relevant to the current review of groundfish essential fish habitat (EFH) that may be used to evaluate the efficacy of current regulations designed to protect EFH and minimize adverse impacts. The focus of this synthesis will be to use the Phase 1 Report as the primary source of information. Other readily available data and analyses may be incorporated as time and resources permit.

Outline:

1. **Characterize habitat**
   Question:
   a. What is the distribution and abundance of physical and biogenic habitats along the US west coast and in relation to existing EFH boundaries?

   SCOPE:
   - Although a significant amount of new information on physical habitats throughout the region has been compiled in the Phase 1 report, data sets are not necessarily compatible. No homogeneous west coast physical habitat map exists at this time. NMFS will examine the distribution of three major physical habitat types – hard, soft and mixed – both inside and outside existing EFH conservation areas.
   - NMFS will examine the potential to determine distributions of biogenic habitats throughout the California Current large marine ecosystem. The Phase 1 report highlights a variety of relevant fishery-dependent and fishery-independent data sources, including direct observations and catch of two main biogenic habitat forming organisms: deep-sea corals and sponges. NMFS will examine these disparate data types to identify any previously unknown biogenic habitat areas and their relation to existing EFH conservation areas.

2. **Identify species-habitat relationships**
   Questions:
   a. Given the new information on distribution, abundance and habitat uses for groundfishes, what are the species-habitat relationships for species within the groundfish FMP?
   b. What do we know about the habitat use and distribution of key prey species for groundfish?
   c. How can we model information on groundfish habitat use to identify key habitat areas?

   A fundamental problem in the identification of groundfish EFH is uncertainty in species-habitat relationships. In the past, information about species-habitat relationships has been derived from fine-scale survey work with submersibles or ROVs, large-scale fisheries dependent and fisheries independent surveys, and expert opinion formalized through Bayesian Belief Networks (BBNs). A major challenge for identifying EFH is figuring out how to combine these disparate data types to identify habitat characteristics and spatial areas that are particularly valuable to species of interest.

SCOPE:

- NMFS will evaluate the adequacy of the updated assessment of west coast habitats to both support EFH-related groundfish science and to inform decision-making and management.
- NMFS will investigate the application of complementary modeling approaches (e.g., Delta Generalized Linear Models and Hierarchical Bayesian Models) to provide an updated description of species-habitat relationships. Such models may be applied to both groundfish FMP species and their prey.
- Groundfish have complex life histories and habitat associations. These approaches will attempt to highlight differences based on species-specific or life-stage habitat uses.

3. Describe spatial distribution of impacts on species within the groundfish FMP

Question:

a. How are fishing and non-fishing (e.g., ocean acidification, hypoxia, alternative energy development, nearshore development) impacts distributed along the west coast?

SCOPE:

- NMFS will conduct spatial analyses on data layers developed for the Phase I Report in order to quantify the distribution of impacts.
- For each of the three major gear types (i.e., bottom trawl, mid-water trawl, fixed gear), NMFS will create "change" maps comparing the two time periods highlighted in the Phase 1 report and showing where fishing effort has increased, decreased and remained unchanged. NMFS will examine changes in fishing effort before and after Amendment 19; within each of the EFH conservation areas and with regard to their specific gear restrictions.
- Available information/analyses/models used by the Integrated Ecosystem Assessment team of the NWFSC will be applied to this synthesis.

4. Describe the coincidence of areas of high abundance/diversity of groundfish and high anthropogenically-driven impact areas with current EFH boundaries

Questions:

a. Can we determine which habitats include areas of high abundance and diversity for multiple groundfish species?
b. How are these habitats distributed throughout the area of the groundfish FMP and within EFH boundaries?
c. Can we overlay information on various fishing and non-fishing impacts to those areas?

SCOPE:

- NMFS will overlay predicted distributions for species or species groups with similar habitat uses (see Outline Item #2 above) to compare against fishing and non-fishing impacts.
- NMFS will provide a synthesis of published research, since Amendment 19 was adopted, related to the impacts of EFH regulatory measures on habitats and ecosystems for west coast groundfishes.

GROUNDFISH ESSENTIAL FISH HABITAT REVIEW COMMITTEE REPORT

The Pacific Coast groundfish Essential Fish Habitat Review Committee (EFHRC) met on September 16 and 17, 2012 to discuss the groundfish essential fish habitat (EFH) review process, the Phase 1 Report (Agenda Item H.6.a, Attachment 1), the draft request for proposals (RFP), and other issues. Overall, the EFHRC agrees that in all areas considered, there is sufficient new information to warrant further investigation into potential changes to EFH.

The EFHRC also supports the proposed National Marine Fisheries Service (NMFS) synthesis product as described in Agenda Item H.6.b, NMFS Report. This product will provide extremely valuable information for use in the EFH review process.

The EFHRC makes the following recommendations to the Council:

Process

The EFHRC recommends that the Council adopt the Phase 1 Report and conclude Phase 1 of the EFH review process. The EFHRC further recommends that the Council issue the RFP only after the proposed NMFS synthesis is finalized.

Phase 1 Report and Addendum

The EFHRC commends the efforts of several individuals, who dedicated enormous amounts of work in compiling the elements of the Phase 1 Report. The EFHRC recommends the Council approve the EFHRC Phase 1 Report and the consolidated online data catalog and registry, for use as an available tool for further consideration of potential changes to Pacific coast groundfish EFH. However, the EFHRC proposes an addendum with the following items:

1. Marine Protected Area (MPA) maps were omitted from the report issued on August 23 2012, and will be made available on the Consolidated GIS Data Catalog and Online Registry for the 5-Year Review of Pacific Coast Groundfish EFH: http://efh-catalog.coas.oregonstate.edu/overview/

2. Section 4.5.4 Marine Fisheries Managed by the Tribes
   Indian treaty rights apply in the Usual and Accustomed (U & A) fishing areas of the Makah, Hoh, Quileute Tribes, and the Quinault Indian Nation. In recognition of the sovereign status and co-manager role of these Indian tribes over shared Federal and tribal fishery resources, the regulations at 50 CFR 660.324(d) establish procedures that will be followed for the development of regulations regarding tribal fisheries within the U & A fishing grounds and stations. These regulations describe how NMFS will develop regulations in consultation with the affected tribe(s). Application of management measures intended to minimize the adverse impacts of fishing on EFH within the U & As will be subject to these procedures. Because of this unique characteristic of treaty fisheries, recommendations by the Council to NMFS regarding actions to minimize adverse impacts to groundfish EFH do not apply to tribal fisheries. Therefore, should the need for more

robust conservation management strategies arise, each tribe, as a co-manager, would develop management and regulatory solutions to accommodate that need.

In 1994, the United States formally recognized that the four Washington coastal treaty Indian tribes (Makah, Quileute, Hoh, and Quinault), retained their treaty rights to manage and harvest groundfish in the Pacific Ocean, and concluded that in general terms, the quantification of those rights is 50 percent of the harvestable surplus of groundfish that pass through the tribes U & A fishing areas. This followed previous court decisions reaffirming treaty rights to salmon and steelhead in the ocean and rivers. Tribal fisheries are managed by each of the respective tribes and in coordination with NMFS.

Specific to treaty fisheries, the coastal treaty tribes combined area for fishery activities is north of Point Chehalis, WA to the U.S/Canada border. Ocean going treaty fishing vessels are based out of Neah Bay, La Push and Westport; and harvest occurs throughout most of the year. The following are examples of active fisheries:

- Fixed Gear (longline/pots) Fisheries: Pacific halibut, sablefish, Dungeness crab
- Hook and Line Fisheries: Salmon troll, black rockfish, lingcod
- Midwater Trawl: Pacific hake (whiting)
- Bottom Trawl: various flatfish species
- Purse Seine Gear: sardines

3. Appendix C, page 145, Paragraph 3: It is essential to understand that the Acoustic Data Coverage comparison plates simply reveal the distribution of new acoustic data identified across the region. It should not be assumed that each new data source has been mapped for seabed substrate type. Although many nearshore and continental shelf sources have been interpreted, there are continental slope and deep-water sources that need substrate interpretation. Table C.1 may be used to determine which bathymetry or backscatter source has been used to create a seabed habitat map. Therefore, map users should not assume that the *Aggregate Seabed Habitat Map Distribution 2011* (bottom figure of each plate) map presents a spatially uniform understanding of seabed type. *The Aggregate Seabed Habitat Map Distribution 2011*map is a "mashup" of varying quality and certainty.

4. Appendix C-2: Substrate, Map Plate 7 of 12: Seabed Habitat Map Distribution 2005 to 2011: San Francisco & Monterey Bay and Aggregate Seabed Habitat Map Distribution 2011: San Francisco & Monterey Bay: Cochrane Bank, which is west of Fanny Shoal, is missing from the two map plates in the Council report issued on August 23, 2012, but is available online and has been added to the Consolidated GIS Data Catalog and Online Registry for the 5-Year Review of Pacific Coast Groundfish EFH and data portal plate maps at: http://efh-catalog.coas.oregonstate.edu/platesCD/

5. Information and Research Needs
The EFHRC developed additional detail on the recommended information and research needs in Section 7 of the Phase 1 Report, in order to improve the designation, monitoring, and effectiveness of groundfish EFH. The priorities and time frames are also intended to provide guidance to NMFS for completion of their synthesis report. The following research and information needs replace Section 7 in the Phase 1 Report.

* Short-term task are recommended to be completed in the next six months.

** Medium-term tasks are recommended to be completed by the end of Phase 2.

***   Long-term tasks expected to be completed after Phase 2 is completed.
High, medium, and low priorities for each of the short-, medium- and long-term time frames are indicated in parentheses.

I. Analyze the new information gathered in the EFHRC groundfish EFH Phase 1 Report, in order to inform decisions to modify the 2006 groundfish EFH designations.
   a. *(**high**) Evaluate the boundaries of the 2005 EFH closures, relevant to the distribution of seafloor habitats in the newly developed 2011 maps, to identify areas where habitat protection should be refined.
   b. *(**high**) Evaluate changes in the distribution of fishing effort, using the new 2005 and 2011 maps of effort for the bottom-contact fisheries, and determine if changes to current area management measures and gear restrictions from 2006 groundfish EFH regulations may be warranted.
   c. *(**high**) Update the table in Amendment 19 (*Summary of mean sensitivity levels and recovery times for all combinations of major gear types (including new gear types and midwater trawl) and bottom habitat types: Appendix 10 of Appendix A, Table 3*) that addresses relative ranking of gear types in terms of their habitat impacts.
   d. *(**high**) Evaluate new information on EFH relative to Level 1-4 (as defined in the EFH guidance, EFHRC Phase I Report page 13) and compare to information level available in establishing the 2006 groundfish EFH regulations.
   e. *(**medium**) Evaluate associations of vulnerable groundfish species and benthic habitats, relevant to the 2011 maps of distribution of seafloor habitats, to identify areas where habitat protection should be refined.
   f. *(**medium**) Evaluate new information on non-fishing-gear impacts to EFH (including environmental/oceanographic trends), especially relevant to 2006 groundfish EFH regulations.
   g. **(**high**) Evaluate corals and sponges as components of EFH for groundfishes.
   h. ***(**high**) Evaluate the 2005 mobile-fishing-gear risk assessment model relevant to new data.
   i. ***(**high**) Run the habitat suitability probability models for all west coast groundfish species, using the new maps of habitat distributions and other relevant data.
   j. ***(**medium**) Conduct field experiments to determine the role of corals and sponges as components of EFH for groundfishes.

II. ***(**high**) Conduct visual, no-take surveys of fishes and habitats inside and outside current EFH closures in order to evaluate the effectiveness of these conservation areas.

III. Improve seafloor maps (bathymetry, backscatter, and associated interpreted substrata types):
   a. **(**high**) Develop maps of interpretative substrate from a backlog of sonar mapping data. The geographic location of all new acoustic mapping (i.e. where surveys have been conducted) is shown. However, all new acoustic mapping may not have been examined or used to create substrate interpretations (i.e. new substrate classifications in the substrate maps in Appendix C-2).
   b. **(**high**) Create an integrated data set from the “aggregate seabed habitat” data, 2011, in Appendix C-2. Specifically, this means to develop an integrated product

from available interpretative substrate data. These integrated data should result in a seamless product that is suitable for a regional scale analysis.
   c. ***(**high**) Conduct high-resolution seafloor mapping, particularly on the shelf and slope associated with groundfish EFH conservation areas.

IV. Improve the Habitat Use Database (HUD):
   a. *(**high**) Develop tools and protocols to aid in data entry and to address specific architectural problems
   b. *(**high**) Address potential biases associated with inclusion of species from the Oregon Nearshore Strategy
   c. *(**high**) Update associations and distribution of groundfish habitat (including prey), using new information reported in the EFHRC report. Add descriptions for other species groups similar to those provided for Flatfish group.
   d. *(**high**) Update HUD definitions, documentation, and standards (e.g. clarify 'preferred depth'; consider young of year (YOY); verify species range and habitat preference using fishery dependent and independent survey data; develop standards for recording database amendments and expert opinion).
   e. *(**low**) Develop crosswalk between HUD habitat types with other seafloor habitat classification schemes (i.e., Greene et al., 1999, FGDC CMECS, 2012)
   f. *(**low**) Implement a maintenance plan, including an oversight committee of HUD users (NOAA, EHFRC, OSU) and a schedule for regular HUD updates

V. ***(**medium**) Conduct surveys and experiments to evaluate adverse impacts to EFH, across the geographic range of groundfishes.

VI. ***(**low**) Advance the understanding of the affects of a changing climate on West Coast groundfishes.

VII. Improve groundfish prey information.
   a. *(**high**) Develop criteria for defining major prey species for groundfish species and lifestages.
   b. *(**high**) Compile lists of major prey species for the all stocks and lifestages in the groundfish FMP.
   c. **(**high**) Evaluate the habitat use and distribution of major prey species for groundfishes.
   d. **(**high**) Evaluate potential adverse effects from fishing and non-fishing activities on the major prey species in the diets of groundfishes.

In addition to the recommendations made regarding research and data needs, the EFHRC recognizes 1) a need to consider data and information on pelagic habitat components, as related to groundfish distribution, abundance, and productivity; and 2) a need for socio-economic impact studies in the wake of EFH changes. The EFHRC does not have the appropriate expertise to evaluate socio-economic impacts. However, the EFHRC assumes that this will be addressed in the fishery management plan (FMP) Amendment NEPA analysis, if the Council decides to move forward with Phase 3.

Data regarding fishing effort

The EFHRC compiled the most accurate, high-resolution data available on fishing effort, including the extent of effort (i.e., the footprint) for both fixed and trawl gears. Although the information is generally considered accurate at a relatively broad scale, it may not reflect actual areas fished when viewed at finer local scales.

The EFHRC requested guidance from National Oceanic and Atmospheric Administration General Counsel (NOAA GC) and the Pacific States Marine Fisheries Commission (PSMFC) on the best means of obtaining the most accurate information given confidentiality constraints. As a result, NMFS analyzed and presented the data using the traditional rule of three. The confidentiality of data and maps in the EFHRC Phase 1 Report is maintained, as described on page 61.

Request for Proposals

The EFHRC recommends adoption of the RFP, with the following changes:

The RFP should clarify in the introductory language, that it is intended to provide general guidance for developing proposals, rather than a prescriptive checklist of items that must be included in a proposal. Also, it should clarify that the EFHRC will consider proposals in the context of potential changes to EFH west coast-wide, in addition to any potential EFH changes recommended for consideration by the EFHRC itself. There may be multiple proposals that are specific to discrete areas. Therefore, the EFHRC must ultimately provide an amalgam of likely scenarios to the Council, for consideration of whether to subsequently pursue changes to EFH via an FMP amendment or other relevant process.

Under Section B1, the introductory paragraph should be amended to read:

> It is expected that proposals will use the Phase 1 Report and the forthcoming NMFS synthesis document as a primary source of information and as a basis for any proposed changes to EFH or management measures. If a proposal is based on information not contained or referenced in the Phase 1 Report or the NMFS synthesis document, it should document the data quality, methods, and other relevant information; and clearly document how that information supports the proposal. Any information used to develop a proposal must be made available to the EFHRC and ultimately to the Council, for review and evaluation.
>
> Proposals must address items B1 through B4, where applicable. The remaining items under "Proposal Contents" are discretionary, but recommended for inclusion to the extent possible.

Item 6e should read:

The socioeconomics and management of proposed actions. Proponents are encouraged to collaborate with socioeconomic experts as well as affected fishermen and communities. Information on landings and revenues by port area can be found on the Council's website: http://www.pcouncil.org/groundfish/background/documentlibrary/historical-landings-and-revenue-in-groundfish-fisheries/

PFMC
09/17/12

Agenda Item H.6.b
Supplemental GAP Report
September 2012

GROUNDFISH ADVISORY SUBPANEL REPORT ON
PHASE I REPORT FOR ESSENTIAL FISH HABITAT REVIEW

The Groundfish Advisory Panel (GAP) received an overview of the current status of the Groundfish Essential Fish Habitat (EFH) Review, briefing book documents, and Council action. Dr. Waldo Wakefield and Mr. Chris Rosmos presented the Phase I Report for Groundfish EFH Review (Agenda Item H.6.b, EFHRC Report 1).

The Phase I report summarizes important new information and analyses developed subsequent to implementation of Amendment 19 and previous Groundfish EFH reviews. The GAP appreciates the work done by the EFH Review Committee (EFHRC) and National Marine Fisheries Service (NMFS) to develop information for the Council to consider changes to current EFH designations, including the EFH website developed by Mr. Rosmos [http://efh-catalog.coas.oregonstate.edu/overview/].

The GAP also reviewed the NMFS Outline for synthesizing the information provided in the Phase I report. The GAP supports the use of this approach. The GAP recommends the synthesis proposed by NMFS is a necessary step that should be completed before the Council considers moving forward to Phase II of the EFH Review.

Finally, the GAP recommends that the request for proposals (RFP) developed by the EFHRC is appropriate for establishing protocols for submission of proposals that assist the Council in their consideration of the need for changes to EFH. However, the RFP should not be used until after completion of the NMFS synthesis and formal consideration by the Council of moving to Phase II of the EFH Review.

PFMC
09/16/12

Agenda Item H.6.b
Supplemental GMT Report
September 2012

GROUNDFISH MANAGEMENT TEAM REPORT ON THE PHASE 1 REPORT FOR GROUNDFISH ESSENTIAL FISH HABITAT REVIEW

The Groundfish Management Team (GMT) would like to thank Waldo Wakefield, Chris Romsos, and Kerry Griffin for presenting a summary of the Essential Fish Habitat Review Committee (EFHRC) Phase 1 Report and the proposed National Marine Fisheries Service (NMFS) Science Center analysis of the data.

The GMT supports the goal of the Science Center to synthesize existing information to determine the efficacy of existing EFH management measures. This comparison of best available scientific information with existing regulations and management seems well-suited to the primary purpose of the periodic EFH reviews.

We are likewise supportive of the draft Request for Proposals (RFP) as it seems to cover most of the discussion to date and a broad range of considerations that the Council may want to contemplate in reviewing proposed changes to existing EFH regulations and designations.

Finally, the GMT suggests that the type of synthesis proposed by NMFS might help the Council and NMFS refine their policy goals as well as the review process. For example, questions have been raised over the metrics to be used, the protocols for EFHRC review, and ongoing questions over the content of proposals. Some degree of uncertainty is expected in novel processes; however, a lot of the confusion seems centered on the acceptable levels of interaction for coral and sponge protection and their role as EFH. In particular, a thorough analysis of the degree to which coral and sponge are important biogenic habitats relative to the importance of other Pacific Coast groundfish EFH and habitat areas of particular concern may prove invaluable to honing the Council's policy goals and review procedures for future cycles.

PFMC
09/17/12

HABITAT COMMITTEE REPORT ON PHASE 1 REPORT FOR ESSENTIAL FISH HABITAT REVIEW

The Habitat Committee (HC) received a presentation from Kerry Griffin, Council staff, and Waldo Wakefield, National Oceanic and Atmospheric Administration, as a representative of the Essential Fish Habitat Review Committee (EFHRC), regarding the Pacific Coast Groundfish EFH Review Phase 1 Report and the revised request for proposals (RFP). Waldo Wakefield also provided a presentation of the National Marine Fisheries Service (NMFS) Synthesis Outline.

Phase 1 Report: The Phase 1 report summarizes the review of new, or newly available, information since the last Groundfish EFH Review, which concluded in 2006 and included data up to 2002.

- The HC is very appreciative of the thorough review and extensive updates the EFHRC has proposed for groundfish EFH. The information they have made available represents significant advancements in groundfish habitat knowledge and will help the Council better protect EFH.
- Timeline: There has been considerable confusion regarding the schedule for the EFH review process and RFP. The HC suggests that a final schedule be prominently presented on the Council's website.

New information presented in the EFH Report is now available on a website found at http://efh-catalog.coas.oregonstate.edu/overview. The site includes access to a mapping tool that allows users to view data layers for areas they are interested in. A key component of the site is a "revision history" which will help the public using the data assure they are using the most updated version of data layers.

The HC makes the following recommendations:

- Links to this data portal should be prominently included on both the first page of the Executive Summary and again in the main introduction to the report. Mention of the availability of a mapping tool and the revision history would be good to include in these sections as well.
- The last paragraph of Section_ES-3.2, Bathymetry and Seafloor Habitat Maps, explains that the maps displayed in the report give an overview of the available data, and that other displays of the data may be more informative to the proposal process. This statement actually applies to several datasets, and would reduce confusion about the data if it were moved to Section ES-3.
- The EFHRC should consider posting other datasets on the data portal and/or providing links to other web sources (e.g. geographic information system (GIS) files with boundaries for habitat areas of particular concern, EFH, Rockfish Conservation Areas and Marine Protected Areas).

Request for Proposals (RFP)

The HC discussed the contents of the RFP and has additional suggestions:

- The RFP should clarify that the guidelines included in the RFP are not requirements, but are suggestions for submitting a successful proposal.
- The RFP should clarify that data from one proposal may be combined with others.
- The EFHRC's *Draft 5-Year EFH Review Report* (Section 1.3, Table 2) indicates that the RFP will be issued after the Council receives the NMFS Synthesis report, which is scheduled for April 2013. The HC agrees and suggests that the Council delay finalizing and issuing the RFP until after the NMFS Synthesis report is finalized in April 2013, as this synthesis will inform any new EFH proposals and the proposal evaluation process. Therefore, the timeline should be revised to give proposers and evaluators ample opportunity to use the findings in the NMFS report, and in time for the EFHRC and proposers to work together to clarify or correct proposals after submission.

NMFS Science Center Synthesis

Agenda Item H.6.b, NMFS Report outlines the additional synthesis to be performed by NMFS. The Synthesis Report will examine new and existing data to evaluate habitat abundance, diversity and distribution in relationship to existing groundfish EFH closure areas, and other groundfish EFH protections. NMFS will use this information to evaluate if such areas are appropriately placed and impacts to EFH are minimized. Although the outline lists a series of questions to guide the process, NMFS is still refining the synthesis details.

PFMC
09/14/12

Science, Service, Stewardship

Supplemental Essential Fish Habitat Analysis

Michelle McClure
Northwest Fisheries Science Center

September 17, 2012

NOAA FISHERIES SERVICE

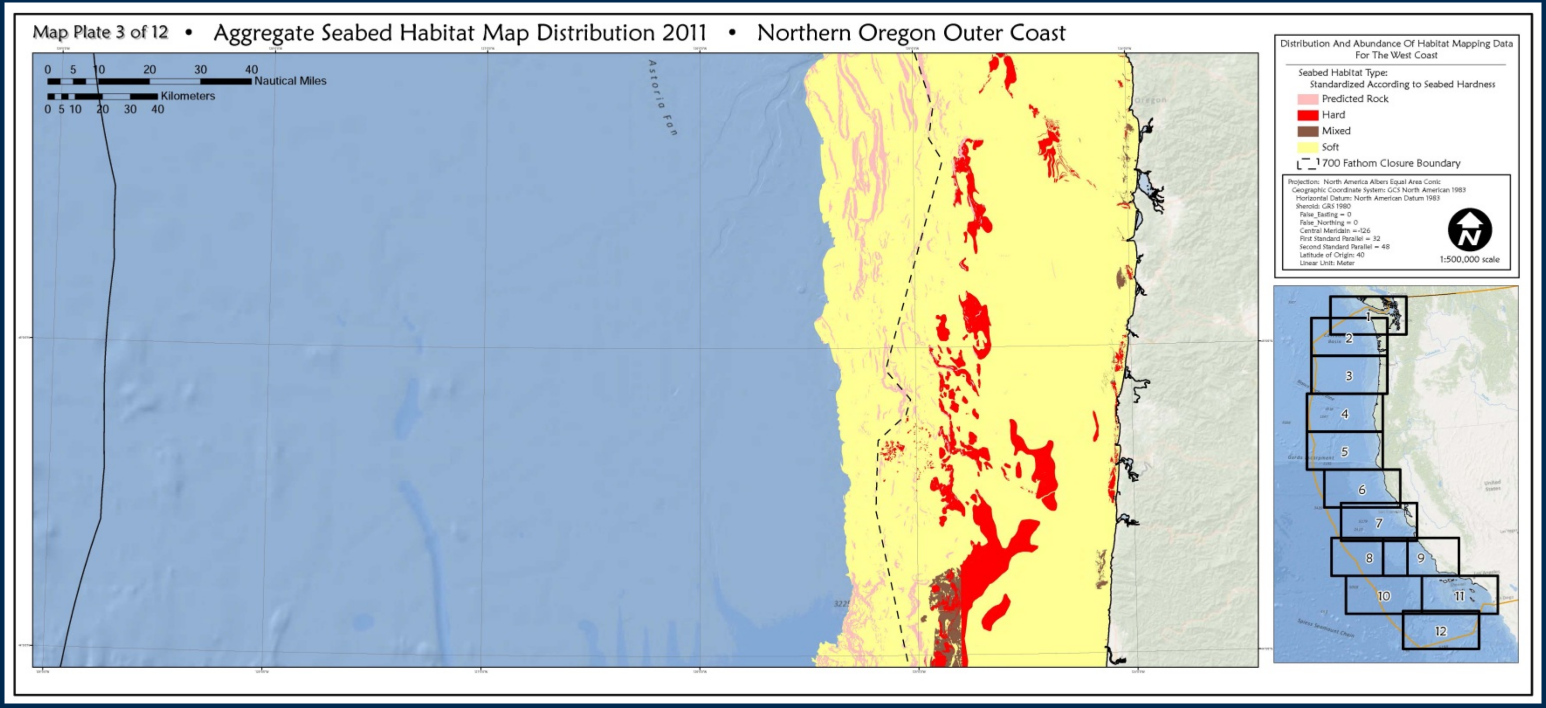
Analysis of the Council's EFHRC Groundfish EFH Phase 1 Report

- **Goal:** To provide a synthesis of information relevant to the current review of groundfish essential fish habitat (EFH) that may be used to evaluate the efficacy of current regulations designed to protect EFH and minimize adverse impacts.
- **Focus:** Use Phase 1 Report as the primary source of information. (Other readily available data and analyses may be incorporated as time and resources permit).

Synthesis Outline Questions

1. Characterize habitat

What is the distribution and abundance of physical and biogenic habitats along the US west coast and in relation to existing EFH boundaries?



Synthesis Outline Questions

2. Identify species-habitat relationships

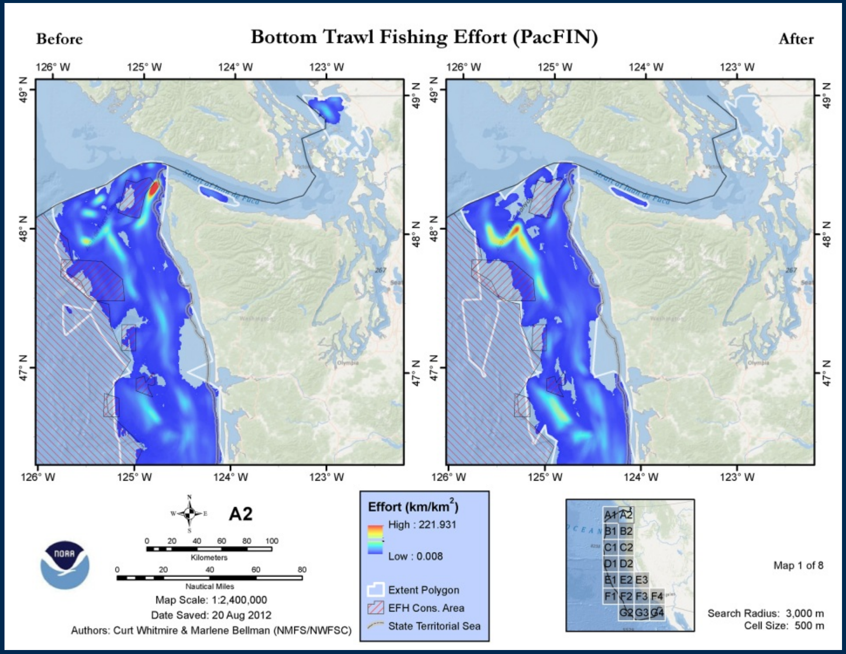
- What are the species-habitat relationships for fishes within the groundfish FMP?
- What do we know about the habitat use and distribution of key prey species for groundfishes?
- How can we model information on groundfish habitat use to identify key habitat areas?

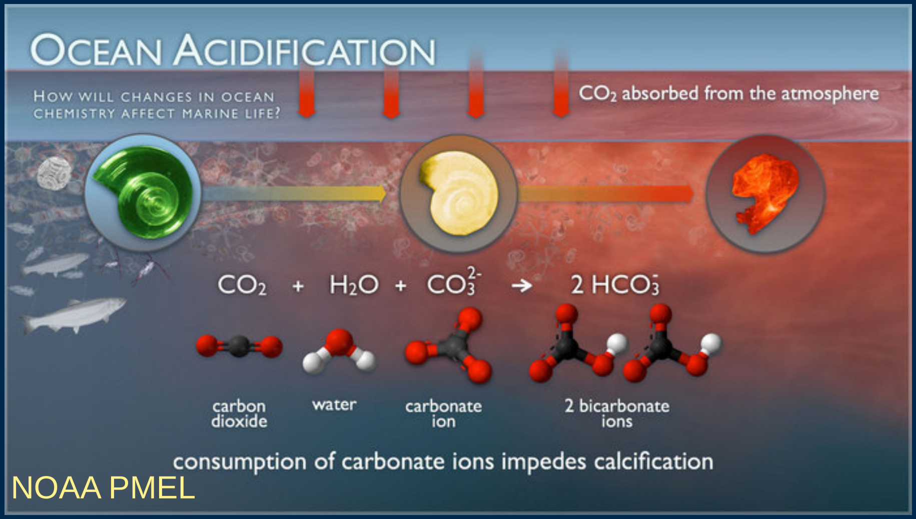
  

Synthesis Outline Questions

3. Describe spatial distribution of impacts on species within the groundfish FMP

How are fishing and non-fishing impacts (*e.g., ocean acidification, hypoxia, alternative energy development, nearshore development*) distributed along the west coast?





NOAA PMEL

Synthesis Outline Questions

4. Describe the coincidence of areas of high abundance/diversity of groundfishes and high anthropogenically-driven impact areas with current EFH boundaries

- Can we determine which habitats include areas of high abundance and diversity for multiple groundfish species?
- How are these habitats distributed throughout the area of the groundfish FMP and within EFH boundaries?
- Can we overlay information on various fishing and non-fishing impacts to those areas?

Agenda Item H.6.b
Supplemental SSC Report
September 2012

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PHASE I REPORT FOR ESSENTIAL FISH HABITAT REVIEW

The Scientific and Statistical Committee (SSC) reviewed the Phase I Report for Groundfish Essential Fish Habitat Review (Agenda Item H.6.b, EFHRC Report 1) and received a summary presentation of the report from Dr. Waldo Wakefield. Mr. Kerry Griffin and Mr. Chris Romsos were available to address questions from the SSC. The Groundfish Essential Fish Habitat (EFH) Review Committee report summarizes the information underlying the EFH designations specified in Amendment 19 as well as new information and analysis techniques that have become available since the conclusion of the last groundfish EFH review. The new information, which was obtained in response to National Marine Fisheries Service (NMFS) data calls and from reviews of published information, represents a considerable expansion of the data available for the analysis of groundfish EFH. The new information is extensive and includes:

- high-resolution maps of seafloor substrate and habitat types for a much wider expanse of the Fishery Management Plan region;
- an expanded database of observations of corals and sponges that will allow the development of more extensive biogenic habitat maps;
- an expanded database of information on associations of groundfish life-stages with different habitats;
- an expanded database of information on the spatial distribution of fishing;
- additional studies and reviews of the effects of fishing on habitat; and
- identification of new non-fishing threats to groundfish EFH.

There also have been further developments of modeling tools that could be used in conjunction with the newly available information.

The SSC supports the use of the information in the report in the Council's review of its groundfish EFH provisions. The SSC notes that it would be useful to prioritize the recommendations in Section 7 into immediate needs to support the Phase II review, versus longer-term recommendations. The SSC also notes that individual activities that contribute to climate change will be impossible to relate directly to groundfish EFH. We encourage research to understand the effects of climate change on groundfish populations, predator/prey relationships, and habitat needs.

The NMFS Science Center Outline for synthesizing the information provided by the Phase I report describes an important step in evaluating the available information and how that information could be used in the EFH review process.

The SSC recommends that the request for proposals for changes to EFH be released subsequent to the analyses indicated in the NMFS Outline.

PFMC
09/15/12

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August 22, 2012

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: Agenda Item H.6: Groundfish Essential Fish Habitat 5-Year Review

Dear Chairman Wolford and Council Members:

Oceana commends the Pacific Fishery Management Council (Council), the National Marine Fisheries Service (NMFS), and the Essential Fish Habitat Review Committee (EFHRC) for the work to date on the groundfish essential fish habitat 5-year review. In particular we are pleased with the monumental effort to compile new data relevant to essential fish habitat (EFH) management embodied in the Phase I report. Given that the Council is not planning to release the request for proposals until April 2013, we feel strongly that there are additional analyses and data sets that can and should be provided to ensure a complete and successful review process.

We are told NMFS plans to use the time between now and April 2013 to conduct additional analyses on groundfish EFH. Further, we understand NMFS is requesting input from the Council on the scope of that analysis. We therefore request the Council prioritize the following three items for continued analysis by NMFS between now and April 2013:

1. Identify major groundfish prey species

EFH Regulations (50 CFR 600.815) state "FMPs should list the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat". The Phase I report summarizes new information from a NOAA synthesis aimed at designing an ecosystem model[1], however, prey data for many groundfish species were not included, and prey species were grouped in a way that prevents the identification of specific prey species (i.e., "small planktivores" rather than "northern anchovy"). Furthermore, there has not been an assessment of data quality on the existing diet information for each groundfish species. We suggest the Council request NMFS build off the work of the existing NOAA diet synthesis to address and fill these gaps so that the Council can better identify groundfish prey as part of this review.

2. Provide detailed analysis and maps of coral and sponge bycatch data

Coral and sponge bycatch serves as a key indicator of adverse impacts to groundfish EFH. Corals and sponges provide structural habitat for multiple groundfish species, are vulnerable to fishing impacts, have very slow recovery times, and are frequently documented as bycatch by federal fisheries observers. There are many pertinent questions to explore, including how bycatch patterns have changed and the extent to which the EFH closures were effective at minimizing adverse impacts as measured by these indicators.

[1] Dufault et al. 2009. A synthesis of diets and trophic overlap of marine species in the California Current. NOAA Tech Memo NMFS-NWFSC-103. November 2009.

The new coral and sponge bycatch data was only released to the Committee as of yesterday, and therefore, the Committee has not had time to analyze or consider alternative displays of this information in the current Phase I report. However, Oceana has provided some initial draft maps showing alternative ways to display this data (attached). We suggest the Council direct NMFS and the EFHRC to work together to provide additional maps and analysis to show this data in multiple formats to help answer the suite of questions that can be asked of this data.

3. Fishing effort data (trawl tracks) from logbooks

In 2005 the Council relied heavily on "trawl track" data from logbooks provided by California, Oregon and Washington to craft the boundaries of EFH closed areas, including the 700 fathom "footprint" closure. Early in that process, this data was not made available, and only after individual states saw the importance and utility of providing this data did they make it available to the Council. As you will recall, at the April 2011 Council meeting, the Council supported having the EFHRC work with respective states and the Pacific States Marine Fisheries Commission to obtain similar, comparable data.

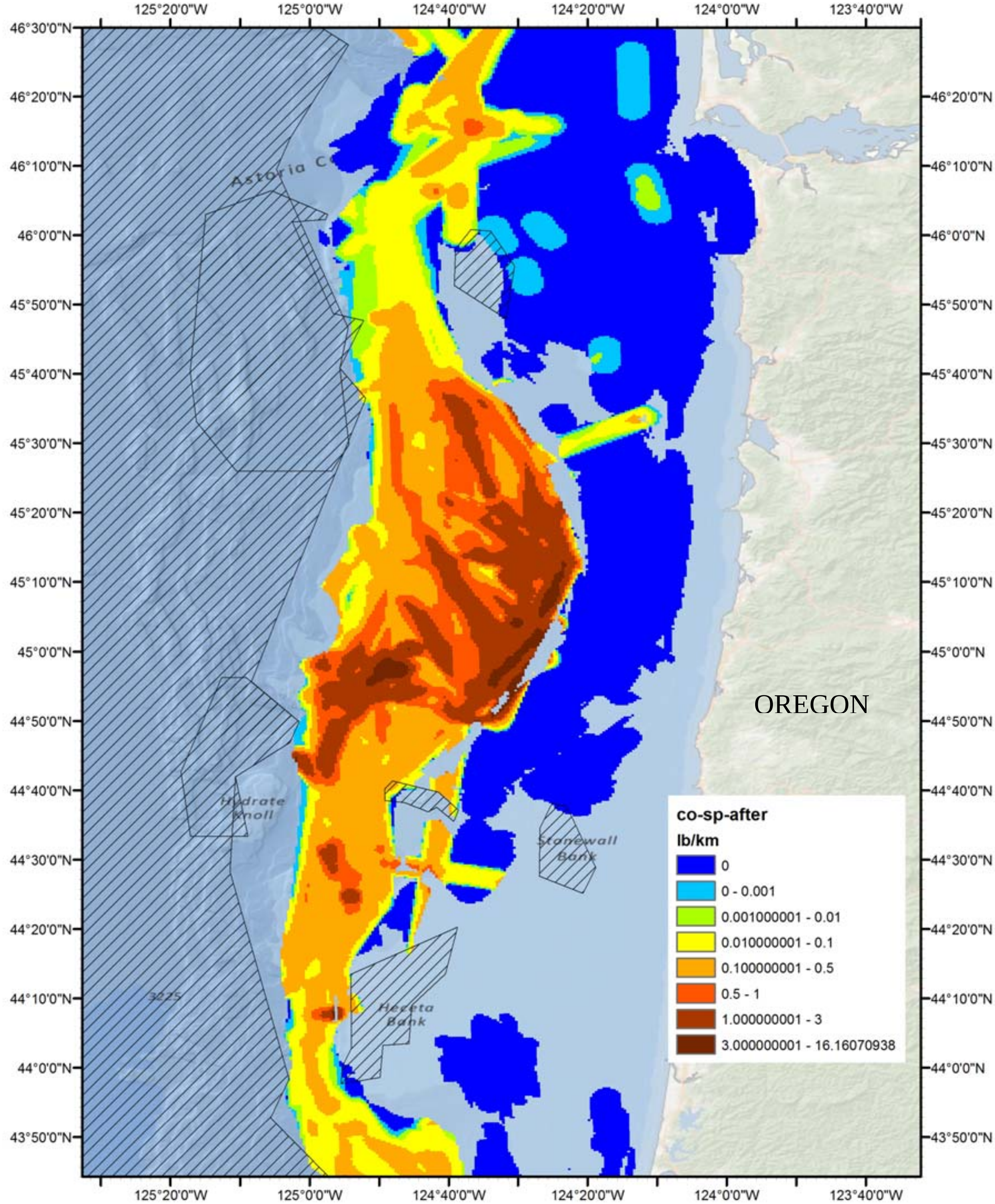
In response, the EFHRC drafted a letter requesting legal guidance from NOAA General Counsel on this issue, which was sent by Dr. McIsaac on behalf of the Council. However, to date, there has been no response to this letter, and the Council has yet to request logbook information for federally managed fisheries from the states. The Council did request logbook data on state-managed fisheries from the states; however, the responses were limited and certainly not at the quality in which they were available during the 2005 Council process. As a result, the Council will not have access to fishing effort data at the same quality or resolution in this EFH Review as it did during the Amendment 19 analysis. Since accurate fishing effort data is critical to understanding potential adverse impacts to EFH, crafting effective management measures, and evaluating potential socioeconomic effects of management changes, this situation puts the Council, its committees and the public at a disadvantage. We suggest the Council formally and directly request the trawl track data from the three states, explaining and emphasizing the importance of obtaining this data for meeting the Council's management goals and the provisions of the Magnuson-Stevens Act.

Again, we recognize and commend the efforts that have occurred to date to make this a successful review of groundfish EFH management. The Council and NMFS have allocated additional time and resources to conduct further work to better prepare for the release of an RFP in April 2013. We believe that focusing on the three areas described in this letter will be the most helpful way to prioritize this effort moving forward. We plan to provide input into this process through our continued participation on the EFHRC, by providing our own scientific data and analysis, and by responding to the Council's upcoming RFP. Thank you for considering these comments.

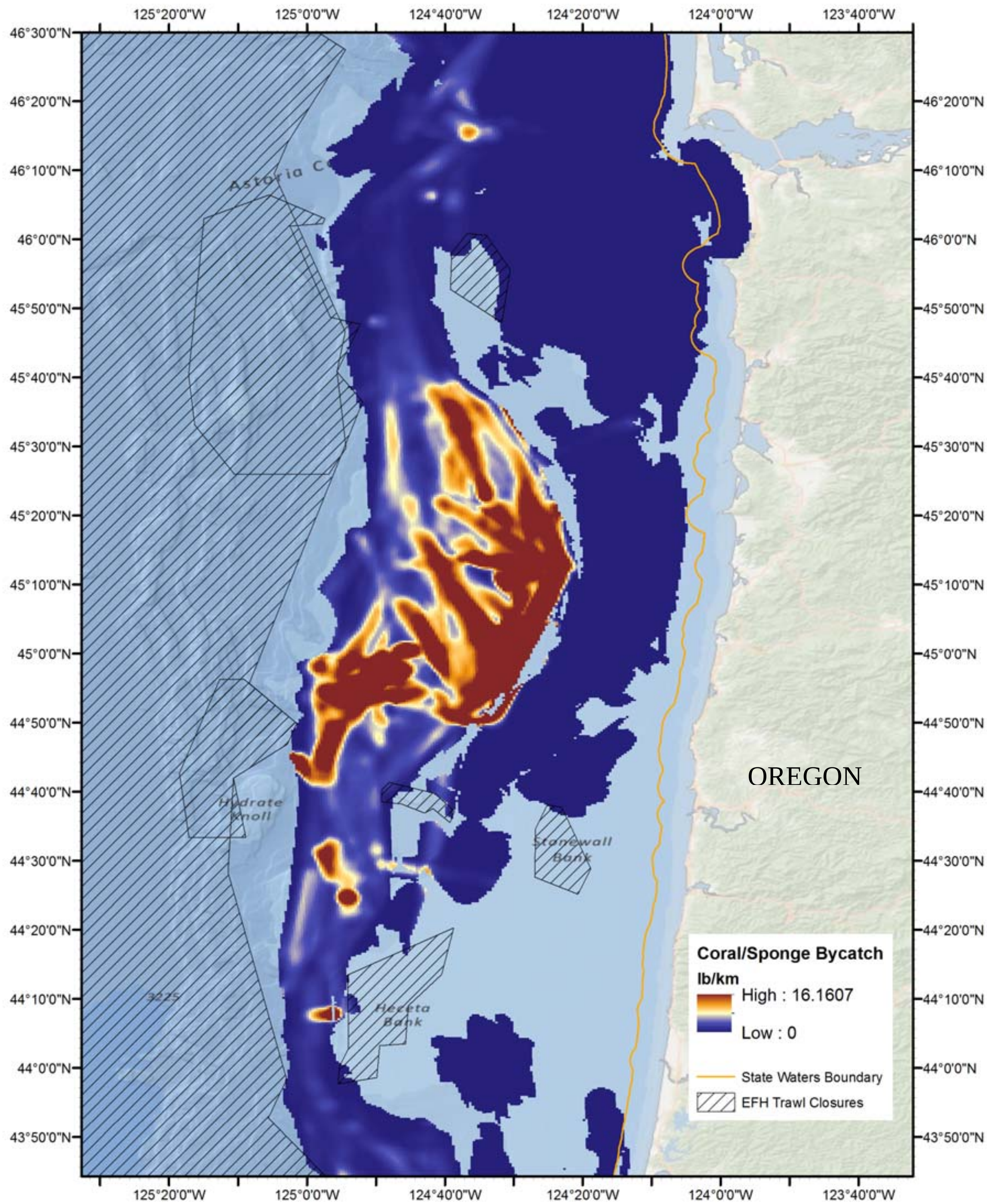
Sincerely,

Geoffrey Shester, Ph.D.
California Program Director

Attachment:
Alternative displays with different color scales showing the same coral and sponge bycatch data from the West Coast Groundfish Observer Program off northern Oregon since the 2006 implementation of the Amendment 19 EFH conservation measures. Maps produced by Oceana with data provided by NMFS.



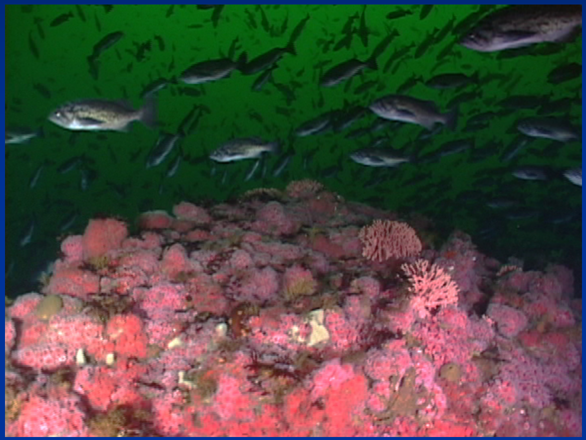
Display designed to distinguish areas where coral and sponge bycatch occurred from areas where bycatch did not occur, using discretely classified coloration.



Display designed to identify areas with highest bycatch rates within the region displayed, using a "stretch" display with a standard deviation-based histogram.

Agenda Item H.6.c
Supplemental Public Comment PowerPoint
September 2012

Comments on Groundfish EFH 5-Year Review


Geoff Shester, Ph.D.

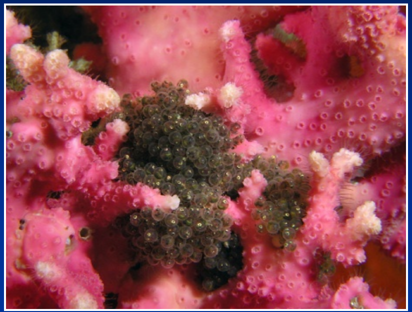
California Program Director

Sept. 17, 2012

OCEANA

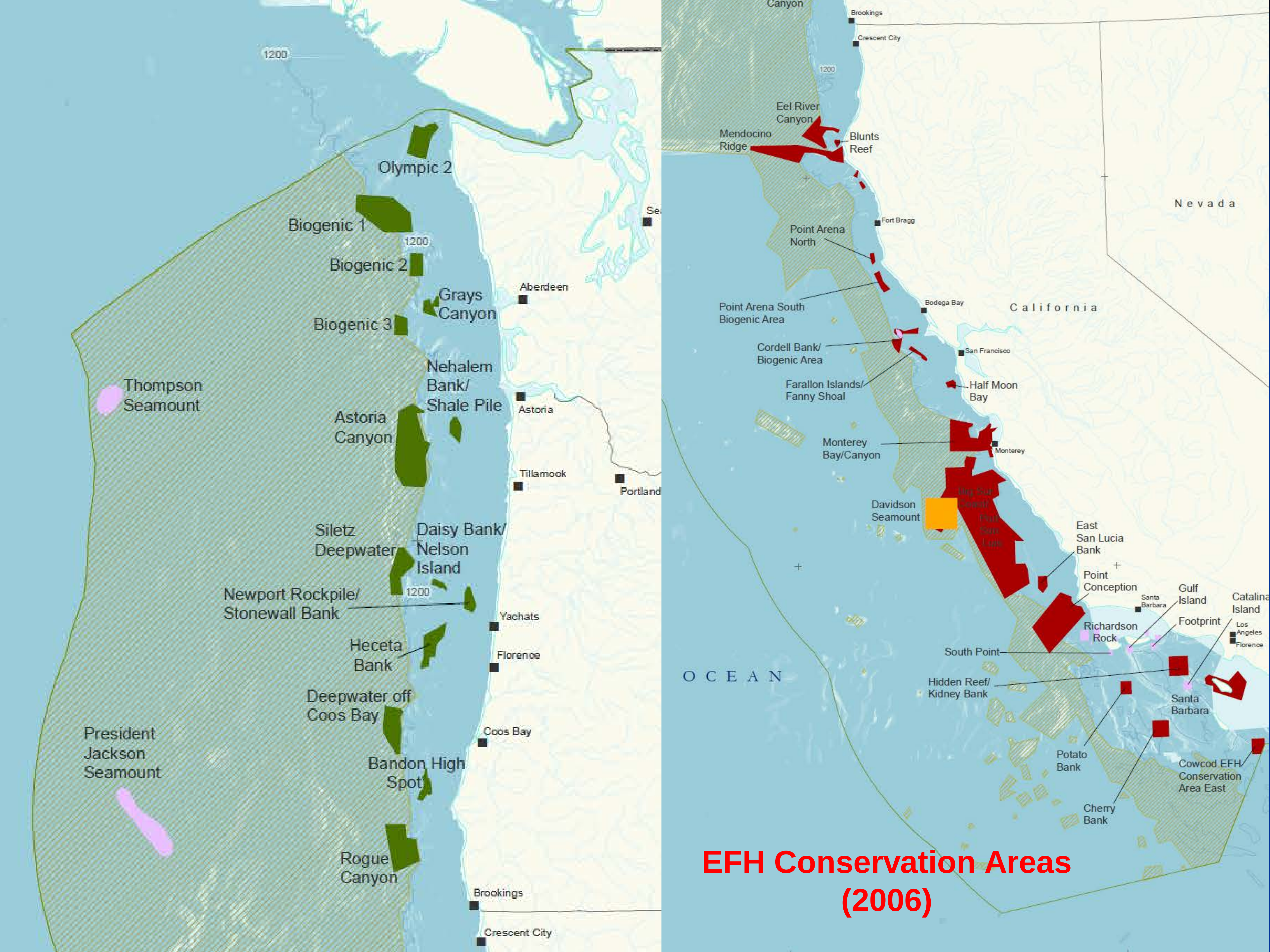
Oceana's Approach

- Protect habitat while maintaining vibrant fisheries and coastal communities



- Submit conservation proposal
  - "Freeze the footprint"
  - Close important ecological areas within the footprint
  - Additional research, monitoring, mapping

- Refine protections over time



EFH Conservation Areas (2006)

Table 2. Habitat features closed to bottom trawling by final EFH regulations off U.S. West Coast.

Criteria	Closed to bottom trawling in final regulations
Hard substrate	12,813 of 19,548 km^2 (65.5%)
Coral records	551 of 2,396 records (23.0%)
Sponge records	206 of 1,294 records (15.9%)
Seamounts	5,151 of 5,151 km^2 (100%)
Submarine canyons	8,321 of 15,286 km^2 (54.4%)
Untrawlable areas/trawl hangs	398 of 1,847 km^2 (21.5%)
Total area of seafloor habitat within U.S. West Coast EEZ	353,500 of 826,680 km^2 (42.8%)

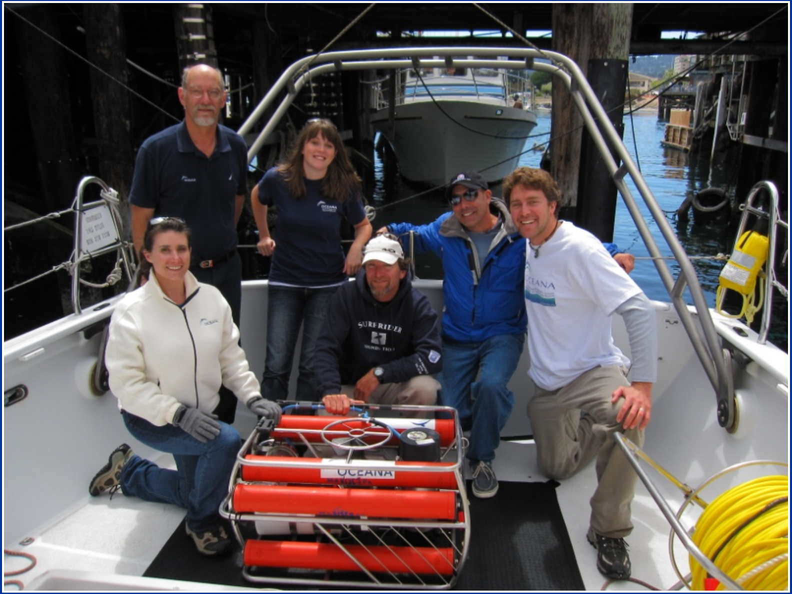
Table 3. Coral records contained within area closed to bottom trawling off U.S. West Coast.

Coral records from NMFS trawl surveys (1977–2003) and other institutions (Etnoyer and Morgan, 2005).	Number of records (trawl survey start points and sample locations)	Within final area closed to bottom trawling
Total	2,396	551 (23.0%)
Antipatharians	199	50 (25.1%)
Gorgonians	576	231 (40.1%)
Pennatulaceans	1,558	248 (15.9%)
Scleractinians	22	7 (31.8%)
Stylasterids	41	15 (36.6%)

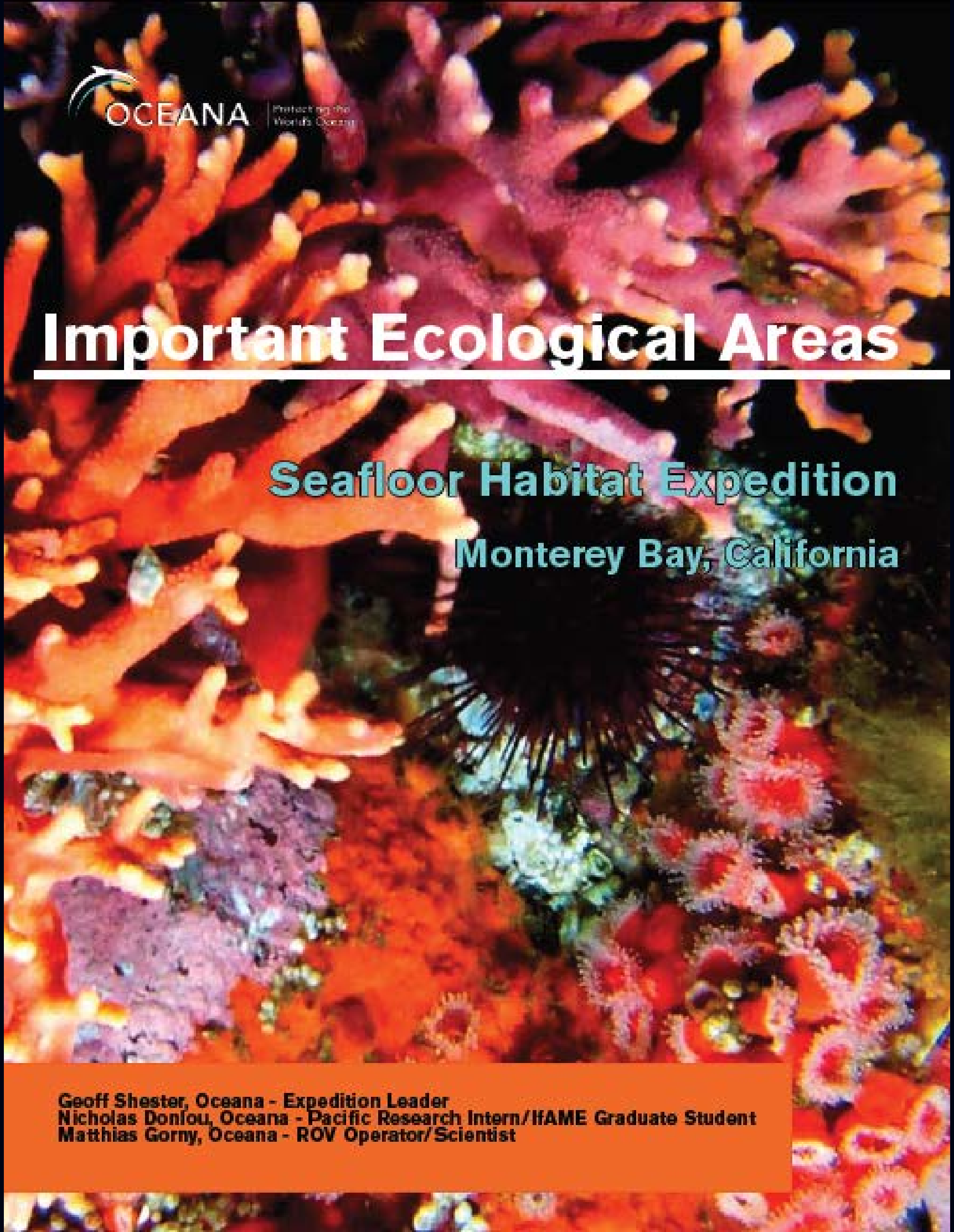
From Shester & Warrenchuk 2007

Oceana's Undersea Expeditions

- Monterey Bay, California (2010, 2011)
- Southern Oregon (2011)
- San Juan Islands, Washington (2011)



Oceana Expedition: June 2011

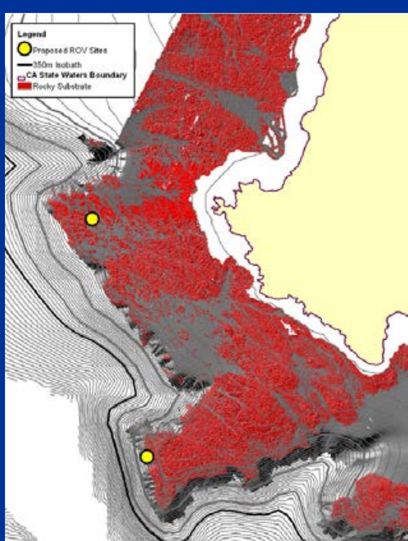


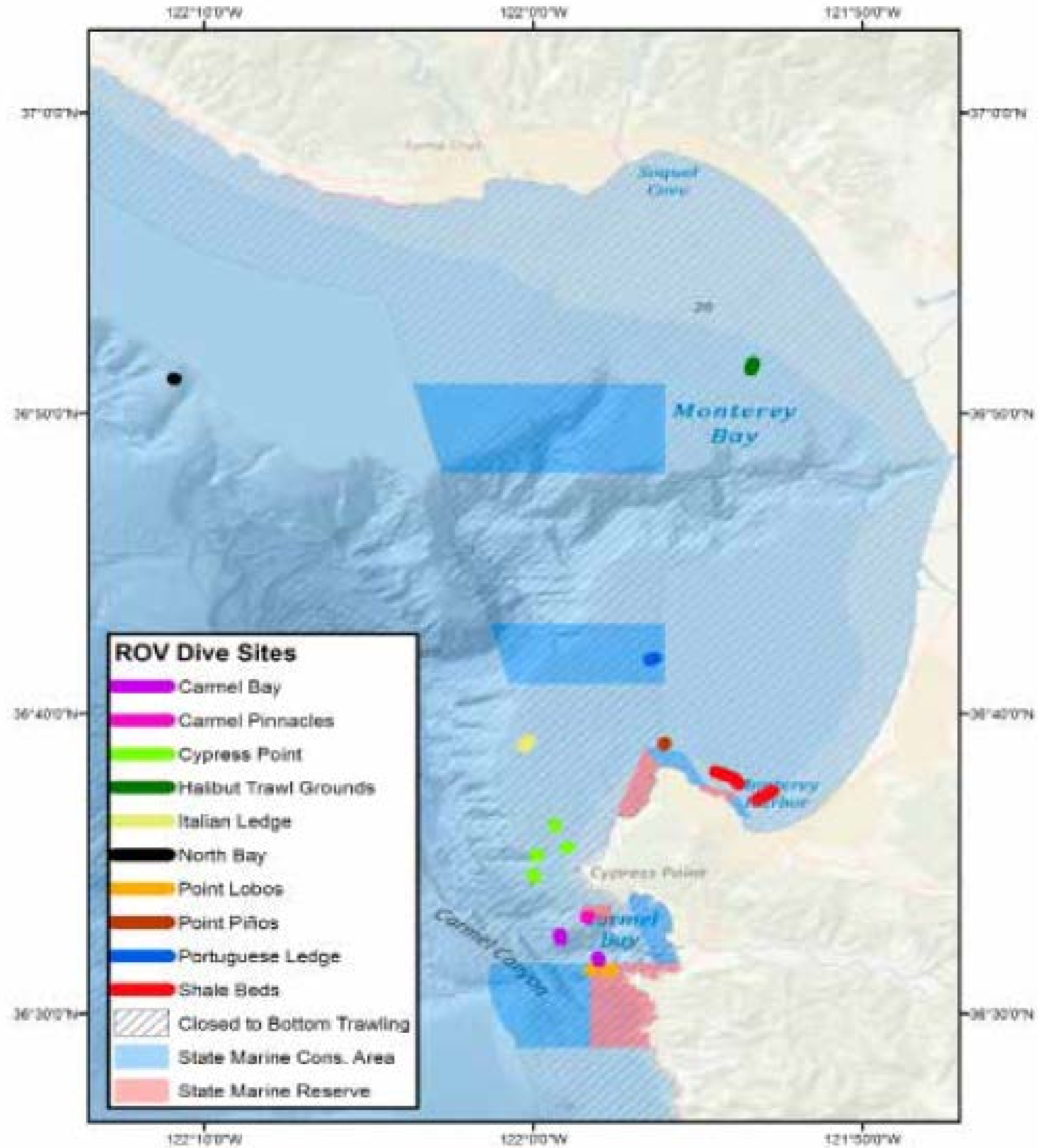
Important Ecological Areas

Seafloor Habitat Expedition

Monterey Bay, California

Geoff Shester, Oceana - Expedition Leader
Nicholas Donlou, Oceana - Pacific Research Intern/IfAME Graduate Student
Matthias Gorny, Oceana - ROV Operator/Scientist


Legend
Proposed ROV Sites
350m Isobath
CA State Waters Boundary
Rocky Substrate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122°0'0"W
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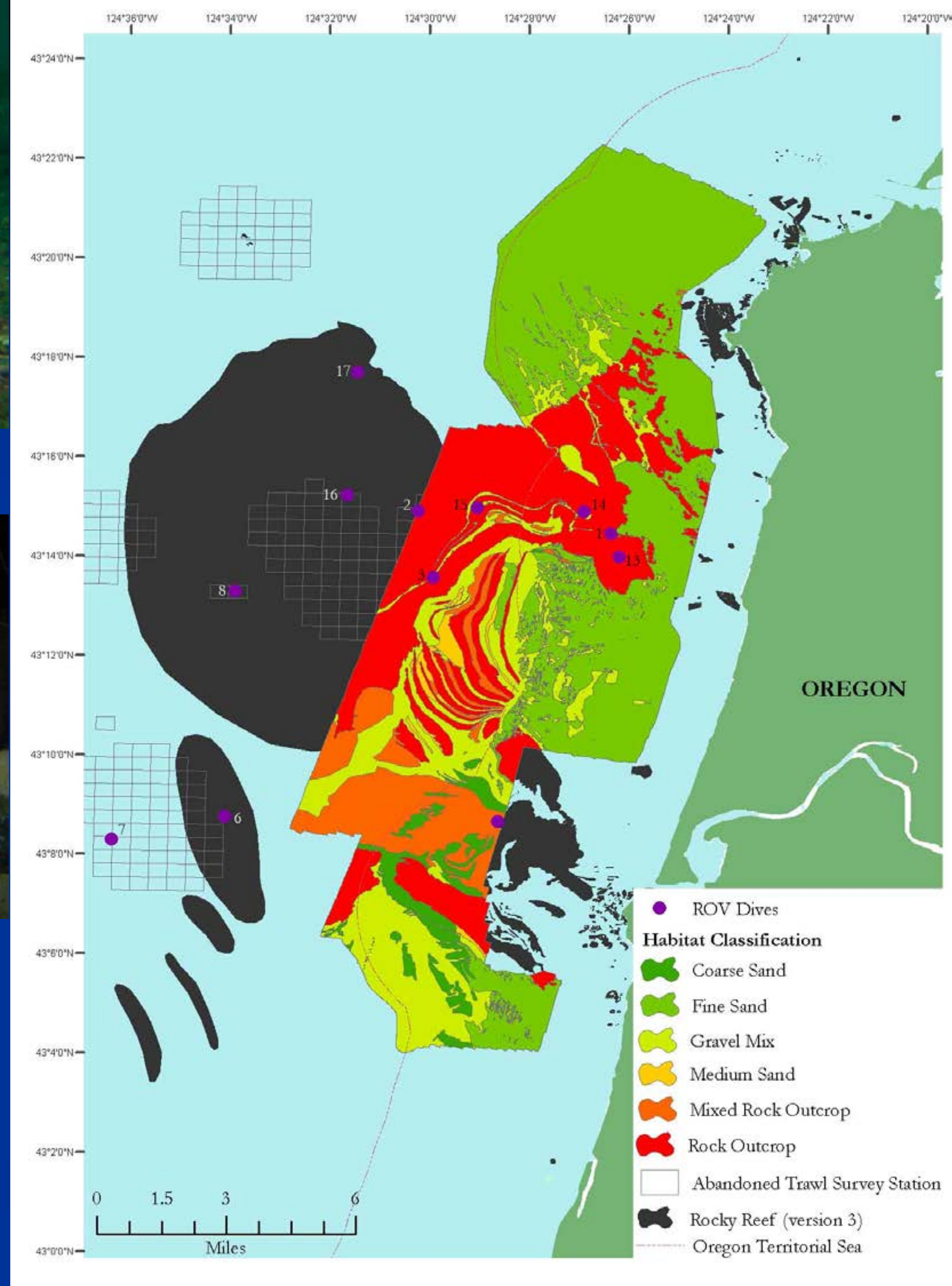
37°0'0"N
36°50'0"N
36°40'0"N
36°30'0"N
Soquel Cove
Monterey Bay
Cypress Point
Carmel Canyon
ROV Dive Sites
Carmel Bay
Carmel Pinnacles
Cypress Point
Halibut Trawl Grounds
Italian Ledge
North Bay
Point Lobos
Point Piños
Portuguese Ledge
Shale Beds
Closed to Bottom Trawling
State Marine Cons. Area
State Marine Reserve

Co-occurrence of Groundfish with Corals and Sponges

Group	Type	Blue Rockfish	Cabezon	Canary Rockfish	China Rockfish	Copper Rockfish	Dover Sole	Flag Rockfish	Gopher Rockfish	Greenspotted Rockfish	Greenstriped Rockfish	Halfbanded Rockfish	Kelp Greenling	Lingcod	Olive/Yellowtail Rockfish	Pacific Sanddab	Pygmy Rockfish	Rex sole	Rock sole	Rosy Rockfish	Splitnose/Aurora Rockfish	Squarespot Rockfish	Starry Rockfish	Stripetail Rockfish	Treefish	Vermilion Rockfish	Vermilion/Canary Rockfish	Yelloweye Rockfish	# Groundfish Species
Coral (Order)	Pennatulacea			X		X		X		X	X	X		X	X		X			X						X		X	12
	Gorgonacea	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X			X		X	X		X	X	X	X	22
	Scleractinia	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Stylasterina	X	X	X	X	X			X			X	X	X	X		X			X		X	X		X	X	X	X	18
Sponge (Morphology)	Mound	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	25
	Foliose	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Shelf	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Barrel	X	X	X	X	X	X		X			X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	22
	Branching	X		X	X	X		X	X	X	X	X	X	X	X		X			X		X	X			X	X	X	19
	Vase	X		X	X	X						X		X	X		X			X		X	X			X		X	13
	Other	X	X	X	X	X		X	X	X	X		X	X	X		X			X		X	X		X	X	X	X	20

Oceana Dives sites off Cape Arago, Oregon



EFH Final Rule: Prey Species

- **600.815(a)(7)** ***Prey species*****.**
- Loss of prey may be an adverse effect on EFH and managed species.
- FMPs should list the major prey species for the species in the fishery management unit and discuss the location of prey species' habitat

EFH Request For Proposals

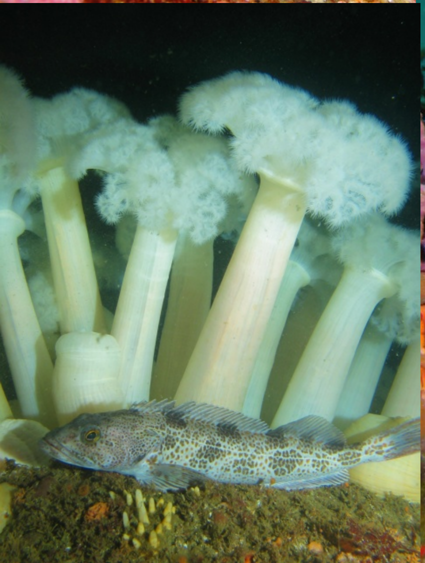
- Premature to release before NMFS Analysis
- Clarify required vs. optional proposal contents
- Thinking ahead…
  - Council will need to decide whether to initiate an FMP amendment after Phase 2
  - Do you want a qualitative review or a quantitative analysis of proposals?

Thank you

OCEANA






Agenda Item H.6.c
Supplemental Public Comment 2
September 2012

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Important Ecological Areas

Seafloor Habitat Expedition

Monterey Bay, California

Geoff Shester, Oceana - Expedition Leader
Nicholas Donlou, Oceana - Pacific Research Intern/IfAME Graduate Student
Matthias Gorny, Oceana - ROV Operator/Scientist

ACKNOWLEDGMENTS

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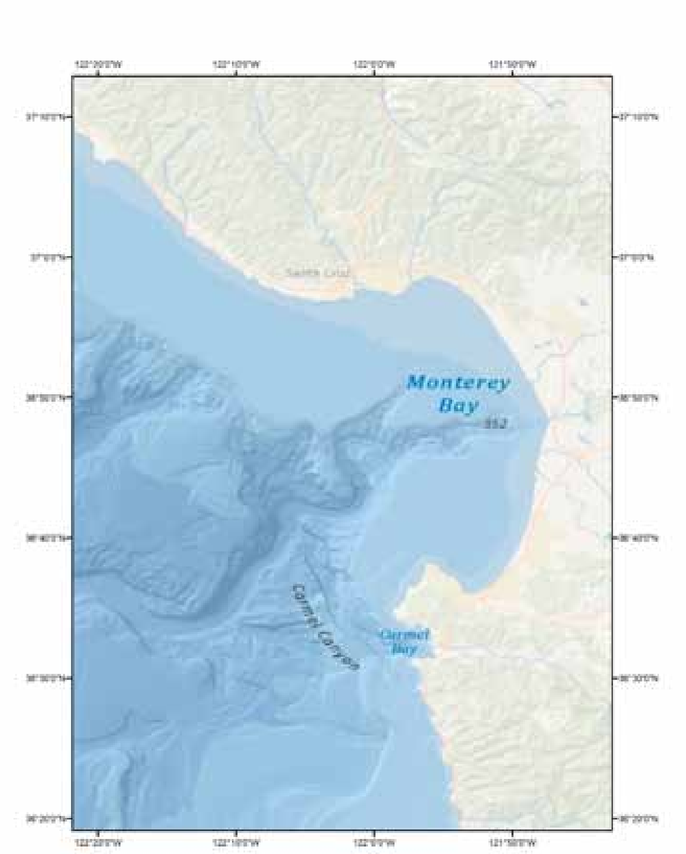
EXECUTIVE SUMMARY

Located in the Central Coast of California, Monterey Bay is renowned for its complex seafloor habitat, deep submarine canyons, strong seasonal upwelling, and abundance of forage species. As an Important Ecological Area within the California Current Large Marine Ecosystem and home to our nation's largest national marine sanctuary, Monterey Bay plays a vital role in the region's marine health and biodiversity. In late August and early September of 2010, a team of Oceana researchers explored the depths of Monterey Bay using a Remotely Operated Vehicle equipped with high definition video camera with the primary goal of characterizing seafloor habitats and associated fish species at specific areas of interest on the continental shelf of the Monterey Bay region.

While there has been extensive visual exploration of deep sea areas and nearshore environments around Monterey relative to other marine regions, the intermediate depths of the continental shelf and slope are largely unexplored, with much of the biological information coming from National Oceanic and Atmospheric Administration (NOAA) trawl surveys since the 1970s. Such trawl surveys provide limited data on habitat characteristics, however, as small, delicate, and fragile organisms are crushed and torn apart when nets are brought up to the surface. Additionally, these surveys also do not discern how organisms interact in the marine environment. Deep habitats on the continental shelf and upper slope contain a high diversity of species that have been fished for decades, but far less is known about these habitats and associated communities than is known about shallow water marine environment (SCUBA depth). New technologies, including camera sleds and remotely operated vehicles (ROVs), provide scientists the opportunity to visually assess and characterize the seafloor using non-destructive methods, and to see the interactions between deep-sea organisms and their associated habitats.



Habitat characterizations are important for fisheries managers to assist in developing spatial management measures to protect sensitive habitats from damaging bottom tending fishing gear. Bottom trawling is among the most damaging practices to west coast seafloor habitat. Trawling has occurred in Monterey Bay for over a century, though in recent years, state and federal governments have enacted a number of bottom trawl closures to protect sensitive seafloor habitats from damage. Sixty-four percent of the Monterey Bay National Marine Sanctuary is currently closed to bottom trawling, though significant areas of the continental shelf and slope remain open.

Using a remotely operated vehicle Oceana was able to capture high definition video and images of marine species co-existing in their natural habitat

Closures include all state waters, which extend as far as 14 miles from the coastline in Monterey Bay, federal Essential Fish Habitat (EFH) Conservation Areas, and federal "footprint closure" that closes areas seaward of 700 fathoms. EFH Conservation Areas were designed based on available data on

the presence of hard substrate and biogenic habitat, particularly corals and sponges. EFH designation and management areas for the U.S. west coast are currently under review, and the Pacific Fishery Management Council (PFMC) is considering new information for possible modifications to the current EFH designations. Along with these protections, the Monterey Bay region also contains several recently designated state Marine Protected Areas implemented through the California Marine Life Protection Act in 2007.

Oceana conducted a study to help answer key management questions regarding the distribution of fish species across habitat types, the types of habitats contained both inside and outside protected areas, and the potential impacts of bottom trawling on seafloor habitats. In the summer of 2010, Oceana deployed a Remotely Operated Vehicle (ROV) in the Monterey Bay region from Davenport to Point Lobos. We used a "roving diver" approach (where unlike a transect survey there is more freedom to observe and follow fish and other species) at depths of 22-189 m to characterize seafloor habitats and associations of fish species managed under the federal Pacific Coast Groundfish Fishery Management Plan and California Nearshore Fishery Management Plan. The study yielded a total of 12.5 hours of usable video from 17 discrete dive locations.

EXECUTIVE SUMMARY

Our analysis shows that Monterey Bay has a very diverse underwater ecosystem, from expansive soft-bottom sediments to high relief rocky pinnacles. We also found great variation in biogenic habitats and fish assemblages, with a total of 1,658 total fish representing 30 different Fishery Management Plan (FMP) groundfish species observed. The most commonly observed fish species were lingcod, rosy rockfish, and olive/yellowtail rockfish. We identified certain areas with large aggregations of juvenile rockfish as well as "hotspots" for depleted species such as yelloweye rockfish, which have important implications for the boundaries of closed areas (i.e., Rockfish Conservation Areas) currently in place to rebuild such species.

Hydrocorals

A total of 2,130 individual coral colonies and 1,660 individual sponges were identified. Cup and gorgonian corals were the most common coral families found, while hydrocorals were abundant at a few specific sites. Mound and foliose sponges were the most common sponge morphologies. Several new coral and sponge occurrences were documented in the study for addition to NOAA's Deep Sea Coral and Sponge Database. This new information helps to improve our understanding of coral and sponge distribution and abundance patterns across a range of different substrate types and depths.

Sea sponge

The most dramatic areas of observed high relief pinnacles, large corals and sponges are already included in multiple overlapping trawl protections. This verifies that existing habitat protections previously implemented in the region are based on accurate rationale and are meeting their original intent, thus should remain closed to trawling.

Soft sediment areas observed in our study surveyed included several important biogenic habitats. In particular, the historic halibut trawl grounds in northern Monterey Bay contained numerous sea whips and abundant biogenic mounds and depressions, indicating the presence of organisms that could be adversely impacted if trawling resumes in the area. Other soft sediment areas of the Bay included dense fields of filter-feeding brittle star legs, which create structures protruding above the plain of the seafloor, with the bodies embedded in the sediments.

Strawberry anemone & sea sponge

Furthermore, the area where trawling is currently occurring in federal waters had a clear lack of biogenic habitats or mounds. However, the lack of similar data at our sites before the initiation and/or cessation of trawling precludes us from making definitive conclusions about the impacts of trawling or the recovery of habitats following trawl closures. That said, given the dearth of data on trawling impacts in Monterey Bay, the fact that these habitats with similar physical characteristics but with different trawling histories lacked biogenic structures suggests some degree of trawl damage.

This study provides a wealth of new data relevant to multiple management questions on several key unexplored areas in the Monterey Bay National Marine Sanctuary. Our analysis indicates that current trawl closures are successfully protecting key sensitive areas used as habitat by commercially and recreationally important groundfish species. These areas should remain closed, as reopening them to trawling may impact biogenic habitats found in both soft and hard substrates. Furthermore, this study provides some key quantitative and qualitative results, which can guide the development of more specific future studies.

The data gathered in this report is intended to provide new information to be considered in the Pacific Groundfish Essential Fish Habitat 5-year review, currently being conducted by the National Marine Fisheries Service and Pacific Fishery Management Council. It also adds additional observations of corals and sponges not currently included in the NOAA database. In particular, this study describes habitat usage associations at various life stages in substantially greater detail than previous attempts, which will allow a refinement of Pacific Coast Groundfish Essential Fish Habitat descriptions and designations, which will assist in improving management measures aimed at protecting seafloor habitats.

"The future is in the hands of those who explore and from all the beauty they discover while crossing perpetually receding frontiers, they develop for nature and humankind an infinite love."

-Jacques Cousteau

INTRODUCTION

The primary goal of this study is to characterize seafloor habitats and associated fish species at specific areas of interest on the continental shelf of the Monterey Bay region. Habitat characterizations are important for fisheries managers to identify and protect sensitive habitats through spatial management measures. Managers in charge of Marine Protected Areas (MPAs) need this information to efficiently manage MPAs (Laurel and Bradbury 2006). In 2010, Oceana partnered with the Institute for Applied Marine Ecology (IfAME) at California State University Monterey Bay (CSUMB) to contribute additional scientific information to characterize seafloor habitats off Central California.

The intermediate depths of the continental shelf and slope are largely unexplored, with much of the biological information coming from trawl surveys since the 1970s. Such trawl surveys provide limited data on habitat characteristics, however, as small, delicate, and fragile organisms are crushed and torn apart when nets are brought up to the surface. Species interactions and associations are also difficult to assess.

New technologies, including camera sleds and remotely operated vehicles (ROVs), provide scientists the opportunity to visually assess and characterize the seafloor using non-destructive methods, and to see the interactions between deep-sea organisms and their associated habitats (Yoklavich et al. 2003). Video footage from ROVs allows scientists to review underwater transects and increase the accuracy and precision of the habitat characterization in those areas (Lundsten et al 2009; Norcross and Mueter 1999; Robinson et al. 2009). Small and cryptic species can be missed easily in the first viewing but can be found later after a careful review of the video. ROV footage can also be analyzed not only for presence/absence and abundance of various organisms, but for quantifying species associations with bottom habitat components (Lorance and Trenkel 2006; Trenkel et al. 2004). Analysis of the video can also predict the abundance and distribution of different fish assemblages (Anderson et al. 2009).

Current Seafloor Protections

Large areas of seafloor habitat in the Monterey Bay region have been subjected by bottom trawl fishing gear for decades (Figure 1). Over the last decade, Oceana's advocacy efforts have been critical to protecting seafloor habitats in the Monterey Bay region, particularly through the state waters trawl ban and development of EFH Conservation Areas (Figure 2). In 2004, Governor Schwarzenegger signed Senate Bill 1459 (Alpert), landmark legislation which stated "...it is unlawful to engage in bottom trawling in ocean waters of the state." This legislation went into effect out to three miles from the coastline on January 1, 2005 and became enforced in the state waters of Monterey Bay that extend beyond three miles beginning in October 2006. Senate Bill 1459 also stated that the Fish and Game Commission "... shall facilitate the conversion of bottom trawlers to gear that is more sustainable if the commission determines that conversion will not contribute to overcapacity or overfishing" (California Fish and Game Code Section 8841(h)(j)).

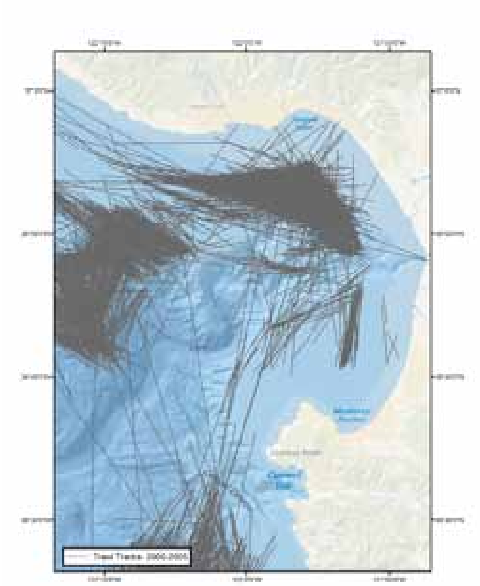


Figure 1: Trawl tracks (2000-2003) prior to federal Essential Fish Habitat closures, state water trawl ban (SB 1459), and the Marine Life Protection Act marine protected areas based on start and end points of tows as recorded in fishery logbooks. Source: PacFIN.

Oceana also led the development of a collaborative proposal that was the basis for the current EFH Conservation Areas and Footprint Closure adopted by the Pacific Fishery Management Council (PFMC) and implemented in 2006 by the National Marine Fisheries Service (NMFS) for the entire west coast region (Shester & Warrenchuk 2007).

These and other policies mean that 64% of the Monterey Bay National Marine Sanctuary is currently closed to bottom trawling, though significant areas of the continental shelf and slope remain open. Closures include all state waters, federal Essential Fish Habitat (EFH) Conservation Areas, and a "footprint closure" that closes areas seaward of 700 fathoms.

EFH Conservation Areas were designed based on available data on the presence of hard substrate and biogenic habitat, particularly corals and sponges. EFH designation and management measures for the U.S. west coast are currently under review, and the PFMC is considering new information for possible modifications to the current EFH designations. The data gathered in this report provides new information to be considered in the Groundfish EFH 5-year review.

Corals and Sponges

Deep sea corals in cold water ecosystems are slow growing and long-lived, which makes them vulnerable to the effects of bottom trawling (Freiwald et al. 2004). Sponges are also vulnerable to bottom trawl gear and have been identified as components of Essential Fish Habitat for many federal groundfish species. As these biogenic habitats play a crucial role in deep-sea ecology they have been the focus of management in recent years (Shester and Warrenchuk 2007).

Deep sea corals and sponges are now a focal area of NOAA's Coral Reef Conservation Program, and significant effort has gone to characterizing these habitats off the U.S. west coast. NOAA is currently maintaining a database on occurrences of deep sea corals and sponges on the U.S. west coast, including trawl surveys and visual surveys, though large areas of the continental slope and shelf remain unsampled.

Crab climbs a wall made of sea sponges

The Oceana 2010 Study

The information provided in this study will help to better inform future management decisions regarding the use of fishing gears that may adversely impact certain features of seafloor habitat important to commercial fish species and biodiversity. Specifically, this study will add to the information being produced through NOAA's Deep Sea Coral program and other efforts to inform the EFH 5-year review. In addition, this study may inform future decisions regarding state-managed fisheries in Monterey Bay state waters. Study objectives included:

1. Survey and characterize the distribution and relative abundance of coral and sponge communities at new sites where occurrences have not been documented to date.
2. Quantify associations of state and federally managed groundfish species with physical and biogenic habitat components.
3. Characterize habitats in areas currently closed to bottom trawling to confirm whether areas now protected from bottom trawling include sensitive habitat features.
4. Characterize habitats in open areas where bottom trawling is currently taking place.
5. Provide visual ground-truthing and refinement of interpreted habitat maps at surveyed locations.
6. Add additional observations of corals and sponges to the NOAA database on the occurrences of these biogenic habitat-forming species.

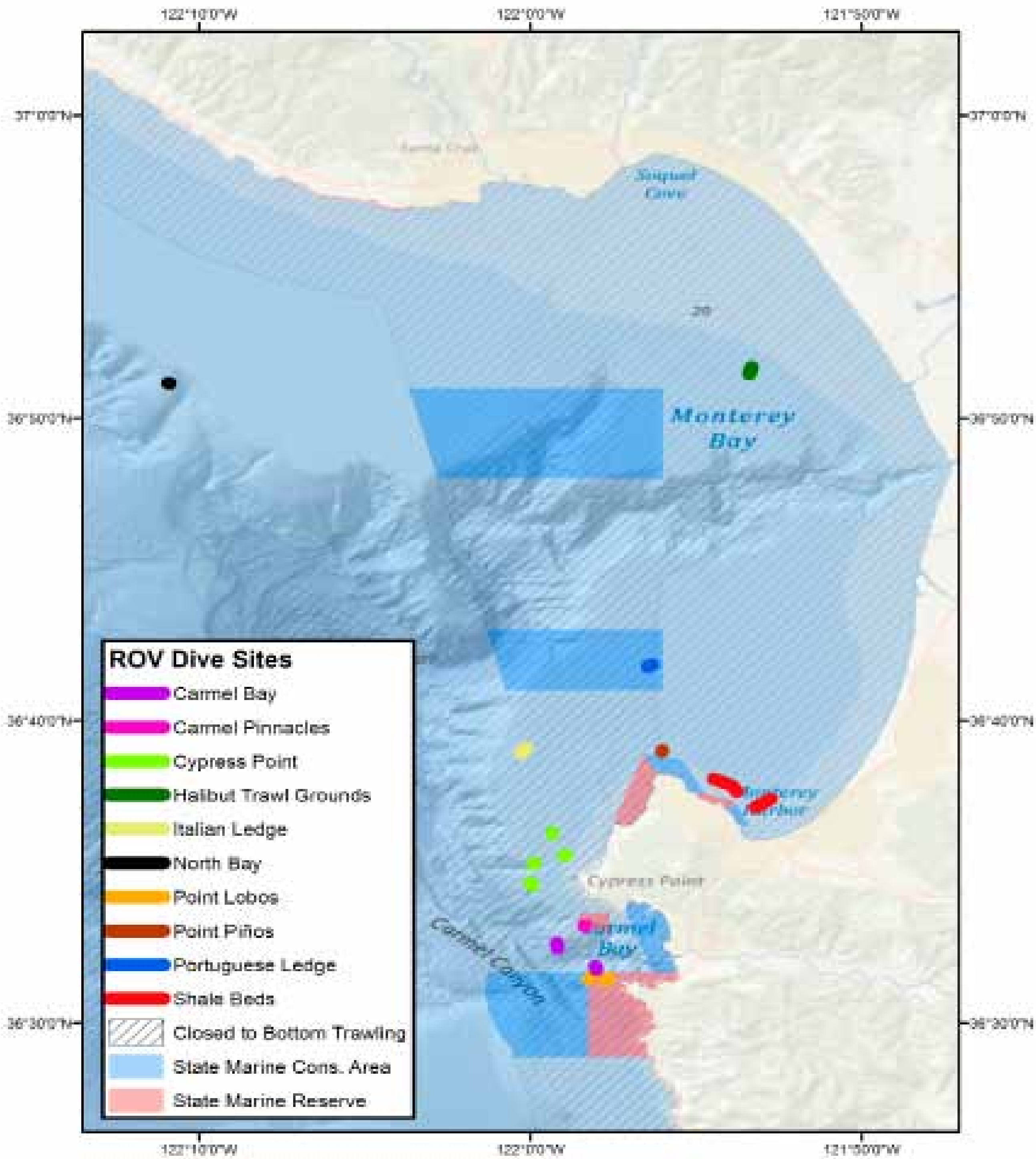
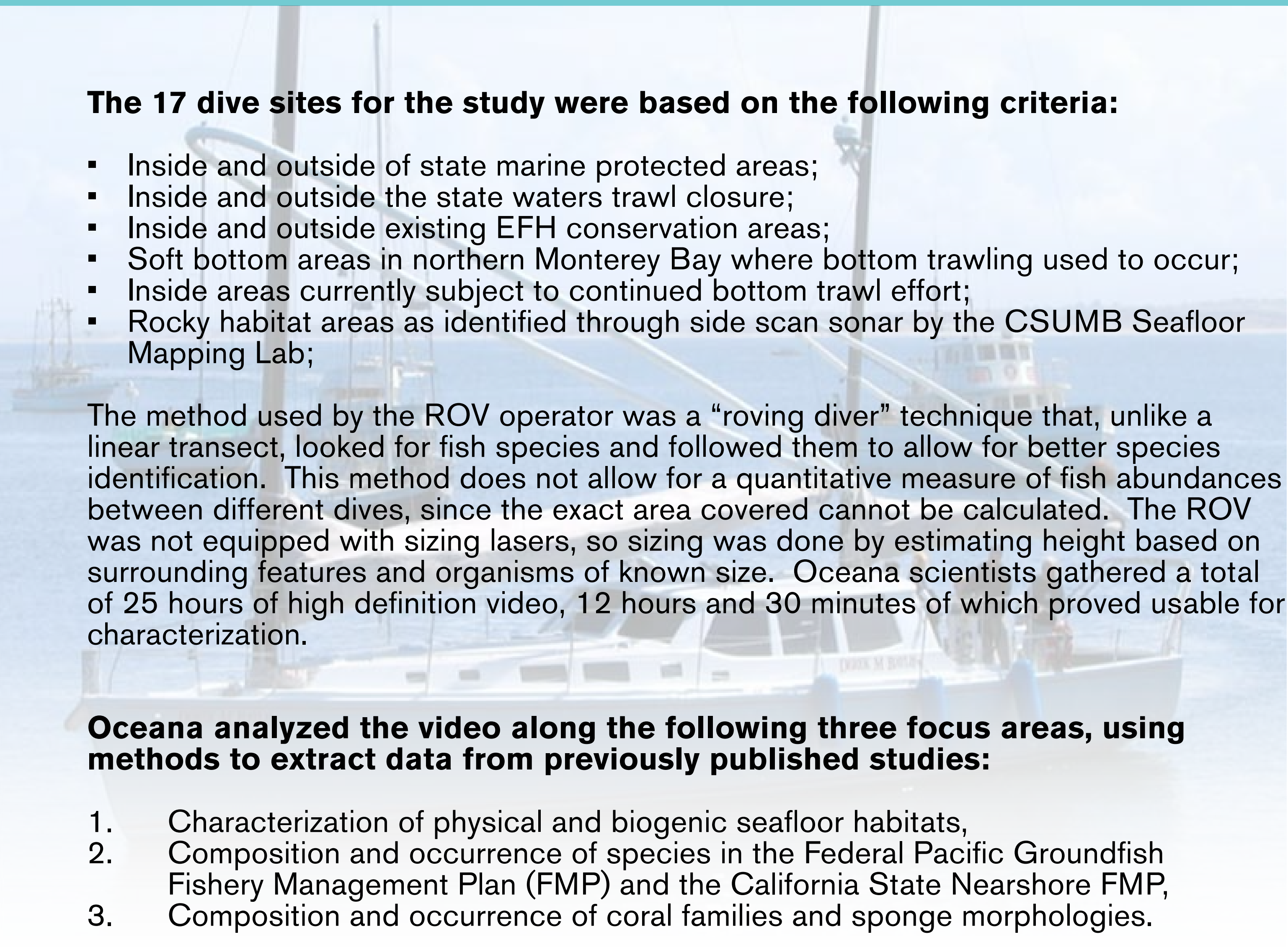


Figure 2: Map of study region with dive locations and relevant spatial management boundaries

METHODS

In late August and early September of 2010, Oceana deployed a remotely operated vehicle (ROV) off the coast of Monterey, California for a total of six days, using the 65-foot Derek M. Baylis research sailing vessel. The vessel's onboard GPS was used as a proxy for the position of the ROV, based on the assumption that the ROV was directly below the vessel. The ROV deployed was a Mariscope FO-II ROV equipped with two cameras. One was connected by a tether to the surface so the ROV operator and scientists could see the seafloor and ROV depth in real time and pilot the ROV. The other was a high definition camera attached on the side of the ROV, which recorded the seafloor in 1080p high definition at 30 frames per second. The high definition video was used in the analysis, while the low definition was used to determine the depth at each dive site. The ROV was also equipped with four lights to illuminate the seafloor, and operated at a maximum of 350 meters.



The 17 dive sites for the study were based on the following criteria:

- Inside and outside of state marine protected areas;
- Inside and outside the state waters trawl closure;
- Inside and outside existing EFH conservation areas;
- Soft bottom areas in northern Monterey Bay where bottom trawling used to occur;
- Inside areas currently subject to continued bottom trawl effort;
- Rocky habitat areas as identified through side scan sonar by the CSUMB Seafloor Mapping Lab;

The method used by the ROV operator was a "roving diver" technique that, unlike a linear transect, looked for fish species and followed them to allow for better species identification. This method does not allow for a quantitative measure of fish abundances between different dives, since the exact area covered cannot be calculated. The ROV was not equipped with sizing lasers, so sizing was done by estimating height based on surrounding features and organisms of known size. Oceana scientists gathered a total of 25 hours of high definition video, 12 hours and 30 minutes of which proved usable for characterization.

Oceana analyzed the video along the following three focus areas, using methods to extract data from previously published studies:

1. Characterization of physical and biogenic seafloor habitats,
2. Composition and occurrence of species in the Federal Pacific Groundfish Fishery Management Plan (FMP) and the California State Nearshore FMP,
3. Composition and occurrence of coral families and sponge morphologies.

Pictured above: Derek M. Baylis research sailing vessel

Physical and Biological Habitat Classification

We classified the physical and biological aspects of seafloor habitat for video frames at 30 second intervals, beginning from when the ROV touched bottom. At each interval, the video was paused and primary and secondary physical habitat and relief recorded. At times during the video the ROV went too far above the seafloor for features to be identified or observed. When this occurred no data was collected and a note was made that nothing could be seen.

Physical habitats were divided into primary and secondary habitat based on visual estimates, with the primary habitat occupying at least 50 percent of the frame and the secondary habitat occupying at least the remaining 20 percent. A relief category of high (for rock 2+ meters vertical), medium (for rock 1-2 meters vertical), or low (for rock 0-1 meters vertical) (Tissot et al. 2006) was assigned to both the primary and secondary habitats.

The categories for physical habitat were rock (rock that is part of the seafloor), boulders (greater than 20cm), cobble (less than 20cm), sand (coarse loose sediment), and mud (fine loose sediment) based on classifications from Greene et al. (1999). Sand and mud were distinguished based on the size of individual grains; if individual grains were visible the substrate was classified as sand, if not the substrate was classified as mud.

Biogenic substrate was identified as the three most numerous organisms present in each frame, from most abundant to least abundant. The possible categories for biogenic habitat are listed in Appendix A. The Taxonomic Distribution Plots (TDPs) for each dive show how different biogenic and physical habitat characteristics change in relation to each other (IfAME 2011). TDPs can be read either vertically or horizontally. When read vertically they show what biogenic habitats occur over specific physical habitats. When read horizontally they track how the distribution of a biogenic habitat changes over the course of a dive. The TDP charts are located in the individual sections for each dive found in Appendix C.

Additionally, there are three levels within both substrate and biogenic categories in the TDP. Substrate levels correspond to high, medium, and low relief related to their position, with the high category being at the top, medium in the middle, and low at the bottom of the row. For biogenic categories the position in the row relates to the biogenic level, with biogenic 1 at the top of the row, biogenic 2 in the middle, and biogenic 3 at the bottom. When spaces occur between observations this notes a section of the video where the seafloor was not observed because the ROV was too high off the seafloor or the video frame was filled with silt clouds from sediment in the water.

Species Compositions: Fish and Fish Associations

All fish species found in the Federal Groundfish Fishery FMP and the California Nearshore FMP were recorded and identified to their lowest taxonomic level. Some fish could not be identified because of the lack of identifying characteristics in the video or poor video quality. These fish were labeled as unidentified flatfish, unidentified rockfish, or unidentified fish. A frame grab was taken of every fish identified for record keeping purposes, and any uncertain identification sent to experts for confirmation. Local fish identification experts Donna Kline, Robert Lea, and Jean de Marignac assisted with fish identification using frame grabs and video clips.

In some cases two or more fish species were grouped together (i.e. vermilion/canary rockfish or olive/yellowtail rockfish) because these fish species could not be distinguished from each other using our video analysis techniques. In addition, *Sebastomus* spp., including rosy rockfish (*Sebastes rosaceus*), starry rockfish (*Sebastes constellatus*), greenspotted rockfish (*Sebastes chlorostictus*), and others primarily identified by their orange/red color and three to six white spots along their back were not identified to species because of a lack of identifying characteristics in the video. See Appendix B for a full list of observed and unobserved fish species.

The time a fish was seen and whether it was a juvenile or adult was noted where possible. We also documented the number of fish present as either a single fish (1), group (2-10), aggregation (10-100), or major school (100+). In addition, we recorded observations of Young-of-the-Year (YOY) fish, which are small juvenile fish that cannot be identified because of their small size and lack of identifying characteristics.

The behavior of each fish was also categorized as resting (includes hovering), searching (slow swimming), or directed movement (fast swimming) as described in Stone (2006). The number of observations for FMP fish species is provided, but these counts should not be compared among different dive sites due to our sampling methods.

Shortbelly rockfish (*Sebastes jordani*)

Species Composition: Corals and Sponges

Corals and sponges were recorded continuously throughout the dives. Identification of coral species was restricted to Orders based on the National Marine Fisheries Service (NMFS) Coral Observation Program (PaCOOS). These categories included *Alcyonacea* (soft corals), *Antipatharia* (black corals), *Gorgonacea* (sea whips, sea fans), *Pennatulacea* (sea pens), *Scleractinia* (cup corals), *Stylasterina* (branched hydrocorals), and unidentified. Each coral record had a rough quantitative estimate of quantity of colonies observed in categories of single (1), group (2-10), or aggregation (10+).

Sponges were also recorded, as they have been shown to comprise a component of Essential Fish Habitat for a number of groundfish species. Since no spicule samples were taken of the sponges, identification was based on morphological categories rather than taxonomic. Sponges were classified based on existing NOAA classification to the following categories: barrel, foliose, mound, branching, vase, shelf, and other.

Gorgonian corals (Order *Gorgonacea*) were among the most commonly observed corals in the study

RESULTS

Table 1 summarizes all dives in which data was gathered and processed, with in-depth individual site characterizations for each dive found in Appendix C. Most dives occurred over rock substrate with a relief of high or medium relief, though sites in the former halibut trawl grounds and North Bay were primarily soft sediment and low relief. The dives typically averaged between 40 and 60 meters, though dives occurred as deep as 189 meters and as shallow as 22 meters. Brittle stars represented the most common biogenic habitat type, followed by sponge mounds, which were the most common sponge morphology. Foliose sponges were also common.

A total of 1,658 fish of 30 different species were observed for all dives. Of these 241 were identified as various *Sebastomus* spp., 212 as Young-of-the-Year fish, and 645 identified to species. The three most common FMP fish species observed were lingcod (*Ophiodon elongates*), rosy rockfish (*Sebastes rosaceus*), and olive/yellowtail rockfish (*Sebastes serranoides/ flavidus*). Lingcod (*Ophiodon elongates*) was the most commonly observed species, found over a mixed variety of habitats. Juvenile lingcod were observed over low relief sand habitat at Cypress Point (Dive 2, Aug 30), while adults were seen over a mix of high and medium relief rock habitat at Point Lobos, Carmel Bay, Carmel Pinnacles, Cypress Point, Italian Ledge, and Portuguese Ledge.

Rosy rockfish (*Sebastes rosaceus*) were found over a mix of medium and high relief rock habitats at Point Lobos, Carmel Bay, Cypress Point, Point Piños, and Portuguese Ledge. Olive/ yellowtail rockfish (*Sebastes serranoides/ flavidus*) were seen over a mix of medium and high relief rock habitats at Point Lobos, Carmel Bay, Cypress Point, Point Piños, and Portuguese Ledge.

Large schools of rockfish were observed over high relief rock habitat, including schools of shortbelly rockfish (*Sebastes jordani*), speckled/widow rockfish (*Sebastes ovalis/ entomelas*), and speckled/ widow/squarespot rockfish (*Sebastes ovalis/ entomelas/ hopkinsi*). Schools of shortbelly rockfish and speckled/widow rockfish were observed on the third dive at Cypress Point over high relief rocky areas that were defined by sharp drop offs.

A total of 2,130 coral colonies were identified during all dives, with 862 observations of *Gorgonacea*, 14 observations of *Pennatulacea*, 1,078 observations of *Scleractinia*, and 176 observations of *Stylasterina*. A total of 1,660 sponges were observed and identified during all dives, with 730 observations of mound morphology, 387 foliose, 180 shelf, 38 barrel, 218 branching, 18 vase, and 89 other.

While this analysis did not examine fish behavior relative to various habitat components, we assessed whether each groundfish species occurred on the same dive as each coral and sponge category (Appendix B - Table 1). This provides “Level 1” (presence/absence) information as described in NOAA’s EFH Regulatory Guidance (50 CFR 600.815). We identified a total of 22 groundfish species present in habitats containing corals and 25 groundfish species present in habitats containing sponges. Of all the groundfish species we observed, only rex sole was observed in a habitat that did not contain corals or sponges.

There were a number of differences observed from southern to northern dive sites. In the south, sites were generally rocky compared to northern sites, which were located over soft habitats consisting of mud or sand. Dives conducted around the Monterey peninsula showed a variety of rock habitats, with relief varying from low to high. North of the Shale Beds, dives were over low relief sand or mud, with brittle stars in the sand around the Shale Beds, sea whips (*Gorgonacea*) in the former halibut trawl grounds, and no biogenic habitats observed in North Bay. In general, dive sites had greater habitat complexity in the south around Point Lobos, Carmel Bay, and Cypress Point, with less complexity in the north at the Shale Beds, former halibut trawl grounds, and North Bay.

Pinnacles observed on the Cypress Point (Dive 1, Aug 30) and Carmel Pinnacles (Dive 3, Sep 2) dives had blue rockfish schools, YOY schools, copper rockfish and olive/yellowtail rockfish. The most common biogenic habitat on these dives was red algae. Dives at the Shale Beds on August 28th (Dive 1) and September 2nd (Dive 5) showed unidentified flatfish and large quantities of brittle stars in the sand--which as detritivores indicate organic enrichment from the overlying waters.

Table 1: Summary of All Dive Locations

Site Name	Date	Dive #	Dive Time	Depth Range (m)	Primary Substrate Types	Primary Relief	Primary Biogenic Cover	Secondary Biogenic Cover
Point Lobos	Aug 31	1	0:55:30	55-65	Rock	Medium	Sponge Mound	Bare
Point Lobos	Sep 2	2	0:55:00	40-55	Rock	Medium	Brittle Stars On	Sponge Mound
Carmel Bay	Aug 31	2	1:33:00	60-80	Rock	Low	Brittle Stars On	Sponge Mound
Carmel Bay	Sep 2	1	0:22:00	155-165	Rock	High	Bare	Bare
Carmel Pinnacles	Sep 2	3	0:56:30	40-60	Rock	High	Algae Red	Algae Red
Cypress Point	Aug 30	1	1:12:30	22-46	Rock	High	Algae Red	Algae Red
Cypress Point	Aug 30	2	0:16:30	91-108	Mud	Low	Bare	Bare
Cypress Point	Aug 30	3	1:21:00	55-70	Rock	Medium	Anemone Aggregating	Sponge Mound
Cypress Point	Aug 30	4	0:52:30	40-60	Boulder	Low	Brittle Stars In	Bare
Italian Ledge	Sep 4	2	0:56:00	85-90	Rock	Low	Brittle Stars On	Bare
Point Piños	Sep 4	1	1:10:30	40-60	Rock	Medium	Sponge Mound	Bare
Portuguese Ledge	Sep 4	3	0:58:00	68-82	Rock	Low	Bare	Bare
Shale Beds	Aug 28	1	0:15:30	35-42	Sand	Low	Brittle Stars In	Bare
Shale Beds	Sep 2	4	0:02:30	40-55	Sand	Low	Brittle Stars In	Bare
Shale Beds	Sep 2	5	0:11:30	40-50	Sand	Low	Brittle Stars In	Bare
Former Halibut Trawl Grounds	Sep 1	2	0:37:30	35-60	Mud	Low	Biogenic Depression	Bare
North Bay	Sep 1	1	0:55:30	182-189	Sand	Low	Bare	Bare

Soft bottom habitats at Cypress Point (Dive 2, Aug 30), North Bay (Dive 1, Sep 1) and the former halibut trawl grounds (Dive 2, Sep 1) contained a variety of differences. The soft sediment at Cypress Point had no biogenic habitats, and there were multiple juvenile lingcod observed. The North Bay site in federal waters had no biogenic habitats and there were a variety of fish observed, including splitnose/aurora rockfish, stripetail rockfish, dover sole and rock sole. The former halibut trawl grounds had biogenic depressions and 38 observations of sea whips (*Gorgonacea*) and unidentified flatfish.

The rocky reefs observed at Cypress Point (Dive 4, Aug 30), Point Lobos (Dive 1, August 31 and Dive 2, Sep 2), Carmel Bay (Dive 2, August 31), Point Piños (Dive 1, Sep 4) and Italian Ledge (Dive 2, Sep 4) had a variety of rockfish species, the most common of which were rosy rockfish (*Sebastes rosaceus*) and olive/yellowtail rockfish (*Sebastes serranoides/ flavidus*). Lingcod (*Ophiodon elongatus*) were also observed on three of these dives.

Mixed habitats observed at Cypress Point (Dive 3, Aug 30) and Portuguese Ledge (Dive 3, Sep 4) differed from each other and other dives. At Cypress Point there were 19 observations of juvenile yelloweye rockfish in mixed habitat that started with sand and boulder low relief habitat and transitions to high relief rock habitat with sharp drop offs. There was also a single observation of a giant Pacific octopus during the beginning of the dive over a mix of sand and boulder habitat. Further in the Cypress Point dive we observed schools of shortbelly rockfish and speckled/widow rockfish over high relief rock habitats with sharp drop offs. Portuguese Ledge was characterized by low relief mud rock habitat with primarily observations of olive/yellowtail rockfish. In addition this dive had the only observation of an adult yelloweye rockfish as well as two juvenile yelloweye rockfish.

DISCUSSION

Our analysis shows a diverse underwater ecosystem in the Monterey Bay region, with a wide range of physical and biogenic habitats and a number of different fish assemblages. While this is aligned with the current understanding of the region, the new information presented here will help improve our understanding of groundfish, biogenic habitat, coral and sponge distribution, and abundance patterns across a range of different substrate types, depths, and relief in areas recently mapped at high resolution.

We identified habitats for key species of interest. The most dramatic area in terms of geological and biological characteristics is the pinnacles at Cypress Point (Dive 3, Aug 30). There were large aggregations of juvenile yelloweye rockfish observed at Cypress Point, with a total of 18 observations during the dive. Yelloweye rockfish are currently under a rebuilding plan, and catch limits can constrain fishermen's ability to harvest other more abundant species. This dive site also had large aggregations of shortbelly rockfish and speckled/widow rockfish. Shortbelly rockfish are a key forage species in the California Current, and the PFMC has prevented directed harvest of this species through the biennial specifications process. Speckled/widow rockfish are a commercially important species that are managed under the PFMC groundfish management plan.

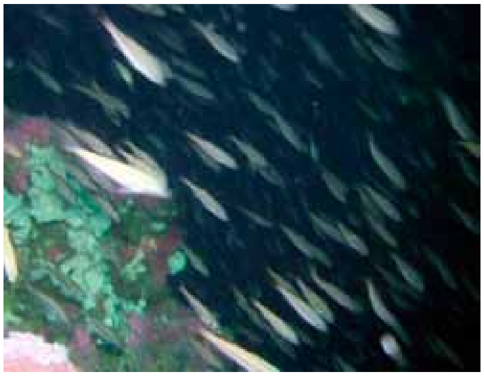
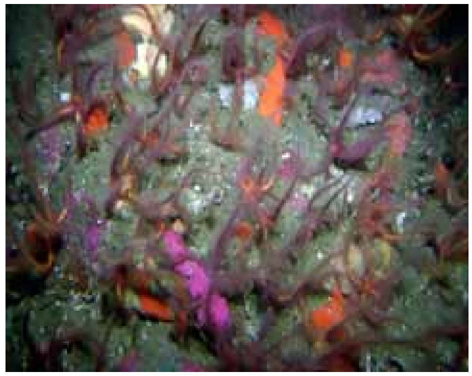
More data needs to be collected, but if these observations are confirmed Cypress Point could be identified as an Important Ecological Area vital to the California Current and may warrant new additional protections.

Point Lobos, Carmel Pinnacles, and Portuguese Ledge have the highest levels of protection, as they are located within state marine protected areas, EFH closures, and within the state waters trawl ban. Multiple observations of corals and sponges at these sites (on primarily hard substrate) and diverse assemblages of managed fish species indicate that the current protections are warranted.

Most dive sites occurred within California state waters, which are currently closed to bottom trawling, though two (North Bay and Italian Ledge) were outside of state waters. North Bay is characterized by flat sand areas of low relief with only a few biogenic habitats. For North Bay, comparing the site to historic trawl tracks shows the area has been trawled before, which could explain the lack of biogenic habitat and relatively flat homogenous features. This could be a result of trawling efforts disturbing the seafloor and reducing the habitat complexity. Without prior data, however, conclusive comparisons cannot be made. However, given the differences between currently trawled areas and areas that have been closed for approximately 5 years, these results highlight that a 5 year window may allow for recovery of some biogenic habitats in soft sediments. Italian Ledge is a rocky habitat currently within an EFH Conservation Area, which makes it unsuitable to trawling, as nets and gear can easily get caught on the rock outcroppings.

Trawl proponents have proposed reopening the potentially sensitive habitats in the former halibut trawl grounds (Dive 1, Sep 1). Our analysis indicates the area has large numbers of sea whips (*Gorgonacea*) and biogenic mounds and depressions created by infaunal burrowing species all of which could be disturbed if the area is reopened to trawling. This suggests the use of these habitat indicators in future evaluations of the effects of trawling, and the quantitative examination of recovery times.

This is especially important considering that biogenic structures like sea whips can create additional three dimensional habitat areas in very low relief physical habitats, providing structure for a different assemblage of commercially important fish (i.e., juvenile flatfish). These habitat-forming organisms could be negatively impacted if trawling were to resume within state waters of Monterey Bay that are currently closed (Engel and Kvitek 1998).

There were four total dives within the MPAs created by the Marine Life Protection Act (MLPA). Three dives (two at Point Lobos and one at Carmel Pinnacles) were within state marine reserves that allow no take within their boundaries, while the remaining dive (Portuguese Ledge) was within state marine conservation areas that allow some take. All four dives also occurred within the California state trawl ban and the EFH closures.

The four dives were characterized by relatively high abundances of biogenic structures and multiple occurrences of FMP fish species. The data collected allows comparison of species composition, but it is not possible to compare differences in relative abundance across sites. We anticipate this information will be useful as part of the California's Marine Protected Area Monitoring Enterprise.

The results in this study will supplement the existing work of Mary Yoklavich (NMFS), the Monterey Bay Aquarium Research Institute, the California Department of Fish and Game, the IfAME Lab at CSUMB, and the Monterey Bay National Marine Sanctuary to provide a more complete characterization of habitats within the Monterey Bay region. The results of this study also indicate that the use of the "roving diver" technique can complement data collected using traditional transects. For example, this technique allowed for the identification of a range extension of the longfin gunnel (*Pholis clemensi*) located at Point Lobos (Dive 1, Aug 30) which might have been unidentified if the ROV did not stop to investigate. This is an important discovery, as the previously understood southern end of the longfin gunnel's range was set at Point Arena.

However, one key limitation with the video methods was the inability to calculate the area surveyed, which makes it difficult to draw comparisons of relative abundance or density of organisms across dive sites. In addition, it is not possible to draw definitive, quantitative conclusions about trawl impacts or recovery, as we do not have data from the same sites before the initiation and/or cessation of trawling. Tentatively, however, our results suggest that currently trawled areas have less biogenic habitat features and are generally more homogenous than untrawled areas of otherwise similar physical characteristics.

A combination of "roving diver" and transect techniques could be used in future expeditions to allow for statistical comparisons between dive sites and for the identification of commercially or ecologically important species. This would allow for statistical analyses between dive sites while still allowing for detailed investigation of specific species, habitats and Important Ecological Areas. The roving diver technique would also allow for proper identification of fish species since the ROV would not be constrained to the transect line. While the video collected has some inherent limitations, we expect to extract more information through further statistical analysis. These methods allowed a qualitative assessment and results which will help design more efficient quantitative presence/absence studies in the future.

CONCLUSION

In conclusion, this study provides a wealth of new data relevant to multiple management questions on several key areas in the Monterey Bay National Marine Sanctuary not previously explored. Our analysis indicates that current trawl closures are successfully protecting key sensitive areas used as habitat by commercial and recreational groundfish species. These biogenic habitats and other important areas should be protected from trawling, and thus the areas should remain closed.

The study found commercially important groundfish using biogenic habitats in both hard and soft substrates, and ultimately this information will assist in our understanding of habitat use at various life stages by various groundfish species. Such information will prove valuable in designing future, more quantitative habitat assessments, and improving and refining management measures aimed at protecting seafloor habitats and healthy fish populations.

Biogenic habitat at Cypress Point with gorgonian corals and rosy rockfish (*Sebastes rosaceus*)

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Biogenic Habitat Categories Used in the Analysis

- Bare (no biogenic cover evident)
- Coral (Alcyonacea, Antipatharia, Gorgonacea, Pennatulacea, Scleractinia, Stylasterina, unidentified)*
- Sponge (barrel, foliose, mound, branching, vase, shelf, other)*
- Anemone (Metridium, large single (not metridium), aggregating (10+ and at least 10 cm in diameter)
- Hydroids (large over 10 cm)
- Tubeworm reef (reef forming Dodecaceria)
- Non-encrusting bryozoans
- Algae (red, articulated coralline, understory brown, giant kelp, bull kelp)
- Brittle stars (in sand or on rock with legs protruding out)
- Crinoids
- Mounds (for sand)
- Biogenic depressions (for sand)
- Other

*Encrusting organisms were not counted

Co-occurrence of Groundfish Species With Corals and Sponges

		Blue Rockfish	Cabezon	Canary Rockfish	China Rockfish	Copper Rockfish	Dover Sole	Flag Rockfish	Gopher Rockfish	Greenspotted Rockfish	Greenstriped Rockfish	Halfbanded Rockfish	Kelp Greenling	Lingcod	Olive/Yellowtail Rockfish	Pacific Sanddab	Pygmy Rockfish	Rex sole	Rock sole	Rosy Rockfish	Splitnose/Aurora Rockfish	Squarespot Rockfish	Starry Rockfish	Stripetail Rockfish	Treefish	Vermilion Rockfish	Vermilion/Canary Rockfish	Yelloweye Rockfish	# Groundfish Species
Coral (Order)	Pennatulacea			X		X		X		X	X	X		X	X		X			X						X		X	12
	Gorgonacea	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X			X		X	X		X	X	X	X	22
	Scleractinia	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Stylasterina	X	X	X	X	X			X			X	X	X	X		X			X		X	X		X	X	X	X	18
Sponge (Morphology)	Mound	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	25
	Foliose	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Shelf	X	X	X	X	X		X	X	X	X	X	X	X	X		X			X		X	X		X	X	X	X	21
	Barrel	X	X	X	X	X	X		X			X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	22
	Branching	X		X	X	X		X	X	X	X	X	X	X	X		X			X		X	X			X	X	X	19
	Vase	X		X	X	X						X		X	X		X			X		X	X			X		X	13
	Other	X	X	X	X	X		X	X	X	X		X	X	X		X			X		X	X		X	X	X	X	20

Table showing co-occurrence of groundfish species with each category of corals and sponges on the same dive. X's indicate where groundfish were observed in habitats containing respective corals and sponges.

APPENDIX B

FMP Species Observed at Each Site

Table of dive sites with presence of observed FMP fish species, listed below this table are the FMP Point Lobos 9/2; D3: Carmel Bay 8/31; D4: Carmel Bay 9/2; D5: Carmel Pinnacles 9/2; D6: Cypress D10: Italian Ledge 9/4; D11: Point Piños 9/4; D12: Portuguese Ledge 9/4; D13: Shale Beds 8/28; Bay 9/1.

Fish Name	Scientific Name	Federal FMP	CA State FMP	D1	D2
Blue Rockfish	*Sebastes mystinus*	Yes	Yes	X	
Cabezon	*Scorpaenichthys marmoratus*	Yes	Yes		
Canary Rockfish	*Sebastes pinniger*	Yes	No		
China Rockfish	*S. nebulosus*	Yes	Yes	X	X
Copper Rockfish	*S. caurinus*	Yes	Yes	X	X
Dover Sole	*Microstomus pacificus*	Yes	No		
Flag Rockfish	*Sebastes rubrivinctus*	Yes	No		
Gopher Rockfish	*S. carnatus*	Yes	Yes		X
Greenspotted Rockfish	*S. chlorostictus*	Yes	No		
Greenstriped Rockfish	*S. elongatus*	Yes	No		
Halfbanded Rockfish	*S. semicinctus*	Yes	No		
Kelp Greenling	*Hexagrammos decagrammus*	Yes	Yes		X
Lingcod	*Ophiodon elongatus*	Yes	Yes		X
Olive/Yellowtail Rockfish	*Sebastes serranoides/ flavidus*	Yes	Yes	X	X
Pacific Sanddab	*Citharichthys sordidus*	Yes	No		
Pygmy Rockfish	*Sebastes wilsoni*	Yes	No	X	
Rex Sole	*Glyptocephalus zachirus*	Yes	No		
Rock Sole	*Lepidopsetta bilineata*	Yes	No		
Rosy Rockfish	*Sebastes rosaceus*	Yes	No	X	X
Speckled/Widow Rockfish	*S. ovalis/ entomelas*	Yes	No		
Speckled/Widow/Squarespot Rockfish	*S. ovalis/ entomelas/ hopkinsi*	Yes	No		
Shortbelly Rockfish	*S. jordani*	Yes	No		
Splitnose/Aurora Rockfish	*S. diploproa/ aurora*	Yes	No		
Squarespot Rockfish	*S. hopkinsi*	Yes	No	X	
Starry Rockfish	*S. constellatus*	Yes	No		X
Stripedtail Rockfish	*S. saxicola*	Yes	No		
Treefish	*S. serriceps*	Yes	Yes		
Vermilion Rockfish	*S. miniatus*	Yes	No		X
Vermilion/Canary Rockfish	*S. miniatus/ pinniger*	Yes	No		
Yelloweye Rockfish	*S. ruberrimus*	Yes	No		

species not observed. The following codes refer to each dive: D1: Point Lobos 8/31; D2:
Point 8/30; D7: Cypress Point 8/30; D8: Cypress Point 8/30; D9: Cypress Point 8/30;
D14: Shale Beds 9/2; D15: Shale Beds 9/2; D16: Halibut Trawl Grounds 9/1; D17: North

D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	Total Sites Present
		X	X			X									4
			X												1
X									X						2
						X									3
		X							X						4
				X										X	2
									X						1
		X	X			X									4
									X						1
									X						1
						X	X								2
			X												2
X		X	X	X	X	X	X		X						9
X			X					X	X						6
											X				1
X					X		X		X						5
				X											1
														X	1
X					X	X		X	X						7
					X										1
X															1
					X										1
														X	1
X							X								3
X					X	X									4
														X	1
			X												1
X			X				X	X							5
			X				X								2
X					X			X	X						4

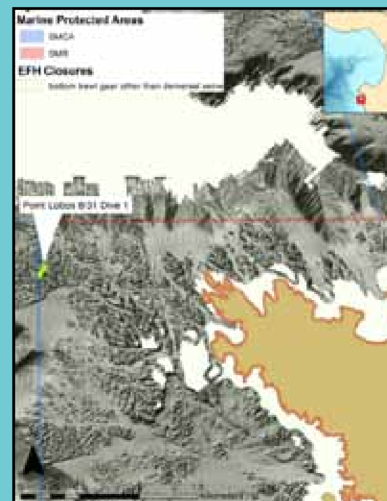
FMP Species Not Observed

Leopard shark, *Triakis semifasciata*	Greenblotched rockfish, *S. rosenblatti*
Soupfin shark, *Galeorhinus zyopterus*	Harlequin rockfish, *S. variegatus*
Spiny dogfish, *Squalus acanthias*	Honeycomb rockfish, *S. umbrosus*
Big skate, *Raja binoculata*	Mexican rockfish, *S. macdonaldi*
California skate, *R. inornata*;	Pink rockfish, *S. eos*
Longnose skate, *R. rhina*	Pinkrose rockfish, *S. simulator*
Ratfish, *Hydrolagus colliei*	Redstripe rockfish, *S. proriger*
Finescale codling, *Antimora microlepis*	Rosethorn rockfish, *S. helvomaculatus*
Pacific rattail, *Coryphaenoides acrolepis*	Silvergray rockfish, *S. brevispinis*
Pacific cod, *Gadus macrocephalus*	Swordspine rockfish, *S. ensifer*
Pacific whiting, *Merluccius productus*	Tiger rockfish, *S. nigrocinctus*
Sablefish, *Anoplopoma fimbria*	Darkblotched rockfish, *S. crameri*
Longspine thornyhead, *S. altivelis*	Pacific ocean perch, *S. alutus*
Shortspine thornyhead, *S. alascanus*	Bank rockfish, *S. rufus*
Black rockfish, *Sebastes melanops*	Blackgill rockfish, *S. melanostomus*
Black and yellow rockfish, *S. chrysomelas*	Pacific ocean perch, *S. alutus*
Grass rockfish, *S. rastrelliger*	Redbanded rockfish, *S. babcocki*
Kelp rockfish, *S. atrovirens*	Rougheye rockfish, *S. aleutianus*
Brown rockfish, *S. auriculatus*	Sharpchin rockfish, *S. zacentrus*
Calico rockfish, *S. dalli*	Shortraker rockfish, *S. borealis*
Quillback rockfish, *S. maliger*	Yellowmouth rockfish, *S. reedi*
California scorpionfish, *Scorpaena guttata*	Arrowtooth flounder (arrowtooth turbot),
Bocaccio, *Sebastes paucispinis*	*Atheresthes stomias*
Chilipepper, *S. goodei*	Butter sole, *Isopsetta isolepis*;
Cowcod, *S. levis*	Curlfin sole, *Pleuronichthys decurrens*
Bronze spotted rockfish, *S. gilli*	English sole, *Parophrys vetulus*
Chameleon rockfish, *S. phillipsi*	Flathead sole, *Hippoglossoides elassodon*
Dusky rockfish, *S. ciliatus*	Petrale sole, *Eopsetta jordani*
Dwarf-red rockfish, *S. rufianus*	Sand sole, *Psettichthys melanostictus*
Freckled rockfish, *S. lentiginosus*	Starry flounder, *Platichthys stellatus*


Black and yellow Rockfish (*S. chrysomelas*)

Individual Site Characterizations

Point Lobos, Dive 1 (8/31/10)



Dive Description
Depth range: 55-60 meters
GPS start: 36.524304, -121.970694
GPS stop: 36.524949, -121.970203
Start Time (PST): 11:35 am
Stop Time (PST): 12:27 pm
Total Time: 55 minutes 30 seconds

Management Status
MLPA – Yes, Point Lobos State Marine Reserve
EFH Conservation Area – Yes, closed to bottom trawl gear other than demersal seine
State Water Trawl Closure - Yes

Summary Text

The physical habitat observed on this dive was primarily rock medium-relief habitat (Figure 4 and 5), intermixed with both sand and boulder habitat. The biogenic habitat was comprised of sponges, with the most commonly observed being foliose and branching (Figure 6 and 7). Most of the biogenic habitat observed was over the rock or boulder habitat and only one category, "brittle stars in", was observed over the sand habitat (Figure 8).

The most common sponges seen on this dive were sponge mounds, though branching sponges were a close second (Figure 9 and 10). The majority of the coral species observed were gorgonians (Order Gorgonacea) (Figure 11 and 12).

Rosy rockfish and olive/yellowtail rockfish were the most common FMP fish species observed (Figure 13 and 14). There were new geographical observations of fish species, including a range extension for the longfin gunnel (*Pholis clemensi*) that will be published as a separate research note (Figure 3). This dive also had an observation of a striped ronquil (*Rathbunnella alleni*) (Figure 3).

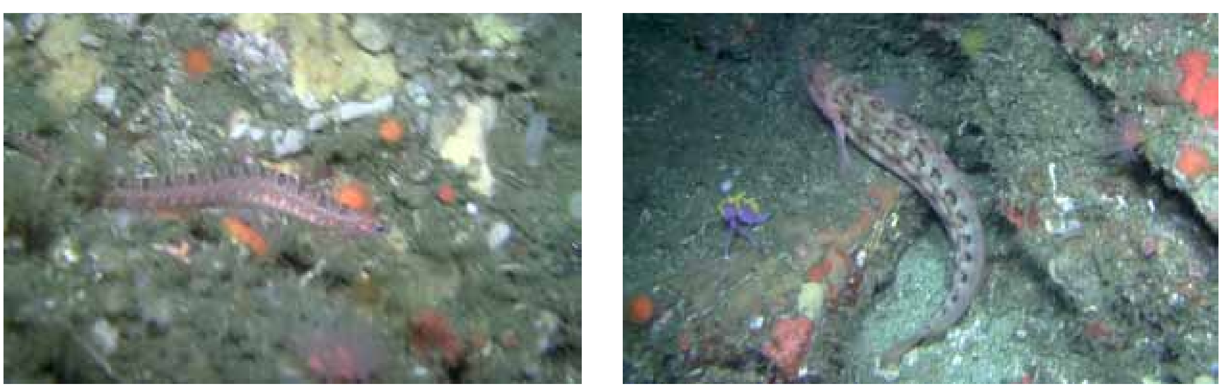


Figure 3: (Left) Longfin gunnel (*Pholis clemensi*), (Right) striped ronquil (*Rathbunnella alleni*)

Physical Habitat

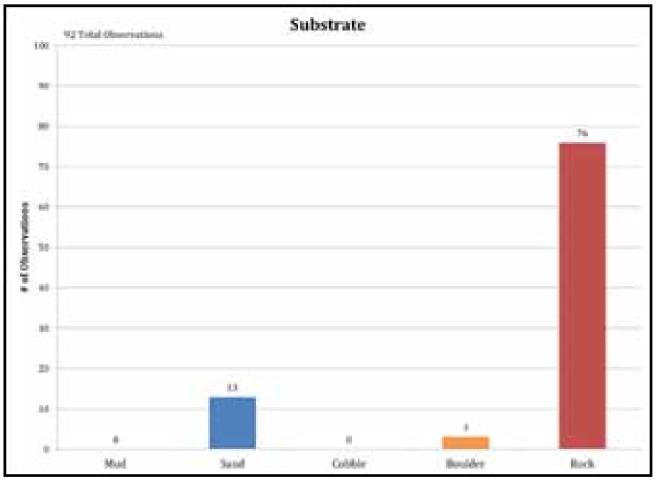


Figure 4: Number of observations of primary substrate from Point Lobos, Dive 1 (8/31/10)

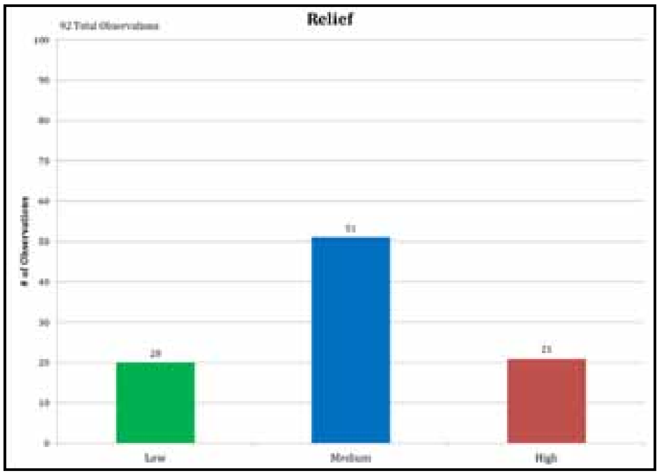


Figure 5: Number of observations of primary relief from Point Lobos, Dive 1 (8/31/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

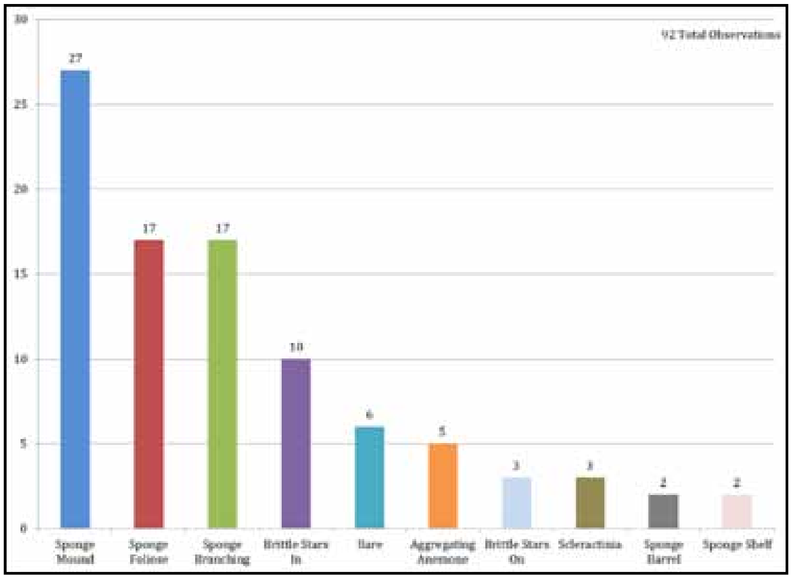


Figure 6: Number of observations of primary biogenic habitat category from Point Lobos, Dive 1

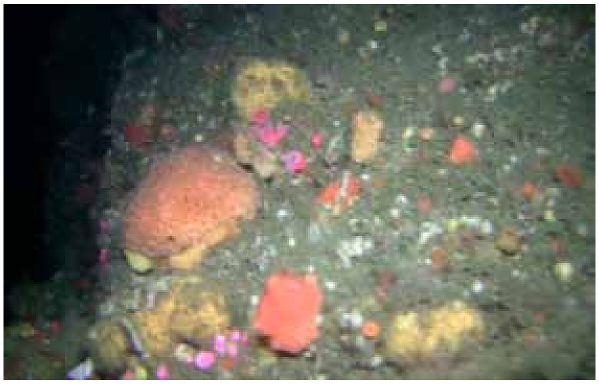


Figure 7: Sponge mounds were the most commonly observed biogenic habitat

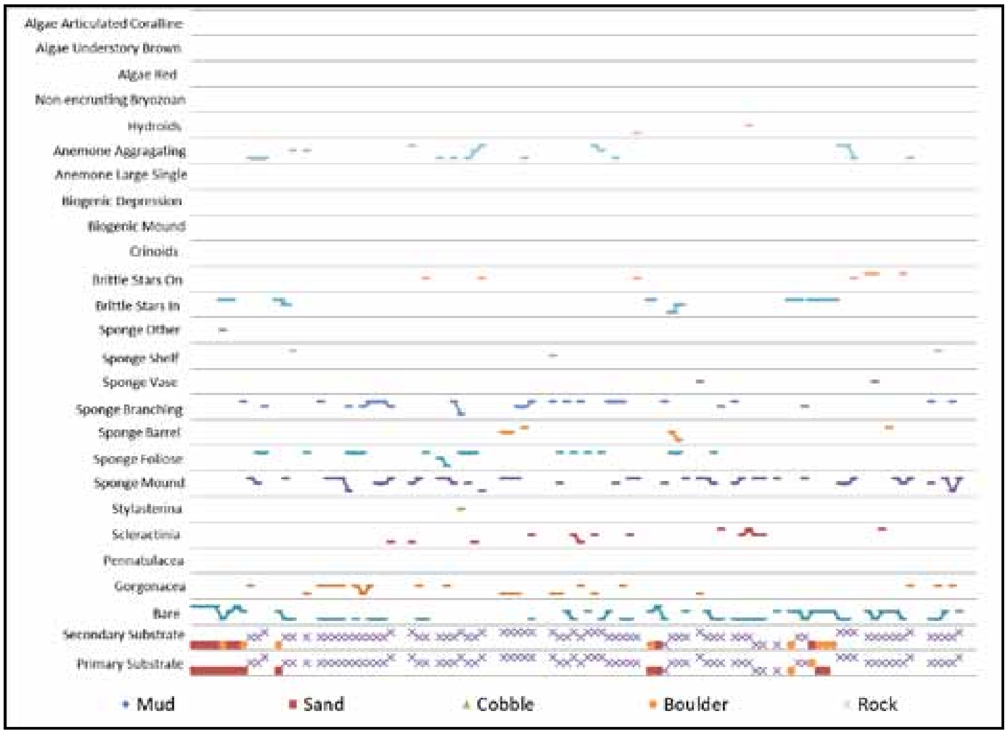


Figure 8: TDP for substrate and biogenic habitat for Point Lobos, Dive 1 (8/31/10)

Corals

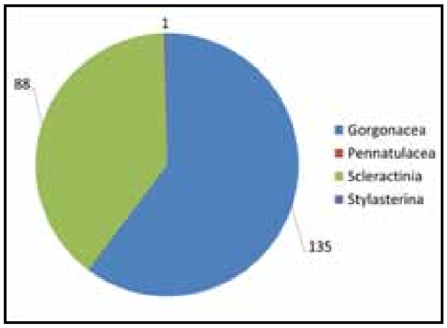


Figure 9: Proportion of corals observed at Point Lobos, Dive 1 (8/31/10)

Figure 10: Gorgonians (*Gorgonacea*) were the most commonly observed order of corals at Point Lobos, Dive 1 (8/31/10)

Sponges

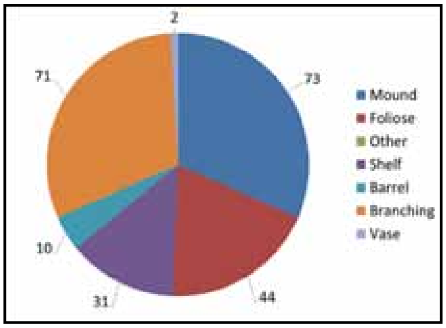


Figure 11: Proportion of sponges observed at Point Lobos, Dive 1 (8/31/10)

Figure 12: Sponge mounds were the most commonly observed sponge morphology observed at Point Lobos, Dive 1 (8/31/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

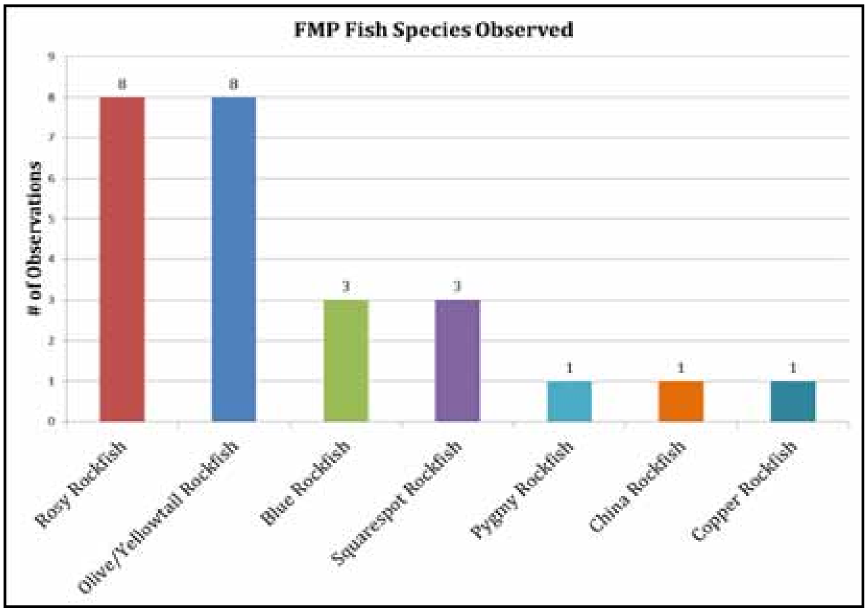


Figure 13: FMP fish species observed at Point Lobos, Dive 1 (8/31/10)

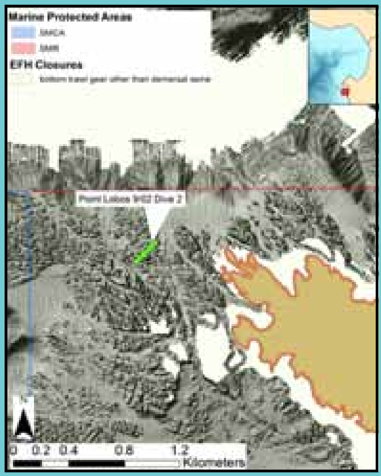
Figure 14: Rosy rockfish (*Sebastes rosaceus*) with biogenic habitat at Point Lobos, Dive 1 (8/31/10)

APPENDIX C - POINT LOBOS

Point Lobos, Dive 2 (9/2/10)

Dive Description
Depth range: 40 – 55 meters
GPS start: 36.523521, -121.962189
GPS stop: 36.524753, -121.960648
Start Time (PST): 10:48 am
Stop Time (PST): 11:43 am
Total Time: 55 minutes

Management Status
MLPA – Yes, Point Lobos State Marine Reserve
EFH Conservation Area – Yes, closed to bottom trawling except for demersal purse seine
State Water Trawl Closure - Yes



Summary Text

The second Point Lobos dive on September 2nd was characterized by low to medium relief rock habitat (Figures 16 and 17). The primary biogenic habitat observed on this dive was "brittle stars" on (Figures 18 and 19), with sponge mounds and red algae also common biogenic habitats (Figure 20).

Cup corals were the most common coral species observed (*Scleractinia*) (Figures 21 and 22). The most common sponges observed on this dive were sponge mounds (Figures 23 and 24).

Gopher rockfish were the most common FMP fish species observed (Figures 25 and 26), though kelp greenlings (*Hexagrammos decagrammus*) and Vermilion rockfish (*Sebastes miniatus*) (Figures 15) were also seen.

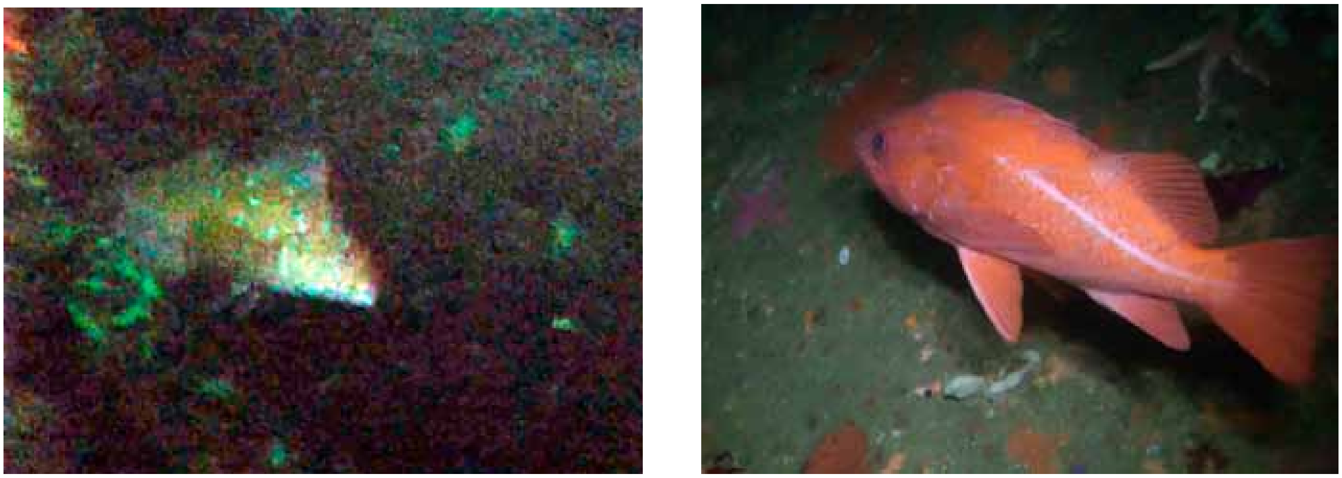


Figure 15: (Left) Kelp greenling (*Hexagrammos decagrammus*), (Right) Vermilion rockfish (*Sebastes miniatus*)

Physical Habitat

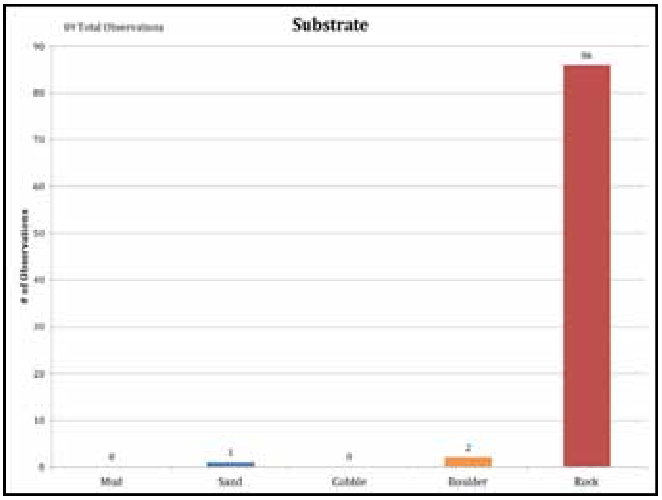


Figure 16: Number of observations of primary substrate from Point Lobos, Dive 2 (9/2/10)

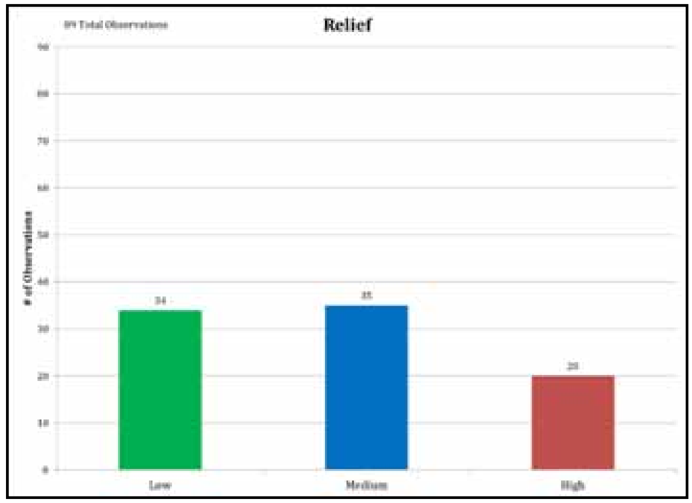


Figure 17: Number of observations of primary relief from Point Lobos, Dive 2 (9/2/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

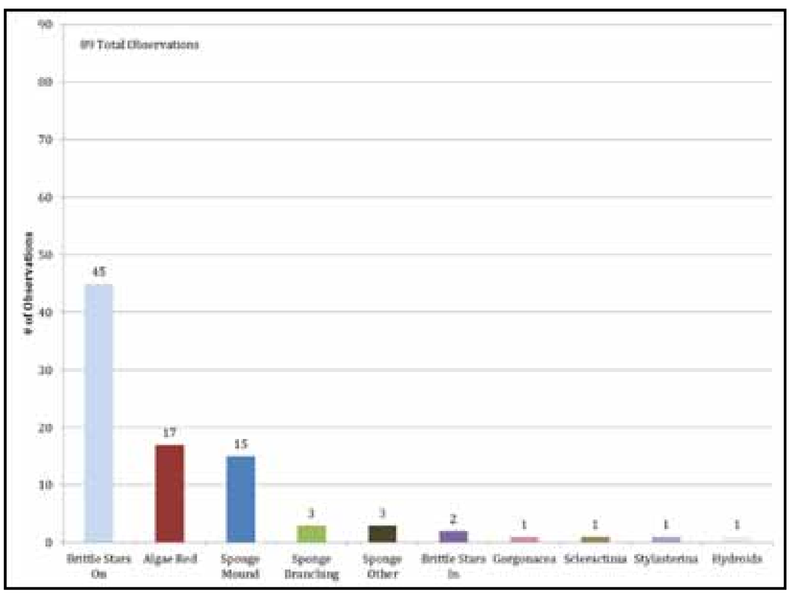


Figure 18: Number of observations of primary biogenic habitat category from Point Lobos, Dive 2

Figure 19: “Brittle stars on” were the most commonly observed biogenic habitat

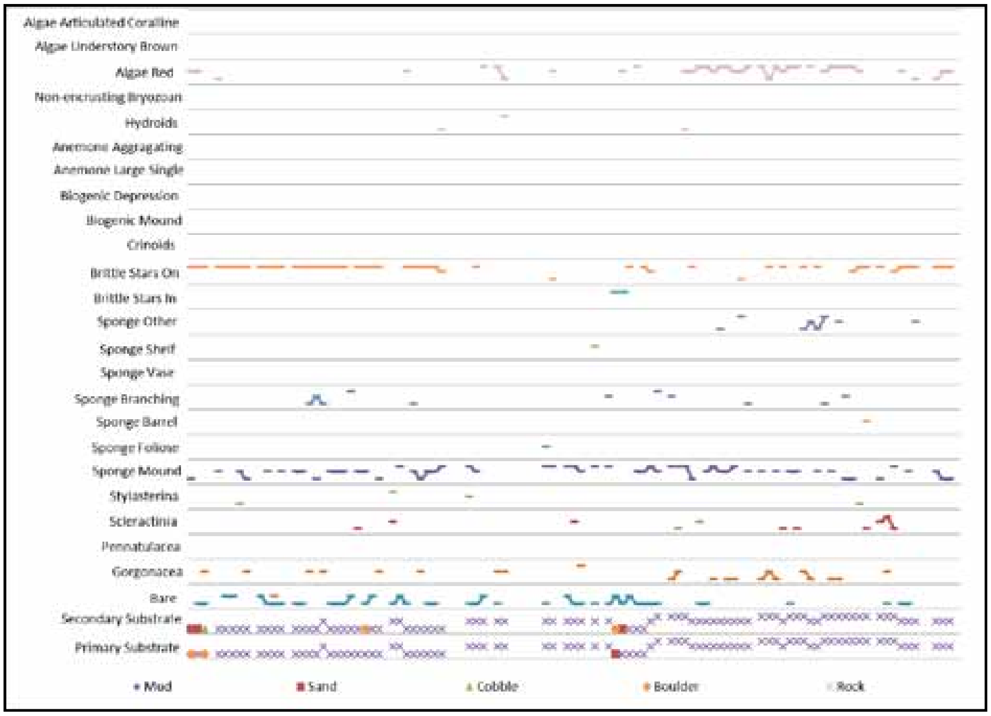


Figure 20: TDP of substrate and biogenic habitat for Point Lobos, Dive 2 (9/2/10)

Corals

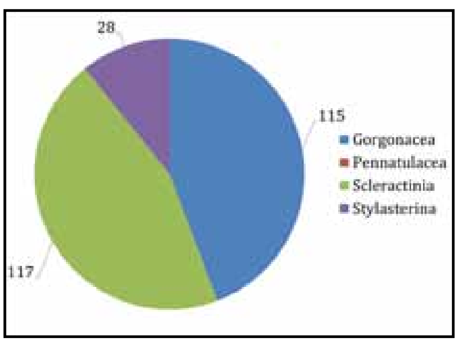


Figure 21: Proportion of corals observed at Point Lobos, Dive 2 (9/2/10)

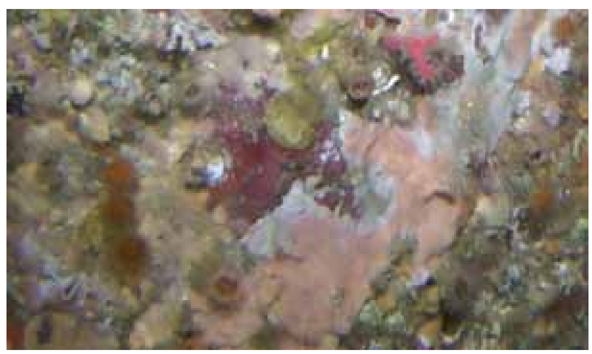


Figure 22: Cup corals (*Scleractinia*) were the most commonly observed coral order at Point Lobos, Dive 2 (9/2/10)

Sponges

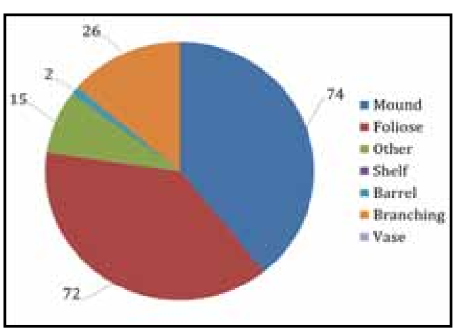


Figure 23: Proportion of sponges observed at Point Lobos, Dive 2 (9/2/10)

Figure 24: Sponge mounds were the most commonly observed sponge morphology observed at Point Lobos, Dive 2

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

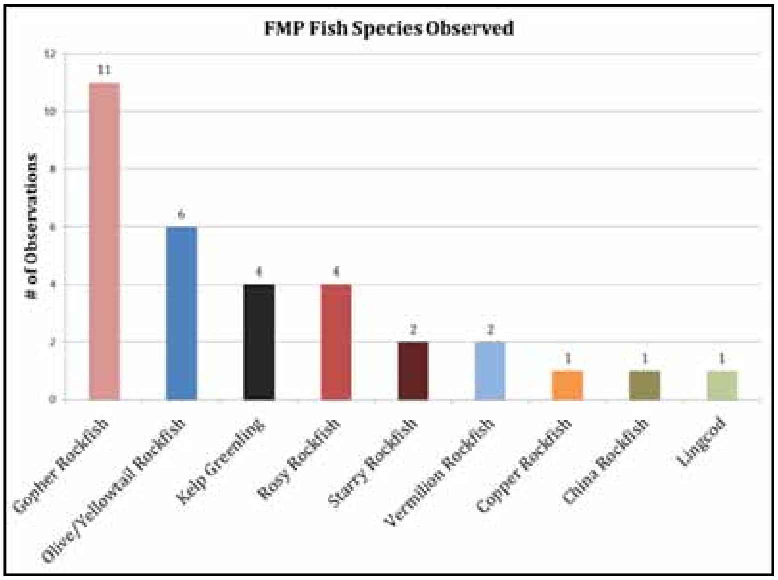


Figure 25: FMP fish species observed at Point Lobos, Dive 2 (9/2/10)

Figure 26: Gopher rockfish (*Sebastes carnatus*) were the most commonly observed species

APPENDIX C - CARMEL BAY

Carmel Bay, Dive 2 (8/31/10)

Dive Description
Depth range: 60 – 80 meters
GPS start: 36.544404, -121.986586
GPS stop: 36.541445, -121.986207
Start Time (PST): 1:08 pm
Stop Time (PST): 2:41 pm
Total Time: 1 hour 33 minutes

Management Status
MLPA – No
EFH Conservation Area – Yes, closed to bottom trawl gear other than demersal seine
State Water Trawl Closure - Yes

Summary Text

The Carmel Bay dive on August 31st was characterized by low to medium relief rock habitat (Figures 28 and 29), with “brittle stars on” the primary biogenic habitat (Figures 30 and 31). Sponge mounds and aggregating anemones were also common biogenic habitats found (Figure 32).

Cup corals (*Scleractinia*) were the most common coral observed (Figures 33 and 34). Sponge mounds were the most common sponge observed (Figures 35 and 36).

Rosy rockfish (Sebastes rosaceus) were the most commonly observed FMP fish species (Figures 37 and 38). Pygmy rockfish (*Sebastes wilsoni*) and Squarespot rockfish (*Sebastes hopkinsi*) were also observed (Figure 27).

Figure 27: (Left) Pygmy rockfish (*Sebastes wilsoni*), (Right) Squarespot rockfish (*Sebastes hopkinsi*)

Physical Habitat

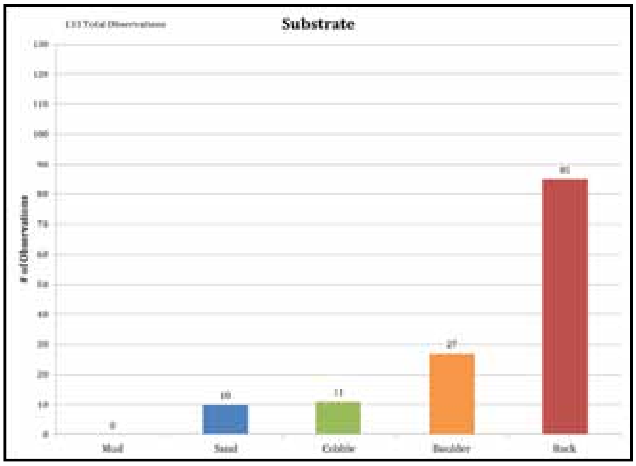


Figure 28: Number of observations of primary substrate from Carmel Bay, Dive 2 (8/31/10)

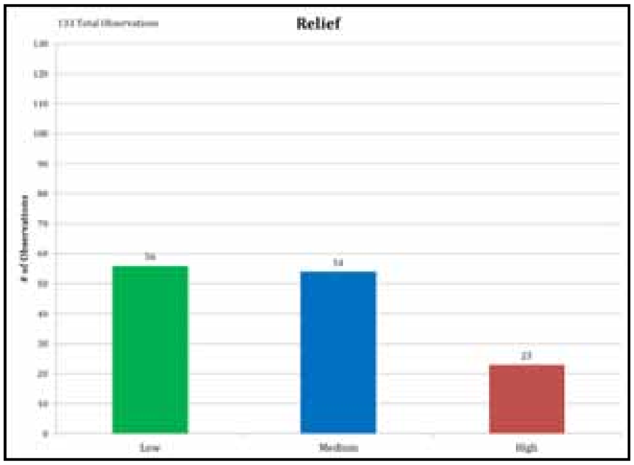


Figure 29: Number of observations of primary relief from Carmel Bay, Dive 2 (8/31/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

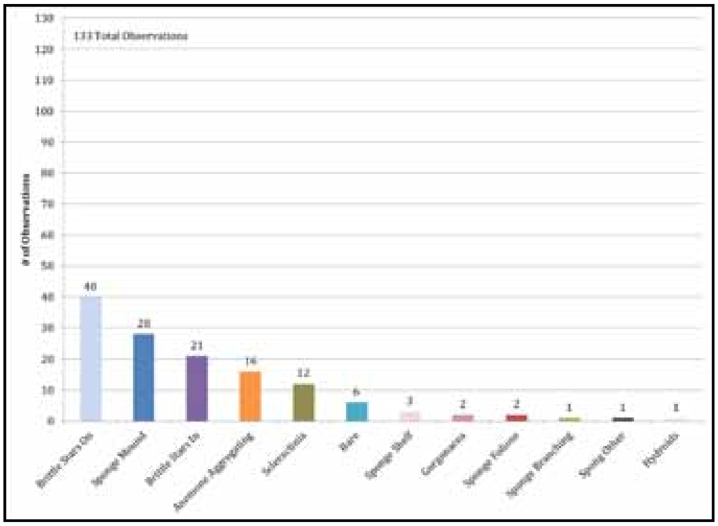


Figure 30: Number of observations of primary biogenic habitat category from Carmel Bay, Dive 2

Figure 31: “Brittle stars on” were the most commonly observed biogenic habitat

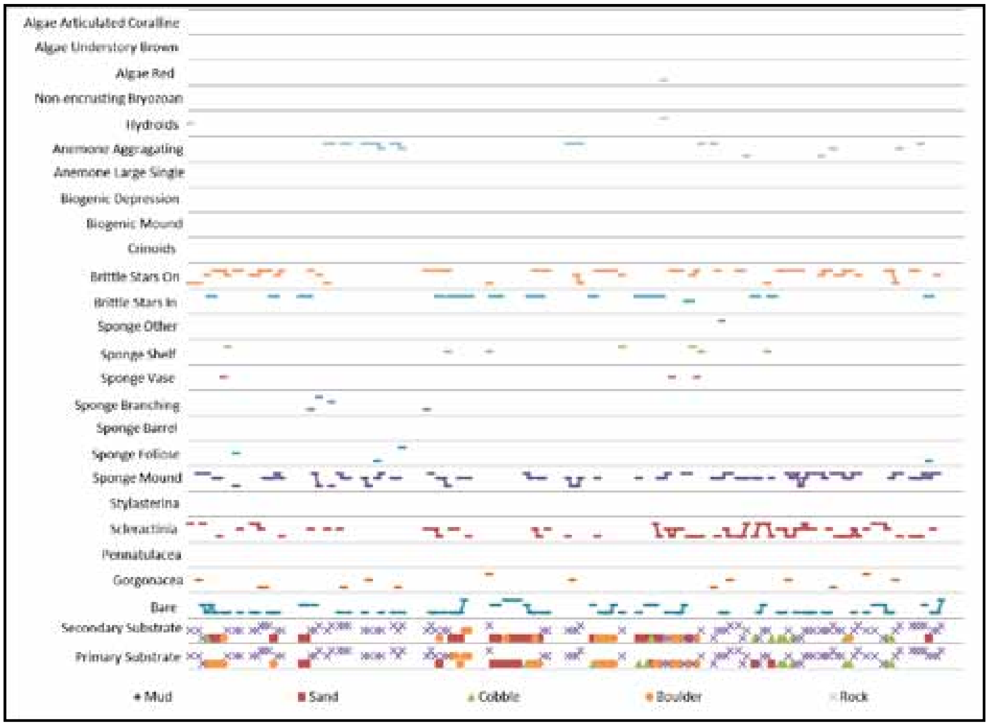


Figure 32: TDP of substrate and biogenic habitat for Carmel Bay, Dive 2 (8/31/10)

Corals

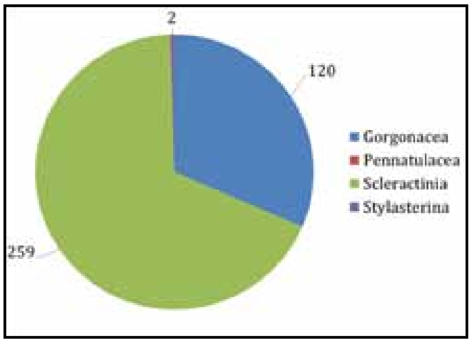


Figure 33: Proportion of corals observed at Carmel Bay, Dive 2 (8/31/10)

Figure 34: Cup corals (*Scleractinia*) were the most commonly observed coral order at Carmel Bay, Dive 2 (8/31/10)

Sponges

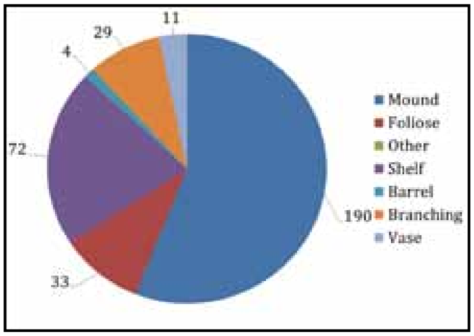


Figure 35: Proportion of sponges observed at Carmel Bay, Dive 2 (8/31/10)

Figure 36: Sponge mounds were the most commonly observed sponge morphology observed at Carmel Bay (8/31/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

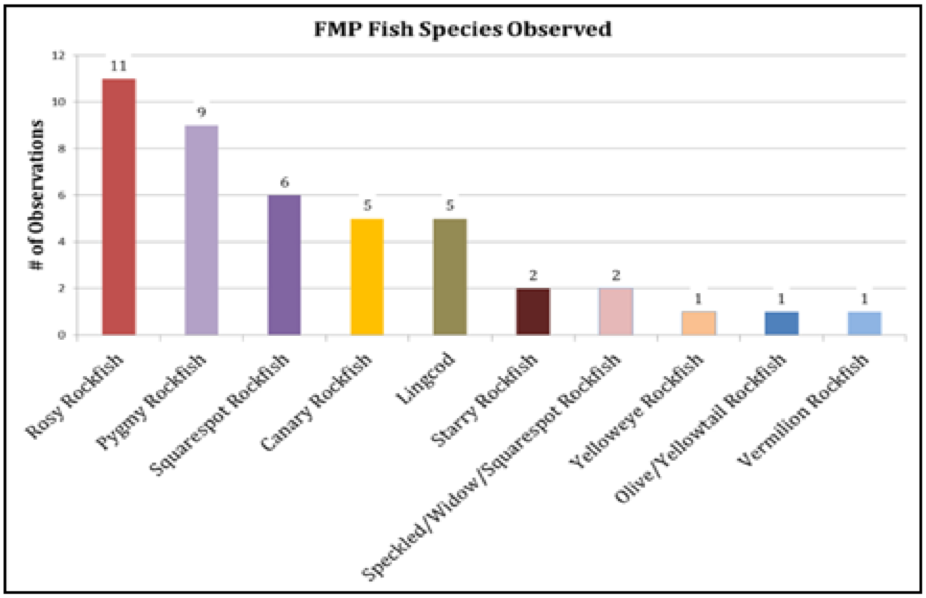


Figure 37: FMP fish species observed at Carmel Bay, Dive 2 (8/31/10)

Figure 38: Rosy rockfish (*Sebastes rosaceus*) were the most commonly observed species at Carmel Bay, Dive 2 (8/31/10)

APPENDIX C - CARMEL BAY

Carmel Bay, Dive 1 (9/2/10)

Dive Description
Depth range: 155 – 165 meters
GPS start: 36.529904, -121.966828
GPS stop: 36.531453, -121.967225
Start Time (PST): 9:45 am
Stop Time (PST): 10:07 am
Total Time: 22 minutes

Management Status
MLPA – No
EFH Conservation Area – Yes, closed to bottom trawling except for demersal purse seine.
State Water Trawl Closure - Yes

Summary Text

The second Carmel Bay dive on September 2nd was characterized by high relief rock habitat (Figures 40 and 41). There was little biogenic habitat observed on this dive, (Figures 42 and 43) with most of the physical structure bare of any biogenic habitats (Figure 44).

Cup corals (*Scleractinia*) were the only coral order observed on this dive (Figures 45). The most commonly observed sponge on this dive was sponge mounds (Figures 46 and 47).

No FMP fish species could be identified, though there were unidentified rockfish and flatfish species observed (Figures 48 and 49). There were also a large presence of squat lobsters (Munida quadrispina) and spot prawns (Pandalus platycerus) (Figure 39).

Figure 39: (Left) Squat lobster (*Munida quadrispina*), (Right) Spot prawn (*Pandalus platycerus*)

Physical Habitat

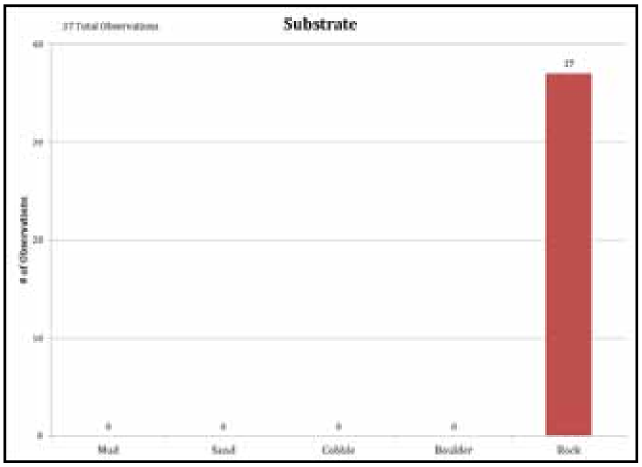


Figure 40: Number of observations of primary substrate from Carmel Bay, Dive 1 (9/2/10)

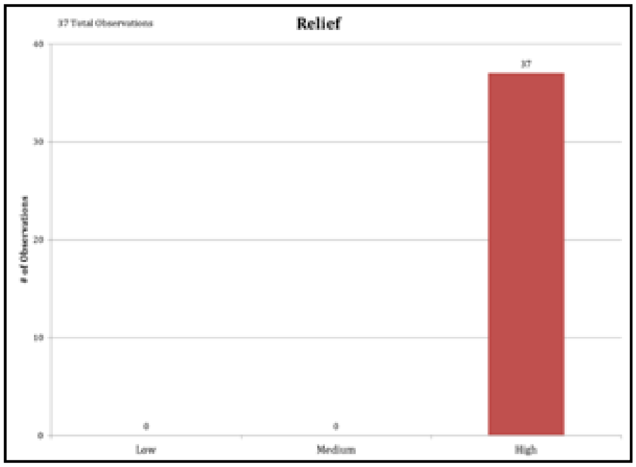


Figure 41: Number of observations of primary relief from Carmel Bay, Dive 1 (9/2/10)(Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

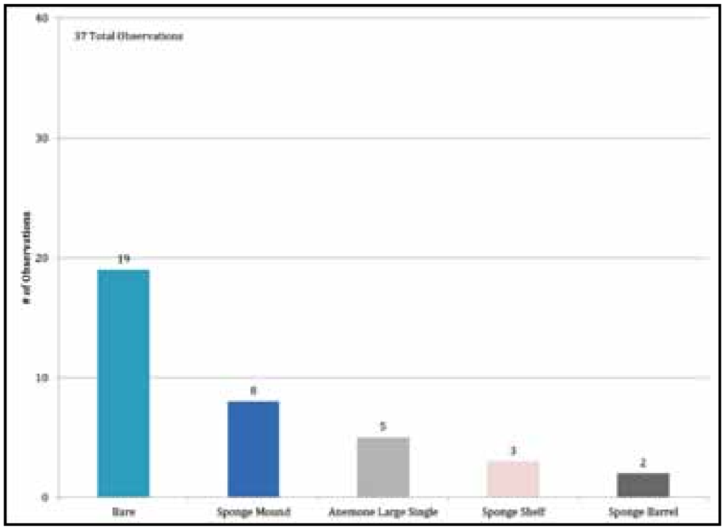


Figure 42: Number of observations of primary biogenic habitat category from Carmel Bay, Dive 1

Figure 43: Bare was the most commonly observed biogenic habitat

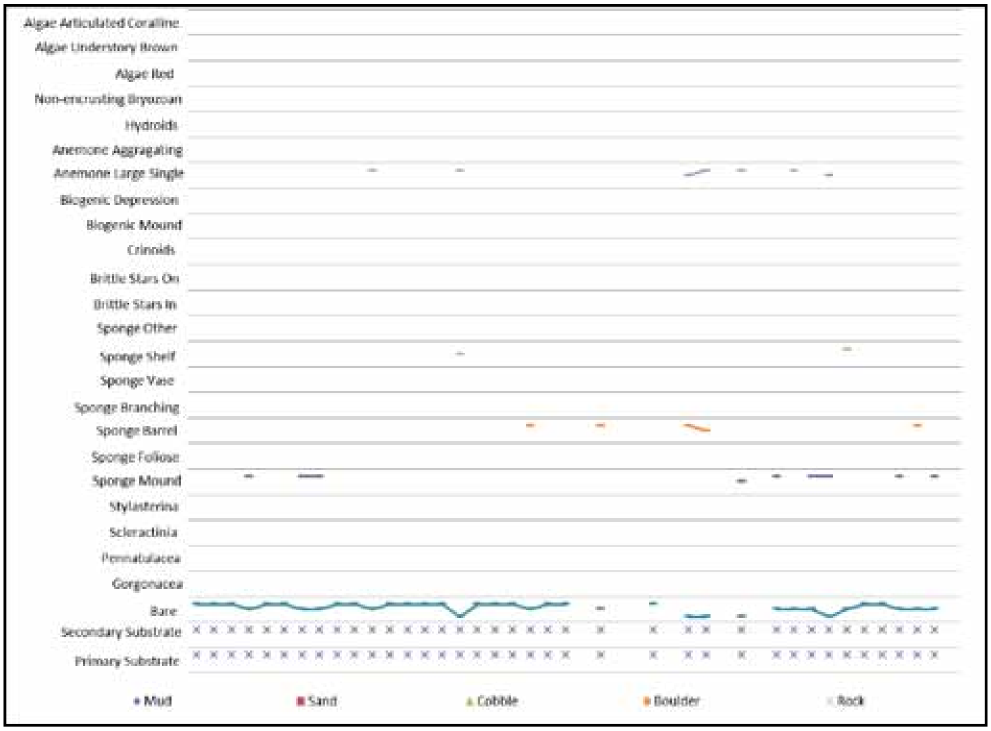


Figure 44: TDP of substrate and biogenic habitat for Carmel Bay, Dive 1 (9/2/10)

Corals

ONLY ONE CORAL ORDER *SCLERACTINIA* WAS OBSERVED ON THIS DIVE.

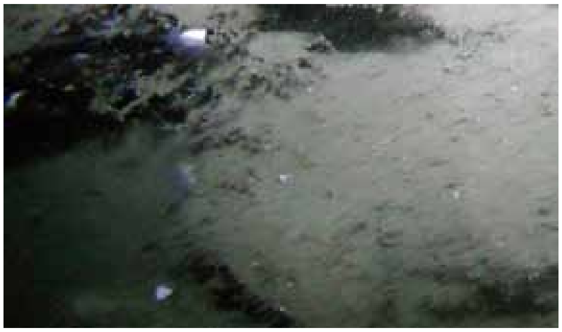


Figure 45: Cup corals (*Scleractinia*) were the only observed coral order at Carmel Bay, Dive 1 (9/02/10)

Sponges

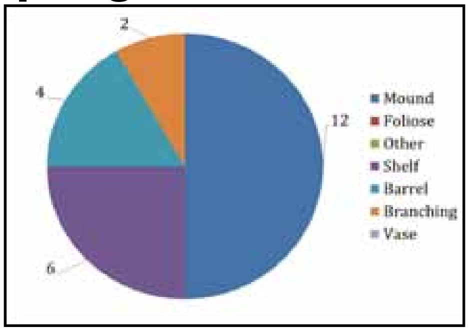


Figure 46: Proportion of sponges observed at Carmel Bay, Dive 1 (9/2/10)

Figure 47: Sponge mounds were the most commonly observed sponge morphology observed at Carmel Bay, Dive 1 (9/2/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

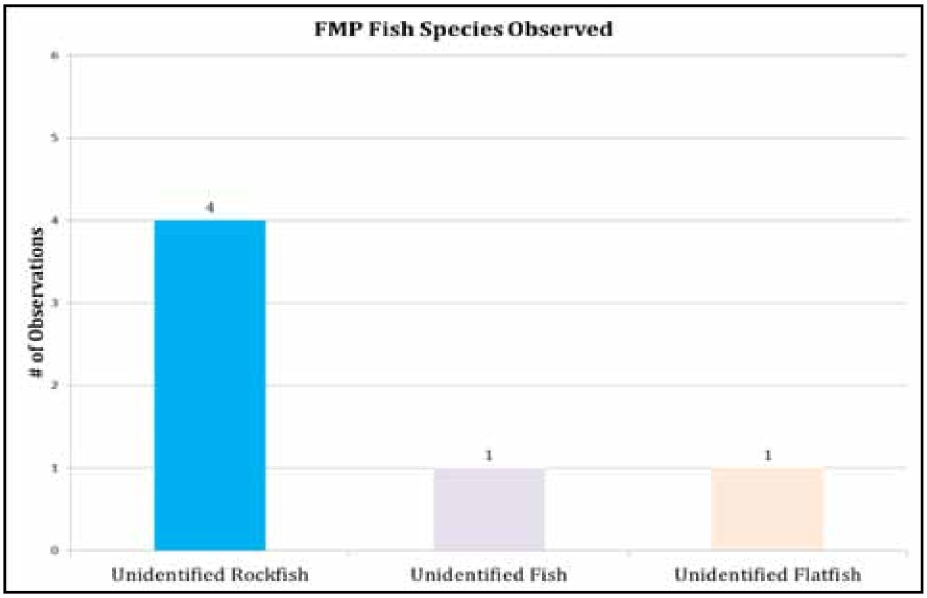


Figure 48: FMP fish species observed at Carmel Bay, Dive 1 (9/2/10)

Figure 49: Unidentified rockfish were the most commonly observed species at Carmel Bay, Dive 1

APPENDIX C - CARMEL PINNACLES

Carmel Pinnacles, Dive 2 (9/2/10)

Dive Description
Depth range: 40 – 60 meters
GPS start: 36.553346, -121.972591
GPS stop: 36.554029, -121.972857
Start Time (PST): 12:40 pm
Stop Time (PST): 1:36 pm
Total Time: 56 minutes 30 seconds

Management Status
MLPA – Yes, Carmel Pinnacles State Marine Reserve
EFH Conservation Area – Yes, closed to bottom trawling except demersal purse seine
State Water Trawl Closure - Yes

Summary Text

The Carmel Pinnacles dive on September 2nd was characterized by high relief rock habitat (Figures 51 and 52), and the primary biogenic habitat observed was red algae (Figure 53 and 54). There were a variety of other biogenic habitats present, including aggregating anemones, California hydrocorals (*Stylasterina*), and various sponges (Figure 55).

Gorgonians (*Gorgonacea*) were the most commonly observed coral (Figures 56 and 57). The most commonly observed sponge were sponges foliose (Figure 58 and 59).

Copper rockfish (*Sebastes caurinus*) were the most commonly observed FMP fish species (Figures 60 and 61). In addition, there were also schools of Blue rockfish (*Sebastes mystinus*) and unidentified schools of young-of-year fish (Figure 50).

Figure 50: (Left) Blue rockfish school (*Sebastes mystinus*), (Right) young-of-the-year school

Physical Habitat

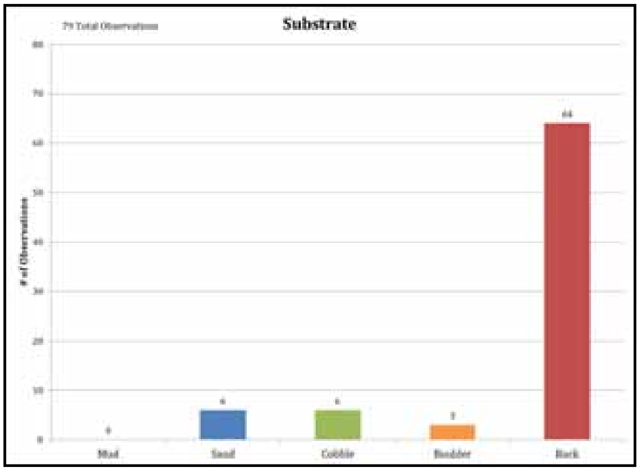


Figure 51: Number of observations of primary substrate from Carmel Pinnacles, Dive 3 (9/2/10)

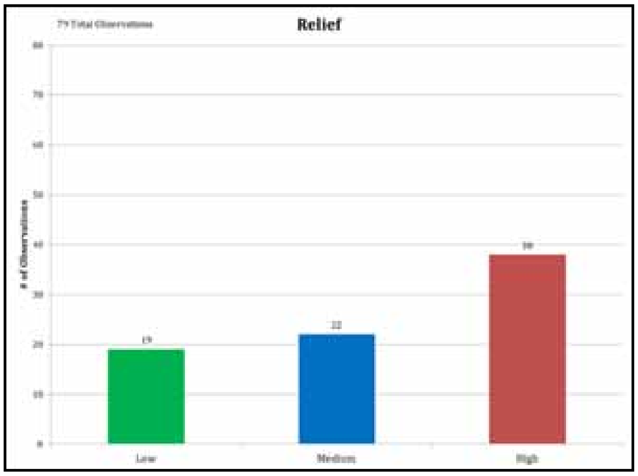


Figure 52: Number of observations of primary relief from Carmel Pinnacles, Dive 3 (9/2)(Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

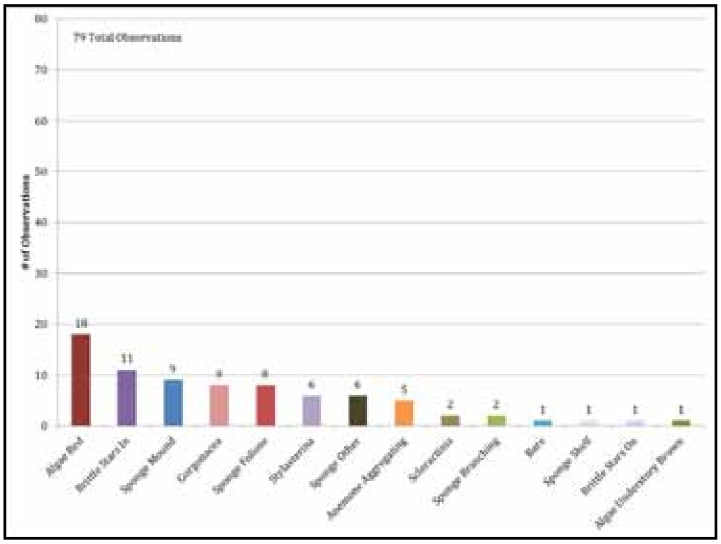


Figure 53: Number of observations of primary biogenic habitat category from Carmel Pinnacles

Figure 54: Algae red was the most commonly observed biogenic habitat

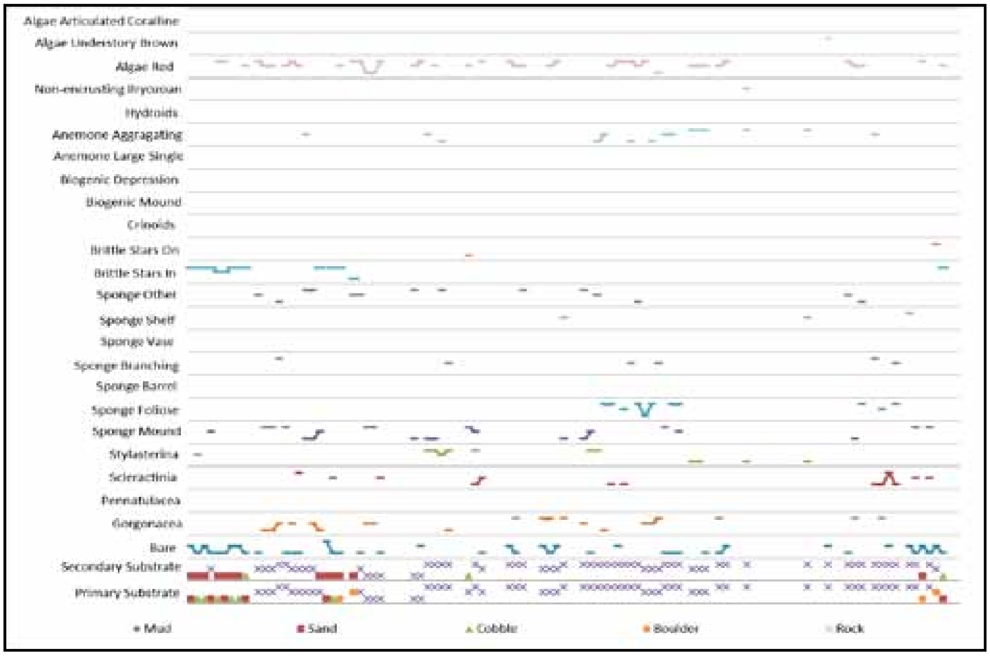


Figure 55: TDP of substrate and biogenic habitat for Carmel Pinnacles, Dive 3 (9/2/10)

Corals

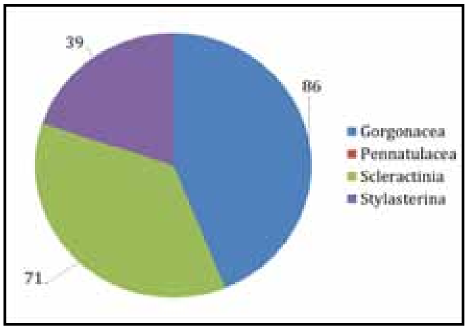


Figure 56: Proportion of corals observed at Carmel Pinnacles, Dive 3 (9/2/10)

Figure 57: Gorgonians (*Gorgonacea*) were the most commonly observed coral order at Carmel Pinnacles, Dive 3 (9/2/10)

Sponges

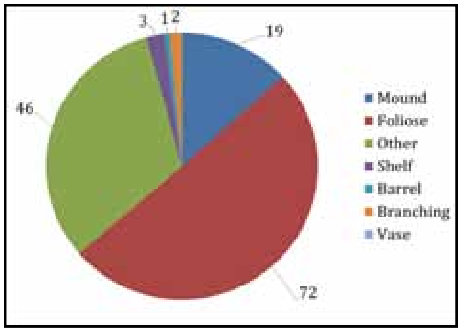


Figure 58: Proportion of sponges observed at Carmel Pinnacles, Dive 3 (9/2/10)

Figure 59: Sponge foliose were the most commonly observed sponge morphology observed at Carmel Pinnacles, Dive 3 (9/2/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

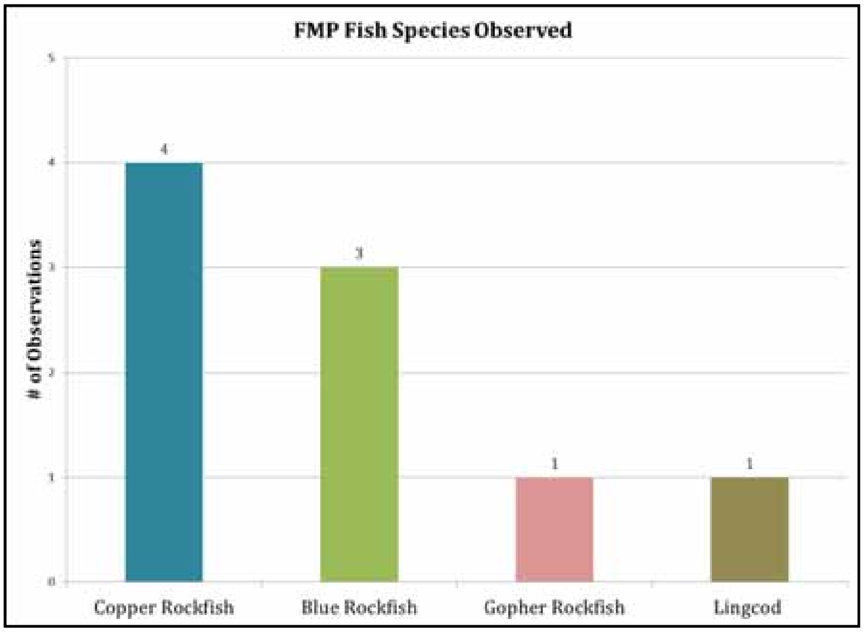


Figure 60: FMP fish species observed at Carmel Pinnacles, Dive 3 (9/2/10)

Figure 61: Copper rockfish (*Sebastes caurinus*) were the most commonly observed species at Carmel Pinnacles, Dive 3 (9/2/10)

APPENDIX C - CYPRESS

Cypress Point, Dive 1 (8/30/10)

Dive Description
- Depth range: 22-46 meters
- GPS start: 36.592491, -121.982749
- GPS stop: 36.592649, -121.982433
- Start Time (PST): 9:36 am
- Stop Time (PST): 10:48 am

Total Time: 1 hour 12 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – Yes, closed to bottom trawl gear other than demersal seine
State Water Trawl Closure - Yes

Summary Text

The Cypress Point dive on August 30th was characterized by high relief rock habitat (Figure 63 and 64), with red algae the primary biogenic habitat observed (Figure 65 and 66). In addition to algae red there was also a large presence of both aggregating anemones and non-encrusting bryozoans (Figure 67).

California hydrocoral (*Stylasterina*) was the most commonly observed coral (Figure 68 and 69). Sponge mounds were the most commonly observed sponges (Figure 70 and 71).

Blue rockfish (Sebastes mystinus) were the most commonly occurring FMP fish species (Figure 72 and 73). This dive also found the only recorded occurrence of Cabezon (*Scorpaenichthys marmoratus*), as well as two Lingcod (*Ophiodon elongatus*) attempting to prey on rockfish (Figure 62).

Figure 62: (Left) Cabezon (*Scorpaenichthys marmoratus*), (Right) Lingcod (*Ophiodon elongatus*)

Physical Habitat

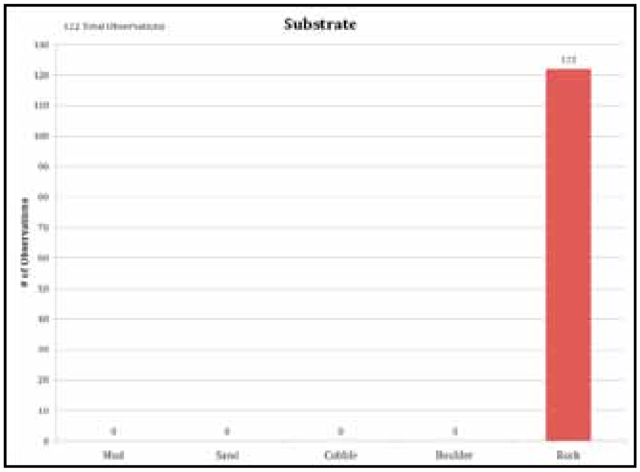


Figure 63: Number of observations of primary substrate from Cypress Point, Dive 1 (8/30/10)

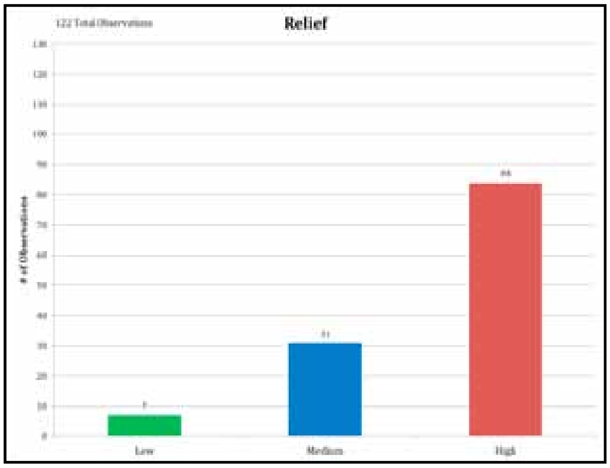


Figure 64: Number of observations of primary relief from Cypress Point, Dive 1 (8/30/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

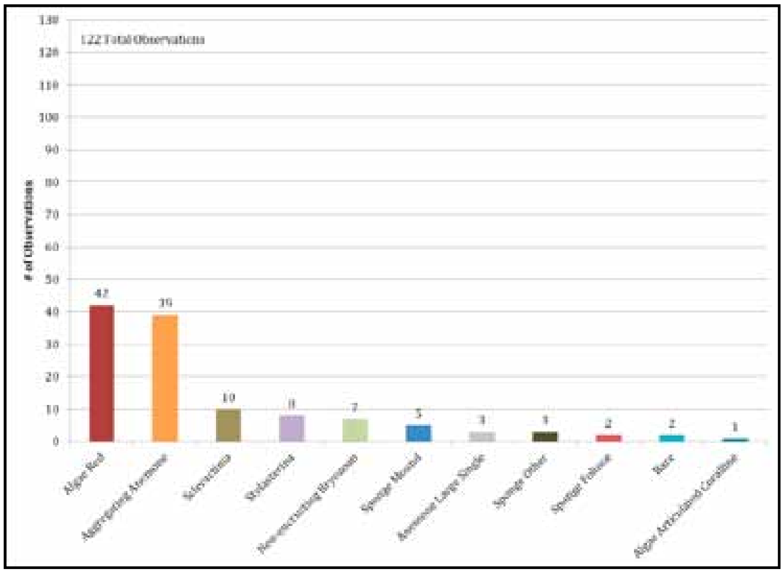


Figure 65: Number of observations of primary biogenic habitat category from Cypress Point, Dive 1

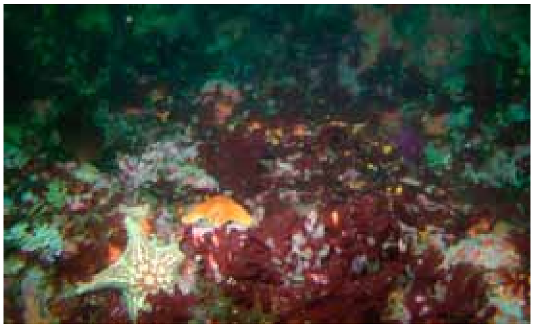


Figure 66: Algae red was the most commonly observed biogenic habitat

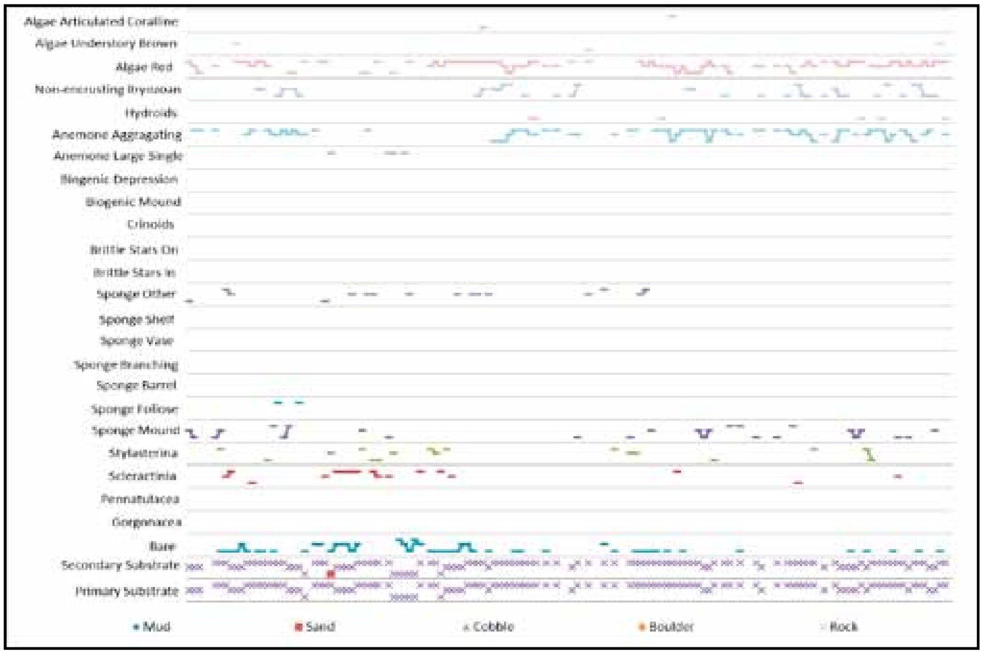


Figure 67: TDP of substrate and biogenic habitat for Cypress Point, Dive 1 (8/30/10)

Corals

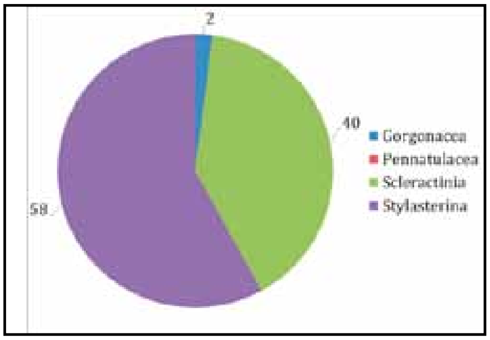


Figure 68: Proportion of corals observed at Cypress Point, Dive 1 (8/30/10)

Figure 69: California Hydrocoral (*Stylasterina*) was the most commonly observed coral order at Cypress Point, Dive 1 (8/30/10)

Sponges

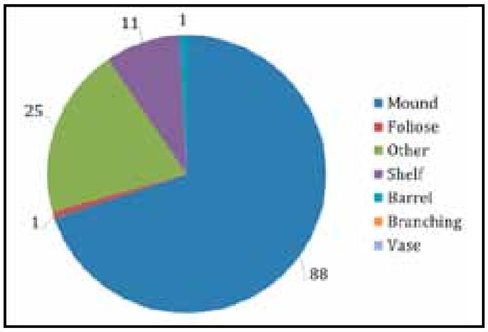


Figure 70: Proportion of sponges observed at Cypress Point, Dive 1 (8/30/10)

Figure 71: Sponge mounds were the most commonly observed sponge morphology observed at Cypress Point, Dive 1 (8/30/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

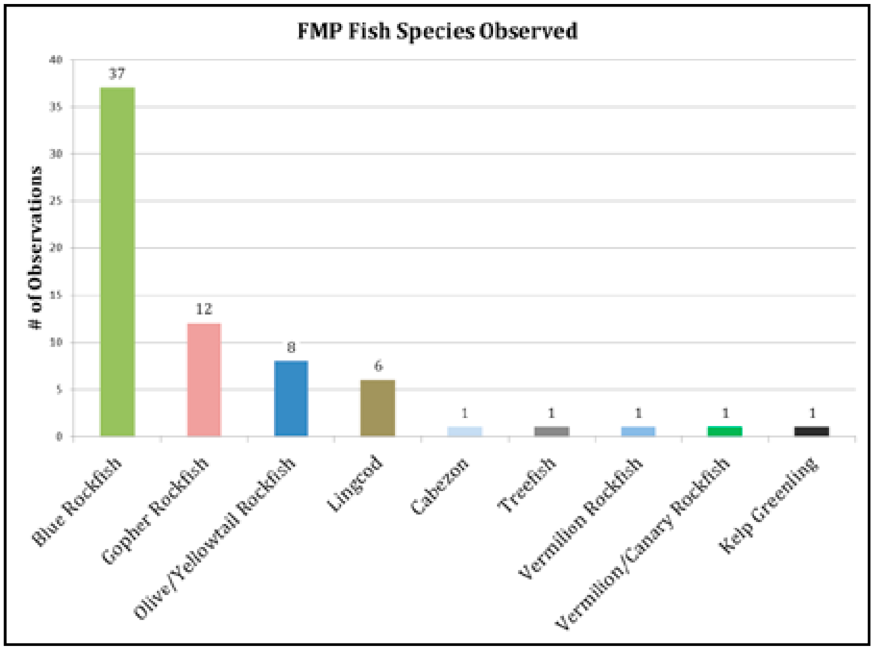


Figure 72: FMP fish species observed at Cypress Point, Dive 1 (8/30/10)

Figure 73: Blue rockfish (*Sebastes mystinus*) were the most commonly observed species at Cypress Point, Dive 1 (8/30/10)

APPENDIX C - CYPRESS

Cypress Point, Dive 2 (8/30/10)

Dive Description
Depth range: 91- 108 meters
GPS start: 36.588272, -121.998397
GPS stop: 36.588243, -121.997629
Start Time (PST): 12:10pm
Stop Time (PST): 12:26pm
Total Time: 16 minutes and 30 seconds

Management Status
MLPA – No
EFH Conservation Area – Yes closed to bottom trawling except demersal purse seine
State Water Trawl Closure - Yes

Summary Text

The second Cypress Point dive on August 30th was characterized by low relief mud habitat (Figures 75 and 76) with little biogenic habitat observed. All physical structures were bare of biogenic features (Figure 77 and 78) aside from one biogenic depression (Figure 79).

No corals or sponges were observed on this dive.

Lingcod (*Ophiodon elongates*) (Figure 80 and 81) was the most commonly observed FMP fish species observed on this dive. In addition, there were observations of unidentified flatfish and rex sole (*Glyptocephalus zachirus*) on this dive (Figure 74).

Figure 74: (Left) unidentified flatfish, (Right) rex sole (*Glyptocephalus zachirus*)

Physical Habitat

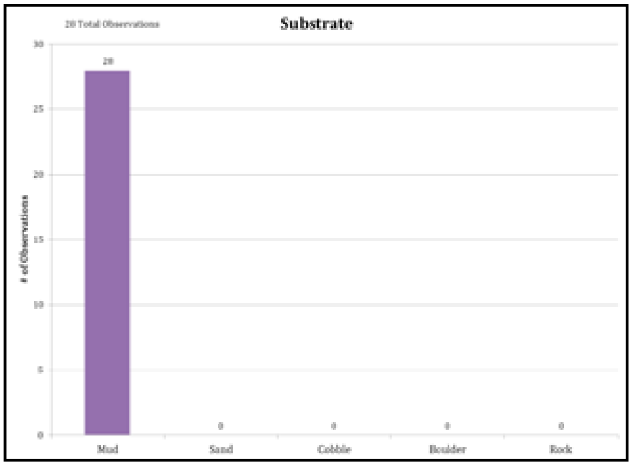


Figure 75: Number of observations of primary substrate from Cypress Point, Dive 2 (8/30/10)

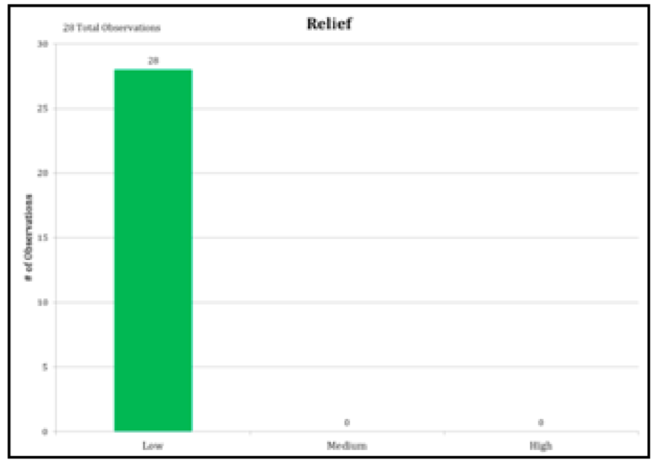


Figure 76: Number of observations of primary relief from Cypress Point, Dive 2 (8/30/10) Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

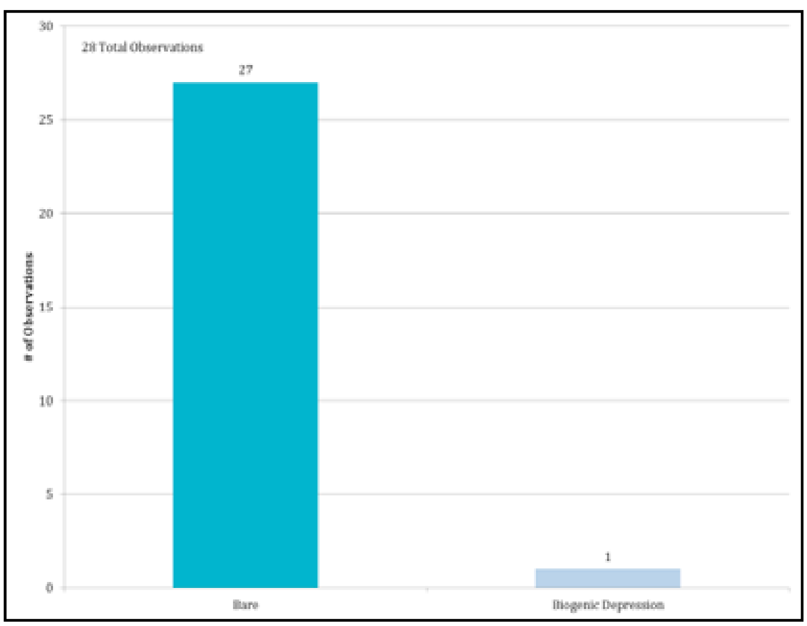


Figure 77: Number of observations of primary biogenic habitat category from Cypress Point, Dive 2 (8/30/10)

Figure 78: Bare was the most commonly observed biogenic habitat

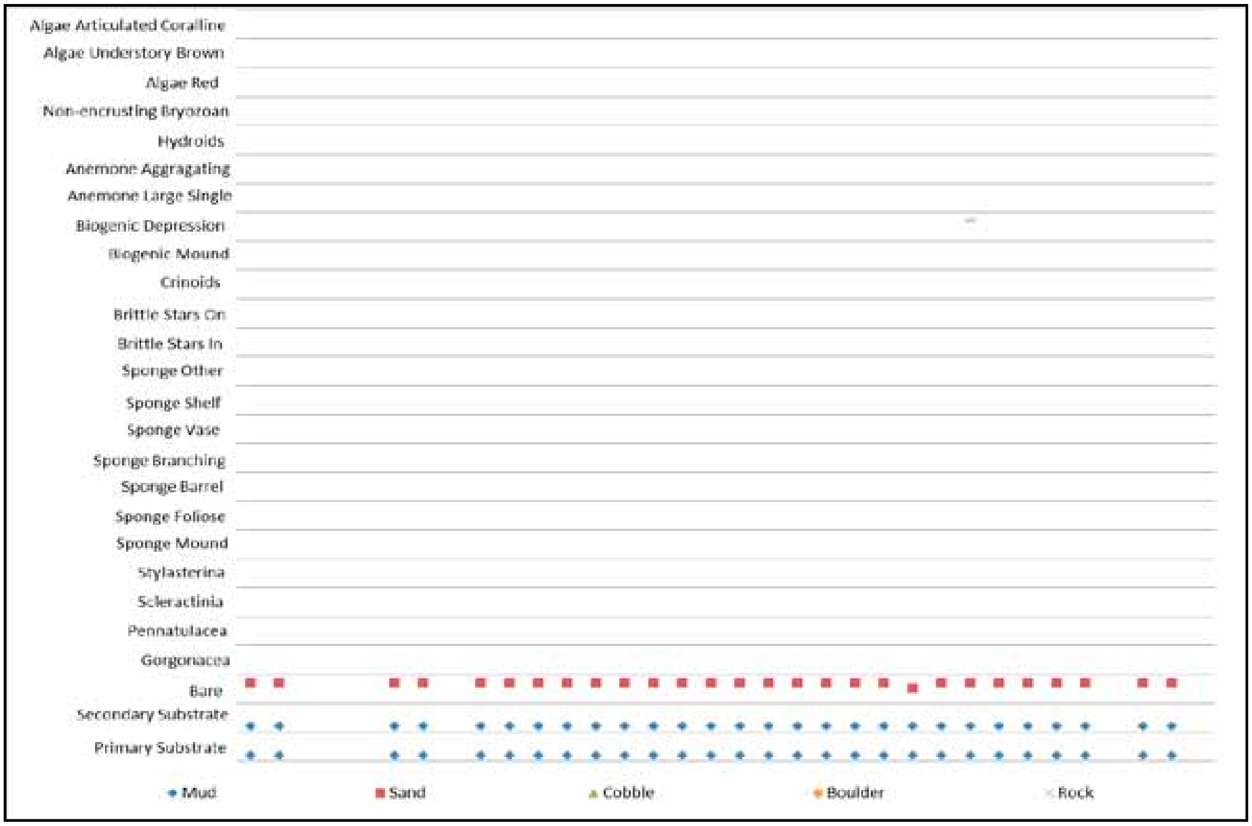


Figure 79: TDP and biogenic habitat for Cypress Point, Dive 2 (8/30/10)

Corals

NO CORALS WERE OBSERVED ON THIS DIVE.

Sponges

NO SPONGES WERE OBSERVED ON THIS DIVE.

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

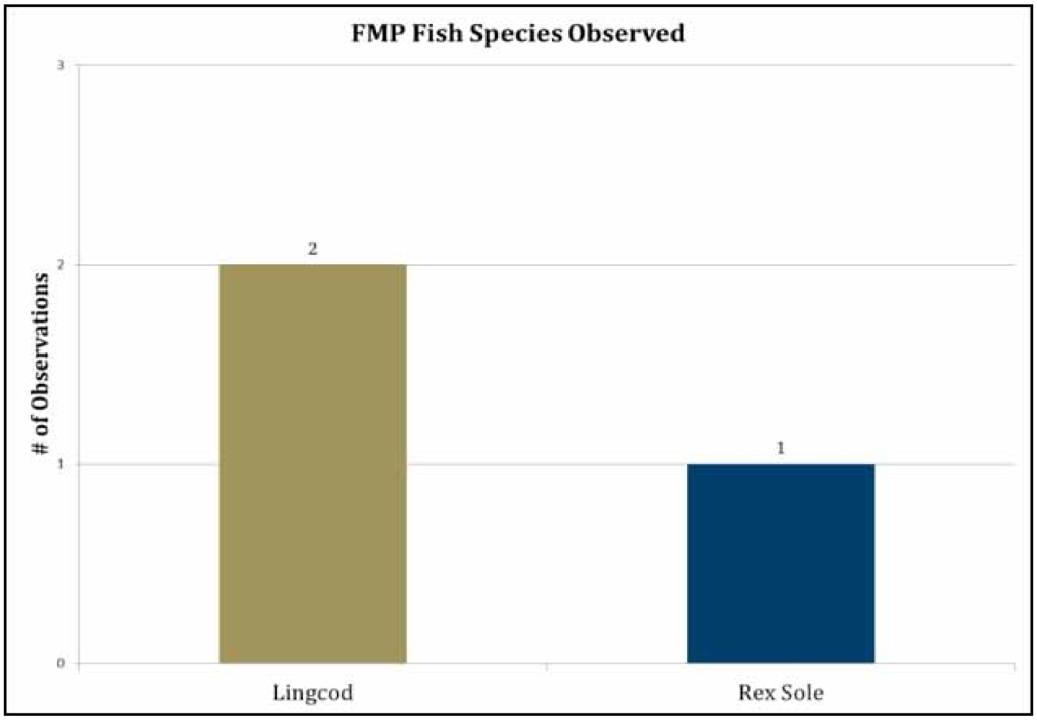


Figure 80: FMP fish species observed at Cypress Point, Dive 2 (8/30/10)

Figure 81: Lingcod (*Ophiodon elongatus*) were the most commonly observed species

Cypress Point, Dive 3 (8/30/10)

Dive Description
- Depth range: 55-70 meters
- GPS start: 36.577589, -121.999812
- GPS stop: 36.57622, -121.99933
- Start Time (PST): 12:44 pm
- Stop Time (PST): 2:05 pm

Total Time: 1 hour 21 minutes

Management Status
MLPA – No
EFH Conservation Area – Yes, closed to bottom trawling except demersal seine
State Water Trawl Closure – Yes

Summary Text

The third Cypress Point dive on August 30th was characterized by medium relief rock habitat (Figure 83 and 84), with aggregating anemones the primary biogenic habitat observed (Figure 85 and 86). The aggregating anemones occured over the last two-thirds of the dive once the ROV moved away from the sand cobble habitat (Figure 87).

Gorgonians (*Gorgonacea*) were the most common coral observed (Figure 88 and 89). The most common sponge observed was sponge mounds (Figure 90 and 91).

Yelloweye rockfish (*Sebastes ruberrimus*) were the most common FMP fish species observed, all of which were juveniles (Figure 92 and 93). The dive was also characterized by schools of Shortbelly rockfish (*Sebastes jordani*) and a giant pacific octopus (*Enteroctopus dofleini*) (Figure 82).

Figure 82: (Left) Shortbelly rockfish (*Sebastes jordani*) school, (Right) giant pacific octopus (*Enteroctopus dofleini*)

Physical Habitat

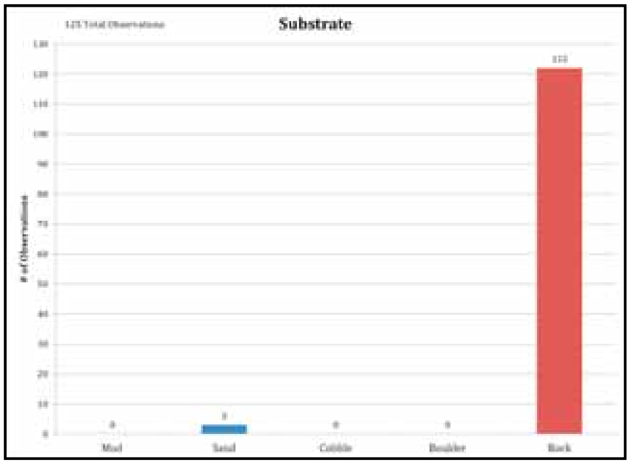


Figure 83: Number of observations of primary substrate from Cypress Point, Dive 3 (8/30/10)

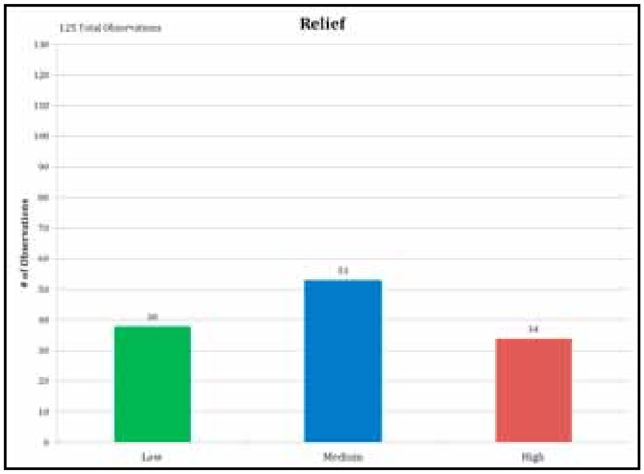


Figure 84: Number of observations of primary relief from Cypress Point, Dive 3 (8/30/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

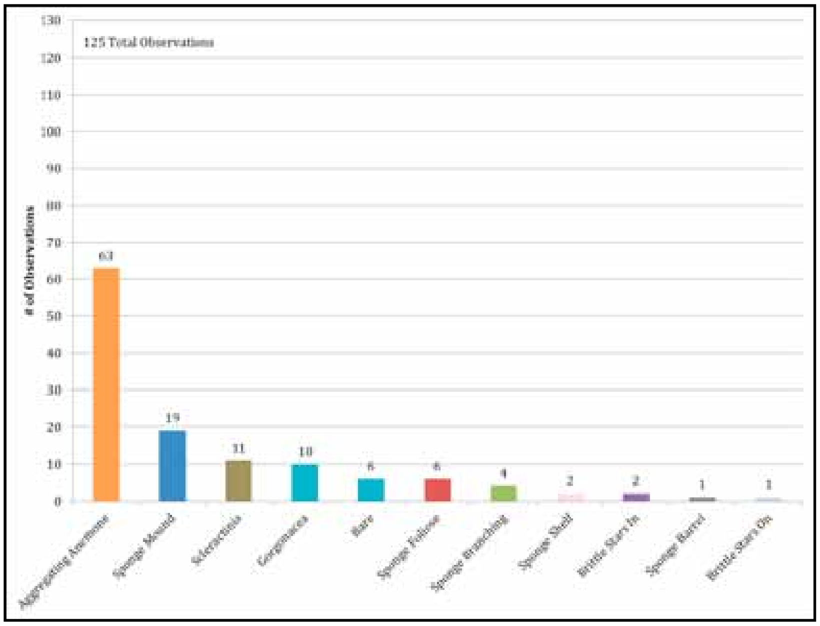


Figure 85: Number of observations of primary biogenic habitat category from Cypress Point, Dive 3

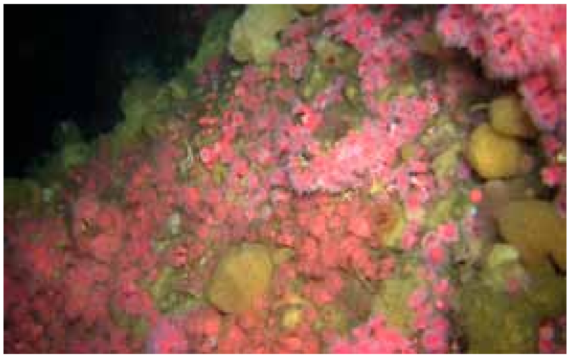


Figure 86: Anemone aggregating was the most commonly observed biogenic habitat

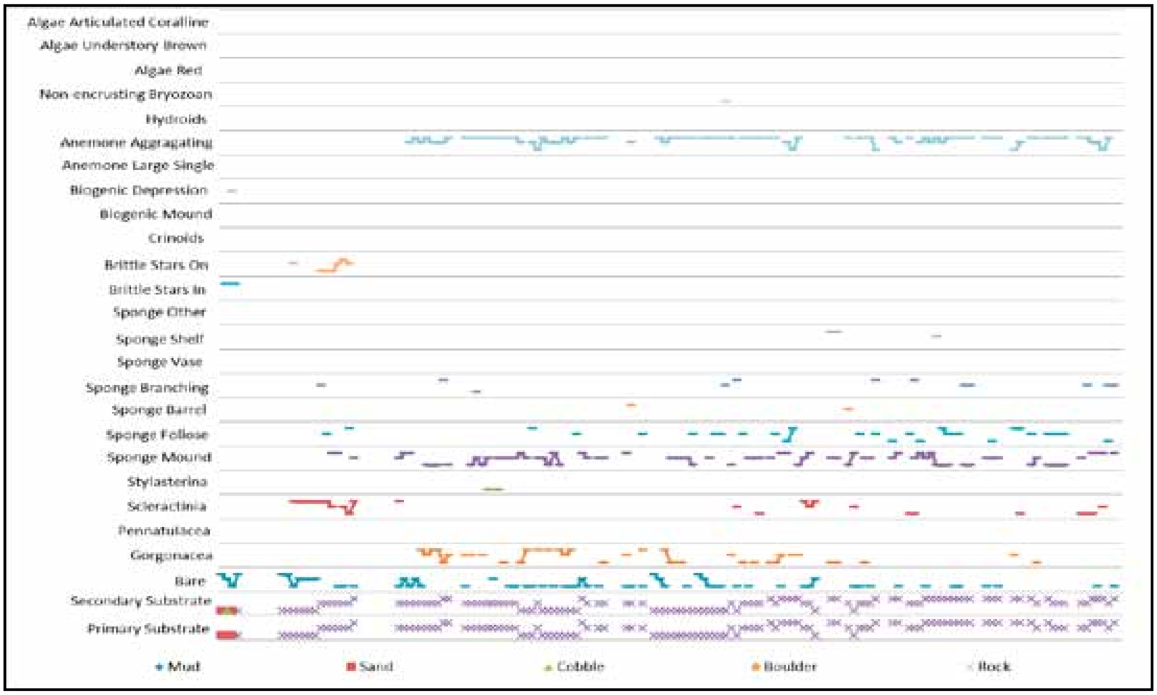


Figure 87: TDP of substrate and biogenic habitat for Cypress Point, Dive 3 (8/30/10)

Corals

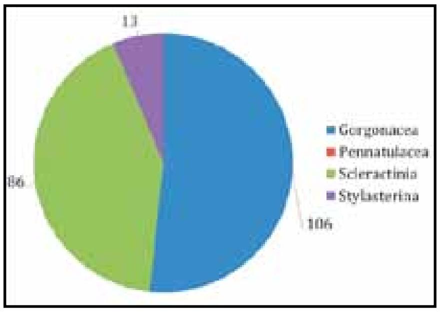


Figure 88: Proportion of corals observed at Cypress Point, Dive 3 (8/30/10)

Figure 89: Gorgonians (*Gorgonacea*) were the most commonly observed coral order at Cypress Point, Dive 3 (8/30/10)

Sponges

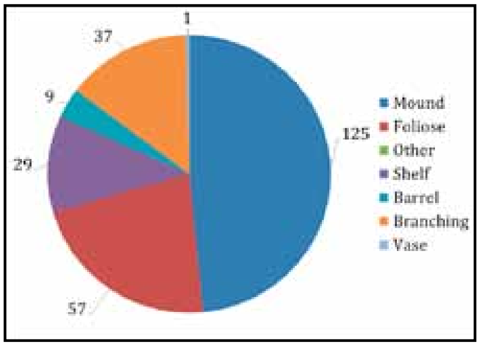


Figure 90: Proportion of sponges observed at Cypress Point, Dive 3 (8/30/10)

Figure 91: Sponge mounds were the most commonly observed sponge morphology observed at Cypress Point, Dive 3 (8/30/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

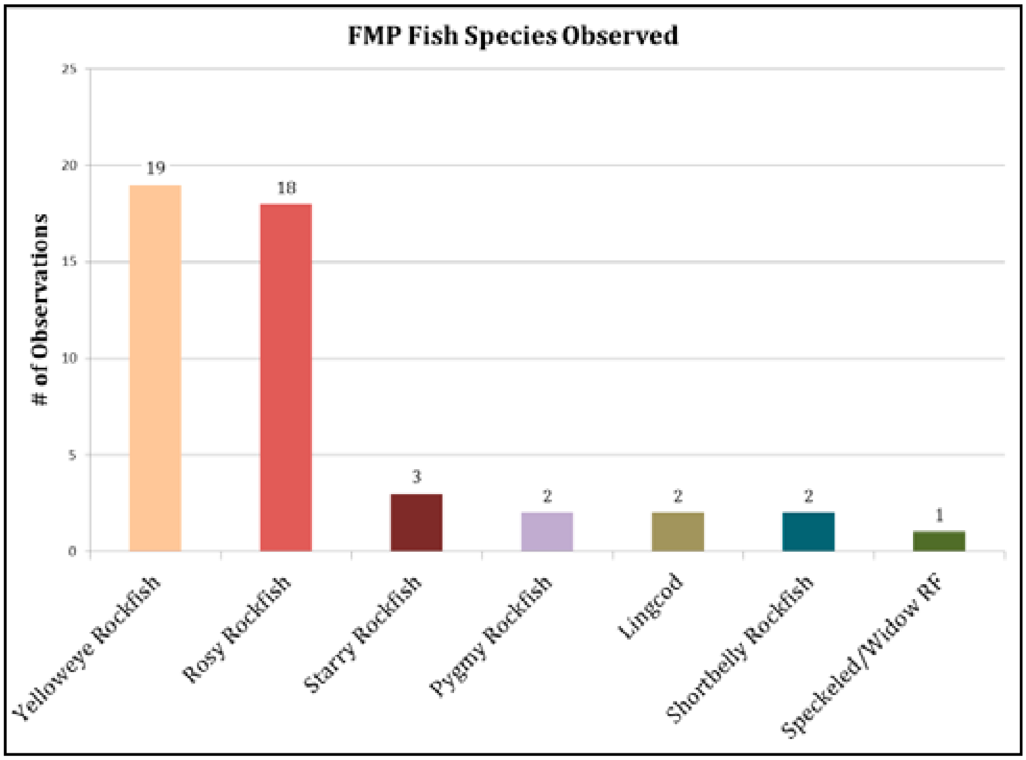


Figure 92: FMP fish species observed at Cypress Point, Dive 3 (8/30/10)

Figure 93: Yelloweye rockfish *(Sebastes ruberrimus*) were the most commonly observed species at Cypress Point, Dive 3 (8/30/10)

APPENDIX C - CYPRESS POINT

Cypress Point, Dive 4 (8/30/10)

Dive Description
Depth range: 40 – 60 meters
GPS start: 36.604775, -121.988825
GPS stop: 36.604253, -121.989098
Start Time (PST): 2:38 pm
Stop Time (PST): 3:30 pm
Total Time: 52 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – Yes, closed to bottom trawling except demersal seine
State Water Trawl Closure - Yes

Summary Text

The fourth Cypress Point dive on August 30th was characterized by low relief boulder habitat (Figures 95 and 96), and the primary biogenic habitat observed was brittle stars in the sand (Figure 97 and 98). Different sponges, red algae, and hydroids were found as well (Figure 99).

Gorgonians (*Gorgonacea*) were the most common corals observed on this dive (Figures 100 and 101). Branching sponges were the most commonly occurring sponge (Figures 102 and 103).

Rosy rockfish (*Sebastes rosaceus*) was the most commonly observed FMP fish species (Figures 104 and 105). In addition there were observations of China rockfish (*Sebastes nebulosus*) and Gopher rockfish (*Sebastes carnatus*) (Figure 94).

Figure 94: (Left) China rockfish (*Sebastes nebulosus*), (Right) Gopher rockfish (*Sebastes carnatus*)

Physical Habitat

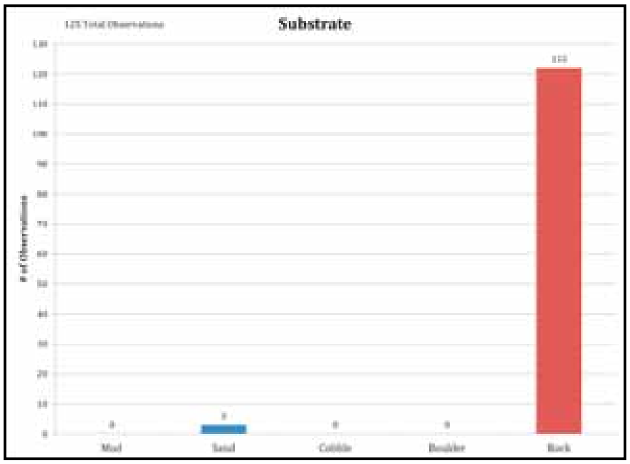


Figure 95: Number of observations of primary substrate from Cypress Point, Dive 4 (8/30/10)

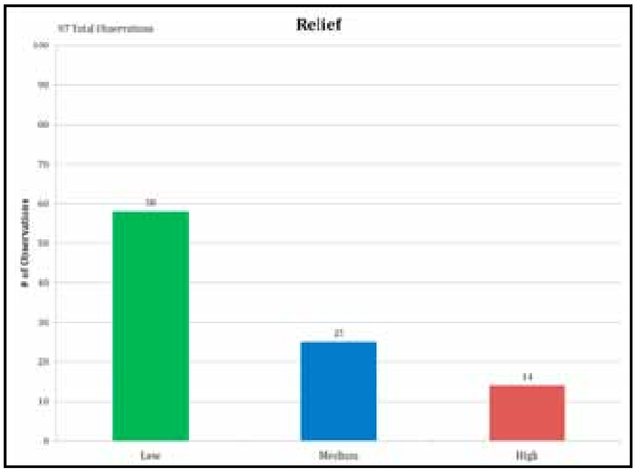


Figure 96: Number of observations of primary relief from Cypress Point, Dive 4 (8/30/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters) 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

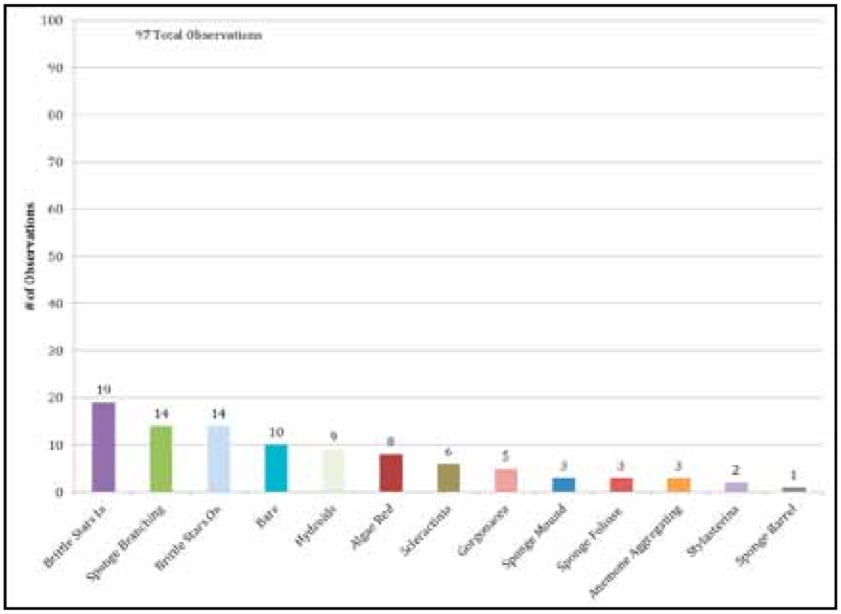


Figure 97: Number of observations of primary biogenic habitat category from Cypress Point, Dive 4

Figure 98: "Brittle stars in" were the most commonly observed biogenic habitat

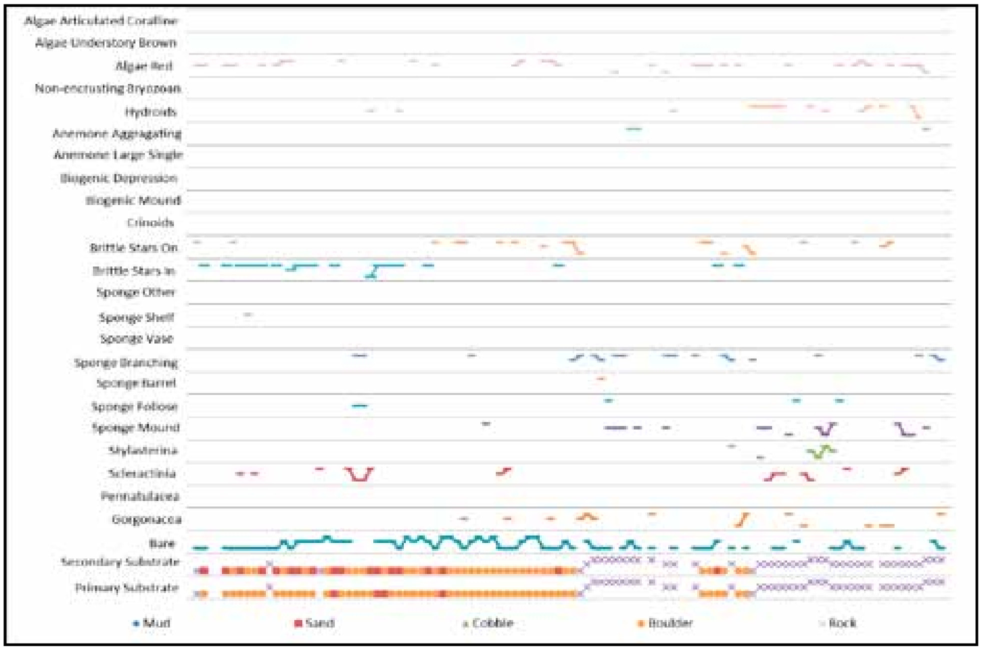


Figure 99: TDP of substrate and biogenic habitat for Cypress Point, Dive 4 (8/30/10)

Corals

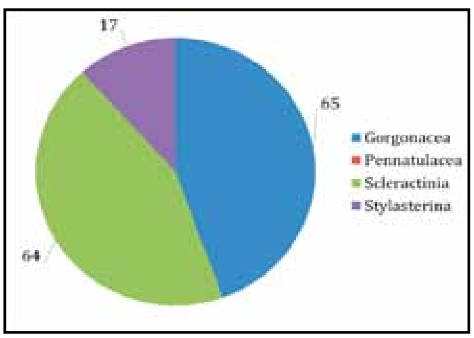


Figure 100: Proportion of corals observed at Cypress Point, Dive 4 (8/30/10)

Figure 101: Gorgonians (*Gorgonacea*) were the most commonly observed coral order at Cypress Point, Dive 4 (8/30/10)

Sponges

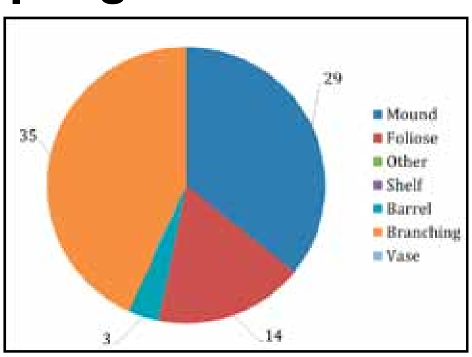


Figure 102: Proportion of sponges observed at Cypress Point, Dive 4 (8/30/10)

Figure 103: Sponge branching was the most commonly observed sponge morphology observed at Cypress Point, Dive 4 (8/30/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

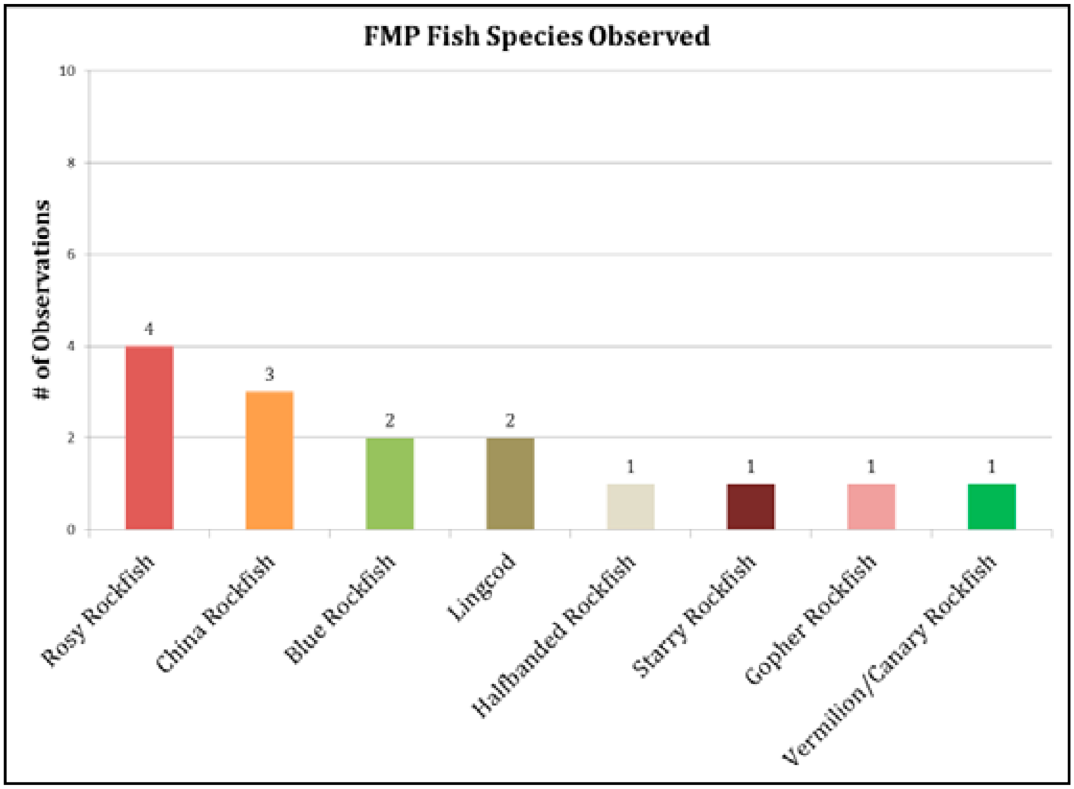


Figure 104: FMP fish species observed at Cypress Point, Dive 4 (8/30/10)

Figure 105: Rosy rockfish (*Sebastes rosaceus*) were the most commonly observed species at Cypress Point, Dive 4 (8/30/10)

APPENDIX C - ITALIAN LEDGE

Italian Ledge, Dive 2 (9/4/10)

Dive Description

Depth range: 85 – 90 meters
GPS start: 36.649009, -122.004793
GPS stop: 36.651687, -122.00207
Start Time (PST): 9:20 am
Stop Time (PST): 10:16 am

Total Time: 56 minutes

Management Status

MLPA – No

EFH Conservation Area – Yes, closed to bottom trawling except demersal purse seine

State Water Trawl Closure - No

Summary Text

The Italian Ledge dive on September 4th was characterized by primarily low relief rock habitat (Figure 107 and 108), with "brittle stars on" the rocks the primary biogenic habitat (Figure 109 and 110) and sponge mounds a secondary biogenic habitat (Figure 111).

Cup corals (*Scleractinia*) were the most commonly observed coral (Figure 112 and 113). Sponge mounds were the most commonly observed sponge (Figure 114 and 115).

Halfbanded rockfish (*Sebastes semicinctus*) was the most commonly observed FMP fish species (Figure 116 and 117). This dive also had observations of lingcod (*Ophiodon elongatus*) and sponge vases (Figure 106).

Figure 106: (Left) Lingcod (*Ophiodon elongates*), (Right) sponge vase

Physical Habitat

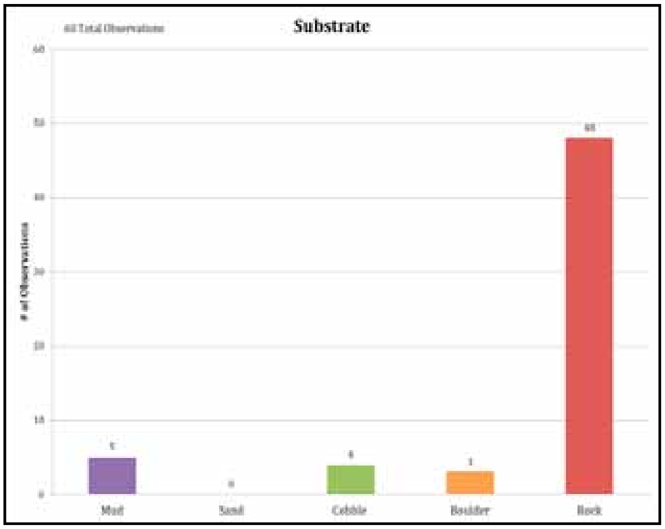


Figure 107: Number of observations of primary substrate from Italian Ledge, Dive 2 (9/4/10)

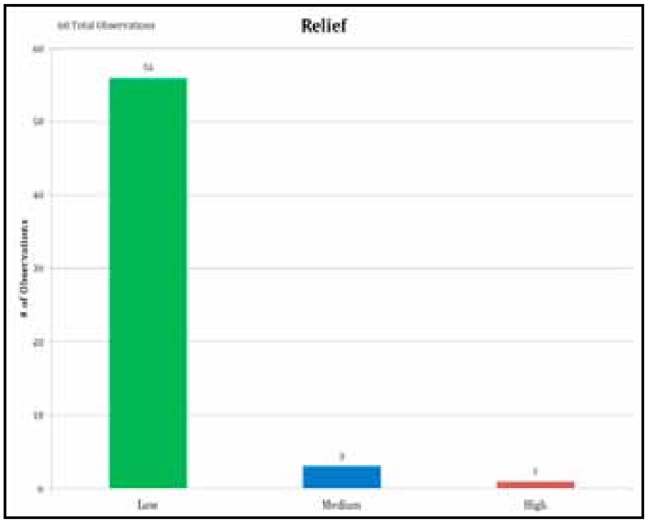


Figure 108: Number of observations of primary relief from Italian Ledge, Dive 2 (9/4/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

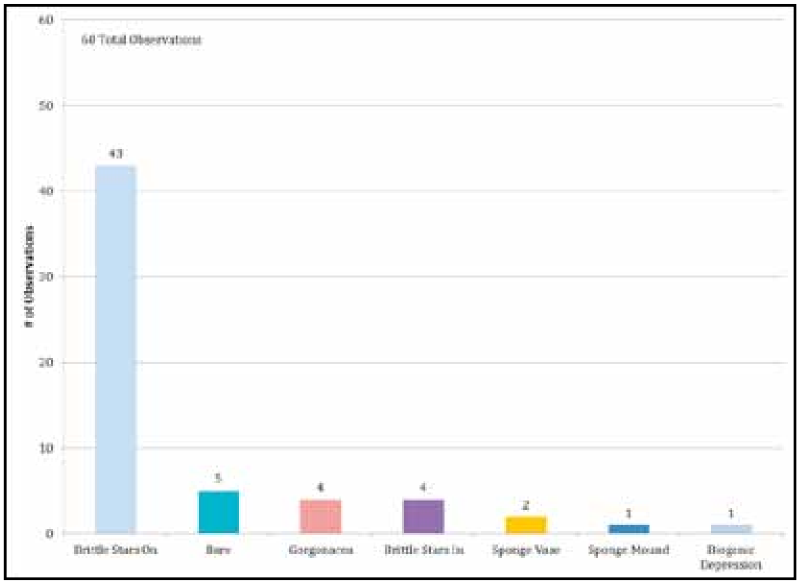


Figure 109: Number of observations of primary biogenic habitat category from Italian Ledge, Dive 2

Figure 110: “Brittle stars on” were the most commonly observed biogenic habitat

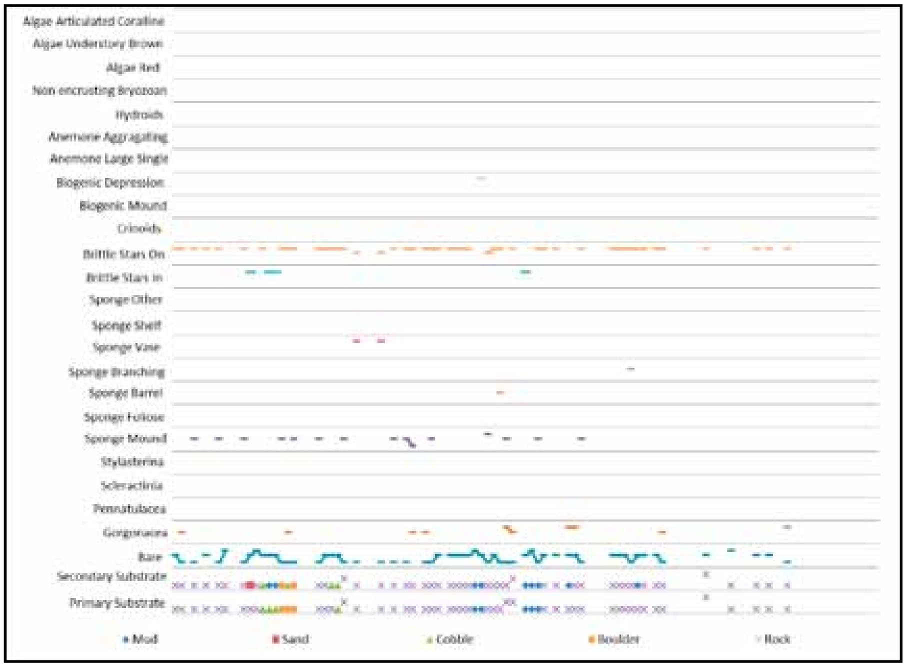


Figure 111: TDP of substrate and biogenic habitat for Italian Ledge, Dive 2 (9/4/10)

Corals

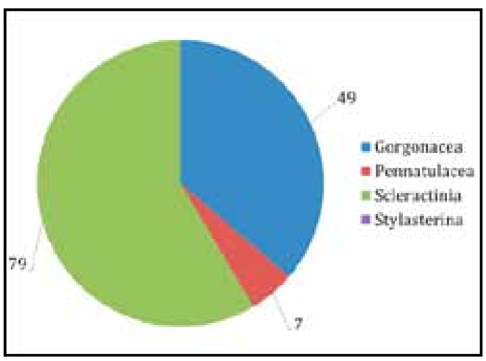


Figure 112: Proportion of corals observed at Italian Ledge, Dive 2 (9/4/10)

Figure 113: Cup Corals (*Scleractinia*) were the most commonly observed coral order at Italian Ledge, Dive 2 (9/4/10)

Sponges

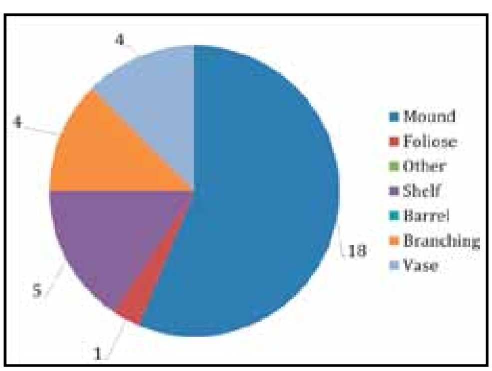


Figure 114: Proportion of sponges observed at Italian Ledge, Dive 2 (9/4/10)

Figure 115: Sponge mounds were the most commonly observed sponge morphology observed at Italian Ledge, Dive 2 (9/4/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

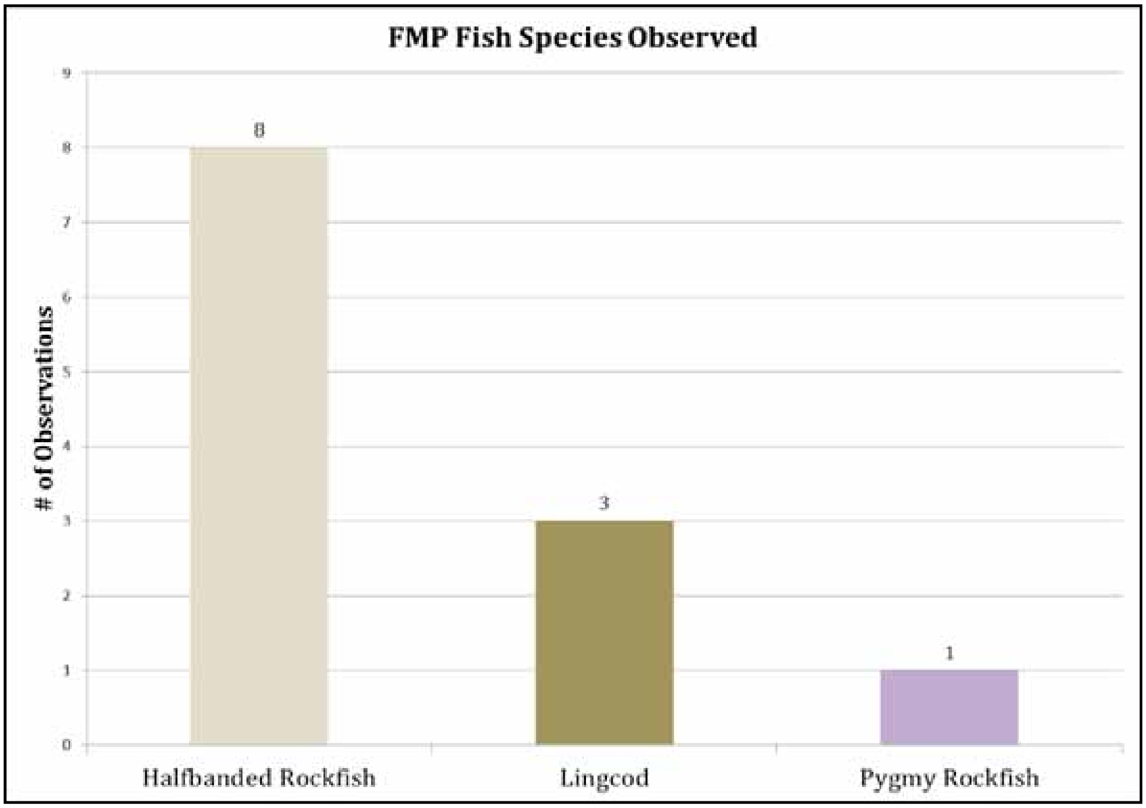


Figure 116: FMP fish species observed at Italian Ledge, Dive 2 (9/4/10)

Figure 117: Halfbanded rockfish (*Sebastes semicinctus*) was the most commonly observed species at Italian Ledge, Dive 2 (9/4/10)

APPENDIX C - POINT PINOS

Point Piños, Dive 1 (9/4/10)

Dive Description
Depth range: 40 – 60 meters
GPS start: 36.650331, -121.933632
GPS stop: 36.649936, -121.933789
Start Time (PST): 7:12 am
Stop Time (PST): 8:42 am
Total Time: 1 hour 30 minutes

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - Yes

Summary Text

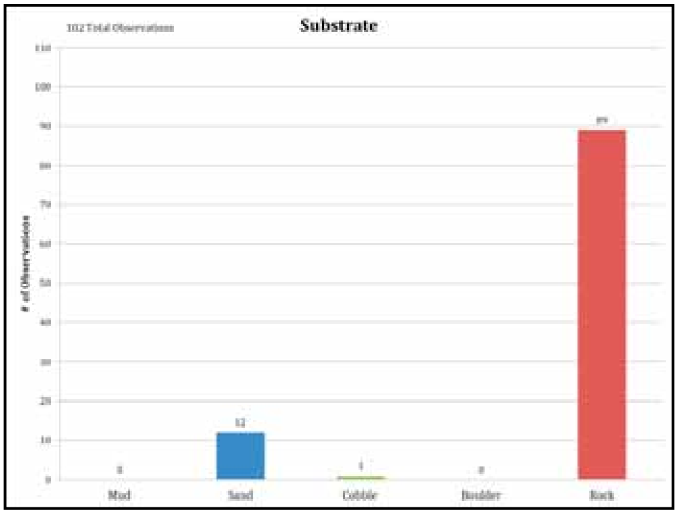
The Point Piños dive on September 4th was characterized by medium relief rock habitat (Figure 119 and 120), with sponge mounds the primary biogenic habitat (Figure 121 and 122). Brittle stars, aggregating anemones, and hydroids were also observed (Figure 123).

Cup corals (*Scleractinia*) were the most common coral observed (Figure 124 and 125). The most common sponge observed on this dive were sponge mounds (Figure 126 and 127).

Olive/Yellowtail rockfish (*Sebastes serranoides/Sebastes flavidus*) was the most common FMP fish species observed on this dive (Figure 128 and 129). There were also occurrences of Rosy rockfish (*Sebastes rosaceus*) and Squarespot rockfish (*Sebastes hopkinsi*) (Figure 118).

Figure 118: (Left) Rosy rockfish (*Sebastes rosaceus*), (Right) Squarespot rockfish (*Sebastes*)

Physical Habitat



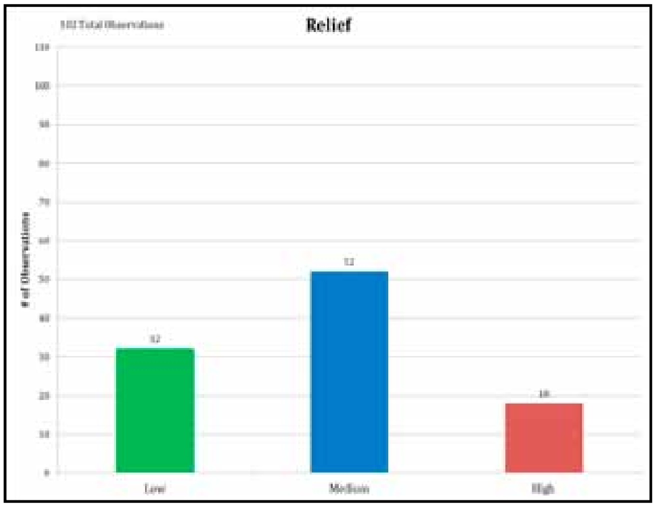


Figure 119: Number of observations of primary substrate from Point Piños, Dive 1 (9/4/10)

Figure 120: Number of observations of primary relief from Point Piños, Dive 1 (9/4) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

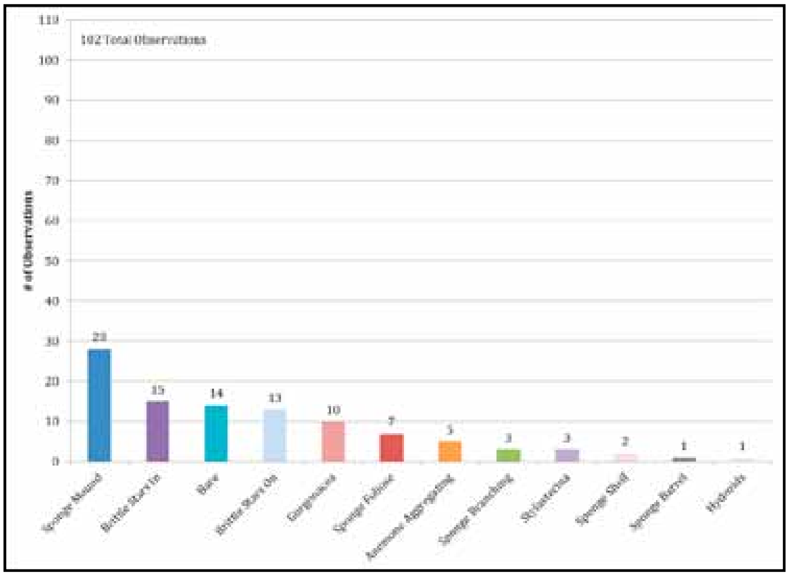


Figure 121: Number of observations of primary biogenic habitat category from Point Piños, Dive 1

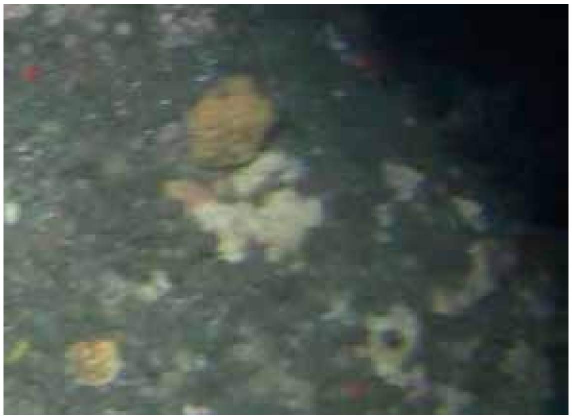


Figure 122: Sponge mound was the most commonly observed biogenic habitat

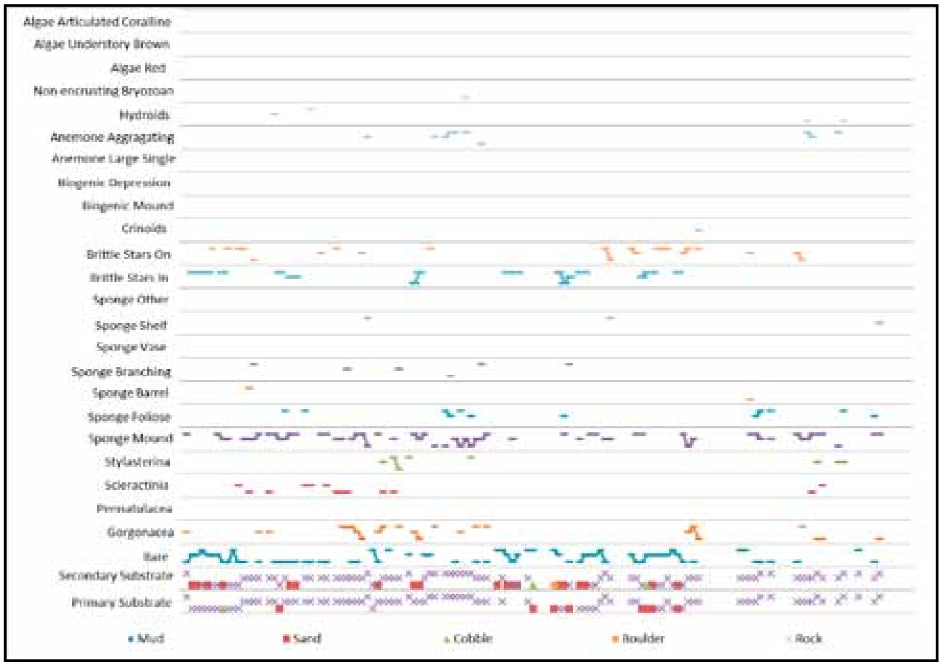


Figure 123: TDP of substrate and biogenic habitat for Point Piños, Dive 1 (9/4/10)

Corals

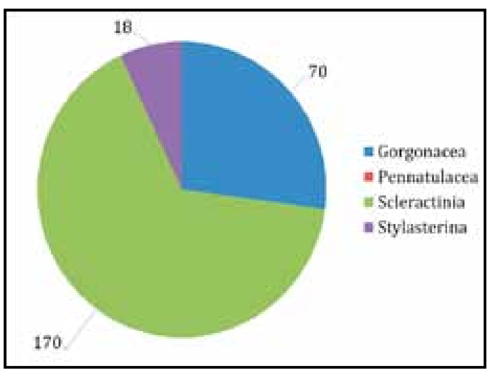


Figure 124: Proportion of corals observed at Point Piños, Dive 1 (9/4/10)

Figure 125: Cup corals (*Scleractinia*) were the most commonly observed coral order at Point Piños, Dive 1 (9/4/10)

Sponges

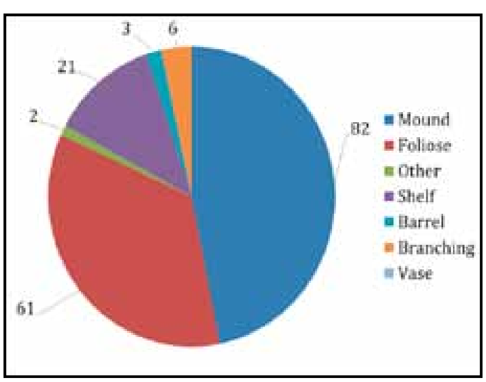


Figure 126: Proportion of sponges observed at Point Piños, Dive 1 (9/4/10)

Figure 127: Sponge mounds were the most commonly observed sponge morphology observed at Point Piños, Dive 1 (9/4/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

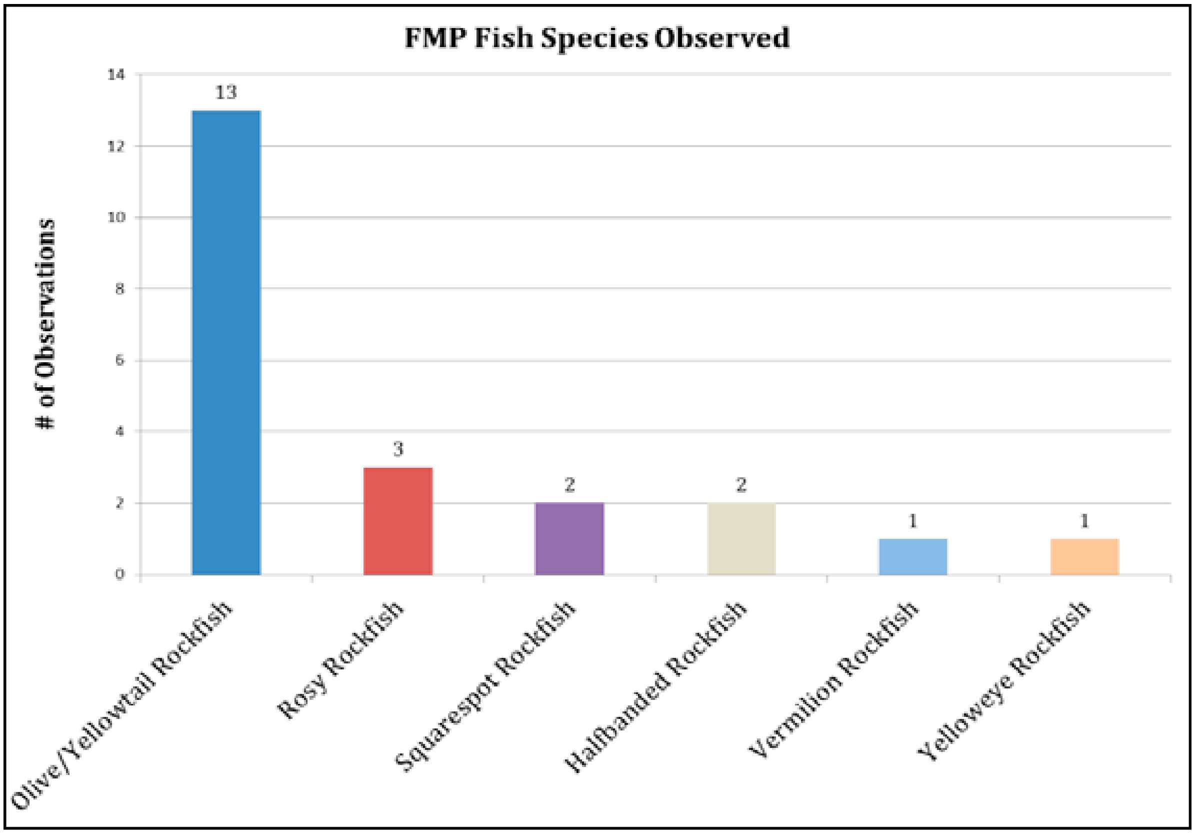


Figure 128: FMP fish species observed at Point Piños, Dive 1 (9/4/10)

Figure 129: Olive/Yellowtail rockfish (*Sebastes serranoides/Sebastes flavidus*) was the most commonly observed species at Point Piños, Dive 1 (9/4/10)

Portuguese Ledge, Dive 3 (9/4/10)

Dive Description

Depth range: 68 – 82 meters
GPS start: 36.696595, -121.940749
GPS stop: 36.697506, -121.938678
Start Time (PST): 11:04 am
Stop Time (PST): 12:02 pm

Total Time: 58 minutes

Management Status
MLPA – Yes, Portuguese Ledge State Marine Conservation Area
EFH Conservation Area – Yes, closed to bottom trawling except for demersal purse seine
State Water Trawl Closure - Yes

Summary Text

The Portuguese Ledge dive on September 4th was characterized primarily by low relief rock habitat with mud habitat a close second (Figure 131 and 132). The physical structure observed on this dive was primarily bare of biogenic habitat (Figure 133 and 134). Mud habitat had primarily bare biogenic habitat as did rock habitat (Figure 135). Crinoids occurred on this dive over the boulder and rock habitat.

Cup corals (*Scleractinia*) were the most commonly observed coral (Figure 136 and 137). Sponge foliose were the most commonly observed sponge (Figure 138 and 139).

Olive/yellowtail rockfish was the most commonly observed fish species (Figure 140 and 141). This dive also had the only occurrences of greenspotted rockfish (*Sebastes chlorostictus*) and the only observation of an adult yelloweye rockfish (*Sebastes rubrivinctus*) (Figure 130).

Figure 130: (Left) Greenspotted rockfish (*Sebastes chlorostictus*), (Right) Yelloweye rockfish (*Sebastes rubrivinctus*)

Physical Habitat

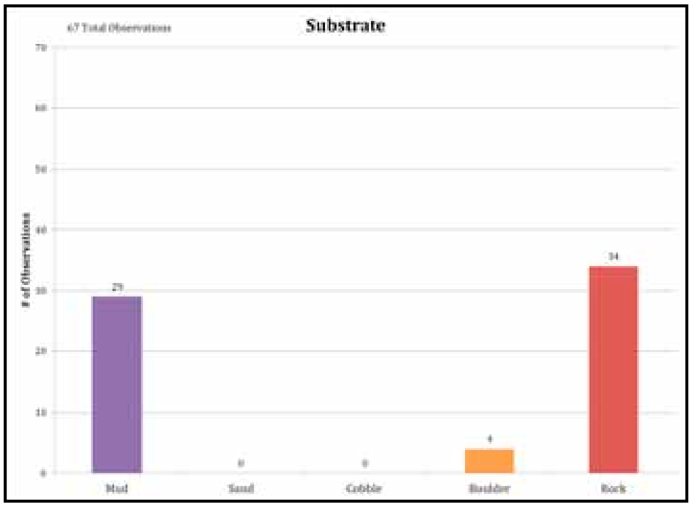


Figure 131: Number of observations of primary substrate from Portuguese Ledge, Dive 3 (9/4/10)

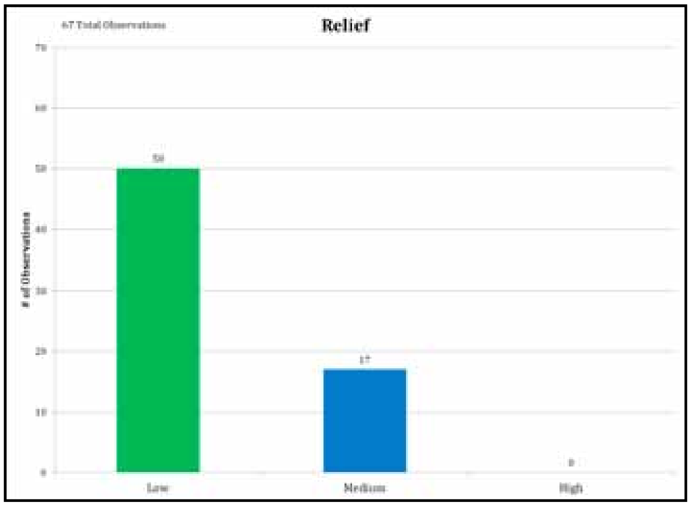


Figure 132: Number of observations of primary relief from Portuguese Ledge, Dive 3 (9/4/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

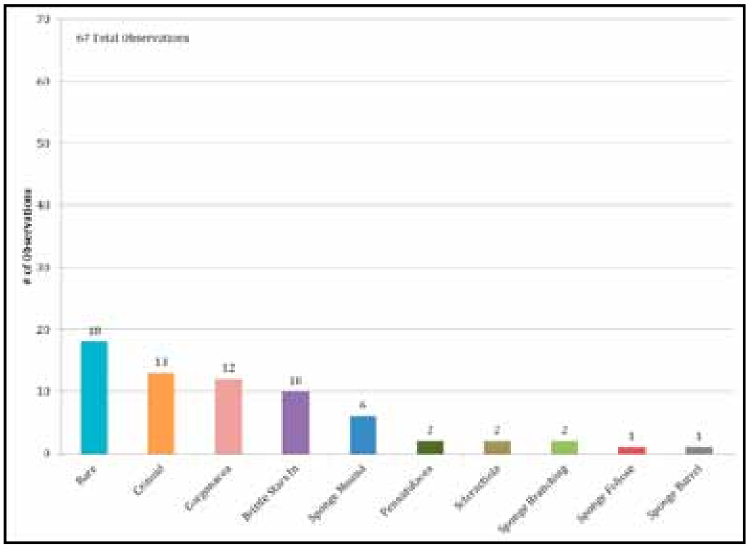


Figure 133: Number of observations of primary biogenic habitat category from Portuguese Ledge

Figure 134: Bare was the most commonly observed biogenic habitat

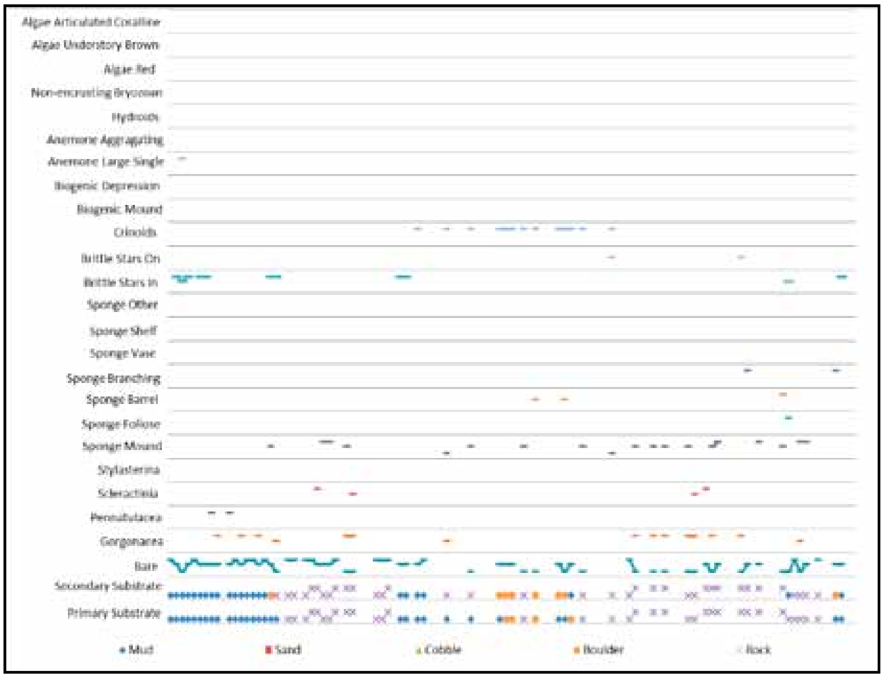


Figure 135: TDP of substrate and biogenic habitat for Portuguese Ledge, Dive 3 (9/4/10)

Corals

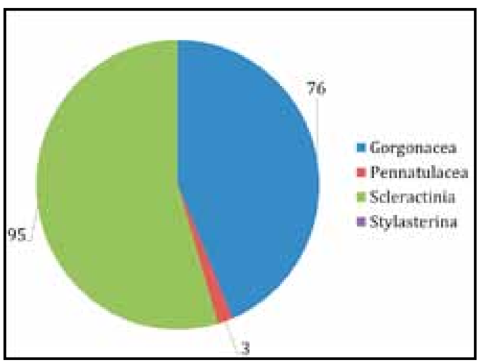


Figure 136: Proportion of corals observed at Portuguese Ledge, Dive 3 (9/4/10)

Figure 137: Cup corals (*Scleractinia*) were the most commonly observed coral order at Portuguese Ledge, Dive 3 (9/4/10)

Sponges

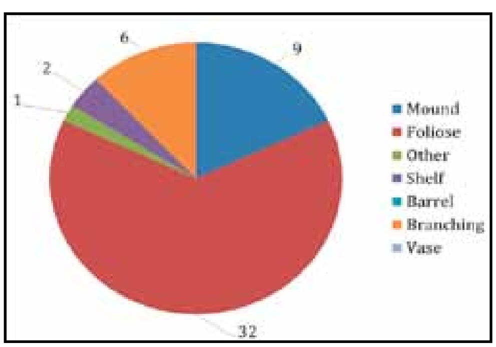


Figure 138: Proportion of sponges observed at Portuguese Ledge, Dive 3 (9/4/10)

Figure 139: Sponge Foliose was the most commonly observed sponge morphology observed at Portuguese Ledge, Dive 3 (9/4/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

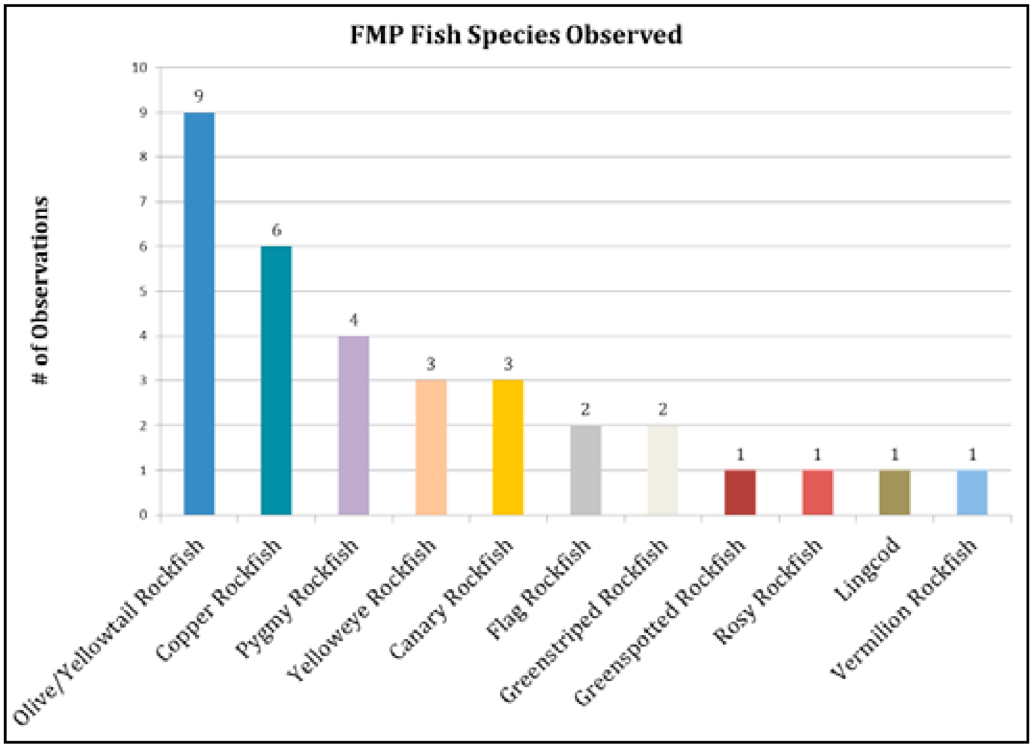


Figure 140: FMP fish species observed at Portuguese Ledge, Dive 3 (9/4/10)

Figure 141: Olive/yellowtail rockfish (*Sebastes serranoides/Sebastes flavidus*) was the most commonly observed species at Portuguese Ledge, Dive 3 (9/4/10)

APPENDIX C - SHALE BEDS

Shale Beds, Dive 1 (8/28/10)

Dive Description

Depth range: 35-42 meters
GPS start: 36.623732, -121.87902
GPS stop: 36.619071, -121.886689
Start Time (PST): 11:29 am
Stop Time (PST): 11:44 am

Total Time: 15 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - Yes

Summary Text

The Shale Beds dive on August 28th was characterized by low relief sand habitat (Figures 143 and 144). The primary biogenic habitat was brittle stars in the sand (Figure 145 and 146), which were found along almost the entire dive with no interruptions (Figure 147).

A sea pen (*Pennatulacea*) was the only coral observation (Figure 148). There were no sponge observations on this dive.

There were also no fish identified on this dive due to its short duration and lack of clear images of observed fish (Figure 149 and 150). The large presence of brittle stars provide habitat for small fish to hide from predators (Figure 142).

Figure 142: Brittle stars in the sand provide structure in an otherwise low relief environment

Physical Habitat

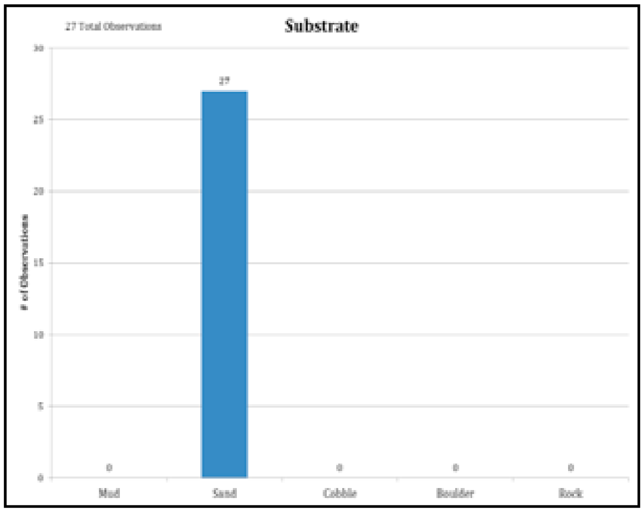


Figure 143: Number of observations of primary substrate from Shale Beds, Dive 1 (8/28/10)

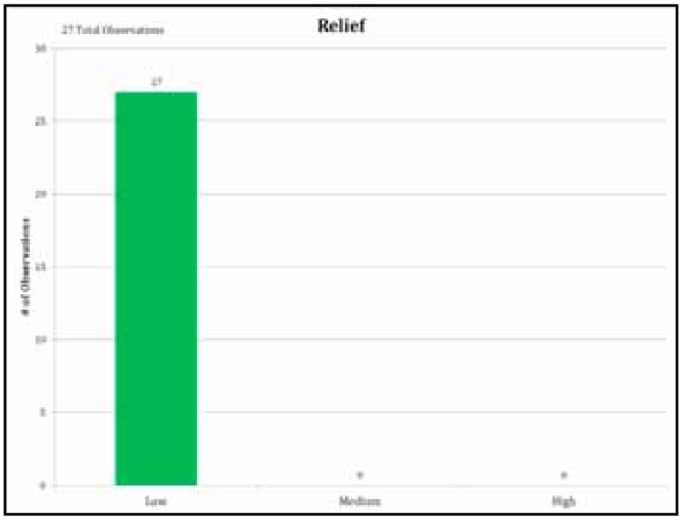


Figure 144: Number of observations of primary relief from Shale Beds, Dive 1 (8/28/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

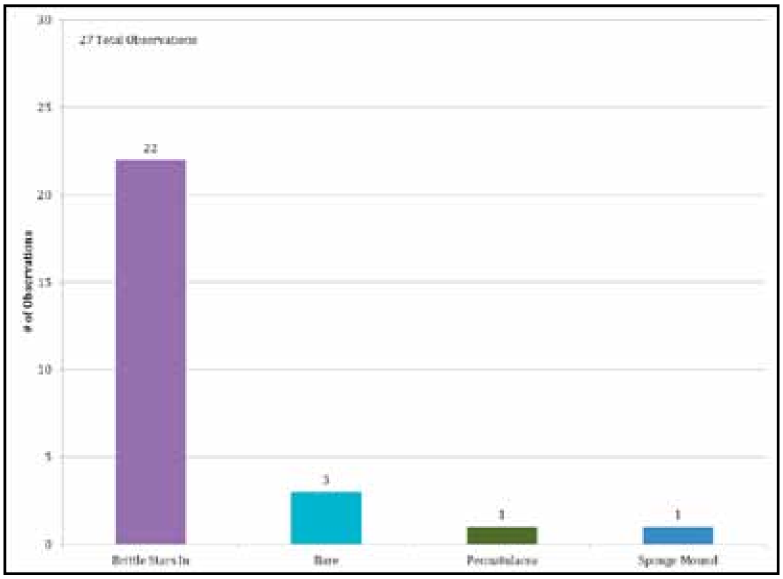
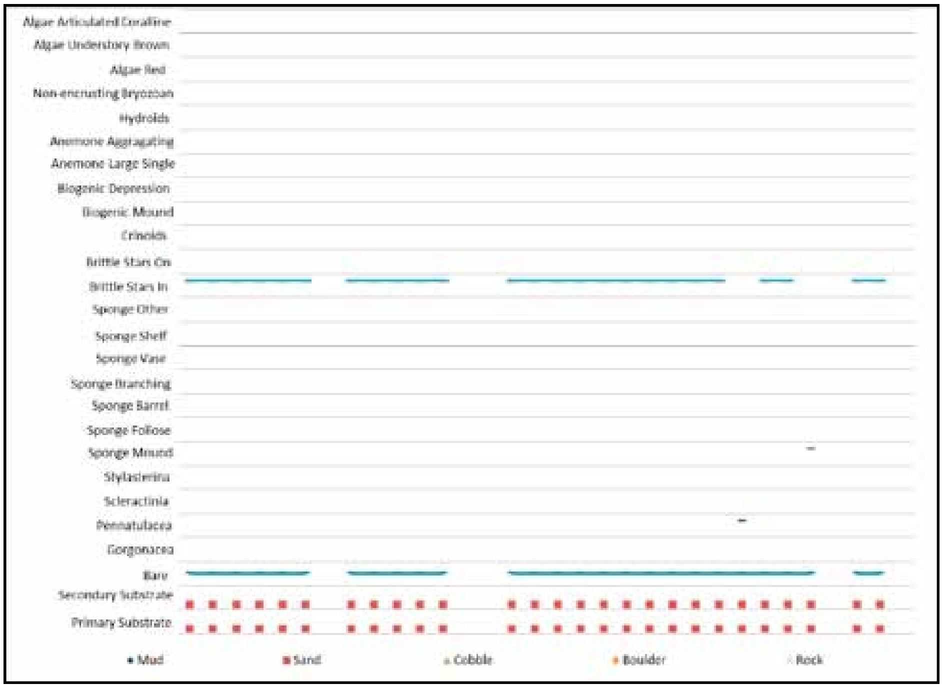


Figure 145: Number of observations of primary biogenic habitat category from Shale Beds, Dive 1

Figure 146: “Brittle stars in” was the most commonly observed biogenic habitat



Corals

There was only one coral observation of a sea pen *Pennatulacea* **on this dive.**

Figure 148: Orange sea pen (*Pennatulacea*), the only observed coral order at the Shale Beds, Dive 1 (8/28/10)

Sponges

NO SPONGES WERE OBSERVED ON THIS DIVE.

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

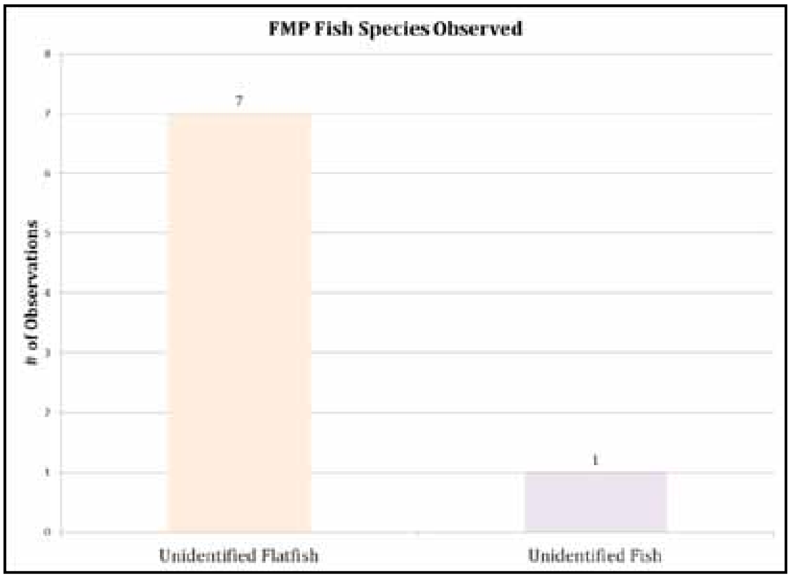


Figure 149: FMP fish species observed at Shale Beds, Dive 1 (8/28/10)

Figure 150: Unidentified flatfish were the most commonly observed species at the Shale Beds, Dive 1

Shale Beds, Dive 4 (9/2/10)

Dive Description
Depth range: 40 -55 meters
GPS start: 36.634501, -121.907663
GPS stop: 36.631992, -121.901028
Start Time (PST): 2:05 pm
Stop Time (PST): 2:08 pm
Total Time: 2 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - Yes

Summary Text

The Shale Beds dive on September 2nd was characterized by low relief sand habitat (Figure 152 and 153). Brittle stars in the sand was the only biogenic habitat (Figure 154, 155 and156).

A sea whip (*Gorgonacea*) represented the only coral observation (Figures 157). No sponges were observed on this dive.

The only identifiable fish observed on this dive was a (Figure 158 and 159), Pacific Sanddab (*Cithartichthys sordidus*) (Figure 151).

Figure 151: Pacific Sanddab (*Cithartichthys sordidus*)

Physical Habitat

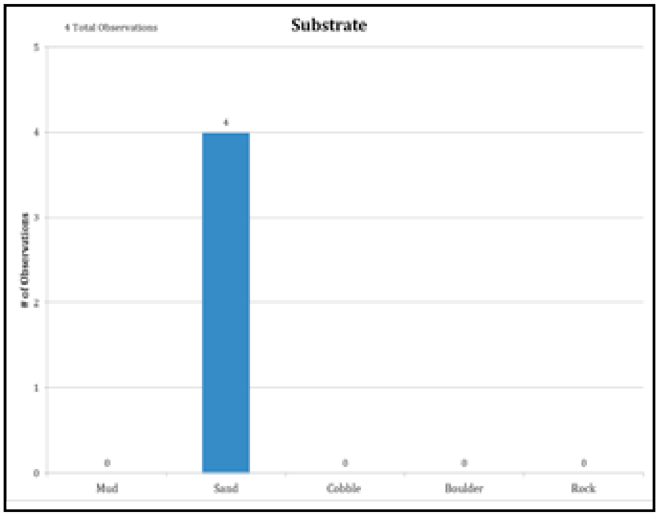


Figure 152: Number of observations of primary substrate from Shale Beds, Dive 4 (9/2/10)

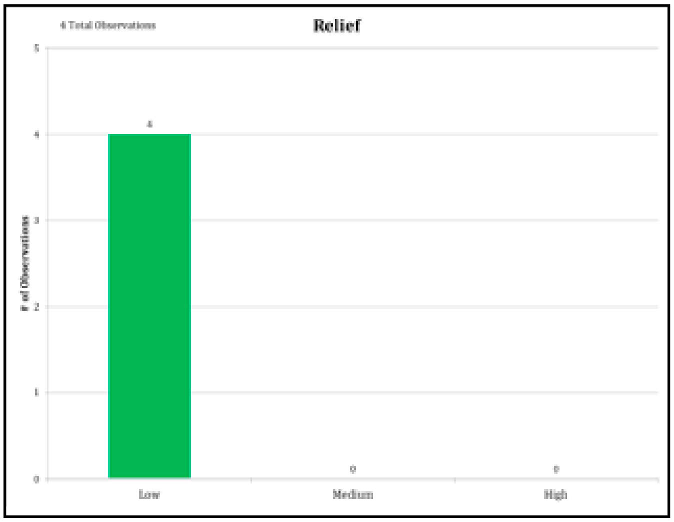


Figure 153: Number of observations of primary relief from Shale Beds, Dive 4 (9/2/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

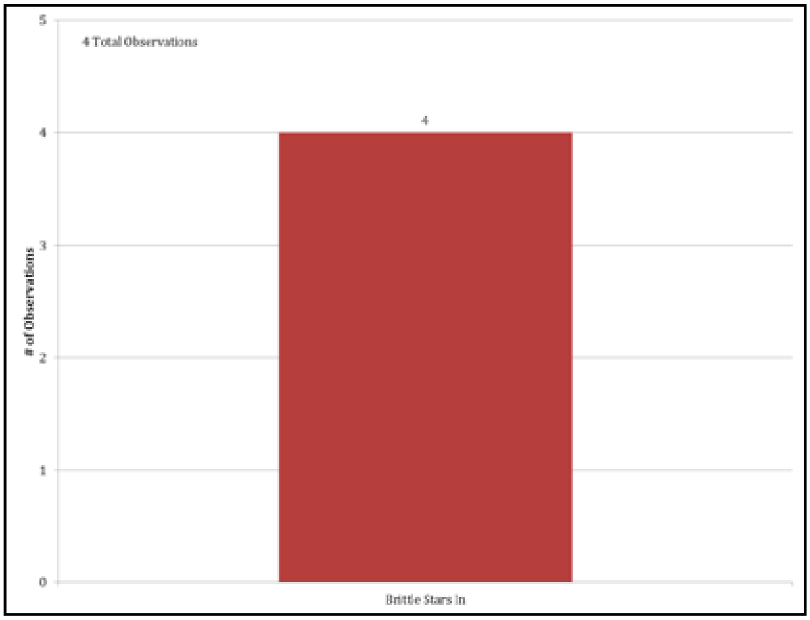
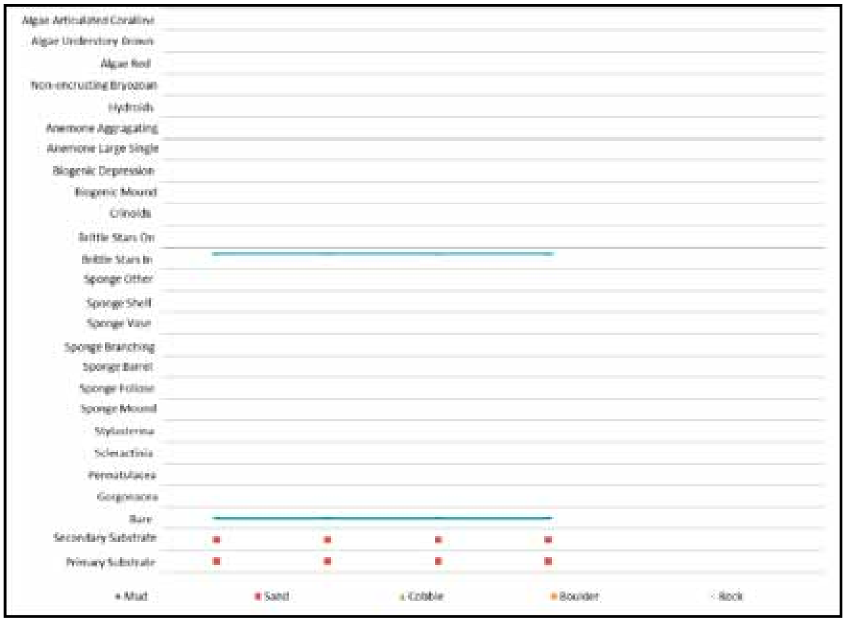


Figure 154: Number of observations of primary biogenic habitat category from Shale Beds, Dive 4

Figure 155: “Brittle stars in” was the most commonly observed biogenic habitat



Corals

THERE WAS ONLY ONE CORAL OBSERVATION OF *GORGONACEA* ON THIS DIVE.

Figure 157: Sea whips (*Gorgonacea*) were the only observed coral order at Shale Beds, Dive 4

Sponges

NO SPONGES WERE OBSERVED ON THIS DIVE.

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

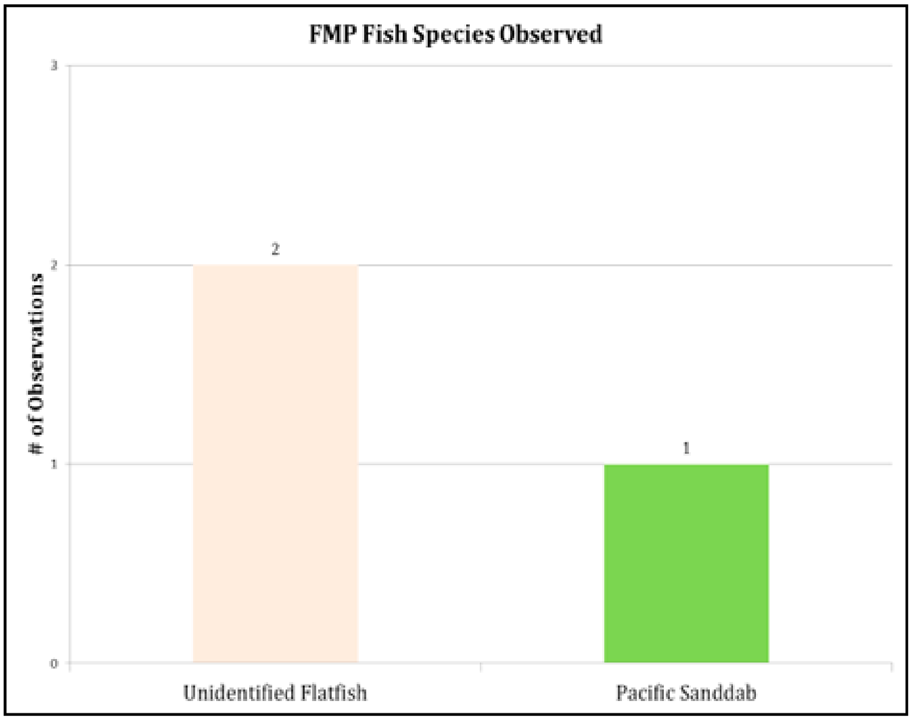


Figure 158: FMP fish species observed at Shale Beds, Dive 4 (9/2/10)

Figure 159: Unidentified flatfish were the most commonly observed species at Shale Beds, Dive 4 (9/2/10)

Shale Beds, Dive 5 (9/2/10)

Dive Description
Depth range: 40 - 50 meters
GPS start: 36.631023, -121.898763
GPS stop: 36.627832, -121.896075
Start Time (PST): 3:25 pm
Stop Time (PST): 3:37 pm
Total Time: 11 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - Yes

Summary Text

The Shale Beds dive of September 2nd was characterized by low relief sand habitat (Figure 161 and 162). As in the previous two dives at the Shale Beds, brittle stars in the sand were the most common biogenic habitat observed (Figure 163 and 164). There were also observations of a biogenic mound and a single large anemone (Figure 165).

There were only two coral observations on this dive, both of sea whips (Gorgonacea) (Figure 166). There were no sponges observed on this dive.

The fish that were observed on this dive could not be identified due to a lack of visible characteristics (Figure 167 and 168). This dive also had a large presence of “brittle stars in,” which provide structural habitat in an otherwise low relief environment (Figure 160).

Figure 160: Brittle stars in the sand provide three-dimensional structure as habitat

Physical Habitat

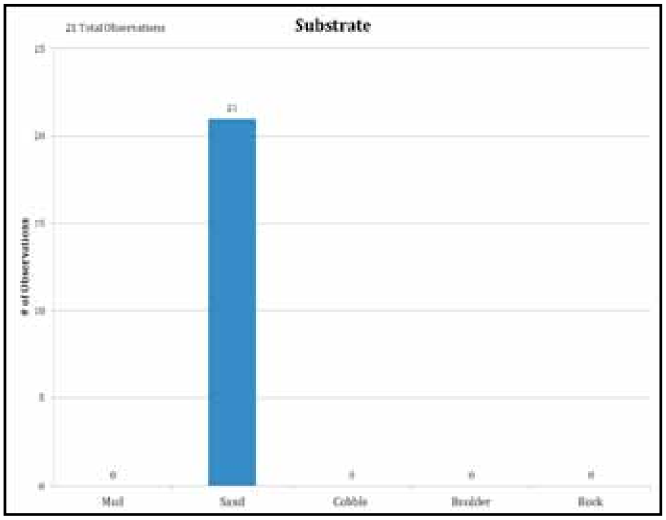


Figure 161: Number of observations of primary substrate from Shale Beds, Dive 5 (9/2/10)

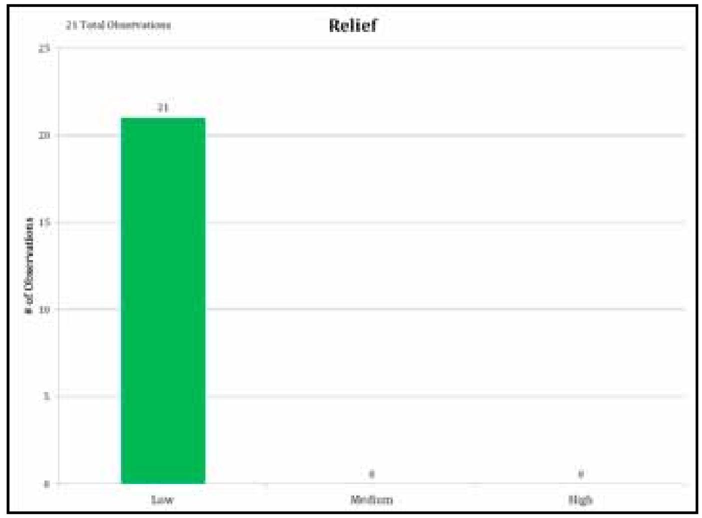


Figure 162: Number of observations of primary relief from Shale Beds, Dive 5 (9/2/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

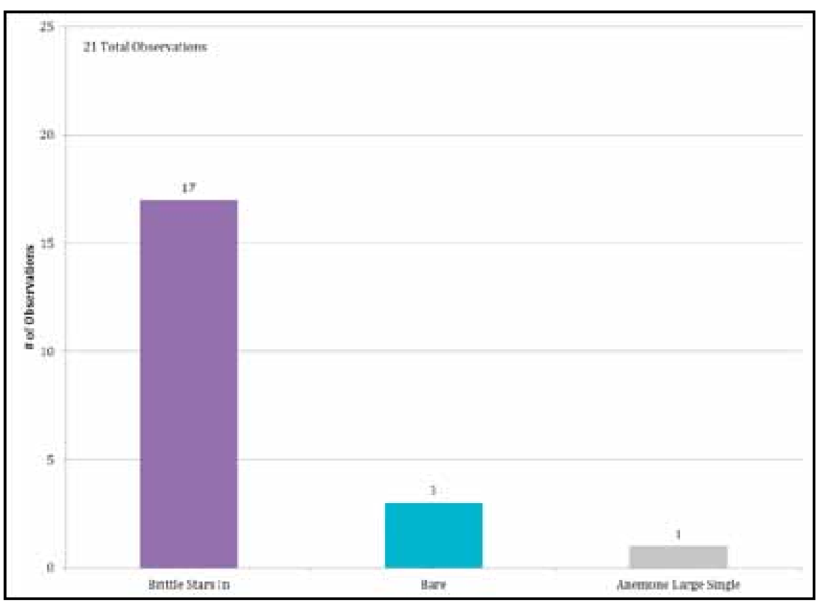


Figure 163: Number of observations of primary biogenic habitat category from Shale Beds, Dive 5

Figure 164: "Brittle stars in" were the most commonly observed biogenic habitat

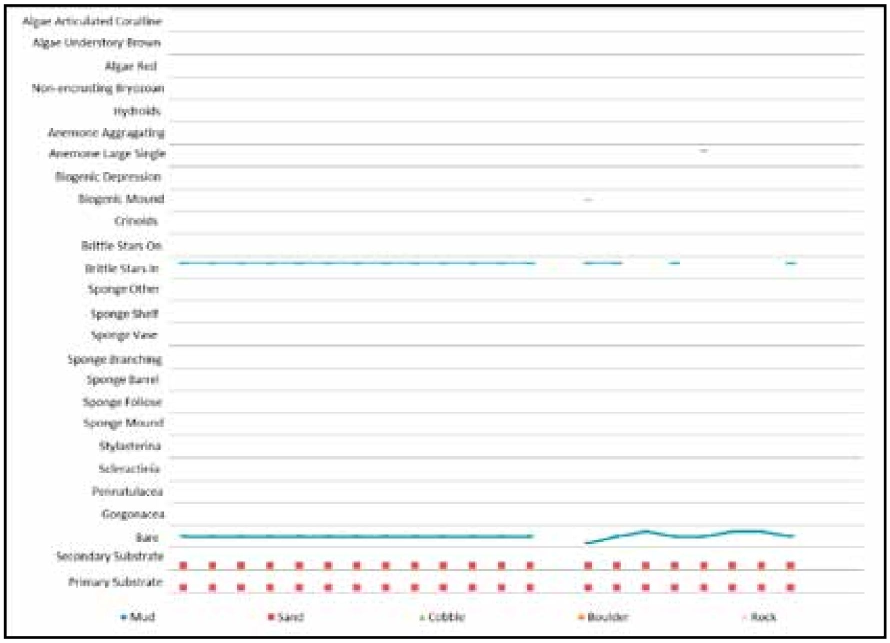


Figure 165: TDP of substrate and biogenic habitat for Shale Beds, Dive 5 (9/2/10)

Corals

THERE WERE ONLY TWO OBSERVATIONS OF CORALS AT THIS DIVE BOTH OF THE SAME ORDER *PENNATULACEA*.

Figure 166: Sea pens (*Pennatulacea*) were the only observed coral order at Shale Beds, Dive 5 (9/2/10)

Sponges

NO SPONGES WERE OBSERVED ON THIS DIVE.

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

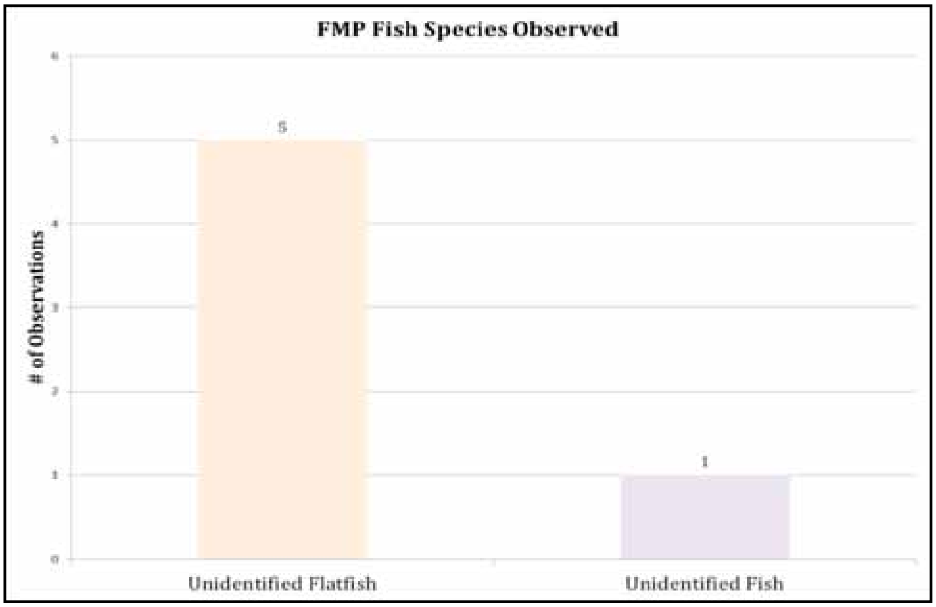


Figure 167: FMP fish species observed at Shale Beds, Dive 5 (9/2/10)

Figure 168: Unidentified flatfish were the most commonly observed species at Shale Beds, Dive 5

APPENDIX C - HALIBUT TRAWL GROUNDS

Halibut Trawl Grounds, Dive 2 (9/1/10)

Dive Description
Depth range: 35 – 60 meters
GPS start: 36.857862, -121.889961
GPS stop: 36.857862, -121.889961
Start Time (PST): 2:15 pm
Stop Time (PST): 2:52 pm
Total Time: 37 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - Yes

Summary Text

The dive in the Halibut Trawl Grounds on September 1st was characterized by low relief mud habitat (Figure 170 and 171). This dive was characterized by numerous biogenic depressions and mounds creating structure for organisms (Figure 172 and 173). The TDP shows that other biogenic habitats occurred but not as the primary component of the habitat within the frame of view (Figure 174).

Sea whips (*Gorgonacea*) were the most common coral order observed on this dive (Figure 175 and 176). There were no sponges observed on this dive.

No fish were identified to level of species; however, there was one flatfish identified to level of genus (Figure 177 and 178), and observations of combfish (*Zaniolepis*) determined to belong in the species of Longspine Combfish (*Zaniolepis latipinnis*) (Figure 169).

Figure 169: (Left) Combfish (*Zaniolepis*), (Right) Longspine Combfish (*Zaniolepis latipinnis*)

Physical Habitat

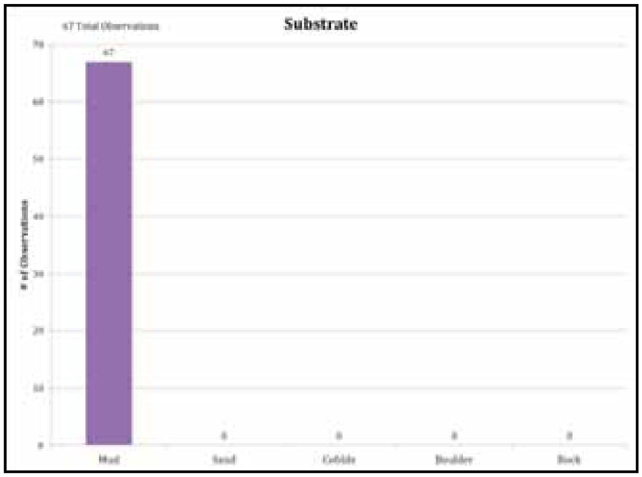


Figure 170: Number of observations of primary substrate from Halibut Trawl Grounds, Dive 2

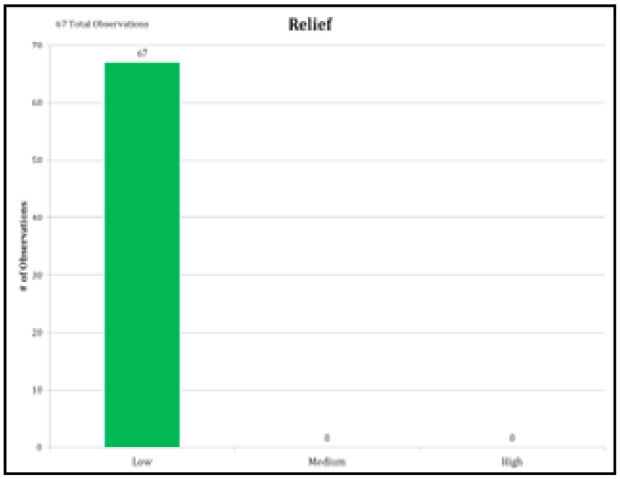


Figure 171: Number of observations of primary relief from Halibut Trawl Grounds, Dive 2 (9/1/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

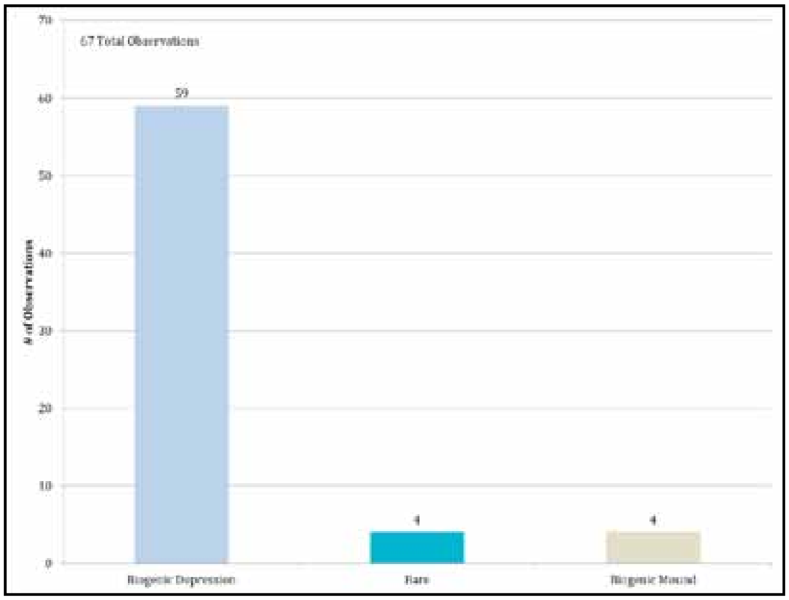


Figure 172: Number of observations of primary biogenic habitat category from Halibut Trawl Grounds, Dive 2 (9/1/10)

Figure 173: Biogenic depressions were the most commonly observed biogenic habitat

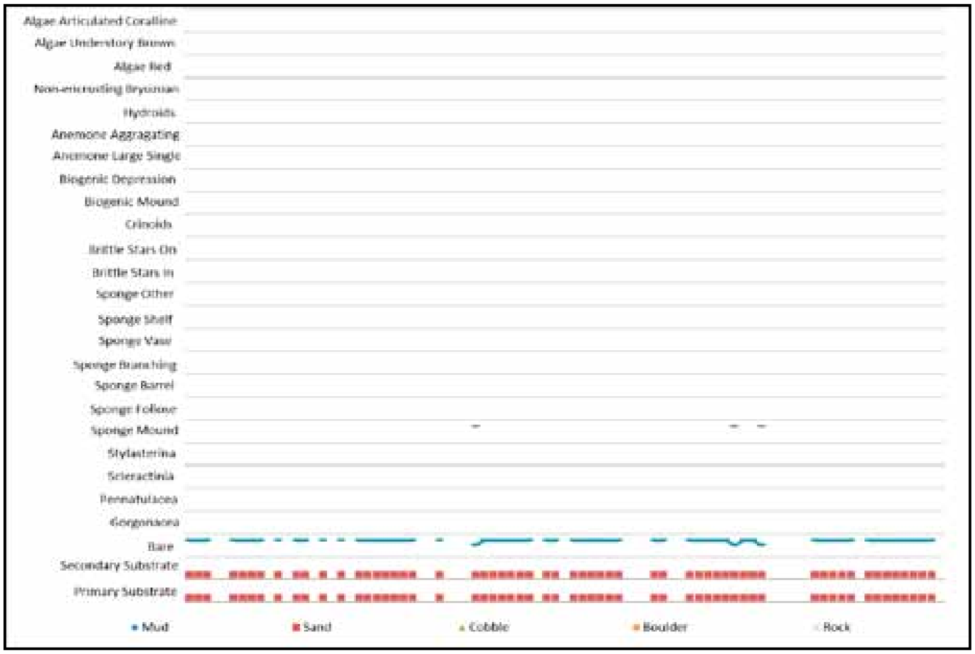


Figure 174: TDP of substrate and biogenic habitat for Halibut Trawl Grounds, Dive 2 (9/1/10)

Corals

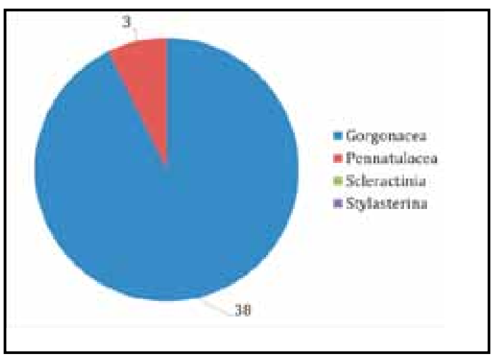


Figure 175: Proportion of corals observed at Halibut Trawl Grounds, Dive 2 (9/1/10)

Figure 176: Sea whips (Gorgonacea) were the most commonly observed coral order at Halibut Trawl Grounds, Dive 2 (9/1/10)

Sponges

NO SPONGES WERE OBSERVED ON THIS DIVE.

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

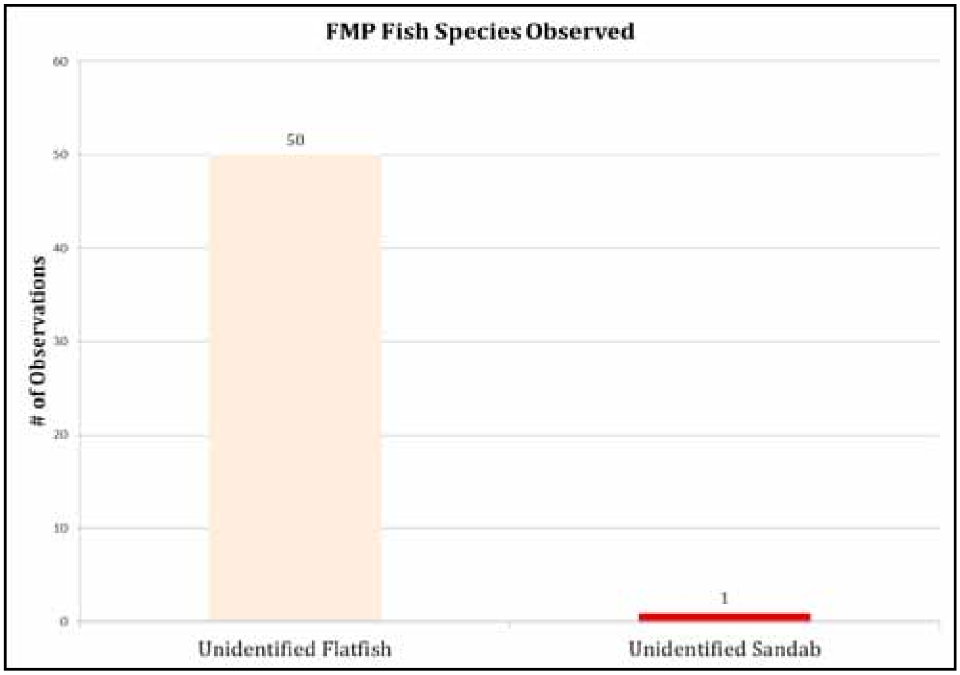
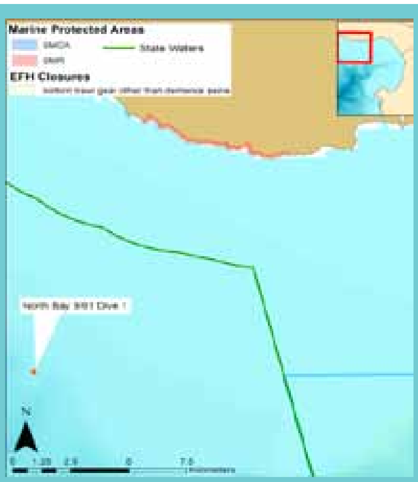


Figure 177: FMP fish species observed at Halibut Trawl Grounds, Dive 2 (9/1/10)

Figure 178: Unidentified flatfish was the most commonly observed species at Halibut Trawl Grounds, Dive 2 (9/1/10)

APPENDIX C - NORTH BAY

North Bay, Dive 1 (9/1/10)



Dive Description
Depth range: 182 - 189
GPS start: 36.852486, -122.181555
GPS stop: 36.852529, -122.181873
Start Time (PST): 9:05 am
Stop Time (PST): 10:00am
Total Time: 55 minutes 30 seconds

Management Status
MLPA – No
EFH Conservation Area – No
State Water Trawl Closure - No

Summary Text

The dive on September 1st in the North Bay of Monterey Bay was characterized by low relief sand habitat (Figures 180 and 181). The physical structure was primarily bare of biogenic habitat (Figure 182 and 183), and this dive occurred over low relief sand habitat with a few observations of sponge mounds (Figure 184).

There were no corals observed on this dive. The most common sponge observed on this dive were sponge mounds (Figures 185 and 186).

Splitnose/aurora rockfish, stripetail rockfish, Dover sole and rock sole were observed on this dive (Figure 187 and 188). In addition to the FMP fish species, this dive also had occurrences of bearded eelpouts and a compelling image of a rock sole with an urchin (Figure 179).

Figure 179: (Left) Bearded eelpout (*Lyconema barbatum*), (Right) rock sole (*Lepidopsetta bilineata*)

Physical Habitat

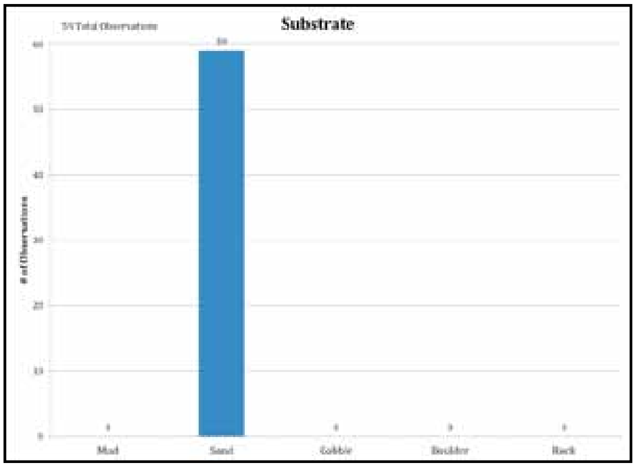


Figure 180: Number of observations of primary substrate from North Bay, Dive 1 (9/1/10)

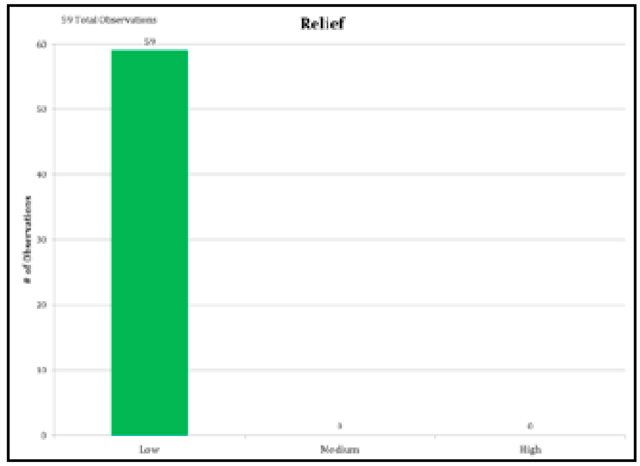


Figure 181: Number of observations of primary relief from North Bay, Dive 1 (9/1/10) (Low relief was categorized from 0-1 meters, medium from 1-2 meters, and high was 2+ meters)

Biogenic Habitat

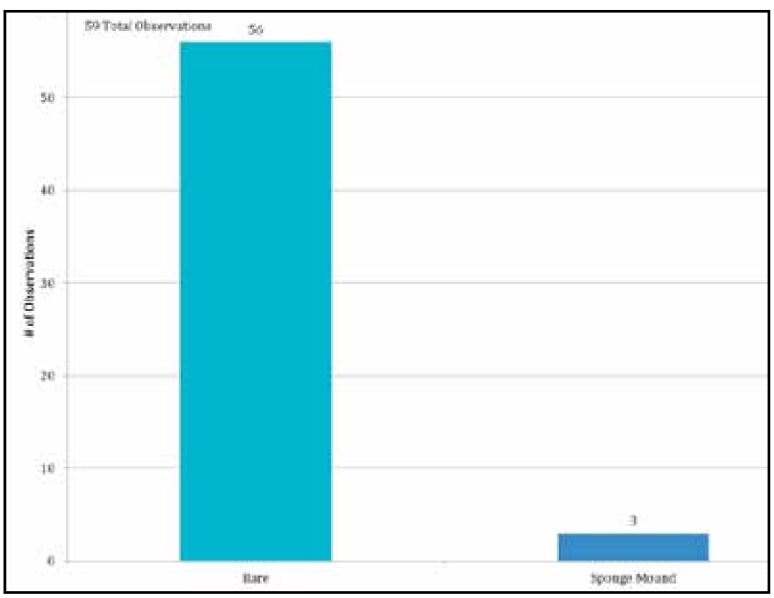


Figure 182: Number of observations of primary biogenic habitat category from North Bay, Dive 1

Figure 183: Bare was the most commonly observed biogenic habitat

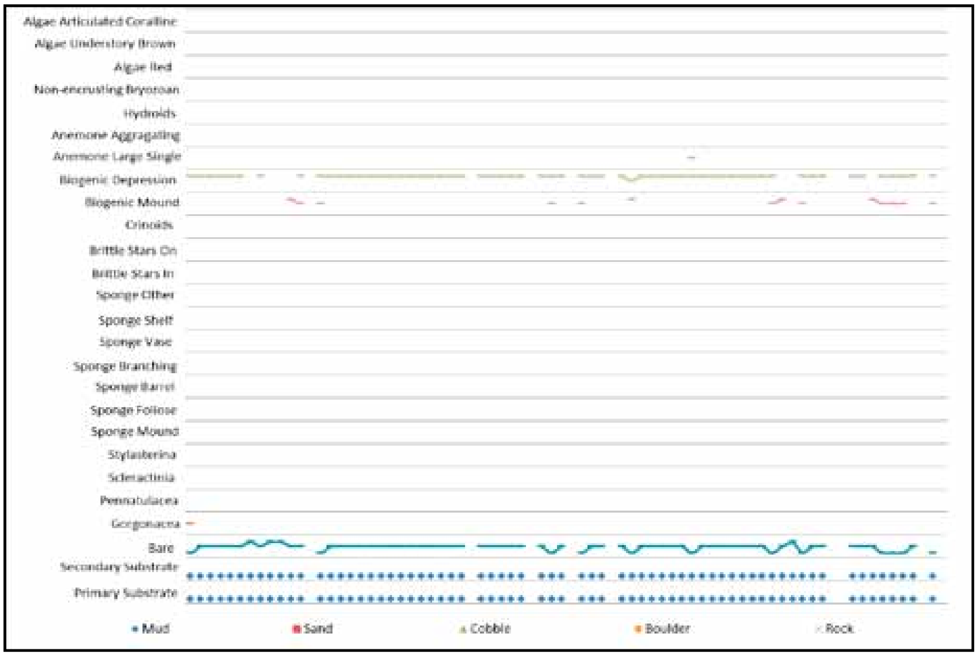


Figure 184: TDP of substrate and biogenic habitat for North Bay, Dive 1 (9/1/10)

Corals

NO CORALS WERE OBSERVED ON THIS DIVE.

Sponges

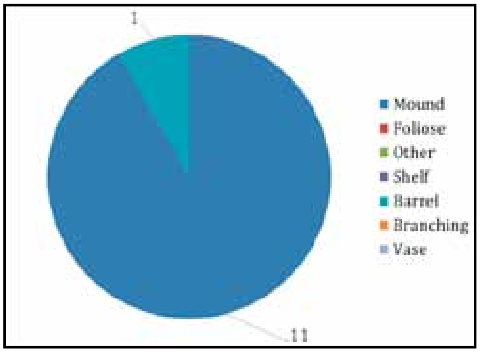


Figure 185: Proportion of sponges observed at North Bay, Dive 1 (9/1/10)

Figure 186: Sponge mounds were the most commonly observed sponge morphology observed at North Bay, Dive 1 (9/1/10)

Fish Species (See Appendix B for a complete list of FMP fish species at this site)

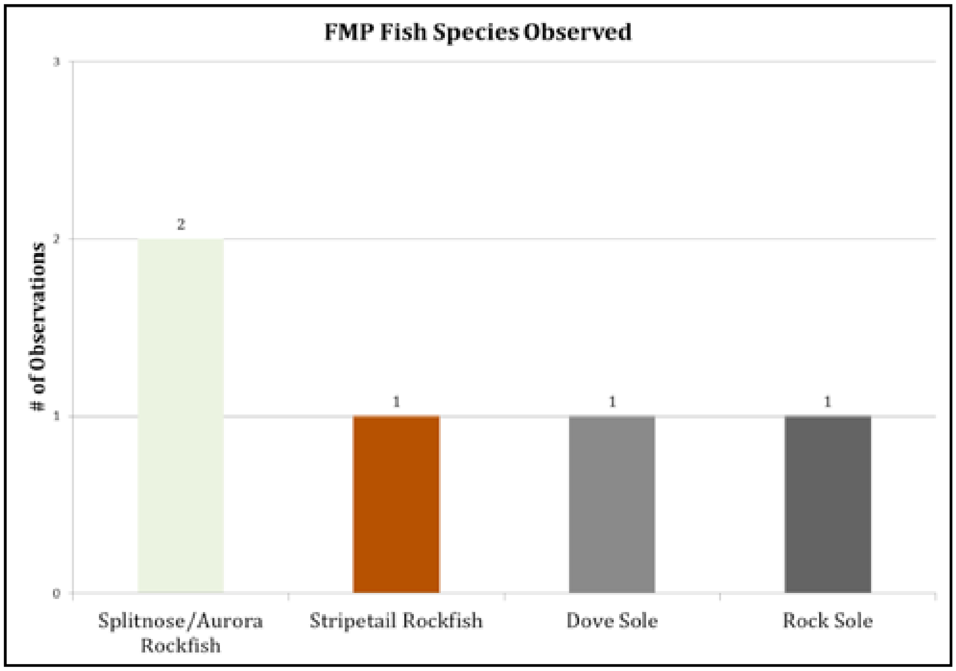


Figure 187: FMP fish species observed at North Bay, Dive 1 (9/1/10)

Figure 188: Splitnose/aurora rockfish (*Sebastes*) were the most commonly observed species at North Bay, Dive 1 (9/1/10)

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RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES

The Council is in the process of reconsidering the initial allocations of whiting in the trawl catch shares program, in response to the December 22, 2011 District Court Judge Thelton E. Henderson decision in the case C10-4829-TEH: Pacific Dawn, LLC, et al. v. John Bryson, et al., referred to here as the Pacific Dawn litigation, including the February 21, 2012 Court Order on Remedy (see full March Council meeting reference materials, including public comment at http://www.pcouncil.org/resources/archives/briefing-books/march-2012-briefing-book/#groundfish). This order remands "for further consideration" the regulations addressing the initial allocation of whiting for the shoreside individual quota fishery and the at-sea mothership fishery. In response, the Council adopted a three-meeting process to meet the court-ordered deadline (implementation by April 1, 2013). Under that process, in April 2012 the Council adopted a set of alternatives for analysis, in June the Council reviewed analysis and refined alternatives but decided to forgo selection of a preliminary preferred alternative, and at this meeting is scheduled to select a final preferred alternative.

An analysis of the alternatives is provided in the draft environmental assessment (EA) (Agenda Item H.7.a, Attachment 1). In the draft EA please note:

1. Chapter 1 provides a description of the action and the purpose and need. Some initial background information is also provided.
2. Chapter 2 describes the no action alternative (status quo) and four action alternatives. It also includes rationale for excluding some alternatives from further analysis.
2. Chapter 3 provides information on changing conditions in the whiting fishery up through recent years.
3. Chapter 4 provides data indicating how the alternatives will impact initial allocation recipients, processors, communities, etc.
4. Chapter 5 contains a qualitative analysis of the impacts of alternatives as they relate to the Magnuson-Stevens Act, groundfish Fishery Management Plan, and other policy goals and objectives. Each section includes three subsections:
   a. policy guidance related to the topic,
   b. an assessment of how the original allocation provisions affected achievement of the goals and objectives, and
   c. an assessment of the effects of the alternatives on the goals and objectives.

A table with the alternatives under consideration is provided in Section 2.1.3 of Chapter 2 of the draft EA. Policy guidance that the Council should take into account in making its final recommendation is provided in Agenda Item H.7.a, Attachment 2.

A schedule for implementation following Council action is provided as Agenda Item H.7.b, NMFS Report. To facilitate implementation of any changes to the allocation, on August 1 the National Marine Fisheries Service (NMFS) published an emergency rule affecting "the transfer of Quota Share (QS) and Incidental Bycatch Quota (IBQ) between QS accounts in the shorebased individual [individual fishing quota] IFQ fishery, and severability in the mothership fishery, both of which will be delayed until NMFS can implement any necessary new allocation regulations required by the court's order" (FR 77(148): 45508-45512).

A remaining area for Council guidance is the degree to which the divestiture period should be extended. At the start of the trawl rationalization program in 2011, individuals receiving allocations in excess of accumulation limits were given a grace period by the end of which they need to have divested themselves of any amounts of their initial allocations that were in excess of the accumulation limits, or face forfeit of the excess. For QS, a trading moratorium has been in place, originally set to expire at the end of 2012, and divestiture of excesses was to be completed by the end of 2014. For mothership whiting catch history allocations, there was no trading moratorium, and divestiture of excesses was to have been completed by the end of 2012 (however, no permit holder received initial allocations in excess of the mothership catcher vessel accumulation limits). Given the whiting reallocation under consideration, the decision to extend the QS trading moratorium into 2013 in order to facilitate whiting QS reallocation, and the possibility that recipients of mothership sector catch history allocations could receive amounts in excess of accumulation limits under the revised initial allocation, in June the Council agreed in principle that an extension of the divestiture period would be warranted. The question before the Council is how long the divestiture periods should be extended.

Council Action:

1. **Identify final preferred alternatives for the time periods used for initial whiting catch share allocations.**
2. **Provide recommendation on extension of the divestiture period and other guidance, as needed.**

Reference Materials:

1. Agenda Item H.7.a, Attachment 1: Reconsideration of Initial Catch Share Allocations in the Mothership and Shoreside Pacific Whiting Fisheries, Draft Environmental Assessment.
2. Agenda Item H.7.a, Attachment 2: Guidance For Making Allocation Decisions.
3. Agenda Item H.7.b, NMFS Report: A Draft Rulemaking Schedule for the Reconsideration of Allocation of Whiting for the Shoreside and Mothership Sectors of the Trawl Rationalization Program.
4. Agenda Item H.7.c, Public Comment.

Agenda Order:

a. Agenda Item Overview — Jim Seger
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Select final preferred alternative and provide other guidance, as needed.

PFMC
08/24/12
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RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES,

DRAFT ENVIRONMENTAL ASSESSMENT

Overview of this Document and Changes Since June Draft

Chapter 1. Proposed Action and Purpose and Need together with some initial background information.

Chapter 2. Description of alternative. Includes discussion of corresponding regulatory changes needed and alternatives considered but rejected from further analysis.

Primary changes since June draft:

- Revised processor recent participation period of Alternative 3.
- Specified that the same time period will be used for shoreside and mothership catcher vessel allocation formulas.
- Added Table 2-1 (page 20) summarizing the alternatives and corresponding processor recent participation requirements.
- Added diagram indicating which segments of the allocation are affected.

Chapter 3. Information describing the whiting fishery and communities. Focuses on changing conditions on the whiting fishery, particularly after 2003.

Primary changes since June draft:

- Added biological information, including information on geographic migrations and distribution of whiting.
- Incorporated supplemental materials from June Council meeting
- Provided information on fishing areas accessed out of each port.
- Expanded list of historic events in fishery.
- Provided indicators of changing capacity in the fleet (including fleet maximum harvest rates and season length)
- Included additional information on global markets
- Provided information on activities of permits which appear to have left the whiting fisheries after 2003.
- Provided information on permits transfers occurring after 2003 (see Agenda Item H.7.a, Supplemental Attachment 3).
- Added information on dependence for permits, processors and communities (also in Chapter 4).

Chapter 4. Includes some basic quantitative estimates of the allocational impacts of the alternatives.

Primary changes since June draft:

- Incorporated supplemental materials from June Council meeting
- Added discussion of potential for redistribution of effort to different ocean harvest areas and information on fishing grounds accessed by shoreside sector catcher vessels out of each port.
- Added designations to figures on permit history and allocations to indicate whether permits were associated with AFA vessels.
- Added information on allocations relative to levels of dependence.
- Added information on allocational shifts between permits associated and not associated with AFA and Amendment 15 vessels.
- Added figures on the combined shoreside and mothership allocations.
- Added information on shoreside processor dependence and involvement in the fishery.
- Provided information on permits increasing and decreasing their share of fleet harvest after 2003.
- Provided projections of potential impact on mothership processors resulting from allocation to mothership endorsed catcher vessel permits (based on the processors to which permits were tied in 2011 and 2012).
- Added information on distribution of quota based on permit owners address of record.
- New section discussing cumulative impacts.

Chapter 5. Contains primarily qualitative analysis framed around the management goals and objectives. The sections on each topic are divided into subsections which cover

a. policy guidance related to the topic,
b. an assessment of how the original provisions affected achievement of the goals and objectives, and
c. an assessment of the effects of the alternatives on the goals and objectives.

Primary changes since June draft:

Completed sections on Sector Health, Labor, and Communities

Appendix (new). Amendment 20 EIS Discussion of Rationale for Allocation Periods

Excerpts from the Final Amendment 20 EIS.

Appendix (new). Current Deliberations

Transcripts of public testimony from June and September 2012 Council meetings **(to be added after Council meeting).**

RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES

DRAFT ENVIRONMENTAL ASSESSMENT

PREPARED BY

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CHAPTER 1 INTRODUCTION

1.1 How This Document is Organized

1.2 Proposed Action

The proposed action is to consider modifying the time period used for determining initial allocations of Pacific whiting made to catcher vessels and shoreside processors participating in the Pacific whiting shoreside and mothership sectors of the Pacific Coast Groundfish fishery. The allocations were based upon each catcher vessel permit's historical whiting trips or each shoreside processor's history of whiting deliveries received, as specified in the Amendment 20 trawl rationalization program.

No other regulations will be reconsidered or altered in relation to this proposed action except as necessary to maintain the intent and purpose of other provisions of the program. This includes the intent that QS for bycatch species be allocated for whiting in proportion to the whiting QS allocation.

1.3 Purpose and Need

The purpose of the proposed action is to provide allocations of quota and catch history for Pacific whiting shoreside and mothership sectors based on time periods that are consistent with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), other applicable law, and the goals and objectives of the Pacific Coast Groundfish Fishery Management Plan, including Amendment 20 to that plan (the trawl rationalization program).

The need is to reconsider the time period used to determine initial allocations for Pacific whiting shoreside and mothership sectors of the Pacific Coast Groundfish fishery by including in the consideration years after 2003. The need for this proposed action is driven by the court order in Pacific Dawn v Bryson which remanded the regulations addressing the initial allocation of whiting. The court found that the previous decision on this issue failed to adequately consider history beyond 2003 for harvesters and 2004 for processors. Absent this reconsideration, there is a high likelihood that current regulations would be vacated, and there would be a return to the seasonal-based management of whiting harvest that was in place prior to implementation of the trawl rationalization program. Seasonal-based management entails fishermen racing to catch fish prior to the closure of the season. Such seasonal management has numerous adverse biological, social, and economic consequences, including the potential for higher mortality of overfished and endangered salmon species, decreased safety, higher harvest costs, and lower product quality.

1.4 Background

[Add context of Council decision to implement trawl rationalization and rationale for Council's original action – everything cited in the Council discussion.]

In January 2011, NMFS implemented the trawl rationalization program for the Pacific coast groundfish fishery's trawl fleet (see 75 FR 78344; Dec. 15, 2010). The program was adopted through Amendment 20 to the Pacific Coast Groundfish Fishery Management Plan (FMP) and consists of an IFQ program for the shoreside trawl fleet (including whiting and non-whiting fisheries); and cooperative (coop) programs for the at-sea mothership (MS) and catcher/processor (C/P) trawl fleets (whiting only). Allocations to the limited entry trawl fleet for certain species were developed under Amendment 21 to the FMP, also implemented in 2011.

These rules became the subject of litigation, in Pacific Dawn, LLC v. Bryson, No. C10-4829 TEH (N.D. Cal.). The plaintiffs, fishing vessel owners and fishing processers represented by the named party, Pacific Dawn, LLC, challenged several aspects of the rules, but in particular the initial allocation of whiting QS in the shoreside IFQ and mothership fisheries. Following a decision on summary judgment that NMFS had not considered recent data in setting its initial whiting allocations, on February 21, 2012, Judge Henderson issued an order remanding the regulations setting the initial allocation of whiting for the shoreside IFQ fishery and the at-sea mothership fishery "for further consideration" consistent with the court's December 22, 2011 summary judgment ruling, the Magnuson-Stevens Act (MSA), and all other governing law. The Order also requires NMFS to implement revised regulations setting the quota before the 2013 Pacific whiting fishing season begins on April 1, 2013.

On February 29, 2012, NMFS informed the Pacific Fishery Management Council (Council) of the order issued in Pacific Dawn, LLC v. Bryson. NMFS also requested that the Council initiate the reconsideration of the initial allocations for QS of whiting in the shoreside IFQ fishery and for whiting catch history assignments in the at-sea mothership fishery. NMFS requested the Council schedule this issue to be discussed at its April, June, and September 2012 meetings. NMFS also stated that a rulemaking was needed to delay or revise portions of the existing regulations setting these allocations while the Council and NMFS reconsidered the initial allocation of whiting, and informed the Council of its intent to publish an Advance Notice of Proposed Rulemaking (ANPR) on that reconsideration.

At the Council's March 2012 meeting, the Council added reconsideration of the allocation of whiting to the agenda for its April, June and September 2012 meetings. At the Council's April meeting, the Council adopted a range of alternatives for analysis. The Council will review a draft analysis of the alternatives and select a preliminary preferred alternative at its June meeting. At its September meeting, the Council will choose a final preferred alternative and make a recommendation to NMFS.

NMFS published an ANPR on April 4, 2012 (77 FR 20337) that, among other things, announced the court's order, the Council meetings that would be addressing the whiting reconsideration, and NMFS' plan to publish two rulemakings in response to the court order. These two rulemakings are referred to as Reconsideration of Allocation of Whiting, Rules 1 and 2 (RAW 1 and RAW 2, respectively). NMFS is using emergency action authority under the MSA 305(c)(1) for RAW 1;

RAW 2 will go through the standard FMP Council process followed by a proposed and final rule. The first rulemaking, RAW 1, which is the subject of this proposed rule, would delay or revise several portions of the regulations while NMFS and the Council reconsider the initial allocation of whiting, and until NMFS implements any necessary new regulations in response to the court order. The second rulemaking, RAW 2, would take in to account the Council's September 2012 recommendation and reconsideration of the dates used for initial allocation of whiting for the shoreside IFQ and at-sea mothership fisheries. The proposed rule for RAW 2 is scheduled to publish in November 2012, and the final rule in March 2013. The RAW 2 rule is scheduled to be effective by April 1, 2013, consistent with the court order.

1.5 Council and Agency Scoping

Include tables listing all actions (and meetings) taken to develop the program and this amendment.

CHAPTER 2 DESCRIPTION OF ALTERNATIVES

2.1 Alternatives

There are four action alternatives under consideration in addition to the No Action alternative for this proposed action. *Unless a change is included as part of an alternative, all other aspects of the trawl rationalization program, including the initial allocation provisions would remain in place* (e.g. provisions specifying that that "relative history" will be used in the allocation formula and that a permit's two worst years will be dropped from the calculation. The alternatives are as follows.

2.1.1 No Action Alternative

Under the Amendment 20 IFQ program for the shoreside fishery, 80 percent of the whiting QS was allocated among permits and 20 percent among processors that meet recent participation requirements. For the mothership sector, 100 percent of the catch history assignments went to qualified catcher vessel permits. A portion of the whiting QS allocated among permits was allocated based on landings history on whiting trips from 1994 through 2003 (CFR 660.140(d)(8)(iv)(C)(2)); all of the whiting QS allocated among qualified processors was allocated based on whiting deliveries received from 1998 through 2004 (CFR 660.140(d)(8)(iv)(G)); and all of the mothership catch history assignments made to catcher vessel permits were allocated based on whiting deliveries made from 1994 through 2003 (CFR 660.150(g)(6)(iii)(B)) .

Portion of the Shoreside QS Allocated to Catcher Vessels Based on Permit History for Whiting Trips: Of the 80 percent of the whiting QS allocated among permits, 99.9 percent was allocated based on landings history in the primary whiting fishery with the remainder (0.1 percent) allocated based on whiting landings outside the primary whiting fishery. Of the 99.9 percent, 7.2 percent was allocated equally among all permits (an amount equivalent to the share of primary whiting fishery landings history associated with the permits that were retired in the 2003 buyback program), and the remainder (92.8 percent) was allocated among permits based on each permit's landings history of whiting on whiting targeted trips. The period used to allocate the 92.8 percent of whiting QS allocated for landings on whiting trips was 1994 through 2003.

2.1.2 Action Alternatives

The action alternatives (Alternatives 1-4) being considered would change which years are included in the landings history-based portion of the allocation formula applied to whiting trips for limited entry permits (CFR 660.140(d)(8)(iv)(C)(2) and CFR 660.150(g)(6)(iii)(B)) and the allocation formula for whiting deliveries for processors (CFR 660.140(d)(8)(iv)(G)). Alternative 1 changes the end year from 2004 to 2003 for the shoreside whiting processors, making it the same as for the other two allocation groups under No Action. Alternatives 2 and 3 change the end year for all three allocation groups to 2007 and 2010, respectively. Alternative 4 changes the initial year to 2000 and the end year to 2010 for all three allocation groups.

The alternatives for the allocation periods, including the No Action alternative, are as follows.

Initial Allocation Group	Years Used for History Based Allocation for Whiting Trips				
	Alternatives				
	No Action	Alt 1: thru '03	Alt 2: thru '07	Alt 3: thru '10	Alt 4: thru '10
Catcher Vessel Permits – Shoreside History	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010
Whiting Processors – Shoreside History	1998-2004	1998-2003	1998-2007	1998-2010	2000-2010
Catcher Vessel Permits – Mothership History	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010

Corresponding Adjustments to the Amendment 20 Trawl Rationalization Program

If an action alternative is selected (Alternatives 1 through 4), the following additional adjustments to the quota share distributions and existing regulations would need to be made to implement a change in the whiting trip allocation period and whiting QS distributions while being consistent with the purposes of the program.

Redistribution of Nonwhiting Species QS: In addition to the redistribution of whiting QS, the portion of the nonwhiting species QS that is allocated to LE permit holders in proportion to their whiting QS allocated for whiting trips would be redistributed among QS accounts to maintain pro rata proportions, e.g., if an account receives 1 percent of the whiting QS allocated for whiting trips then the permit will also receive 1 percent of the widow rockfish QS that is allocated pro-rata for whiting trips (CFR 660.140(d)(8)(iv)(C)(2).[1] Allocations of nonwhiting species were not made to shoreside processors nor to permits in the mothership sector co-op program.[2]

The following portions of the initial allocations would not be affected by this action.

- The portion of the initial QS allocation distributed based on trips that were not targeting on whiting.
- The portion of the initial QS allocation that was distributed equally among all permits.

QS accounts for which the landings-based portion of the allocation was based entirely on nonwhiting trips would not be affected by this action (i.e. QS accounts created for permits associated with vessels that did not target on whiting). For those QS accounts receiving an initial allocation based on both whiting and nonwhiting trips, the portion of the allocation based on nonwhiting trips would not be affected and the portion of the allocation for whiting trips that was allocated equally among all permits would also not be affected.

[1] The amount to be allocated on a prorata basis is 100 percent, minus the amount allocated for nonwhiting permits, minus the amount allocated equally.
[2] The mothership sector as a whole is limited by sector set-asides for nonwhiting species.

Processor Recent Participation: If the allocation period is extended, the regulatory language on the "recent participation requirement" for processors would also be adjusted (Council, 2010). The recent participation requirement in the regulations is: "received deliveries of at least 1 mt of whiting from whiting trips in each of any two years from 1998 through 2004" (CFR 660.140(d)(8)(iv)(G)(1)). Given that this recent participation requirement covered seven years, for each of the above alternatives the recent participation periods would be adjusted to cover the last seven years of the allocation period, with one exception. For the purpose of analysis, the Council is looking at one option that would start the recent participation period seven years before the end of the allocation window but end it just prior to the Council final action on trawl rationalization (a 2004-2007 recent participation period). This option is matched with Alternative 3s 998-2010 allocation period. Thus under Alternative 3, processors entering after 2006 would not qualify for an allocation (entry by 2006 would be required in order to meet the criteria requiring two years of deliveries during the recent participation period) but qualifying processors would receive credit for additional years of deliveries, up through 2010. The recent participation requirement period for processors for each option would be as follows.

Whiting Processors	Adjusted **Recent Participation Requirement** for Each Alternative				
	Alternatives - receive deliveries of at least 1 mt of whiting from whiting trips in any of two years from				
	No Action	Alt 1: thru '03	Alt 2: thru '07	Alt 3: thru '10	Alt 4: thru '10
Allocation Period	1998-2004	1998-2003	1998-2007	1998-2010	2000-2010
Recent Participation Period	1998-2004	1998-2003	2001-2007	2004-2007	2004-2010

Note that because under No Action (1998-2004) the allocation period and the recent participation period for processors are identical, the recent participation period became more of a minimum threshold than a true recent participation requirement. A similar situation applies for Alternative 1, except the recent participation requirement is shortened to six years because the allocation period is only six years.

Mothership Catcher Vessel Whiting Endorsement: Regulatory language would be adjusted so that the 500 mt minimum qualification level would be applied to the final allocation qualification periods. Mothership catcher vessels were required to qualify for a whiting endorsement in order to be allocated a mothership catch history assignment. Qualification for such an endorsement required delivery of a total of 500 mt of whiting to motherships from 1994 through 2003. Whichever allocation period is selected a vessel would be required to have delivered at least 500 mt in that period to qualify for a mothership catcher vessel endorsement and catch history assignment.

Equal Allocation: Regulatory language would be adjusted such that the amount of shoreside QS allocated equally among permits will not change. Currently, the equal allocation element is specified as: "the buyback permit history as a percent of the total fleet history for the allocation period" (CFR 660.140(d)(8)(iv)(B)(2)(i)). The status quo allocation period, and consequently, the period used for determining the equal allocation portion of the QS allocation, is 1994-2003. The buyback program was completed in 2003; therefore, for each year after 2003 the share accounted for by the buyback permits would be zero. Inclusion of years after the buyback period would substantially reduce the portion of QS allocated equally, altering that aspect of the equity balance of the allocation formula. The purpose here is to reconsider only that portion of the allocation on which the allocations specific to individual permit history is based. For this reason, if there is a change from status quo, in order to stay consistent with the original program, the regulations on the amount of QS to be allocated equally would be adjusted to reference the 1994-2003 period instead of "the allocation period." There is no equal allocation component in the allocation formulas for shoreside processors or mothership catcher vessels.

Eligibility for Allocations: The revised allocations would be distributed to QS account owners rather than to limited entry permit owners. Under the existing program, QS allocations were issued to owners of limited entry permits. The initial QS allocations then went into QS accounts which were under the same ownership as the limited entry permits. However since the initial allocation some limited entry permits have traded hands while the QS accounts have remained under the same ownership (due to the prohibition on QS trading[3]). Therefore it would be necessary to adjust regualtions to specify that for QS that is reallocated, the reallocation would go to the existing QS accounts based on the history of the permits that originally generated those accounts. This change would not affect the allocation of whiting QS to processors or the allocation of catch history to mothership catcher vessel permits.

In sum:

1. For eligible harvesters, QS accounts were originally established for limited entry permits but those limited entry permits may no longer be associated with the QS accounts, therefore the allocations will instead go to the QS accounts based on the history of the permit that generated the account.
2. For processors, the QS accounts were established for companies with processing history and those accounts are still associated with those same companies.
3. For mothership catcher vessels, catch history was assigned to the permits and is still associated with those same permits since implementation of provisions which would allow mothership sector catch history to be transferred separately from the permit has been delayed pending resolution of action on whiting QS reallocation.

2.1.3 Summary of Alternatives Adopted for Analysis and Allocations Affected

Table 2-1 summarizes the alternatives adopted by the Council for analysis. The Council also tentatively decided that the allocation periods for the mothership history should match the allocation period used for the shoreside history.

[3] The moratorium on QS trading was set to expire at the end of 2012 but has been extended to accommodate reallocation of QS for whiting trips.

Table 2-1. Alternatives adopted for analysis (June 2012).

Initial Allocation Group	Years Used for History Based Allocation for Whiting Trips				
	Alternatives				
	No Action	Alt 1: thru '03	Alt 2: thru '07	Alt 3: thru '10	Alt 4: thru '10
Catcher Vessel Permits – Shoreside History	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010
Whiting Processors – Shoreside History	1998-2004	1998-2003	1998-2007	1998-2010	2000-2010
– Corresponding Processor Recent Participation Period[a/]	1998-2004	1998-2003	2001-2007	2004-2007	2004-2010
Catcher Vessel Permits – Mothership History b/	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010

a/ Processor Recent Participation Requirement: 1 mt of deliveries required in each of two years during the recent participation period
b/ Permits are required to land at least 500 mt in total during the indicated allocation period in order to qualify for an whiting endorsement and catch history allocation.

With respect to the whiting quota shares (QS), changing the rellocation period would only affect certain parts of the initial whiting QS allocation, that portion allocated based on catch history. As a consequence of the change in the whiting QS allocations, the portion of the nonwhiting QS distributed to cover bycatch on whiting trips would be reallocated as well. Nonwhiting QS to cover bycatch on whiting trips was allocated proportionally to the whiting QS. Processors were not provided with an initial allocation of nonwhiting species.

The following figure provides a flow chart showing the steps by which QS is distributed to groups and allocated among initial recipients. The steps affected by a change in the allocation period for whiting are identified with shading. The steps in which the allocation period directly affects the calculation are shown with a bold border. The end result for each group of recipients and species group is indicated by a round edged box.

The 20% whiting QS allocated to processors (Box 1 in the figure) may be reallocated among shoreside processors with a change in the processor allocation period. Of the 80% whiting QS allocated among permits, 0.01% goes to cover whiting bycatch on nonwhiting trips and 99.9% goes to cover whiting on whiting directed trips. Taking 99.9% of that 80% yields the 79.92% of the total whiting QS to be allocated for whiting directed trips (Box 2.2). Of this 79.92%, 7.2% is allocated equally among all permits and 92.8% allocated based on a permit's whiting history. Taking 92.8% of that 79.92% yields the 74.17% of the total whiting QS which may be subject to reallocation with a change in the initial allocation period for permits (Box 2.2.2).

As a consequence of the reallocations of whiting, the nonwhiting QS allocated proportionally to whiting would change (Box 4.1.1). This amount varies by species. The figure uses as an example the 1.8% of the sablefish north QS which is allocated to cover sablefish bycatch on whiting trips.

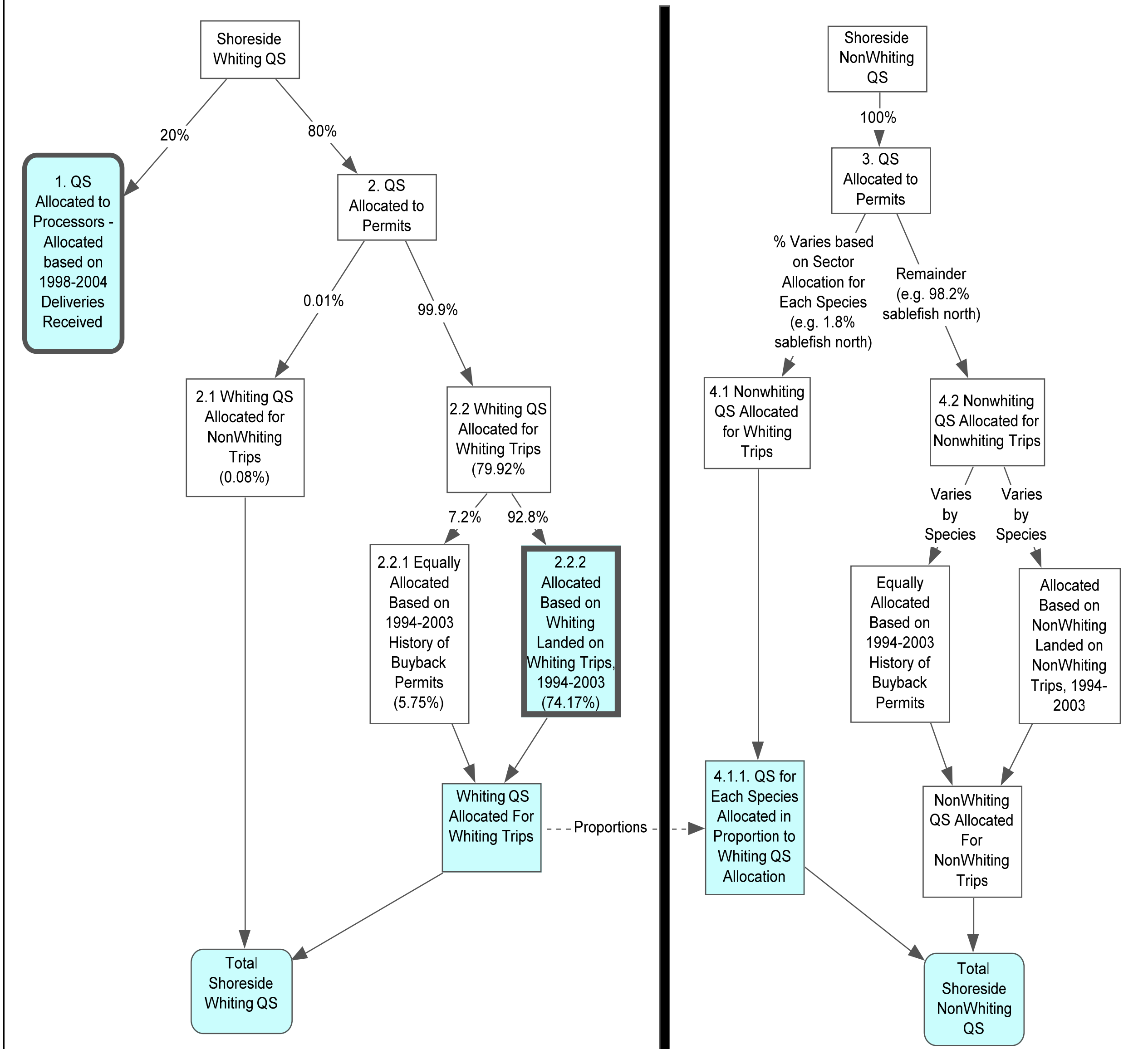


Figure 2-1. Steps in the QS allocation calculations for shoreside whiting QS and nonwhiting QS (heavy boundary boxes indicate the steps in the calculations directly affected by a change in the allocation period, shaded boxes indicate the steps for which calculation results would be affected, and rounded boxes are the final steps in the allocation calculations).

2.1.4 Alternatives Considered But Rejected From Further Analysis

In written comment received at the April 2012 Council meeting, it was suggested that in conjunction with the extension of the ten year allocation period by from five to seven years under certain alternatives, the number of worst years a permit would be allowed to drop from its catch history calculation should be increased from two to four. The drop year provision was provided to account for mechanical breakdowns, major illnesses or other hardships that might temporarily affect a vessel's ability to participate in the fishery. In part, the provision was viewed as an alternative to creating a cumbersome and costly review and appeal process. The provision also provided an opportunity for more recent entrants to accumulate catch history approaching that of longer term participants. The Council felt that not extending the number of drop years would be appropriate because it would accommodate more breakdowns, health problems or other hardships than would be expected for a truly fishery-dependent vessel. The Council further noted that dropping years hurts those participants that showed consistent dependence on the fishery by fishing every year during the allocation period. Additionally, landings history would be attached to the permit rather than to a vessel. Thus disablement of a vessel would not have prevented the owner from transferring the permit onto another vessel in order to maintain involvement in the fishery while repairs or refitting were being completed.

Initially (June 2012), Council staff suggested that the Alternative 3 allocation period for processors (1998-2010) be matched with a 2004-2010 period for the recent participation period requirement. Because Alternative 4 already included a was already a 2004-2010 recent participation period, in order to broaden the analysis the Council asked for analysis of a 2004-2007 recent participation period under Alternative 3.

In written comment received at the April 2012 Council meeting, the following alternative base periods were suggested for consideration: 2001-2010, 2000-2009, and 1999-2008. The Council adopted for consideration a 2000-2010 base period. This alternative split the difference among the alternatives with respect to the initial year for the allocation period and selected 2010 (the most recent year) for the end year of the allocation period. Narrowing the number of alternatives while covering a reasonable range of years was intended to focus the analysis and public discussion. Data in the analysis will show annual participation by permits moving into and out of the fishery, providing a sense of how performance of the alternatives might vary depending on whether the bookend years of the allocation period are changed slightly.

CHAPTER 3 DESCRIPTION OF THE AFFECTED

To allow the Pacific whiting industry to have the opportunity to harvest the full Pacific whiting OY, the nontribal commercial fishery is managed with whiting sector specific bycatch limits for certain overfished species. To date, bycatch limits have been established for darkblotched, canary, and widow rockfish. Regulations provide for the automatic closure of the commercial (nontribal) portion of the Pacific whiting fishery upon attainment of a bycatch limit.

Incidental take of endangered or threatened salmon runs is another concern for the Pacific whiting fishery. Chinook is the salmon species most likely to be affected because of the spatial/temporal overlap between the Pacific whiting fishery and the distribution of Chinook salmon that could result in incidental take of listed salmon. The discussion below is taken from: Final EA on Trailing Actions for Pacific Coast Groundfish Trawl Rationalization Program *(PDF 1.3MB—(October 2011) and from the13-14Spex DEIS (May 2012)*

3.1 Physical Environment, including Habitat and Ecosystem

3.1.1 West Coast Marine Ecosystems

The California Current Ecosystem (CCE) is loosely defined as encompassing most of the U.S. and Canada west coasts, from the northern end of Vancouver Island, British Columbia, to Point Conception, California. The trophic interactions in the CCE are extremely complex, with tremendous fluctuations over years and decades (Mann and Lazier 1996; Parrish, *et al.* 1981). To some degree, food webs are structured around coastal pelagic species (CPS) that exhibit boom-bust cycles over decadal time scales in response to low frequency climate variability (Bakun 1996; Schwartzlose, *et al.* 1999), although this is a broad generalization of the trophic dynamics. Similarly, the top trophic levels of such ecosystems are often dominated by highly migratory species such as salmon, albacore tuna, sooty shearwaters, fur seals and baleen whales, whose dynamics may be partially or wholly driven by processes in entirely different ecosystems, even different hemispheres. For this description of the affected environment, the ecosystem is considered in terms of physical and biological oceanography, climate, biogeography, and essential fish habitat (EFH). A more detailed description of these elements of the environment is found in Council, 2008.

3.1.2 Physical and Biological Oceanography

A divergence in prevailing wind patterns causes the west wind drift (North Pacific Current), when it reaches the North American Continent, to split into two broad coastal currents, the California Current to the south and the Alaska Current to the north. As there are really several dominant currents in the California Current region, all of which vary in geographical location, intensity, and direction with the seasons, this region is often referred to as the California Current

System (Hickey 1979). A more detailed description of the physical and biological oceanography of west coast marine ecosystems can be found in Volume 1 of the 2008 SAFE document (Council, 2008c).

3.1.3 Interannual and Interdecadal Climate Forcing

The effects of climate on the biota of the California Current ecosystem have been recognized for some time (Hubbs, 1948). The El Niño/Southern Oscillation (ENSO) is widely recognized to be the dominant mode of interannual variability in the equatorial Pacific, with impacts throughout the rest of the Pacific basin and the globe (Mann and Lazier 1996). During the negative (El Niño) phase of the ENSO cycle, jet stream winds are typically diverted northward, often resulting in increased exposure of the west coast of the U.S. to subtropical weather systems. The impacts of these events to the coastal ocean generally include reduced upwelling winds, deepening of the thermocline, intrusion of offshore (subtropical) waters, dramatic declines in primary and secondary production, poor recruitment, reduced growth and survival of many resident species (such as salmon and groundfish), and northward extensions in the range of many tropical species (McGowan, *et al.* 1998; Pearcy 2002; Pearcy and Schoener 1987; Wooster, *et al.* 1985). There is reduced availability of many forage species, particularly market squid, and juvenile survival of most rockfish is extremely low. Concurrently, top predators such as seabirds and pinnipeds often exhibit reproductive failure. In addition to interannual variability in ocean conditions, the North Pacific seems to exhibit substantial interdecadal variability, which is referred to as the Pacific (inter) Decadal Oscillation (PDO).

Within the California Current itself, Mendelssohn, *et al.* 2003) described long-term warming trends in the upper 50 to 75 m of the water column. Recent paleoecological studies from marine sediments have indicated that 20th century warming trend in the California Current have exceeded natural variability in ocean temperatures over the last 1,400 years. Statistical analyses of past climate data have improved our understanding of how climate has affected North Pacific ecosystems and associated marine species productivities. Our ability to predict future impacts on the ecosystem stemming from climate forcing events remains poor at best.

3.1.4 Biogeography

Along the U.S. west coast within the California Current system, spatial patterns of biological distribution (Biogeography) have been observed to be influenced by various factors including depth, ocean conditions, and latitude. Each is discussed in Volume 1 of the 2008 groundfish SAFE document (Council 2008c), and is hereby incorporated by reference.

3.1.5 Essential Fish Habitat

EFH has been described within the project area for highly migratory species, CPS, salmon, and groundfish. The MSA defines EFH to mean “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 U.S.C. 1802 sec. 3(10)). Regulatory guidelines elaborate that the words “essential” and “necessary” mean EFH should be sufficient to “support a population adequate to maintain a sustainable fishery and the managed species’ contributions to a healthy ecosystem.” The regulatory guidelines also establish authority for Councils to designate Habitat Areas of Particular Concern (HAPC) based on the vulnerability and ecological value of specific habitat types. Councils are required to minimize, to the extent practicable, the potentially adverse of fishing on EFH and HAPCs. EFH for highly migratory species, CPS, and salmon are discussed in detail in Volume 1 of the 2008 groundfish SAFE document (Council 2008c), which is incorporated herein by reference.

3.1.6 Marine Protected Areas

There are numerous Federal and state-managed MPAs distributed throughout the project area. The EIS for Pacific Coast Groundfish EFH contains a complete analysis of these sites and is incorporated herein by reference.

3.2 Biological Resources

The life history of Pacific whiting affects the degree to which they overlap and interact with other marine resources. The coastal stock of these fish is highly migratory in nature, spawning off southern California and northern Baja California during winter months and migrating north as adult fish during spring and summer months to feeding grounds primarily off Oregon, Washington, and Vancouver Island, Canada (Bailey et al 1982). The larger, older fish tend to migrate farther north. The fish return to their spawning grounds primarily during fall and winter months

The biological resources covered in this subsection include those species that share the same marine environment both temporally and spatially with Pacific whiting (coastal stock), the species under consideration in this assessment. At-sea whiting vessels incidentally catch a variety of species in addition to whiting. By weight, yellowtail rockfish, widow rockfish, dogfish, squid, and mackerel are the species encountered most frequently in the at-sea sectors outside of whiting. When measured as a percentage of the amount of whiting taken, the amount is small. In many years, the bycatch rate is less than 1 percent, while in other years it is between 1 and 2 percent. The fish species of special conservation or allocation concern in this report include canary, darkblotched and widow rockfish, Pacific ocean perch, Pacific salmon, green sturgeon, eulachon, and Pacific halibut. While the weight of these fish is small in comparison to the whiting catch, the impact is important in terms of species protection and recovery and/or fishery allocation objectives.

3.2.1 Groundfish

Section 3.1.1 in the Groundfish Harvest Specifications FEIS' (Council 2011, Council 2012) describes the species and stocks managed under the Groundfish FMP. This information is incorporated by reference and summarized below. More than 90 fish species are managed under the Groundfish FMP: The remaining discussion on Biological Resources is taken from the Council DEIS (2012). Presented below are only those species specifically associated with the whiting fishery.

3.2.1.1 ***Overfished Groundfish***

The most recent stock assessments for overfished groundfish species that are impacted in the Pacific whiting fishery have shown improving recovery trends (measured as a percent of unfished stock) for canary and darkblotched rockfish (from 10 percent for both species to 24 percent and 30.2 percent, respectively) and that widow rockfish has successfully rebuilt (51.1 percent of unfished)). The status trend for POP continues to show very low recovery rate (19.1 percent of unfished), which is substantially below the status objective for all rockfish stocks of 50 percent of unfished population size (NMFS 2012).

3.2.1.2 ***Pacific Whiting (Hake)***

Pacific hake displays the highest degree of recruitment variability of any west coast groundfish stock, resulting in large and rapid changes in stock biomass. This volatility, coupled with a dynamic fishery, which potentially targets strong cohorts, and a biennial rather than annual fishery-independent acoustic survey, will continue to result in highly uncertain estimates of current stock status and even less certain projections of stock trajectory in future stock assessments. The Joint U.S. and Canadian Hake Technical Working Group (JTWG) prepared a new stock assessment for Pacific whiting in 2011 (Stewart, *et al.* 2011a). The spawning biomass at the beginning of 2011 was estimated at 1.87 million mt by the SS model and 2.18 million mt in the TINSS model. The 2011 spawning biomass in both the SS and TINSS models was estimated to be rebounding rapidly based on the strength of the 2005, 2006, and particularly the 2008 year classes.

Pacific hake are seasonally migratory

> ranging from offshore and generally southern waters during the winter spawning season to coastal areas between northern California and northern British Columbia during the spring, summer and fall when the fishery is conducted. In years with warmer water temperatures the stock tends to move farther North during the summer and older hake tend to migrate farther than younger fish in all years. (Stewart, et. al. 2011, p. 5)
>
> The distribution of Pacific hake can vary greatly between years. It appears that northward migration patterns are related to the strength of subsurface flow of the California Current (Agostini et al. 2006) and upwelling conditions (Benson et al. 2002). Distributions of hake backscatter plotted for each acoustic survey since 1995 illustrate the variable spatial patterns among years (Figure [3-]1). The 1998 acoustic survey is notable because it shows an extremely northward occurrence that is thought to be related to the strong 1997-1998 El Nino (Figure [3-] 2). In contrast, the distribution of hake during the 2001 survey was compressed into the lower latitudes off the coast of Oregon and Northern California. In 2003, 2005 and 2007 the distributions generally followed the “normal” coast-wide pattern, but in 2009 and 2011, the majority of the hake distribution was again found in U.S. waters. Pacific hake also tend to migrate farther north as they age. Figure [3-]2 shows the mean location of Pacific hake observed in the acoustic survey by age and year. Age-2 hake are located in the southern portion of their distribution, while older age classes are found in more northerly locations within the same year. The mean locations of Pacific hake age-6 and older tend to be more similar among years than those for the younger ages. With the aging of the strong 1999 year

class causing a reduction in the number of older fish, a more southerly distribution has been observed in recent surveys. (Stewart, et. al. 2011, p. 33)

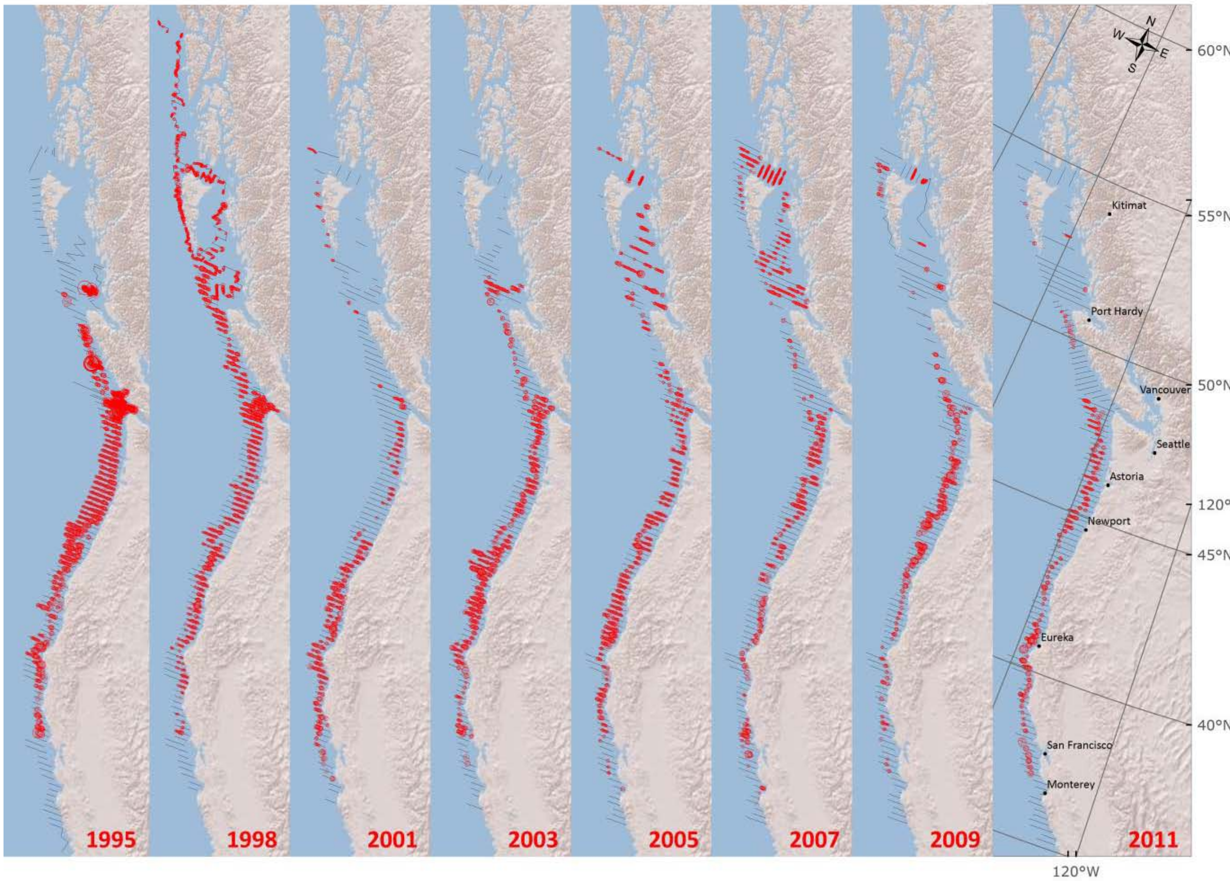


Figure 3-1. Spatial distribution of acoustic backscatter attributable to Pacific hake from joint US-Canada acoustic surveys 1995-2011. Area of the circles is roughly proportional to observed backscatter. (Stewart, *et al.* 2011a).

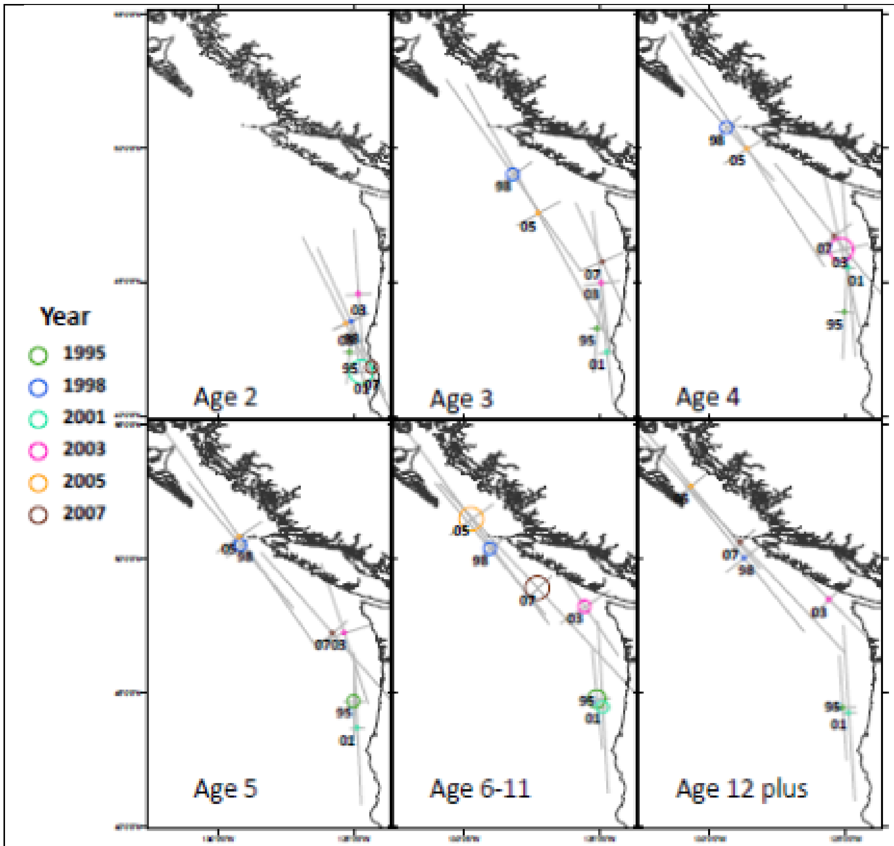


Figure 3-2. The mean spatial location of the hake stock (circles are proportional to biomass) and variance (grey lines) by age group and year based on acoustic survey observations 1995-2007 (Figure courtesy of O'Conner and Haltuch's ongoing Fisheries And The Environment project investigating the links between ocean conditions and Pacific hake distribution) (Stewart, *et al.* 2011a)

3.2.1.3 *Other Groundfish*

Other roundfish species not discussed above are occasionally caught in the at-sea whiting fisheries including yellowtail rockfish, dogfish, lingcod, sablefish, and thornyheads. Except for yellowtail rockfish and dogfish, their numbers are typically very small, but their occurrences are not unusual.

3.2.2 Pacific Halibut

Pacific halibut (*Hippoglossus stenolepis*) belong to a family of flounders called *Pleuronectidae*. Pacific
halibut are managed by the bilateral (U.S./Canada) International IPHC with implementing regulations set by Canada and the U.S. in their own waters. The Pacific Halibut Catch Sharing Plan for waters off Washington, Oregon, and California (Area 2A) specifies IPHC management measures for Pacific halibut on the west coast. Pacific halibut are occasionally caught in the whiting fishery.

3.2.3 Coastal Pelagic Species (CPS)

CPS are taken incidentally in the groundfish fishery, and are believed to be most vulnerable to midwater trawl gear compared to other groundfish gear types. Estimates of total catch in the mothership, catcher/processor, shoreside and tribal whiting fisheries from 2007-2010 ranged from nil for Pacific mackerel in 2009 to 1,226 mt for squid (unidentified) in 2008.

3.2.4 Highly Migratory Species and Salmon

Highly migratory species, such as albacore, are rarely encountered in the at-sea whiting fishery while salmon are not unusual in the catch, especially when trawling during May and June shoreward of the continental slope (PFMC 2008). The major concern with salmon interception has to do with listed species impacts, which are discussed below.

3.3 Protected Species, including ESA, MMPA, and MBTA

A variety of species are protected by applicable law (other than the MSA) with the objective of sustaining or rebuilding their populations from critically depleted levels. The applicability of these laws to the action area is described in Chapter 5. Section 3.3 of the 2011-2012 Groundfish Harvest Specifications FEIS and Section 3.18 and 3.19 (Council, 2011) of the *Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery* FEIS (Council, 2010b) describe protected species in the action area that interact with groundfish fisheries. This information is incorporated by reference and summarized here.

3.3.1 ESA-listed Salmon and Steelhead

Salmon caught in West Coast groundfish fisheries originate in fresh water streams and rivers from Central California to Alaska. NMFS has identified seven ESUs that are mostly likely to be more affected by the groundfish fisheries ranging geographically from the Sacramento River (winter-run) to Puget Sound. (NMFS 2006b))

Salmonids caught in the whiting fishery during 2005-2010 ranged from 2,740 in 2009 to 11,916 in 2005. Chinook were by far those most common salmonid in the whiting fishery catch ranging from 82 percent in 2007 to 99 percent in 2010. (NMFS). Salmon bycatch rates tend to be higher closer to shore and earlier in the season. This may explain the higher bycatch rate for the tribal mothership sector since these vessels fish within the tribal usual and accustomed areas, and have less flexibility to make spatial adjustments in response to salmon bycatch. The shorebased sector, for cost and operational reasons, tends to fish closer to shore. However, no such factors adequately account for inter-annual variation in bycatch. Previous work found no "obvious or consistent correlation" between annual Chinook abundance and bycatch (page 19 in NMFS 2006b). Ocean conditions may play a role, but specific causative factors, at least any that can be used predicatively, cannot be identified.

3.3.2 Green Sturgeon

The southern distinct population segment (DPS) of North American green sturgeon was listed as threatened under the ESA in 2006 (71 FR 17757), and critical habitat was designated in 2009 (74

FR 52300). Green sturgeon bycatch in the at-sea hake fishery was very low, as the At-Sea Hake Observer Program only recorded a total of 3 green sturgeon from 2002-2010.

3.3.3 Eulachon

Eulachon are found in the eastern North Pacific Ocean from northern California to southwest Alaska and into the southeastern Bering Sea. The southern DPS of eulachon was listed as threatened under the ESA in 2010 (75 FR 13012). The eulachon southern DPS is defined from the Mad River in northern California, north to the Skeena River in British Columbia. Eulachon are incidentally caught in the groundfish trawl fisheries. Eulachon appear to be encountered more in the catcher-processor sector of the whiting fishery. The highest eulachon bycatch observed in the whiting fishery was in the summer of 2006 with 145 individuals being caught

3.4 Marine Mammals and Seabirds

3.4.1 Marine Mammals

U.S. West Coast waters support a variety of marine mammals. Approximately 30 species, including seals, sea lions, sea otters, whales, dolphins, and porpoise, occur within the EEZ. Many species seasonally migrate through west coast waters, while others are year-round residents. Two of nine listed marine mammal species that occur in the Council area have a higher probability of encounter in groundfish fisheries: sperm whales (Endangered) and Stellar sea lions (Threatened) (Council, 2012).

Among the marine mammals catches estimated in groundfish trawl fisheries, bycatch estimates have been highest for California sea lions, which were caught primarily in trawl nets in the limited entry trawl (bottom and whiting) (Council, 2012). Steller sea lions were the next highest, which were also caught in trawl nets in the at-sea whiting sectors, the limited entry trawl (bottom trawl and whiting) and California halibut trawl fisheries. Stellar sea lions taken on the west coast are believed to be primarily from the eastern stock (east of 140° west longitude). The majority of elephant seals were taken in the at-sea whiting fisheries (Council, 2012)

3.4.2 Seabirds

The California current system supports a diverse array of seabird species. Species found on the west coast include resident species and transitory species (migrating or foraging). All the California Current system seabirds are highly mobile and require an abundant food source to support their high metabolic rates (Ainley, *et al.* 2005). A total of 10 species or species groups of seabirds were documented to interact with the groundfish fishery during 2002-2009. The at-sea whiting fishery interactions were with blackfooted albatross (0-3 per year), common murre (0-3 per year), northern fulmar (0-to about 50 per year), sooty shearwater (0-8 per year), unspecified tubenose species (0-6 per year) and unspecified alcid species (0-3 per year) (Council 2012).

3.5 Ecosystem considerations

Pacific whiting are an important contributor to ecosystem dynamics in the Eastern Pacific due to their relatively large total biomass and potentially large role as both prey and predator. The role of hake predation in the population dynamics of other groundfish species is likely to be important (Harvey et al. 2008), although difficult to quantify. Hake migrate farther north during the summer during relatively warm water years and their local ecosystem role therefore differs year-to-year depending on environmental conditions. Recent research indicates that hake distributions may be growing more responsive to temperature, and that spawning and juvenile hake may be occurring farther North (Phillips et al. 2007; Ressler et al. 2007). Given long-term climate-change projections and changing distributional patterns, considerable uncertainty exists in any forward projections of stationary stock productivity and dynamics.

3.6 Fisheries

Section 3.2 in the 2013-14 Groundfish Harvest Specifications DEIS describes commercial fisheries targeting groundfish. Associated with that description are a series of tables summarizing landings and ex-vessel revenues in the groundfish fisheries, landings, and revenue by port, and indicators of fishery participation (http://www.pcouncil.org/groundfish/background/document-library/historical-landings-and-revenue-in-groundfish-fisheries/website xxxx). The DEIS, and these associated tables, and data developed by Council staff using PacFIN and NorPac data are the primary sources of information for this Section. The two directly affected sectors by this rule making are the shoreside and mothership sectors so these sectors are discussed in more detail with emphasis on trends in participation. Finally Pacific whiting communities are described.

3.6.1 Management of Pacific Hake

The Pacific whiting fishery almost exclusively catches that species, using midwater trawl gear, although co-occurring overfished species are also caught. The whiting fishery is further subdivided into three components. The shore-based fishery delivers its catch to processing facilities on land, and the vessels are similar in size and configuration (with the exception of the type of net used) to the nonwhiting fishery. In the mothership sector, catcher vessels deliver to floating processors called motherships. The catcher-processor sector comprises vessels that both catch Pacific whiting and process it on board.

The Pacific whiting fishery is managed within the Groundfish Limited Entry Program. This program restricts the number of vessels that may use specified gear types to catch allocated groundfish. Limited entry permits define the groundfish trawl sector (further subdivided between vessels delivering catch shoreside, catcher vessels delivering Pacific whiting to at-sea mothership processors, and at-sea Pacific whiting catcher-processors) and the limited entry fixed gear sector, which uses longline and pot gear, mainly to catch sablefish.

Each sector of the Pacific whiting fishery receives an annual allocation, and the fishery is managed under a primary season structure where vessels harvest Pacific whiting until the sector allocation is reached, and the fishery is closed. Incidental catch of nonwhiting groundfish species in the Pacific whiting fishery, however, is managed under the trip limit structure. Season start dates for each whiting sector are set by regulation, and each sector's fishery proceeds until the whiting quota is reached or the fishery is closed.

To allow the Pacific whiting industry to have the opportunity to harvest the full Pacific whiting OY, the nontribal commercial fishery is managed with whiting sector specific bycatch limits for certain overfished species. To date, bycatch limits have been established for darkblotched rockfish, canary rockfish, and widow rockfish. Regulations provide for the automatic closure of the commercial (nontribal) portion of the Pacific whiting fishery upon attainment of a bycatch limit.

Incidental take of endangered or threatened salmon runs is another concern for the Pacific whiting fishery. Chinook is the salmon species most likely to be affected because of the spatial/temporal overlap between the Pacific whiting fishery and the distribution of Chinook salmon that could result in incidental take of listed salmon. The season start dates are, in part, meant to prohibit fishing when listed Chinook salmon are most likely to be taken incidentally. National Marine Fisheries Service (NMFS) also has the option of closing inshore areas to fishing if too many salmon are caught

Prior to 2011, the primary control rules used were sector allocations of whiting and key bycatch species, season start dates, and limited entry permits. The catcher-processor fishery was managed via an industry sponsored co-op. Under the Trawl Rationalization Program, the catch control rules now include whiting IFQs for the shoreside whiting sector (allocated to both processors and limited entry permit holders), co-ops for the at-sea sectors, catch history endorsements for mothership catcher-vessels, and limited entry permits for the mothership processors. Prior to 2011, the major monitoring methods were video cameras for shoreside sector, and observers on board the mothership processors and catcher-processors. There was no direct monitoring of mothership catcher vessels either by camera or observer. Shorebased processors or landing stations that wish to receive whiting from shoreside whiting trawlers now have to meet certain monitoring requirements including the use of catch monitors who observe the offload of the vessels and double check the accuracy of the fish tickets associated with the offload.

Whiting and bycatch species are allocated to the tribes and commercial sectors. For example, the 2012 fishery harvest guideline (HG) for Pacific whiting is 135,481 mt. This amount was determined by deducting from the total U.S. TAC of 186,037 mt, the 48,556 mt tribal allocation, along with 2,000 mt for research catch and bycatch in non-groundfish fisheries. Regulations at 50 CFR 660.55 (i)(2) allocate the fishery HG among the non-tribal catcher/processor, mothership, and shorebased sectors of the Pacific whiting fishery. The catcher/processor sector is allocated 34 percent (46,064 mt for 2012), the mothership sector is allocated 24 percent (32,515 mt for 2012), and the shorebased sector is allocated 42 percent (56,902 mt for 2012). The 2012 allocations of Pacific Ocean perch, canary rockfish, darkblotched rockfish, and widow rockfish to the whiting fishery were published in a final rule on December 13, 2011 (76 FR 77415).

3.6.1.1 Overview of Major Events Affecting the Whiting Fishery

Major Events Affecting the Whiting Fishery

1976 Passage of the Magnuson-Stevens Act
1982 Pacific Groundfish FMP established
1988 Foreign fishing for Pacific whiting ends
1990 Joint venture fishing for Pacific whiting ends
1992 Limited entry implemented
1994 Tribal treaty rights to groundfish formally recognized.
1997 First year Pacific whiting specifically allocated between sectors
1998 American Fisheries Act passed into legislation
1999 Pacific Ocean Perch declared overfished
2000 Pacific Fishery Management Council Groundfish Fishery Strategic Plan "Transition to Sustainability."; Economic Subcommittee-Scientific and Statistical Committee-Report on Overcapitalization in the West Coast Groundfish Fishery
2000 Canary rockfish declared overfished
2000 Pacific Groundfish Disaster declared
2001 Darkblotched rockfish and widow rockfish declared overfished
2002 Yelloweye rockfish declared overfished
2002 Pacific whiting declared overfished
2003 U.S.–Canada Whiting Agreement signed
2003 Pacific Groundfish Trawl Buyback Program implemented (December)
2004 Advance notice of proposed rulemaking for TIQ program and notice of control date (November 6, 2003) for the Pacific coast groundfish fishery
2004 Pacific whiting no longer considered overfished
2004 Market conditions for Pacific whiting start changing, ex-vessel prices, export prices, and exports of H&G whiting start rising significantly
2007 Shorebased and mothership whiting fisheries closed because of bycatch
2008 Shorebased and mothership whiting fisheries closed because of bycatch
2007 Temporary rules prohibiting any vessel from participating in either the mothership, catcher-processor or shoreside delivery sector of the directed Pacific whiting (whiting) fishery off the West Coast in 2007 if it does not have a history of sector-specific participation in the whiting fishery between January 1, 1997, and January 1, 2007. (Effective May 2007 to May 2008)
2009 Amendment 15 Pacific Whiting Vessel License Limitation implemented
2011 Trawl Rationalization Program implemented
2012 U.S.-Canada Whiting Agreement implemented
2012 Widow rockfish declared rebuilt

This timeline shows the Pacific Fishery Management Council actions to address full utilization, over capacity, and efforts to control capacity. In the 2000 "Strategic Plan", the following capacity reduction recommendations were made:

5. For the limited entry trawl fleet, immediately develop and implement a voluntary permit-stacking program that links each permit with a cumulative period landing limit with the intent to transition to an IFQ program. The first, or base permit should be entitled to a full period landing limit, while each stacked permit should entitle the vessel to additional landing limits ona discounted basis as one alternative. Another alternative is to have the full period landing limit the same for all permits. If Congress continues to prohibit IFQ programs, consider making the permit-stacking program mandatory.

6. To prevent future overcapacity in the whiting fishery, consider developing and implementing a whiting species endorsement that restricts future participation in the whiting fishery to vessels registered to a permit with a whiting endorsement. Qualification for a whiting endorsement should be based on a permit's landings since 1994 when the limited entry program began. Consider setting a threshold quantity of whiting above which a whiting endorsement is required for landing. Individual landings below the the threshold would not require an endorsement.

The Amendment 15 "Purpose and Need for Action" provides the following perspectives:-

In 2006, vessels with no previous participation in the Pacific whiting fishery entered the fishery. Additionally, participation shifts between the whiting sectors occurred in 2006. The increased participation resulted in concern by fishers and managers that more vessels may want to enter the fishery or shift between sectors of the fishery. New entry into the Pacific whiting fishery is likely given the increased whiting ex-vessel prices, increased prices for headed and gutted whiting as well as for fillet products, declining West Coast trawl opportunities due to overfished species rebuilding measures, and declining pollock quotas off of Alaska. Action is needed to restrict new vessels from entering into the fully capitalized Pacific whiting fishery. If fishing capacity increases (becomes further overcapitalized) the intensity of fishing may increase such that fishers strive to catch as much Pacific whiting as possible as quickly as possible (also referred to as a derby fishery or the race for fish). This race constrains the available time for vessels to search for whiting, which can cause fishers to neglect safety and bycatch concerns to which they would otherwise be more attentive. This accelerated race for fish would likely increase the incidental catch of non-whiting species, increase management costs, and decrease the economic returns to historical participants and communities. This action is about prohibiting additional capacity from entering the Pacific whiting fishery in part as result of high quotas, prices, and rationalization of the Alaska fisheries under the AFA and from recent North Pacific Fishery Management Council decisions. In 2004, 217,000 tons of Pacific whiting worth $22 million ex-vessel ($0.046/lb) were harvested and processed through the activities of 26 shorebased catcher vessels, 10 mothership-catcher vessels, 4 motherships, 9 shorebased processors and 6 catcher-processors. In sharp contrast, during 2006, 265,000 tons of whiting worth $36 million ($0.62 per lb) involved 37 catcher-vessels, 20 motherships catcher vessels, 14 shoreside processors, 6 motherships, and 9 catcher processors.

Action is needed to restrict new vessels from entering into the fully capitalized Pacific whiting fishery. If fishing capacity increases (becomes further overcapitalized,) the intensity of fishing may increase such that fishers strive to catch as much Pacific whiting as possible as quickly as possible (also referred to a derby fishery or the race for fish). This race constrains the available time for vessels to search for whiting, which can cause fishers to neglect safety and bycatch concerns they would otherwise be more attentive to. An accelerated race for fish would likely increase the incidental catch of non-whiting species, increase management costs, and decrease the economic returns to historical participants and communities. In an accelerated race for fish, there also would be higher risk of reaching the bycatch limits for the established fisheries earlier in the season before a sector's Pacific whiting allocation were reached. Because all sectors of the commercial fishery are closed when a bycatch limit is reached, without other fishing opportunities there could be short periods in which vessels would be forced to sit idle; at worst, the idle periods would be long, with serious disruption of processing facilities that are already under great economic pressure because of the severe cutbacks in groundfish fisheries over the past 10 years. Most recently, on July 26, 2007, the whiting fishery was closed because of attainment of the 220 mt widow bycatch limit for the fishery. At that time, 76 percent of the208,000 mt available whiting was harvested.

New entry into the whiting fishery is occurring despite the fishery being already greatly overcapitalized, having a limited entry groundfish program in place, being heavily regulated in order to protect overfished species, and undergoing planning efforts to rationalize the fishery either through ITQs, and/or co-ops. In recent years, including 2007, fishing seasons have been shortened or otherwise constrained in order to prevent excess incidental catch of protected salmon and overfished groundfish species. With respect to overfished species, the Council is extremely sensitive to any increased probability of a "disaster" tow—one that could lead to closure of a fishery. For example, in 2004, the bycatch cap on canary was 4.7 mt, but the majority of this catch, 3.9 mt, occurred in a single tow of fish. In the summer of 2007, the fishery was closed before the whiting allocation had been taken because the widow bycatch cap had been reached. In part as a response to these inseason closures, and based on a review of past and recent participation in the fishery, the Council has recommended limiting participation to those 64 shore-based vessels that have sector specific participation between January 1, 1994 and January 1, 2007 and to those 10 catcher/processors that have sector participation in the catcher processor sector between January 1, 1997 and January 1, 2007, 39 mothership-catcher-vessels and the 7 mothership vessels have sector specific participation in the mothership sector- between January 1, 1997 and January 1, 2007. The differences in qualifying periods relate to initial definition of fishing sectors—1997 is the first year that the catcher-processor and mothership sectors were explicitly designed.

3.6.2 Harvests and Economic Trends

3.6.2.1 Pacific Whiting Harvests, Revenues, Prices

The following figures and notes on the figures describe current and historic Pacific whiting harvests, revenues and prices.

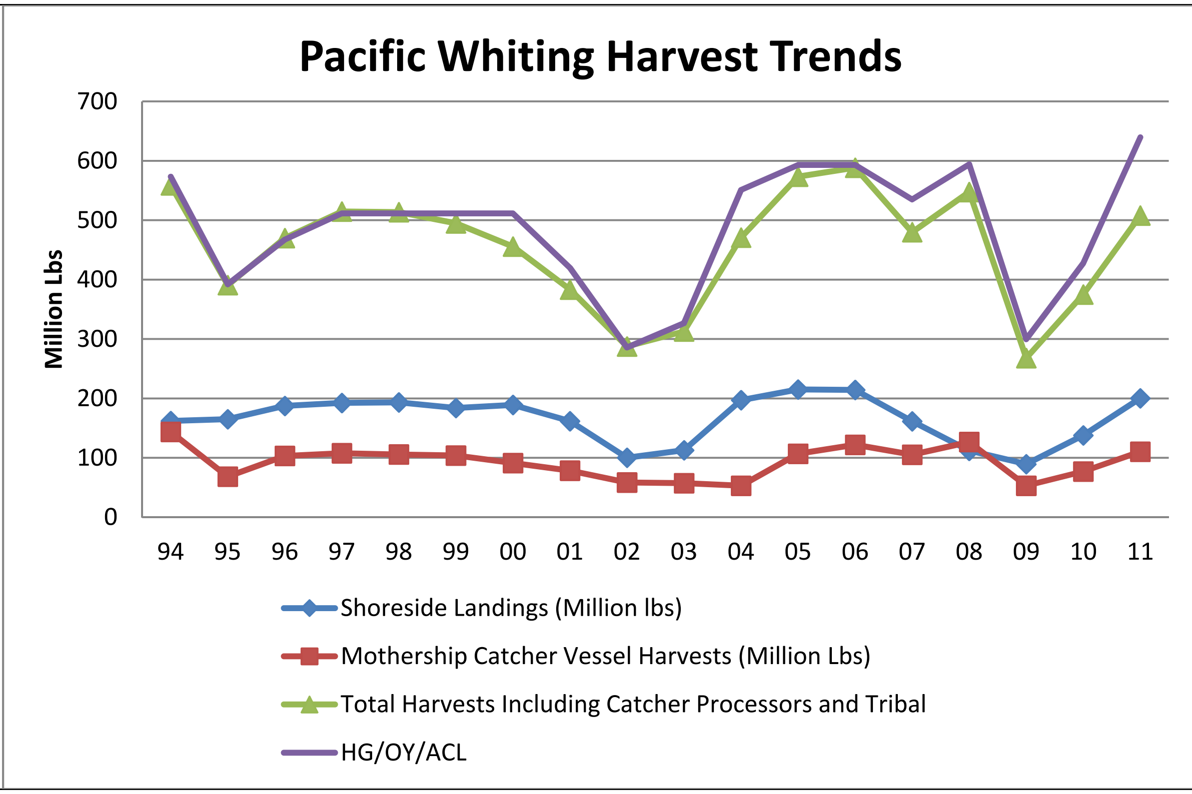


Figure 3-3. Pacific Whiting harvest trends.

Notes and Observations on Whiting Harvests:

- Total whiting harvests have varied over the years.
- Harvests track closely with HG/OY/ACL levels.
- Highest harvests (2006 - 589 million lbs) and lowest harvests (2009 - 268 million lbs) both occurred after 2003.

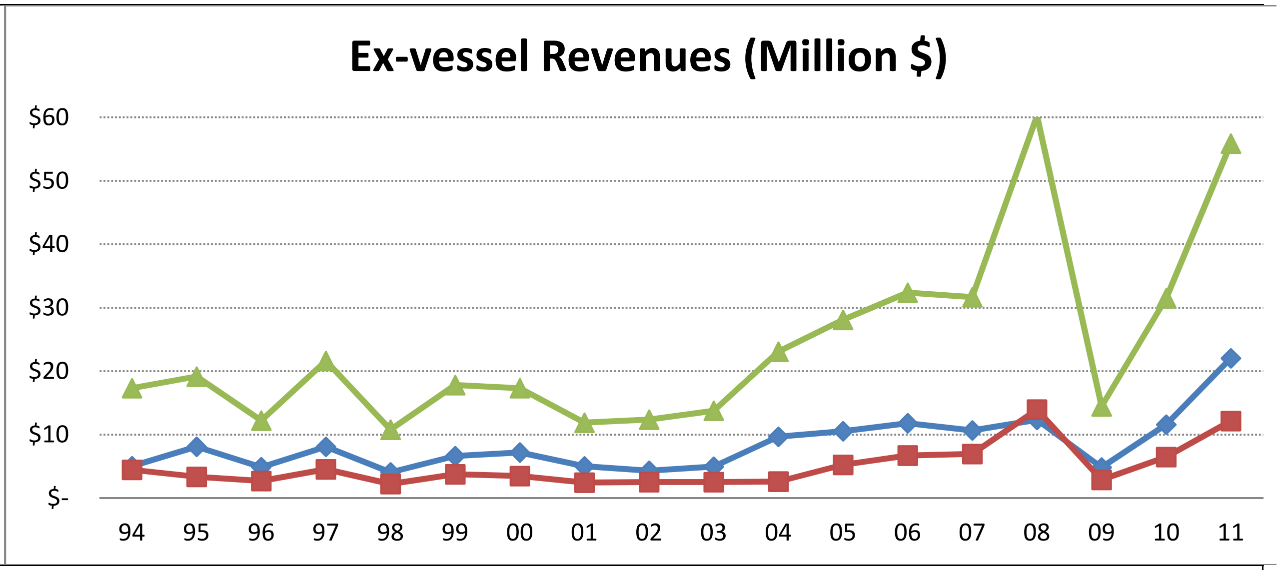


Figure 3-4. Pacific whiting ex-vessel revenue trends.

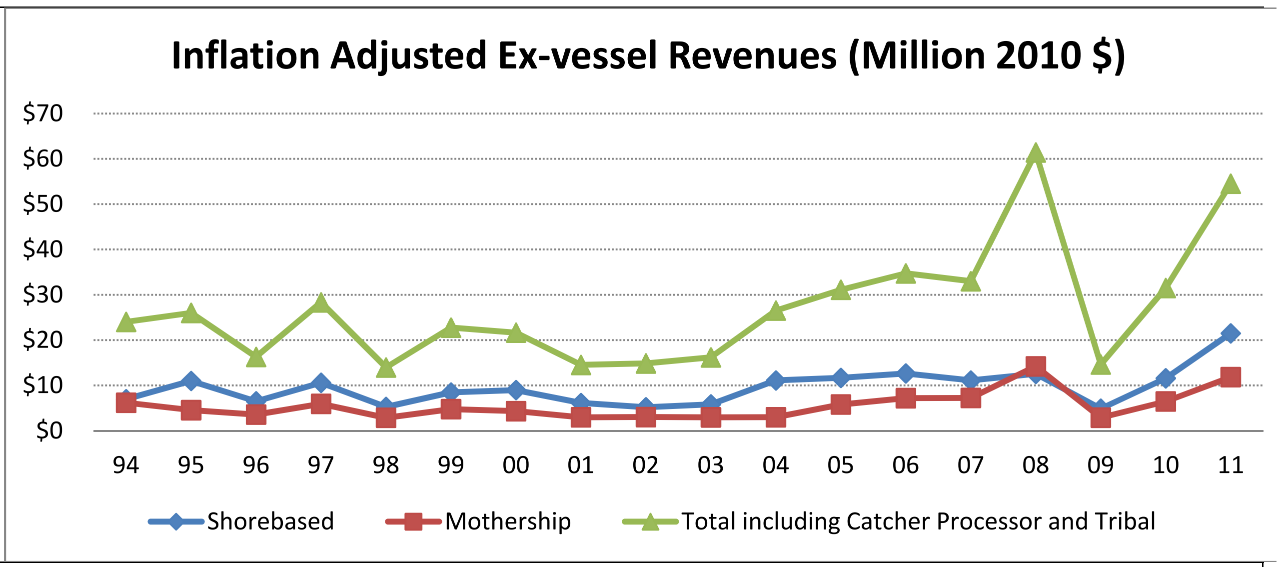


Figure 3-5. Pacific whiting ex-vessel revenue trends-inflation adjusted.

Notes and Observations on Pacific Whiting Ex-vessel Revenues

- Whiting ex-vessel revenues (including imputed exvessel revenues for CP sector) have ranged from a low of $12 million in 1996 to a peak of $60 million in 2008.

- Ex-vessel revenues began an increasing trend in 2003. It is presumed that the declines in 2009 and 2010 are due to the status of world economy and with OY/ACL levels. (See ex-vessel price and export trend below)

- When adjusted for inflation trends are similar trends.

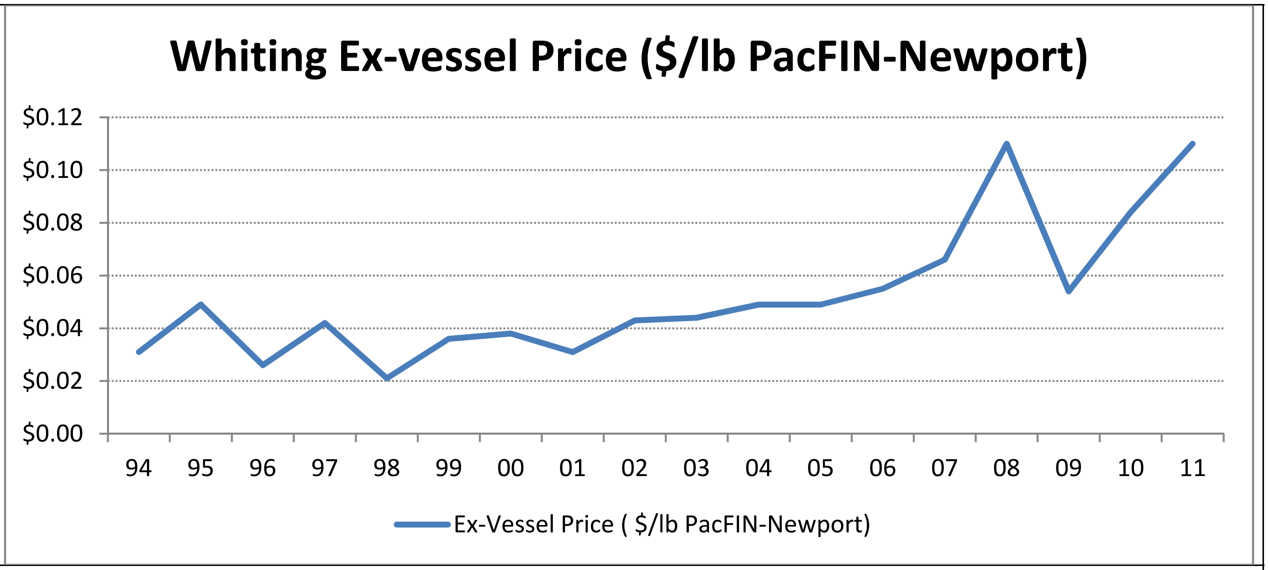


Figure 3-6. Pacific whiting ex-vessel price trends.

Notes and Observations on Whiting Ex-vessel Prices

- Ex-Vessel price trends are similar to revenue trends.
- After taking into account the world recession in 2008- 2011, ex-vessel prices have been increasing since 2003, even as total harvests also increased.

3.6.2.2 World Whiting Markets

The following figures and notes on the figures describe current and historic world whiting markets.

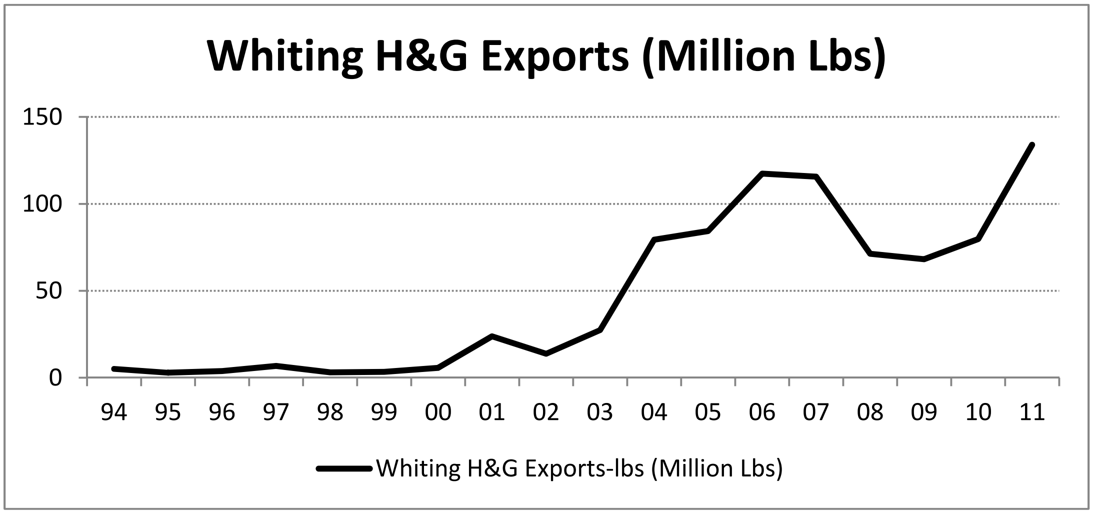


Figure 3-7. Pacific Whiting head and gut (H&G) export trends

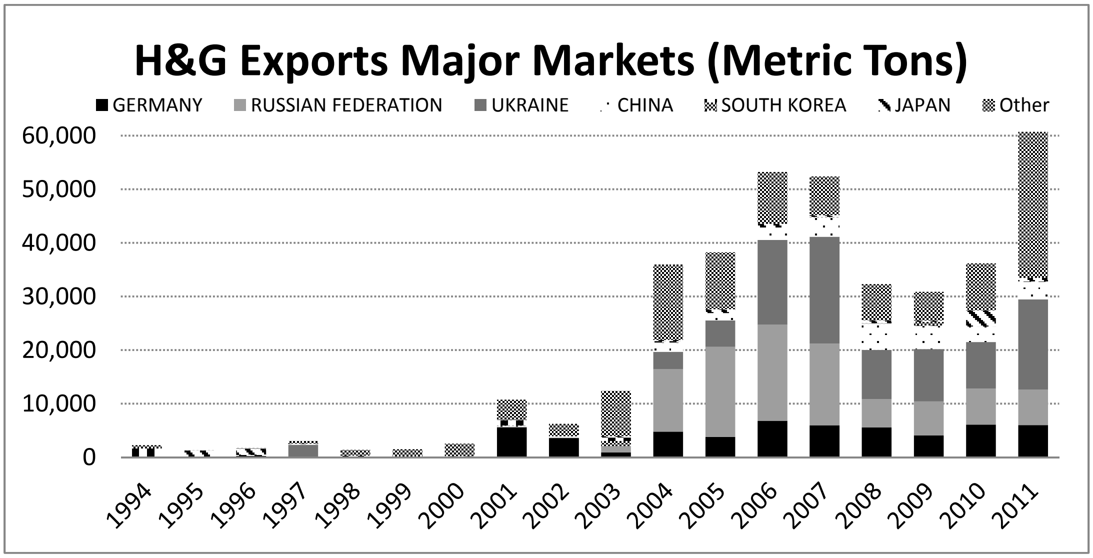


Figure 3-8. Pacific whiting export market trends.

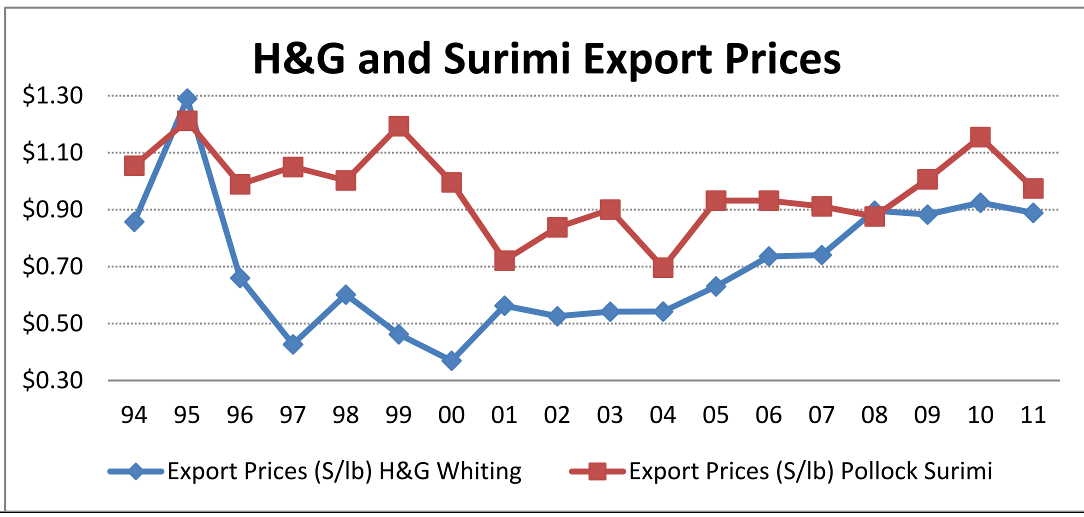


Figure 3-9. Pacific whiting export prices.

Notes and Observations on Export Markets

- Exports of H&G Whiting started an increasing trend in 2001.
- Export market growth increases significantly after 2003, especially exports to Germany, Russian Federation and Ukraine.

- Number of countries receiving H&G whiting exports has grown significantly:

Years	Number of Countries
1994-1996	3-6
1997-2000	9-12
2001-2003	15-18
2004-2009	23-26
2010-2011	30-39

- The relative difference between H&G exports prices and Pollock surimi prices start to narrow in 2001 and become equivalent in 2008.

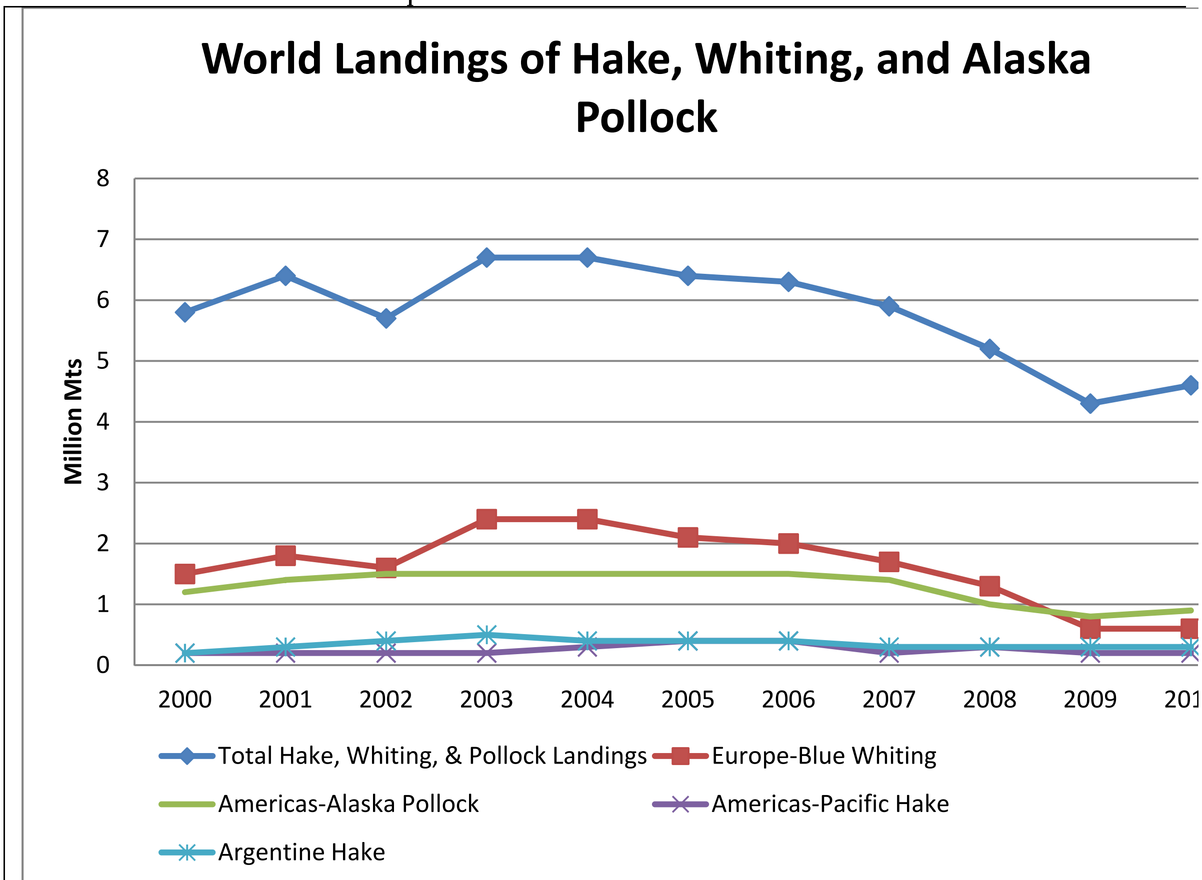


Figure 3-10. World landings of hake, whiting, and pollock (Source: U.N. Food and Agricultural Organization, Fisheries and Aquaculture Information and Statistics Service query system (http://www.fao.org/fishery/statistics/global-capture-production/query/en)[4].

Notes and Observations on World Landings Trends

- The two area-species combinations that appear to driving the change in the total landings of hake, whiting, and Pollock are: European Blue whiting and American-Alaska Pollock.

[4] This data system provides landings by species and year for major areas (Africa, Americas, Asia, Europe, and Oceania).

- Blue whiting is used mainly for fish meal and oil but increasingly for human consumption. Alaska Pollock is used mainly for human consumption but also for fish meal and oil.
- Argentine Hake is often mentioned by representatives of the Pacific whiting industry as a competing species to Pacific whiting.
- In comparing trends and accounting for the recent state of the world economy, there appears to be some correlation between ex-vessel prices for Pacific hake and trends in world landings.

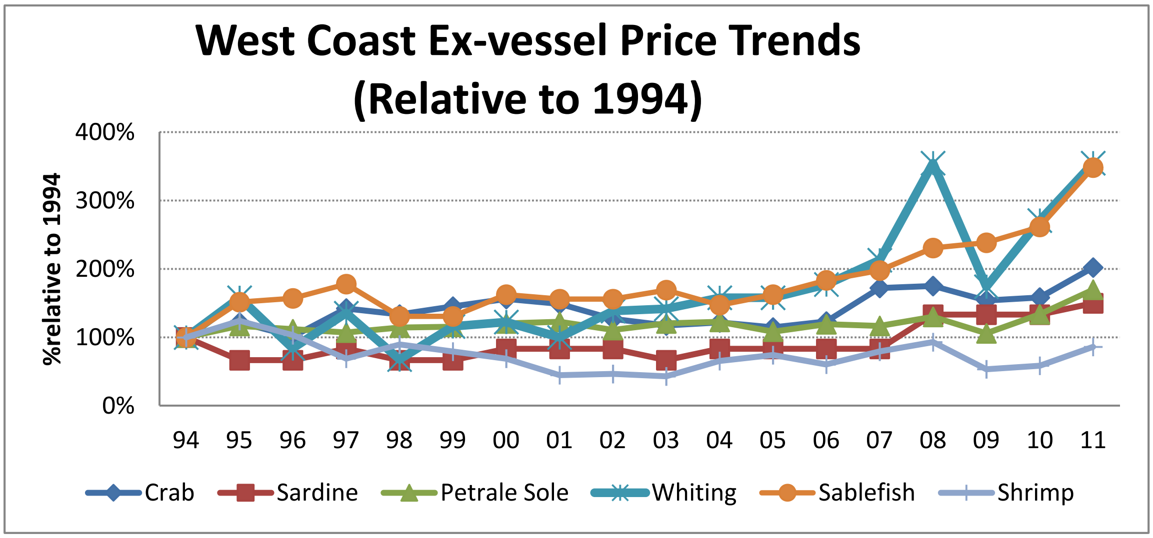


Figure 3-11. Trends in West Coast ex-vessel prices for selected species.

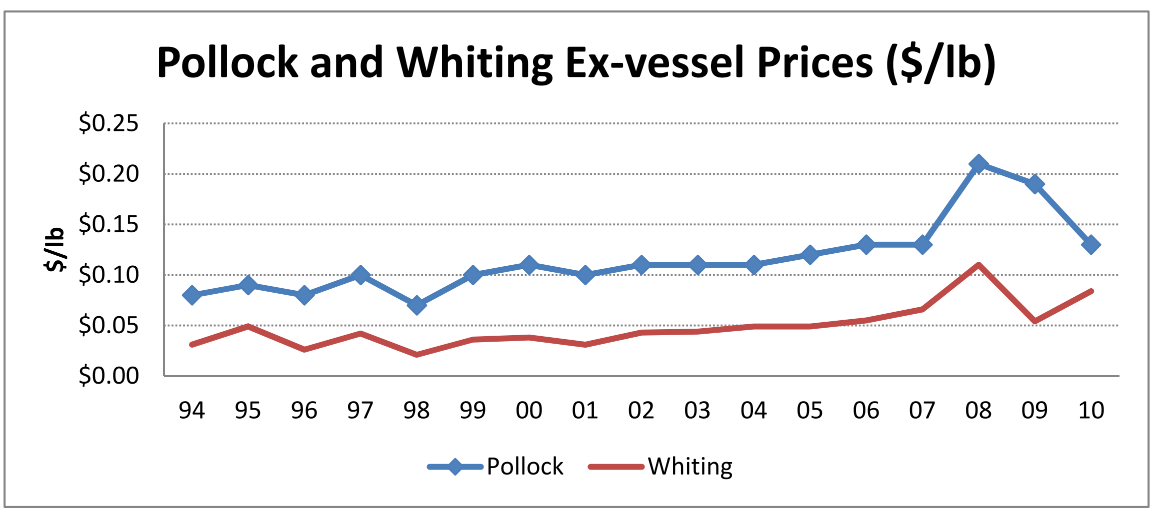


Figure 3-12. Pacific whiting and Alaska pollock ex-vessel price trends.

Notes and Observations on Other Related Species Ex-vessel Price Trends

- Price levels of the species shown are very different. For example, 2011 ex-vessel prices for Dungeness Crab ($2.77), and Sablefish ($3.17) are much higher than for Petrale Sole ($1.41), Shrimp ($0.50), Sardines ($0.09), and whiting ($0.11).
- Because of these differences, it is hard to discern trends by plotting prices on a common scale. Therefore in Figure 3-12 prices are scaled using 1994 price levels as the basis. For example, the 2008 ex-vessel price for whiting ($0.11) is approximately 350% of its 1994 price level ($0.031).
- Except for shrimp, species generally show rising trends relative to 1994 levels. However, both whiting and sablefish show the most significant rising trends, especially since 2003.
- The price trend for whiting mirrors that of pollock caught off Alaska, except for 2010 when the whiting price increased while pollock prices decreased.

3.6.2.3 Number of Active Permits and Ex-vessel Revenues by Permit

The following table, figures, and notes describe current and historic permit activity and average exvessel revenues per permit.

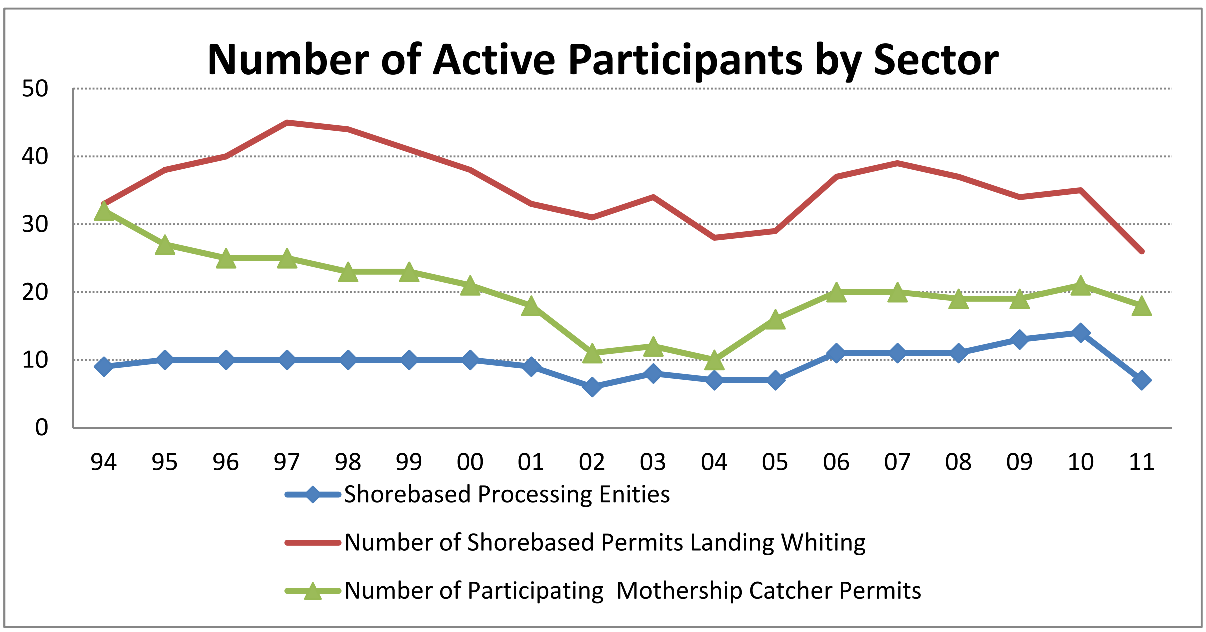


Figure 3-13. Trends in participation: shorebased processing, shorebased permits, mothership catcher permits.

Notes and Observations on Participation

- "Active" means that that the permit fished or entity received fish that year.
- Whiting is landed either at buying stations or directly at processing sites. Analysts have related landings to processors based on buying station linkages, where known. For companies that process whiting at multiple sites, landings have been summed to reflect a single processing entity.

- The number of permits fished includes buyback permits in years prior to 2004 (Buyback occurred in December 2003). Twenty two buyback permits were involved in the Pacific whiting fishery (See Entry and Exit Analysis below).
- The number of active shorebased processing entities increased from 7 in 2005 to 14 in 2010.
- All sectors had lower numbers of active participants in 2011 than in 2010.

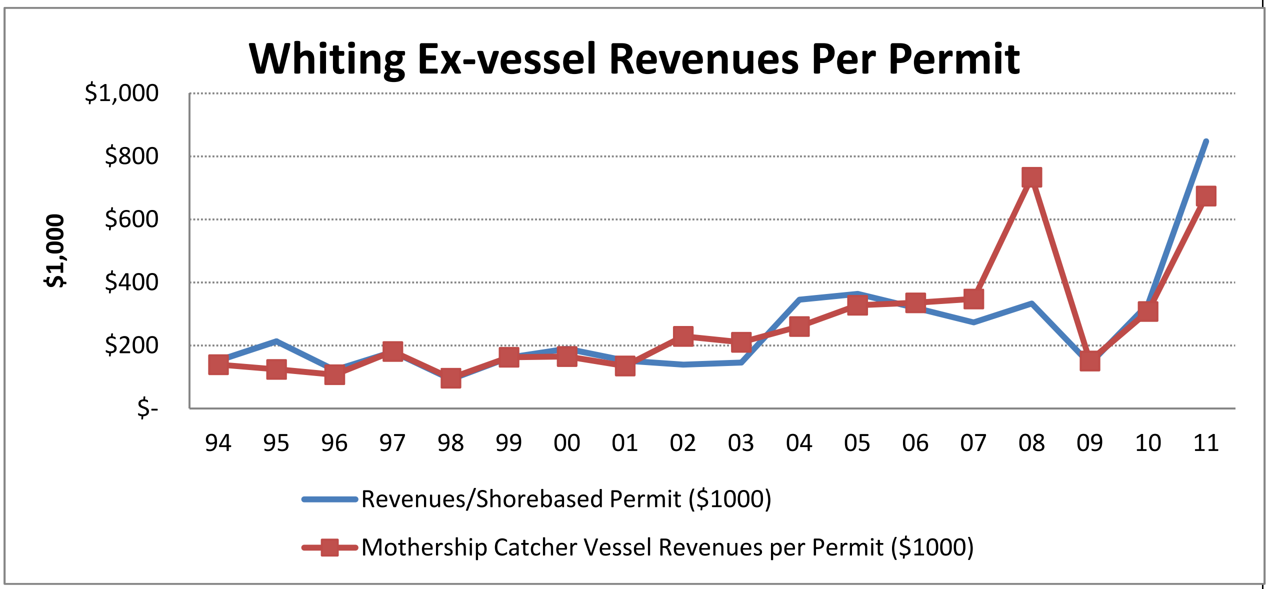


Figure 3-14. Trends in ex-vessel revenues per permit.

Notes and Observations on Ex-Vessel Revenues per Permit

- Revenues per mothership catcher-vessel permit generally increasing after 2003 and in line with sector allocation.
- Revenues per shorebased permit were similar to the mothership trend except for 2008.
- In 2008, the whiting fishery was closed early because the best available information on August 18, 2008 indicated that the 4.7 metric tons (mt) bycatch limit of canary rockfish for the non-tribal whiting fisheries was projected to be reached. The shorebased fishery was not re-opened, but unused shorebased allocations were distributed to the mothership and catcher processor sectors during the fall and winter.
- Relatively high revenues per permit in 2011 reflect increases in OY/ACL, high ex-vessel prices, and decreases in the number of active permits. Permit revenue were also likely high due to the Trawl Rationalization Program. Shorebased permits were able to fish quota pounds of other vessels, and mothership catcher-vessel permits were able to fish the catch history assignments of other permits.

Table 3-1. Primary season closure dates and allocations for mothership and shorebased whiting fisheries.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Primary Pacific whiting season closure dates											
Shoreside	15-Sep	21-Aug	17-Jul	14-Jul	14-Aug	18-Aug	2-Aug	26-Jul	19-Aug	7-Jul	N/A
Mothership	9-Jun	N/A	6-Jun	N/A	N/A	N/A	29-Sep	26-Jul	19-Aug	1-Jun	5-Jun
Initial Whiting Allocations (mt)											
Shoreside	83,790	68,418	44,906	50,904	90,510	97,469	97,469	87,398	97,669	42,063	59,218
Mothership	47,880	39,096	25,661	29,088	51,720	55,696	55,696	49,942	55,811	24,034	33,839

Notes and Observations on Primary Season Closure Dates

- Table 3-1shows the initial allocations for mothership and shoreside fisheries.
- It also shows the dates where fisheries have been closed. Entries marked "N/A" are years when NMFS did not issue a closure notice.
- Except for 2009 these allocations do not include reapportionments. Reapportionments typically occur after September. In 2009 the initial allocations also included amounts reapportioned from the tribal fisheries.
- The mothership and shorebased season opening dates have remained unchanged over the 2000-2010 period .
- The shorebased fishery has staged geographic opening dates: April 1 for south of 42°00 to 42°30 N; April 15 for south of 40°30 N; and June 15 coastwide.
- Sub-quotas for the April 1 and April 15 openers have been small and there have been closures of these fisheries prior to June 15.
- When these closures occur the geographic fisheries are closed until June 15.
- On June 15 the shorebased whiting fishery is opened coastwide.
- The Mothership sector has a May 15th start date.
- Except for 2007 and 2008 closures have been due to the sector reaching its initial allocation.
- Closures in 2007 and 2008 were because of reaching a bycatch allocation.

3.6.2.4 Community Harvest Trends

The following figures and notes describe current and historic permit activity and average exvessel revenues per permit.

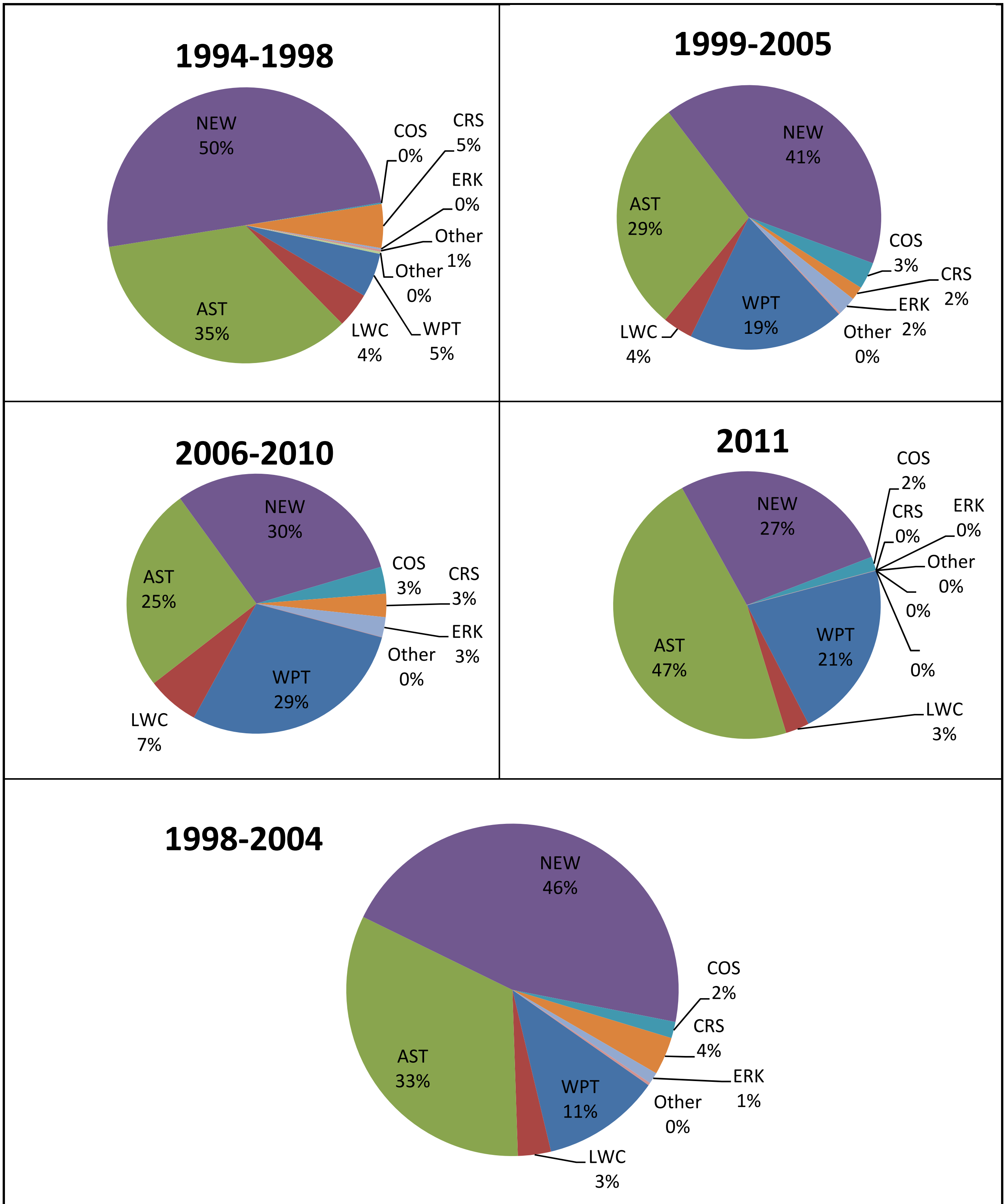


Figure 3-15. Trends in Whiting Harvest and Landings by Community (PacFIN PCID).

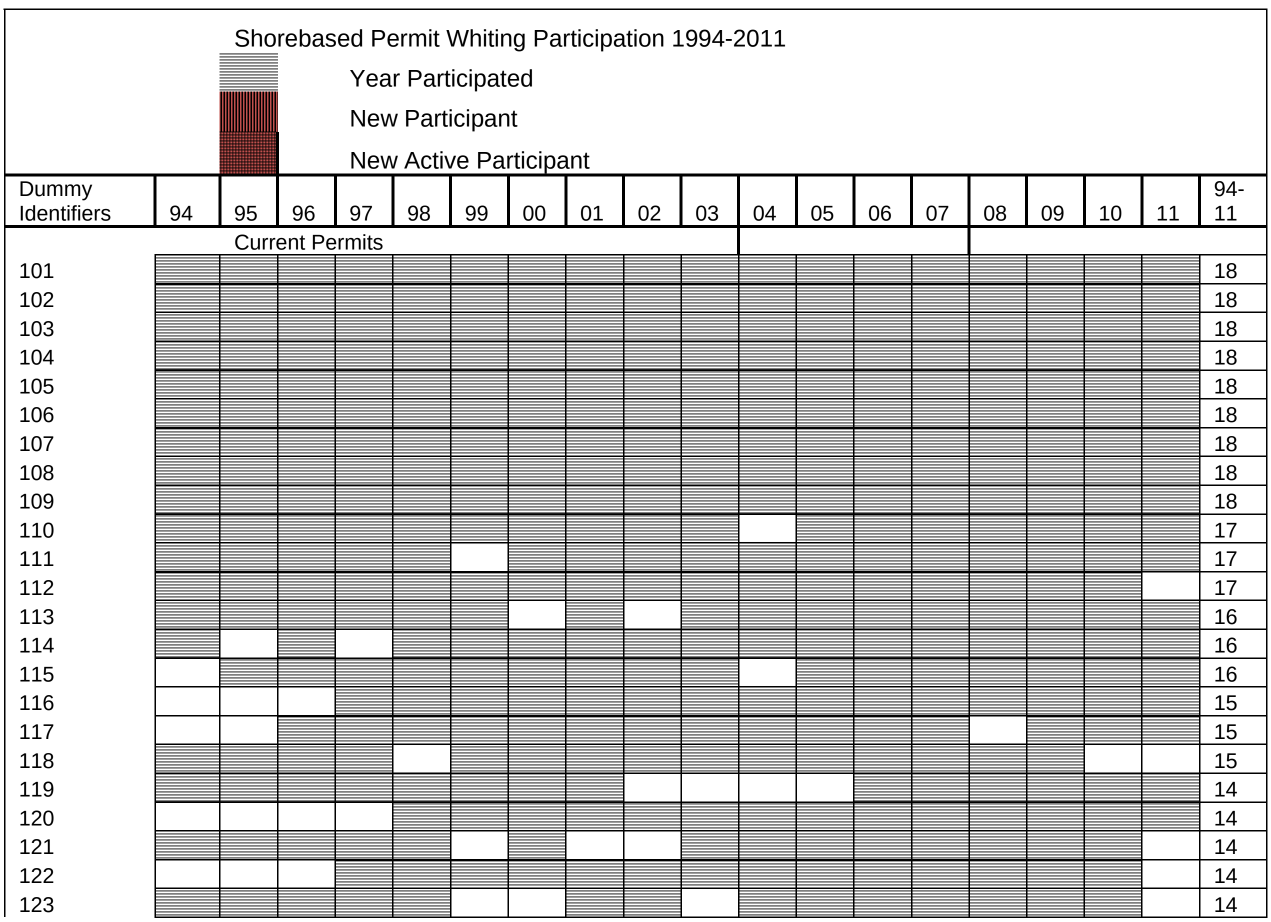
Notes and Observations on Community Whiting Harvest Trends

- Over the years the following ports have been the major communities receiving whiting:, Westport (WPT), Ilwaco (LWC), Astoria (AST), Newport (NEW), Coos Bay (COS), Crescent City (CRS) and Eureka (ERK). "Other" includes Blaine, and Brookings.
- Newport, Astoria and Westport are the major centers of shorebased whiting processing.
- The share of whiting landed in communities has varied over several periods: 1994-1998; 1999-2005; 2006-2010 and 2011 (Note that these estimates do not include tribal whiting).
- In the early years Newport was the lead port, but Westport has been steadily increasing. In 2011 Astoria was the lead port.
- The 1998-2004 chart covers the years used to allocate whiting to processors.
- None of the California ports received whiting landings in 2011.

3.6.3 Entry and Exit Patterns

3.6.3.1 Entry and Exit of Permits from the Shorebased Whiting Fishery

The following figure displays entry and exit patterns- permits landing shorebased whiting. Observations follow the figure.



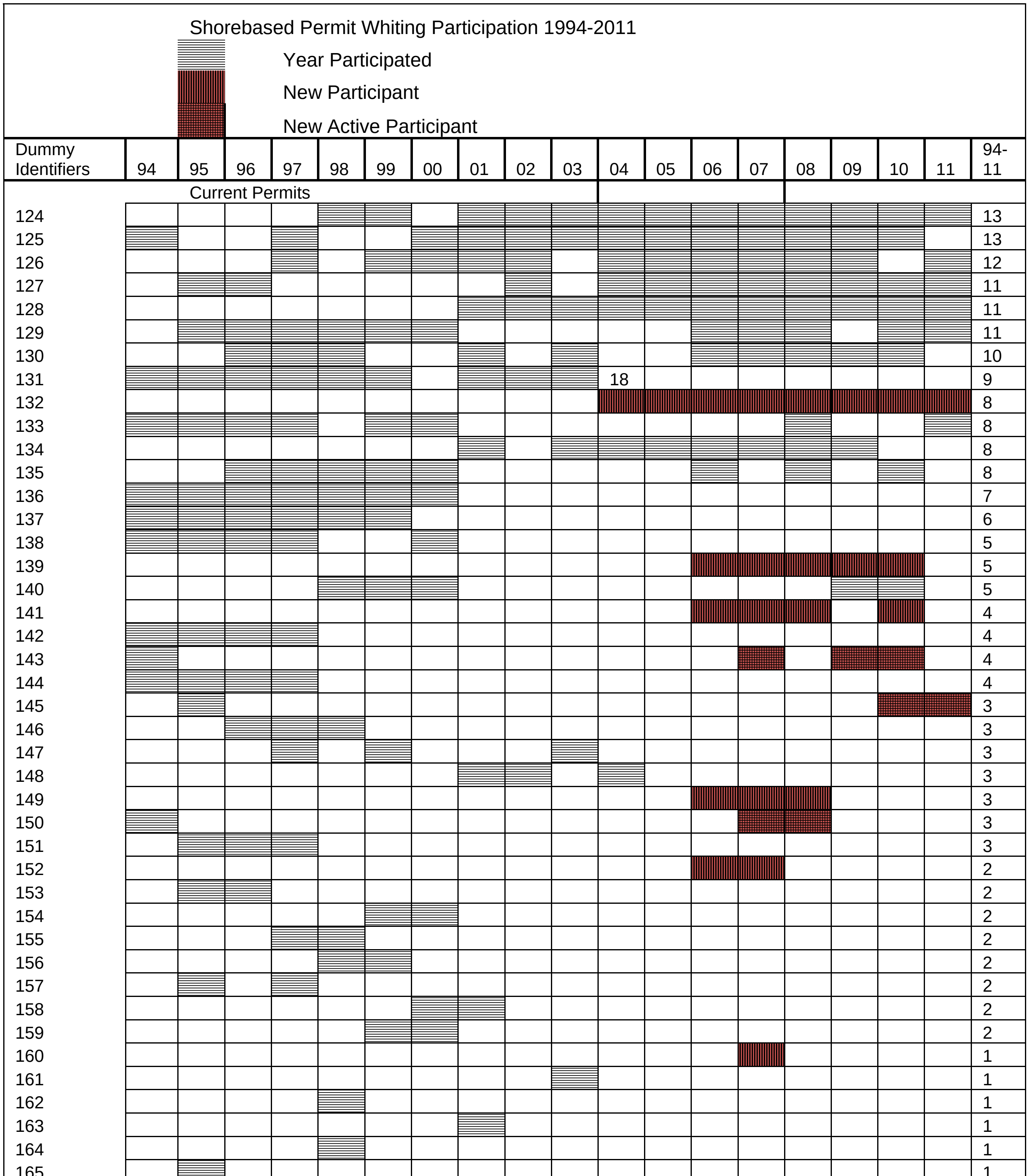


Figure 3-16. Participation Patterns by Limited Entry Permits in the Shorebased Whiting Fishery

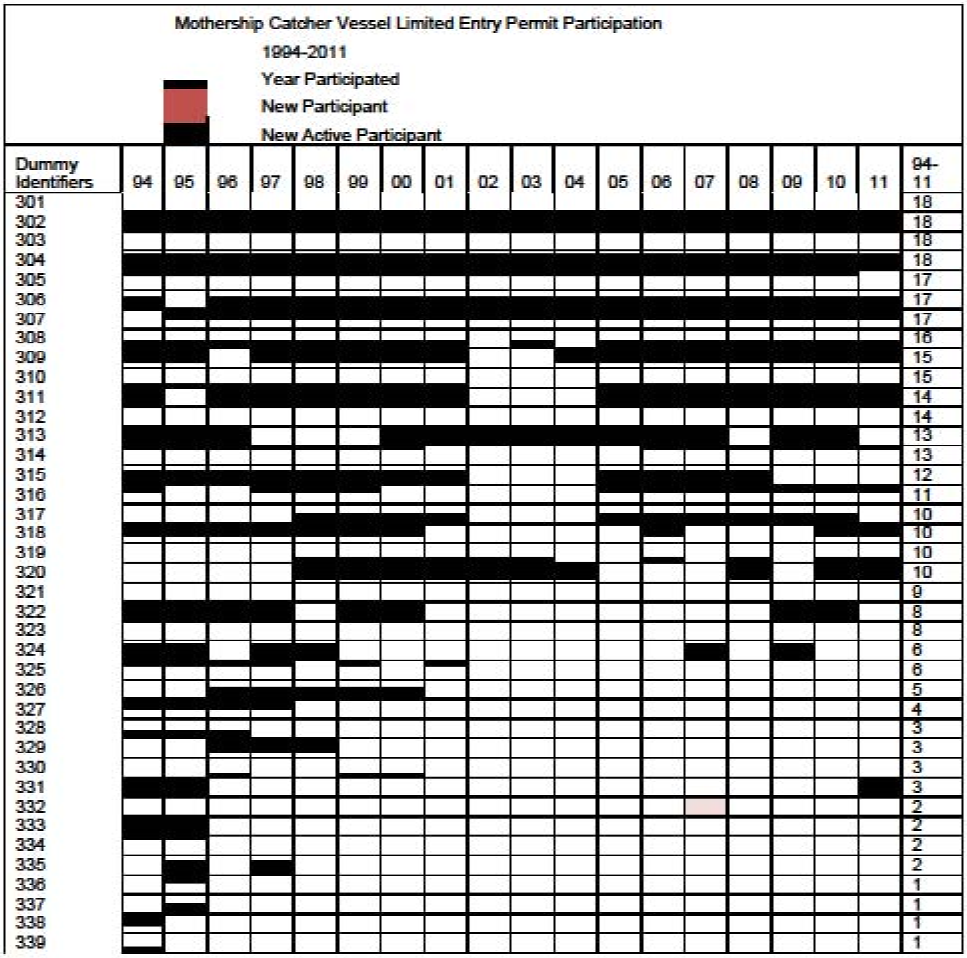
Notes and Observations on Shorebased Whiting Participation by Permits

- Nine permits fished the maximum number of years (18).
- 30 permits fished 10 or more years.
- 20 permits did not fish after 2003.

- Six permits entered after 2003
- Three permits are "New Active Participants"—these permits left the shorebased fishery in either 1994 or 1995 and did not return until 2007 or later.
- Not shown are 23 permits retired via the Buyback Program. These permits accounted for 7 percent of the1994-2003 shoreside landings.

3.6.3.2 Entry and Exit of Catcher Vessel Permits from the Mothership Whiting Fishery

The following figure displays entry and exit patterns of vessels active in the mothership whiting fishery. Observations follow the figure.



Participation patterns by limited entry permits in the mothership whiting fishery.

Figure 3-17. Participation by limited entry permits in the mothership whiting fishery.

Notes and Observations on Mothership Sector Participation by Permits

- Four permits fished the maximum number of years (18).
- 20 permits fished 10 years or more.
- 13 permits did not fish after 2003.
- No new entrants after 2003.
- Two current permits entered after 2003 after leaving in 1994 or 1995.
- Not shown are six buyback, lapsed, or combined permits.

3.6.3.3 Entry and Exit of Shorebased Whiting Processors

The following figure displays entry and exit patterns- of processors active in the shorebased whiting fishery. Observations follow the figure.

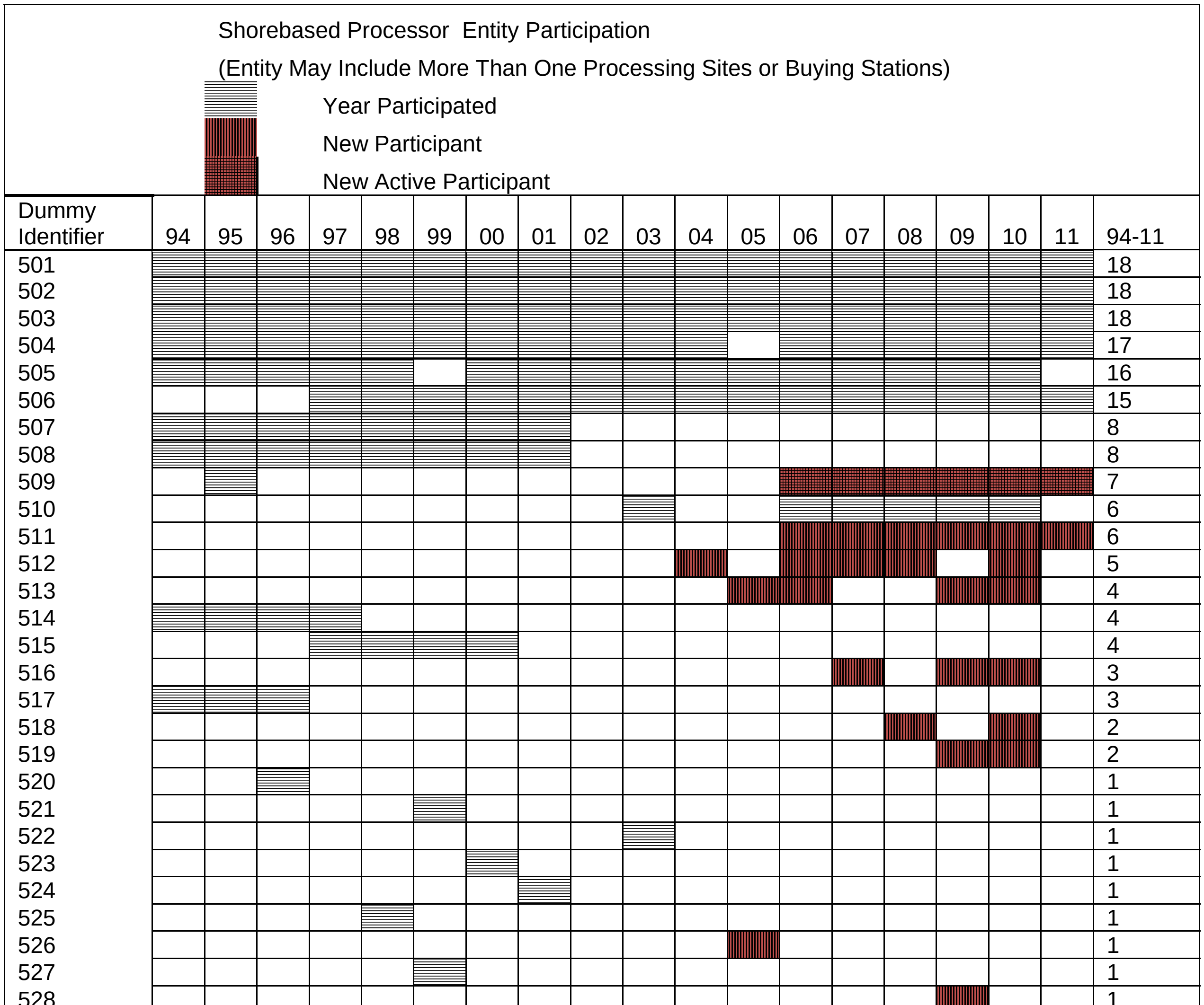


Figure 3-18. Participation Patterns by Processors in the Shorebased Whiting Fishery.

Notes and Observations on Processor Participation in the Shorebased Whiting Fishery

- Whiting is landed either at buying stations or directly at processing sites. Where known, landings at buying stations have linked with processors. Companies processing whiting at multiple sites have been summed up to reflect a single processing entity.
- Three shorebased entities processed whiting the maximum number of years (18).
- Six shorebased entities processed whiting 15 years or more.
- 11 shorebased entities did not process whiting after 2003.
- Eight shorebased entities entered the fishery after 2003
- One shorebased entity re-entered the fishery after leaving in 1995.

3.6.4 Participation and Other Fisheries

A number of permits exited particular segments of the whiting fishery after 2003. The following tables show how those permits moved among West Coast fisheries and between Alaska and the West Coast.

Table 3-2 shows that of the permits exiting the shoreside whiting fishery after 2003 (a total of 21) 5 remained active in other West Coast fisheries, 16 also exited all other West Coast fisheries. Table 3-3 shows the same information with one additional layer, participation in Alaskan fisheries. This table shows that of the 16 permits that were inactive in West Coast fisheries after 2003,one permit was associated with vessels that continued to be active in Alaska, one was associated with a vessel that also left Alaskan fisheries after 2003 and 14 were associated with vessels that did not have any activity in West Coast or Alaskan fisheries after 2003 (i.e. a total of 15 show not activity after 2003).

Table 3-2. Participation in the **shoreside** whiting fishery for two periods (1994-2003 and 2004-2010) for catcher vessel permits, also showing participation patterns in all other West Coast fisheries (combined).

	Activity in All Other West Coast Fisheries (combined, including mothership whiting)				
	Active in Both Periods	Entering After 2003 (Not Active in Earlier Period)	Exiting After 2003 (Active Only in Earlier Period)	Not Active	Total
	Number of Catcher Vessel Permits				
Shoreside Whiting Participation	-	-	-		-
Active in Both Periods	38	-		-	38
Entering After 2003	1	5		-	6
Exiting After 2003	5	-	16	-	21
Total	44	5	16	0	65

Table 3-3. Participation in the **shoreside** whiting fishery for two periods (1994-2003 and 2004-2010) for catcher vessel permits based, also showing participation patterns for all other West Coast fisheries (combined) and Alaska (shaded cells are counts of permits showing no activity after 2003).

		Activity in All Other West Coast Fisheries (combined, including mothership whiting)				
		Active in Both Periods	Entering After 2003 (Not Active in Earlier Period)	Exiting After 2003 (Active Only in Earlier Period)	Not Active	Total
		Number of Catcher Vessel Permits				
Shoreside Whiting Participation	**Alaska Participation**					
Active in Both Periods ('94-'03 & '04-'10)						
	Active in Both Periods	25	-	-	-	25
	Entering After 2003	-	-	-	-	-
	Exiting After 2003	-	-	-	-	-
	Not Active	13	-	-	-	13
Entering After 2003						
	Active in Both Periods	1	-	-	-	1
	Entering After 2003	-	1	-	-	1
	Exiting After 2003	-	-	-	-	-
	Not Active	-	4	-	-	4
Exiting After 2003						
	Active in Both Periods	5	-	1	-	6
	Entering After 2003	-	-	-	-	-
	Exiting After 2003	-	-	1	-	1
	Not Active	-	-	14	-	14
Total Shoreside Whiting Participants		44	5	16	0	65
Those that also participated in Alaska		31	-	2	-	33

Notes: Based on annual PacFIN summary file data and participation records from AKFIN. Alaska participation was evaluated for the vessel associated with the permit in each year.

Table 3-4 shows that of the permits exiting the mothership fishery after 2003 (a total of 14) 10 remained active in other West Coast fisheries, 3 also exited all other West Coast fisheries, and one had no participation in any other West Coast fishery. Table 3-5 shows the same information with one additional layer, participation in Alaskan fisheries. This table shows that of the three permits that were not active in West Coast fisheries after 2003, one permit was associated with vessels that continued to be active in Alaska after 2003 and the other two were not associated with vessels active in Alaska after 2003 (one having never been active in Alaska).

Table 3-4. Participation in the **mothership** whiting fishery for two periods (1994-2003 and 2004-2010) for catcher vessel permits, also showing participation patterns for all other West Coast fisheries (combined).

	Activity in All Other West Coast Fisheries (combined, including the shoreside whiting fishery)				
	Active in Both Periods	Entering After 2003 (Not Active in Earlier Period)	Exiting After 2003 (Active Only in Earlier Period)	Not Active	Total
	Number of Catcher Vessel Permits				
Mothership Whiting Participation					
Active in Both Periods	18	1	4	1	24
Entering After 2003	1	-	-	-	1
Exiting After 2003	10	-	3	1	14
Total	29	1	7	2	39

Notes: Based on annual PacFIN summary file data and participation records from AKFIN. Alaska participation was evaluated for the vessel associated with the permit in each year. Includes to permits with some mothership participation that did not qualify for an allocation.

Table 3-5. Participation in the **mothership** whiting fishery for two periods (1994-2003 and 2004-2010) for catcher vessel permits, also showing participation patterns for all other West Coast fisheries (combined) and Alaska (shaded cells are counts of permits showing no activity after 2003).

		Activity in All Other West Coast Fisheries (combined, including the shoreside whiting fishery)				
		Active in Both Periods	Entering After 2003 (Not Active in Earlier Period)	Exiting After 2003 (Active Only in Earlier Period)	Not Active	Total
		Number of Catcher Vessel Permits				
Mothership Whiting Participation	**Alaska Participation**					
Active in Both Periods ('94-'03 & '04-'10)						
	Active in Both Periods	19	1	4	1	25
	Entering After 2003	-	-	-	-	-
	Exiting After 2003	-	-	-	-	-
	Not Active	-	-	-	-	-
Entering After 2003						
	Active in Both Periods	-	-	-	-	-
	Entering After 2003	-	-	-	-	-
	Exiting After 2003	-	-	-	-	-
	Not Active	-	-	-	-	-
Exiting After 2003						
	Active in Both Periods	6		1	1	8
	Entering After 2003	-	-	-	-	-
	Exiting After 2003	-	-	1	-	1
	Not Active	4		1	-	5
Total Mothership Whiting Participants		29	1	7	2	39
Those that also participated in Alaska		25	1	6	2	34

Notes: Based on annual PacFIN summary file data and participation records from AKFIN. Alaska participation was evaluated for the vessel associated with the permit in each year.

Of the 68 permits with some directed whiting history, 6 permits entered the shoreside whiting fishery for the first time after 2003, only one of which was associated with a vessel also active in the mothership fishery. No permits entered the mothership whiting fishery for the first time after 2003. Of the 21 permits associated with shoreside whiting vessels leaving the shoreside whiting fishery after 2003, 4 remained active in the mothership fishery and 4 exited the mothership fishery. Of the 14 permits associated with mothership whiting vessels leaving the mothership whiting fishery after 2003, 9 remained active in the shoreside fishery and 4 also exited the shoreside fishery.

Table 3-6. Participation in the whiting fishery for two periods (1994-2003 and 2004-2010) for catcher vessel permits, showing participation in the **mothership** whiting fishery and **shoreside** whiting fishery.

	Shoreside Whiting Participation				
	Active in Both Periods	Not Active in Earlier Period (Entering After 2003)	Active Only in Earlier Period (Exiting After 2003)	Not Active (mothership whiting only)	Total
	Number of Catcher Vessel Permits				
Mothership Whiting Participation	-	-	-	-	
Active in Both Periods	18	1	4	2	25
Entering After 2003	-	-	-	-	-
Exiting After 2003	9	-	4	1	14
Not Active (shoreside whiting only)	11	5	13	-	29
Total	38	6	21	3	68

Of the permits associated with AFA vessels, only one is was associated with a vessel that entered a West Coast fishery for the first time after 2003 and three were associated with vessels that exited West Coast fisheries after 2003 (Table 3-8). Fourteen non-AFA affiliated permits exited West Coast fisheries after 2003.

The permits associated permits that qualified for participation under Amendment 15 were relatively evenly divided between AFA affiliated and non AFA affiliated permits (Table 3-7). Those permits that didn't qualify under Amendment 15 tended to also not qualify as AFA vessels.

Table 3-7. Number of permits associated with vessels qualifying under the AFA and Amendment 15.

	Permits Associated with Amendment 15 Vessels	Permits Not Associated with Amendment 15 Vessels	Total
Permits Associated with AFA Vessels	29	1	30
Permits **Not** Associated with AFA Vessels	24	14	38
Total	53	15	68

Table 3-8. Participation in West Coast fisheries by permits with some whiting history for two periods (1994-2003 and 2004-2010) also showing participation by whether the permit is associated with an AFA vessel (columns) or a vessel with Alaska participation history (rows).

	West Coast Participation (All Fisheries)								
	Permits Not Associated With AFA Vessels				Permits Associated With AFA Vessels				
	Active in Both Periods	Not Active in Earlier Period (Entering After 2003)	Active Only in Earlier Period (Exiting After 2003)	Total	Active in Both Periods	Not Active in Earlier Period (Entering After 2003)	Active Only in Earlier Period (Exiting After 2003)	Total	Grand Total
	Number of Catcher Vessel Permits				Number of Catcher Vessel Permits				
Alaska Participation									
Active in Both Periods	7		-	7	26		2	28	35
Entering After 2003	-	-	-	0	-	1	-	1	1
Exiting After 2003	-	-	-	0	-	-	1	1	1
Not Active	13	4	14	31	-	-	-	0	31
	20	4	14	38	26	1	3	30	68

Note: If a permit was ever associated with an AFA vessel then a permit is counted as an AFA permit.

3.6.5 Historic Distributions and the 2011 Fishery

The following graphs and tables provide information on the historic distribution of harvest among permits and the distribution of allocations and harvest among permits in the 2011 shoreside whiting and mothership fisheries.

In each figure, the permits have been ordered along the horizontal axis from those receiving the least to those receiving the largest allocations. The allocations are based on 1994-2003 history so the allocations track that history fairly closely for the shoreside fishery (Figure 3-19) and mothership fishery (Figure 3-21). However, the shoreside allocations are generally about 23.5% below the landing history because 20% of the allocation went to processors and 3.5% went to nonwhiting permits (not included in the graph) as part of the equal allocation. Other variations are due to the provision which drops the two worst years of history from the calculation of each permits allocation.

In some cases, the share of each permit's harvest in 2011 varied substantially from 2011 allocations, running either substantially higher or lower (Figure 3-20 and Figure 3-22, for the shoreside and mothership fisheries, respectively).

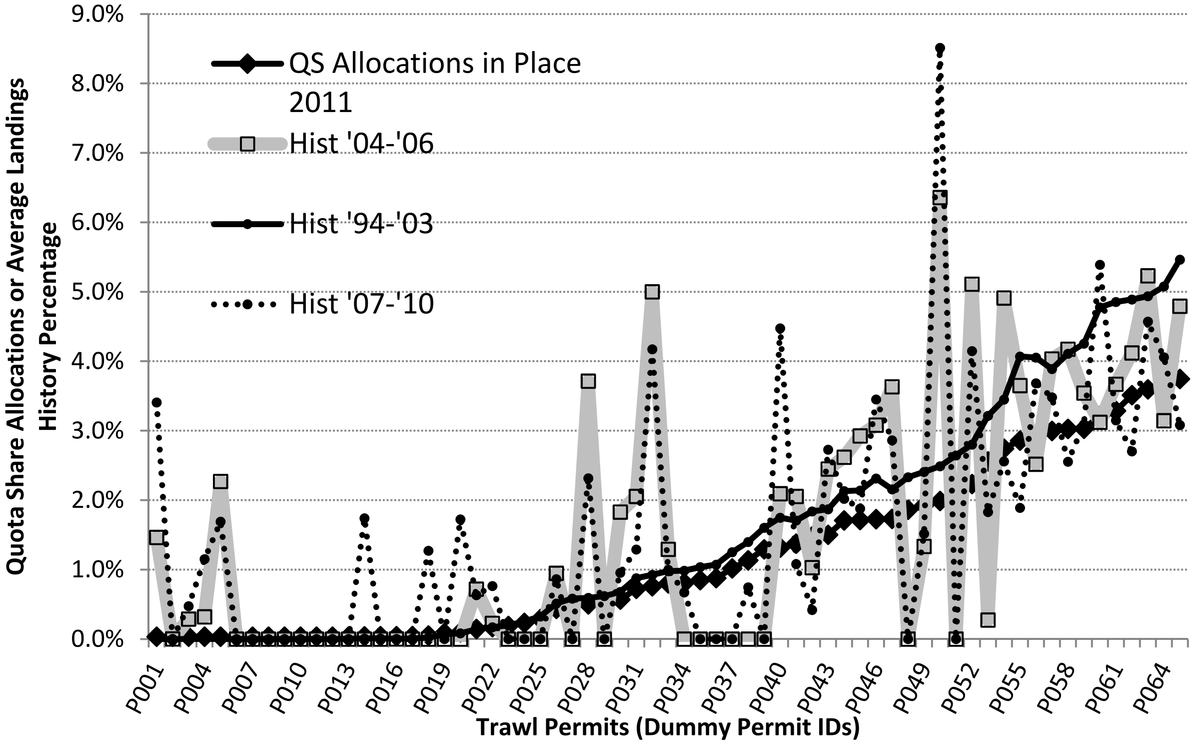


Figure 3-19. Amounts of **shorebased** whiting QS permits were allocated in 2011 compared to recent and historic harvests (1994-2003, 2004-2006, 2007-2010).

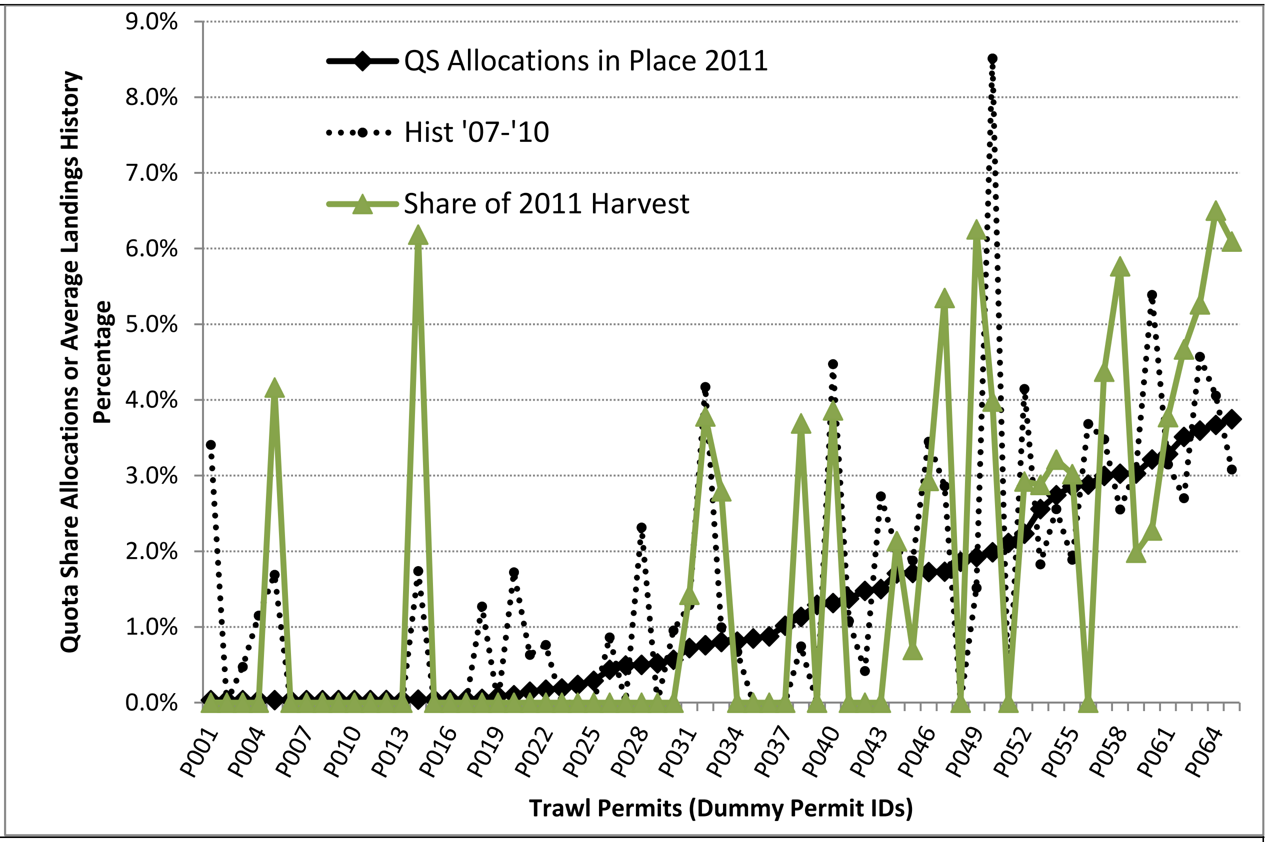


Figure 3-20. Amounts of **shorebased** whiting QS permits were allocated in 2011 compared to recent and historic harvests (2007-2010 and 2011).

Data from Figure 3-20 are summarized in the following table. A total of 39 permits with landings history in the shoreside whiting fishery did not participate in the 2011 fishery. Most permits that remained active landed substantially more fish than they received in their initial allocation (23 permits). This was partially because 20% of the QS was allocated to processors and the resulting QP were transferred to vessels. Only 3 permits remained active and landed less than their initial allocations. Note that the increases relative to allocations (46.9%) are greater than the reductions (23.4%) because the initial allocations to permits with whiting fishery participation were reduced by 20% due to the allocation to processors and 3.5% was equally allocated among all permits Only those permits with whiting directed trips are included in the table and the associated figure.

Table 3-9. **Shorebased** whiting permit share of harvest in 2011 relative to permit catch share allocations.

Permits not fishing (received allocations but did not participate in 2011)	39
Shares for those dropping out.	-20.4%
Maximum reduction for those not fishing.	-2.9%
Permits landing less than their allocations.	3
Shares unfished by those permits	-3.0%
Maximum reduction for any one permit	-1.0%
Max reduction as a % of original allocation	-34.5%
Permits landing more than their allocations.	23
Additional shares fished by those permits	46.9%
Maximum increase for any one permit	6.1%
Max increase as a % of original allocation	15,000%

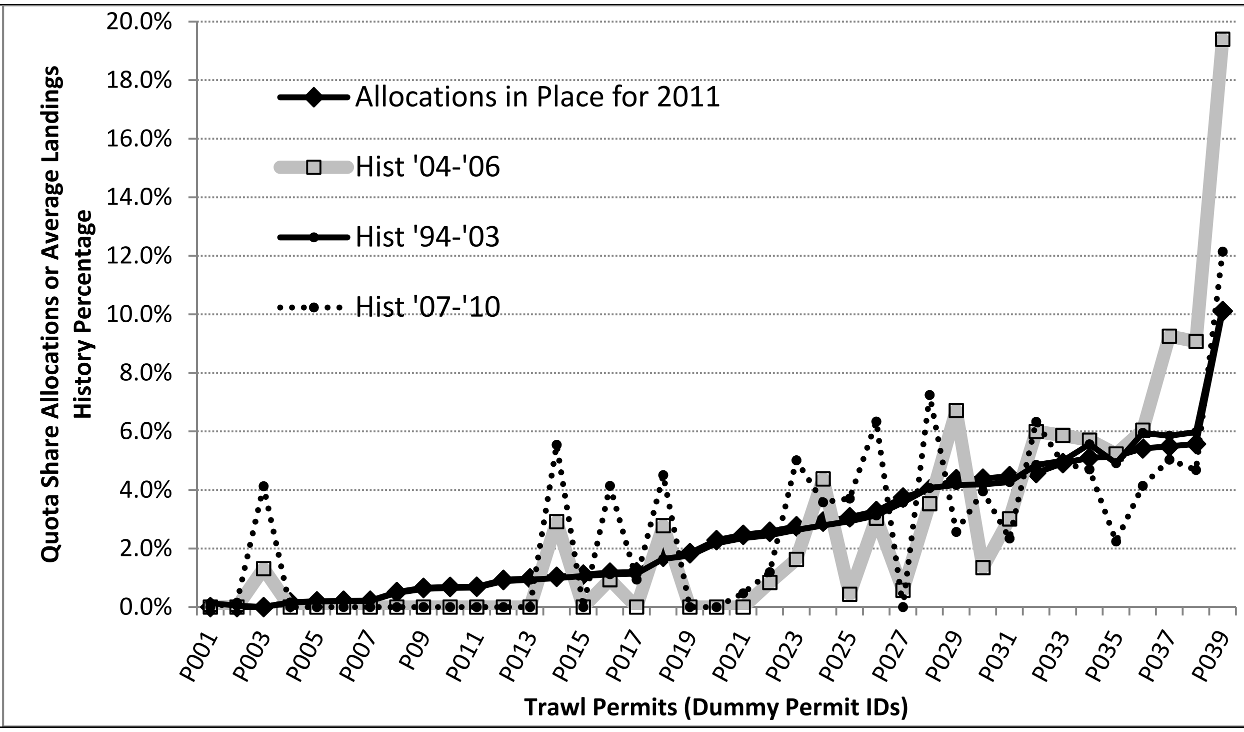


Figure 3-21. **Mothership** whiting Catch history allocations for 2011 compared to recent and historic harvests (1994-2003, 2004-2006, 2007-2010).

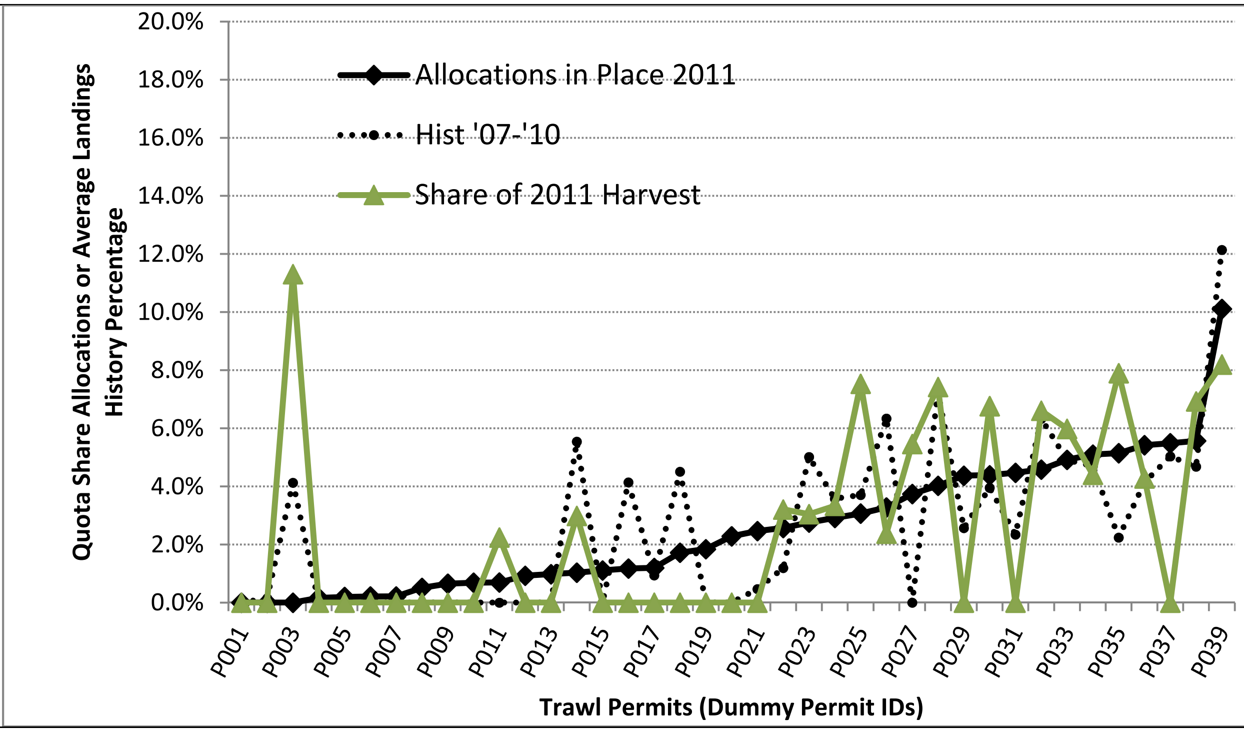


Figure 3-22. **Mothership** whiting Catch history allocations for 2011 compared to recent and historic harvests (2007-2010 and 2011).

Data from Figure 3-22 are summarized in the following table. A total of 19 permits with deliveries history in the mothership whiting fishery did not participate in the 2011 fishery. Most permits that remained active delivered substantially more fish than they received in their initial allocation (14 permits). Only 4 permits remained active and delivered less than their initial allocations.

Table 3-10. **Mothership** permit share of harvest in 2011 relative to permit catch share allocations.

Permits not fishing (received allocations but did not participate in 2011)	19
Shares for those dropping out.	-30.7%
Maximum reduction for those not fishing.	-5.5%
Permits landing less than their allocations.	4
Shares unfished by those permits	-4.6%
Maximum reduction for any one permit	-1.9%
Max reduction as a % of original allocation	-18.9%
Permits landing more than their allocations.	14
Additional shares fished by those permits	35.3%
Maximum increase for any one permit	11.3%
Max increase as a % of original allocation	Original allocation was zero

Figure 3-23 and Figure 3-24 illustrate the distribution of combined (weighted) shoreside and mothership sector status quo whiting quota allocations to permit-owning entities compared with historical average harvest levels for those entities.

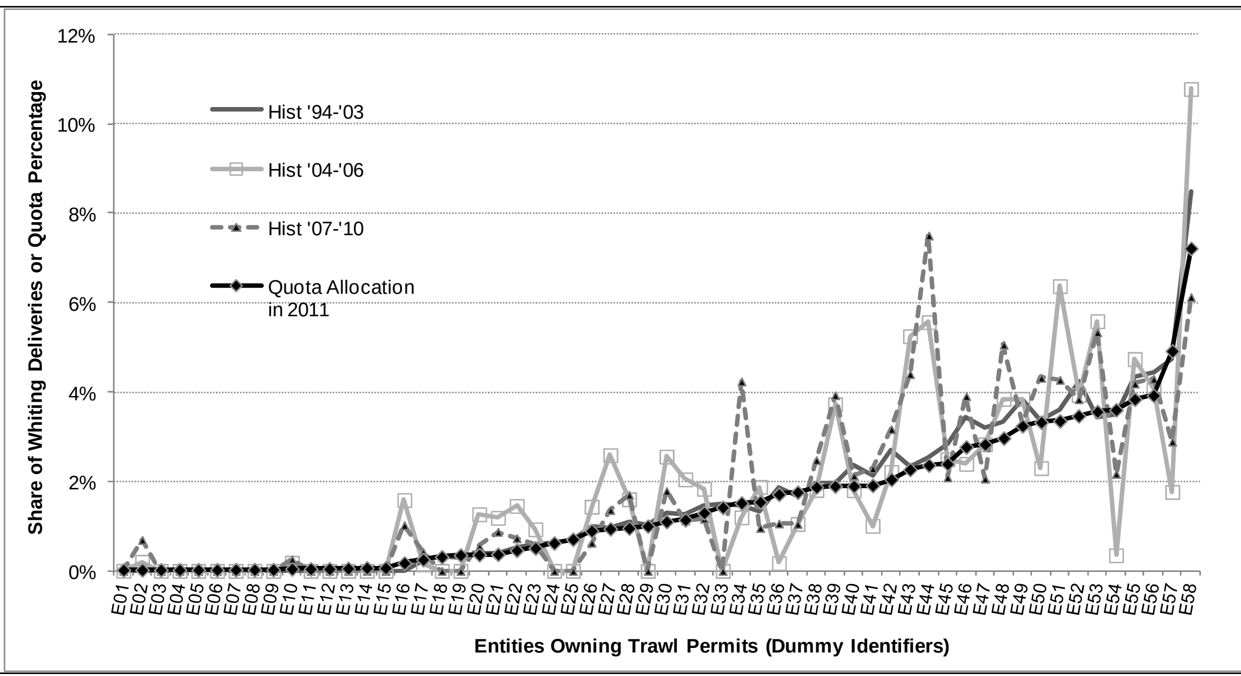


Figure 3-23. Amounts of combined shoreside plus mothership whiting quota allocated in 2011 to permit-owning entities compared to recent and historic harvests (1994-2003, 2004-2006, 2007-2010).

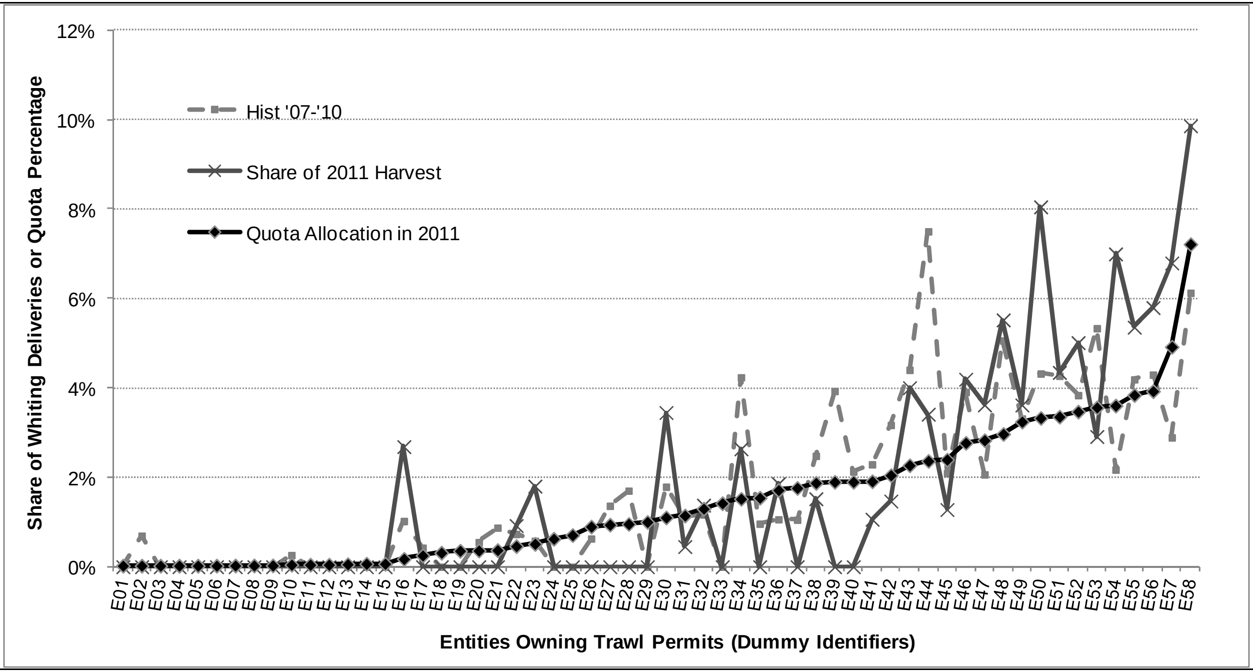


Figure 3-24. Amounts of combined shoreside plus mothership whiting quota allocated in 2011 to permit-owning entities compared to recent and historic harvests (2007-2010 and 2011).

CHAPTER 4 IMPACTS ON THE AFFECTED ENVIRONMENT

The direct and indirect impacts of the actions being considered are addressed under each topic covered in Sections 4.1, 4.2 and 4.3. Cumulative impacts are discussed in Section 4.4. Although CEQ regulations reference the need for a cumulative impact analysis to consider "past, present, and reasonably foreseeable future actions," from an analytical standpoint what is of interest is the net effect of the proposed action and any ongoing effects of these actions because they continue to exist programmatically.

4.1 Direct and Indirect Impacts to the Physical Environment, Including Habitat and Ecosystem

No change in impacts to the physical environment is expected. The alternatives covered by this EA are entirely allocative in nature, changing the allocation among individuals within the shoreside whiting sector and within the at-sea mothership sector but not changing the overall allocations to each sector. Impacts on the physical environment are primarily a function of the areas fished, gear types used, and level of effort. The areas fished are more a function of the location of efficiently harvestable populations of this migratory stock (see Section 3.2.1 for a description of whiting biology) and the shoreside receiving and processing locations than it is the distribution of initial allocations, particularly after QS trading starts . The fleet is highly mobile, particularly the mothership sector, in which the processors can follow the catcher vessels to the areas of best fishing opportunity. Mobility of the shoreside fleet is discussed in the following sections. There is only one gear type used in the fishery (midwater trawl), therefore changing the allocations will not change the gear type used. Finally, changing the distribution of fishing opportunities among individuals within a sector is not expected to affect total fishing effort using that gear type.

4.2 Direct and Indirect Impacts to the Biological Environment

The reallocation of whiting QS and mothership catcher vessel catch history (CHA) assignments is expected to have minimal, if any, impacts on the biological environment, including but not limited to the following categories of potentially impacted resources.

- Groundfish, Including Overfished Species
- ESA Listed Salmon
- Other Protected Species
- Other Fish Resources

As with the impacts to the physical environment, impacts on these resources are primarily a function of the areas fished, gear types used, and level of effort; and, of these, area fished is the only factor that might be affected as a result of the reallocation of quota (see Section 4.1 for additional discussion). Whether this action will affect area fished depends on

- the degree to which the reallocation shifts the geographic distribution among quota recipients,
- the degree to which the geographic allocation of quota is linked to the geographic distribution of fishing effort,
- the nature of the effects of a geographic shift on the fishery resources.

The total amount of quota reallocated by the alternatives would range from less than 1% to around 20%, depending on the alternative and sector (Table 4-1). These reallocation amounts form an upper bound on the amounts by which quota may shift geographically, i.e. some of the reallocation is likely to occur among permits and processors in the same communities and while some allocation might shift from south to north, other allocations may shift from north to south. Table 4-2 shows the amounts of QS allocated to processors that is expected to be reallocated among processors and the amount of QS ownership that is expected to be shifted among communities as a result. Of the mounts reallocated, around 30 to 40% of the QS is expected to stay within the same community, except for Alternative 1 for which only 20% of the amount reallocated is projected to initially stay within the same community. Whether the QP associated with the QS ends up benefiting that community will depend on inseason conditions and transfers. Additionally, any potential impacts of the geographic distribution of the initial allocation will diminish once QS trading starts. Reallocation through QS trading is expected to be driven by factors affecting profits in the use of QS.

Table 4-1. Whiting catch shares reallocated by the alternatives, as compared to status quo.

	Alt 1	Alt 2	Alt 3	Alt 4
QS Reallocated (permits and processors combined)	<1%	8.2%	11.5%	20.5%
Total CHA Reallocated	0%	8.2%	10.8%	19.2%

Table 4-2. Whiting catch shares reallocated among processors and associated redistribution between ports, as compared to status quo.

	Alt 1	Alt 2	Alt 3	Alt 4
QS Reallocated (permits processors)	0.5%	1.9%	2.5%	3.1%
QS Reallocated Among Ports (estimated based on 2011 delivery patterns)	0.4%	1.3%	1.5%	1.8%

Whether the potential geographic distribution has an effect on the environment also depends on the degree to which fishing area is affected by the distribution of quota among communities. As mentioned previously, the geographic distribution of effort by the at-sea fleets, which harvest 58% of the non-tribal commercial allocation (24% for the mothership sector and 34% for the catcher-processors), would likely be unaffected by a reallocation of mothership sector CHA. The potential geographic effect is then most likely limited to the reallocation of shoreside QS (a maximum of 20% of the 42% allocated to the shoreside fishery, 8.4% of the nontribal commercial whiting allocation). Again, given that some of the reallocation is likely to occur among members of the same community or move in opposite directions, 8.4% is an upper bound on the amount of the whiting allocation that may be geographically redistributed over the short-term. Further, any effect on fishing areas occurring as a result of the geographic distribution of QS among communities on fishing areas will be tempered by the fact that vessels travel relatively long distances to fishing grounds. For example, vessels fishing out of Columbia River ports often fish off the northern Olympic Peninsula. Additionally, vessels sometimes shift ports in response to a more northerly distribution of optimal fishery conditions.

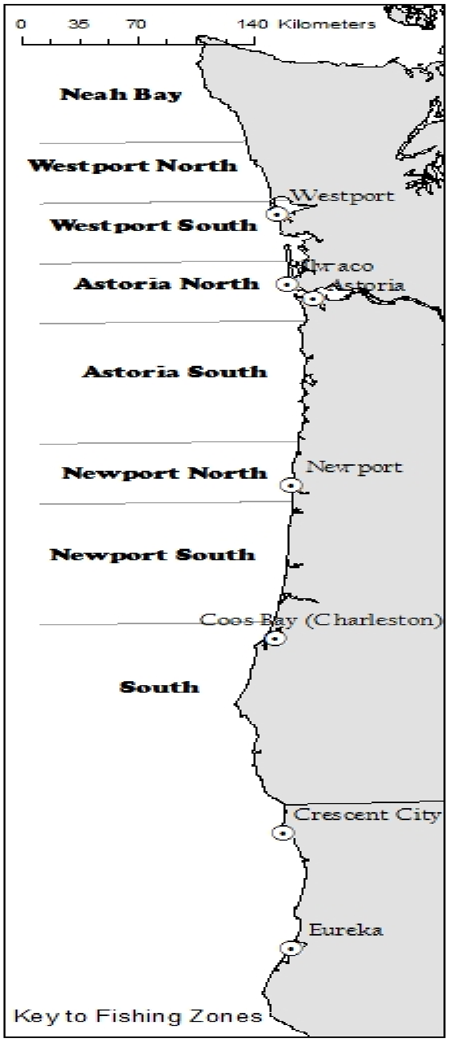


Figure 4-1. Key to fishing zones used for tow analysis.

The following analysis indicates the degree to which vessels range along the coast on a given trip. For purpose of analysis and maintaining confidentiality, the coast was divided up into eight geographic regions (Figure 4-1) and tows were assigned to each region based on the starting point of the tow. Figures 4-2 through 4-5 show the geographic distribution of whiting tows out of each port for trips on which the vessel departed from and returned to the same port. Each dot represents one tow within the respective regional polygon shown in the figures, but the dots are randomly distributed within each polygon. (The polygons bound all tow locations within the given year.) In general, polygons with no dots indicate areas where data was excluded for confidentiality (less than 3 vessels fishing in those areas). Table 4-3 provides counts of tows by region, categorized by port for the trip. In these figures and table it can be seen that in some years vessels fishing out of Astoria range as far north as vessels fishing out of Westport but that vessels fishing out of Newport on a particular trip often do not go that far north. Also notable is the variation in distribution among years and the increased fishing range of vessels in 2011, likely due to the reduction in time pressure under the rationalized fishery. The exception is ports from Coos Bay south, for which trips substantially diminished.

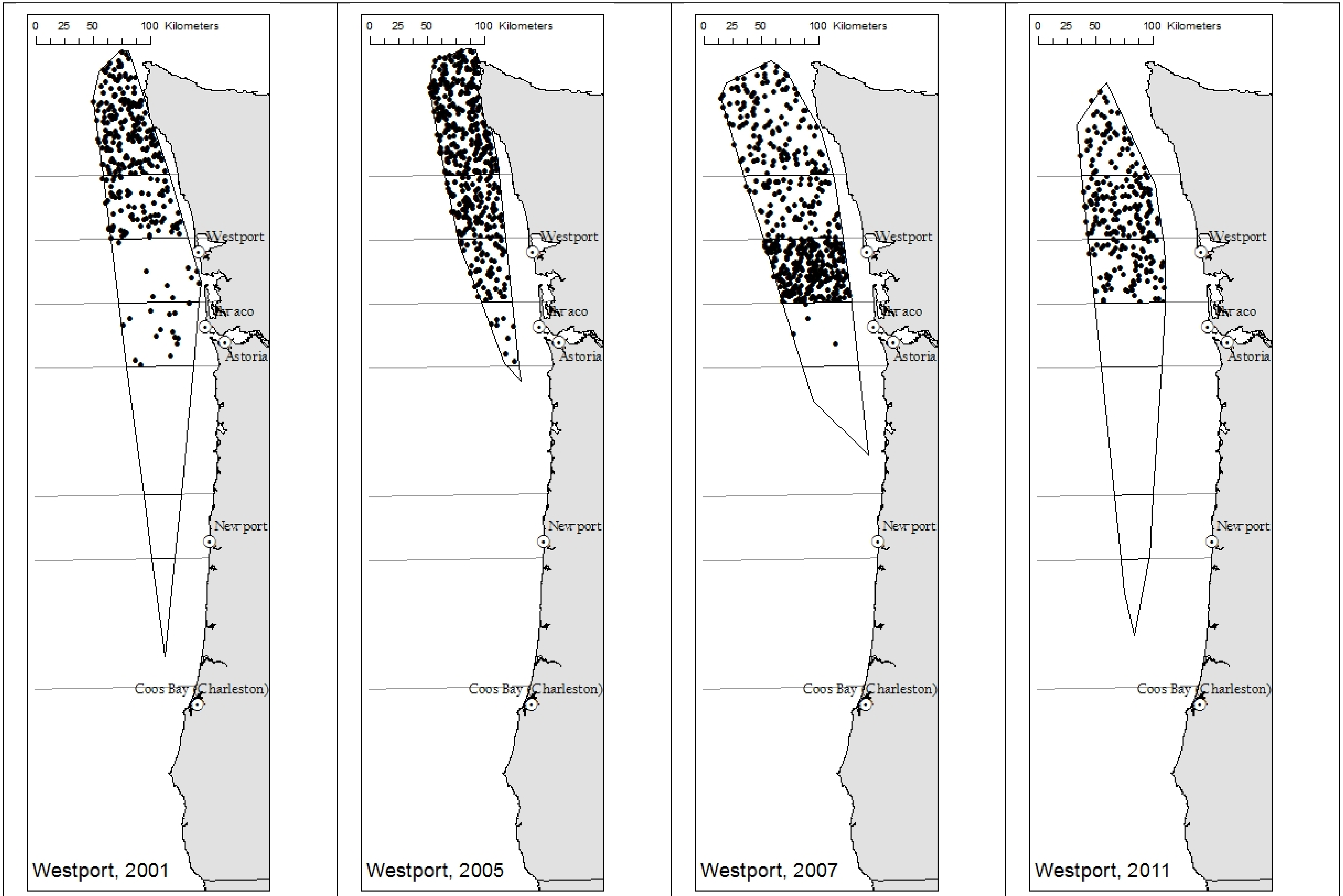


Figure 4-2. Westport: tows on trips for vessels departaing from and returning to the same port (one dot per tow, randomly distributed within the region in which the tow occured, blanks indicate confidential areas (arease where fewer than three vessels operated).

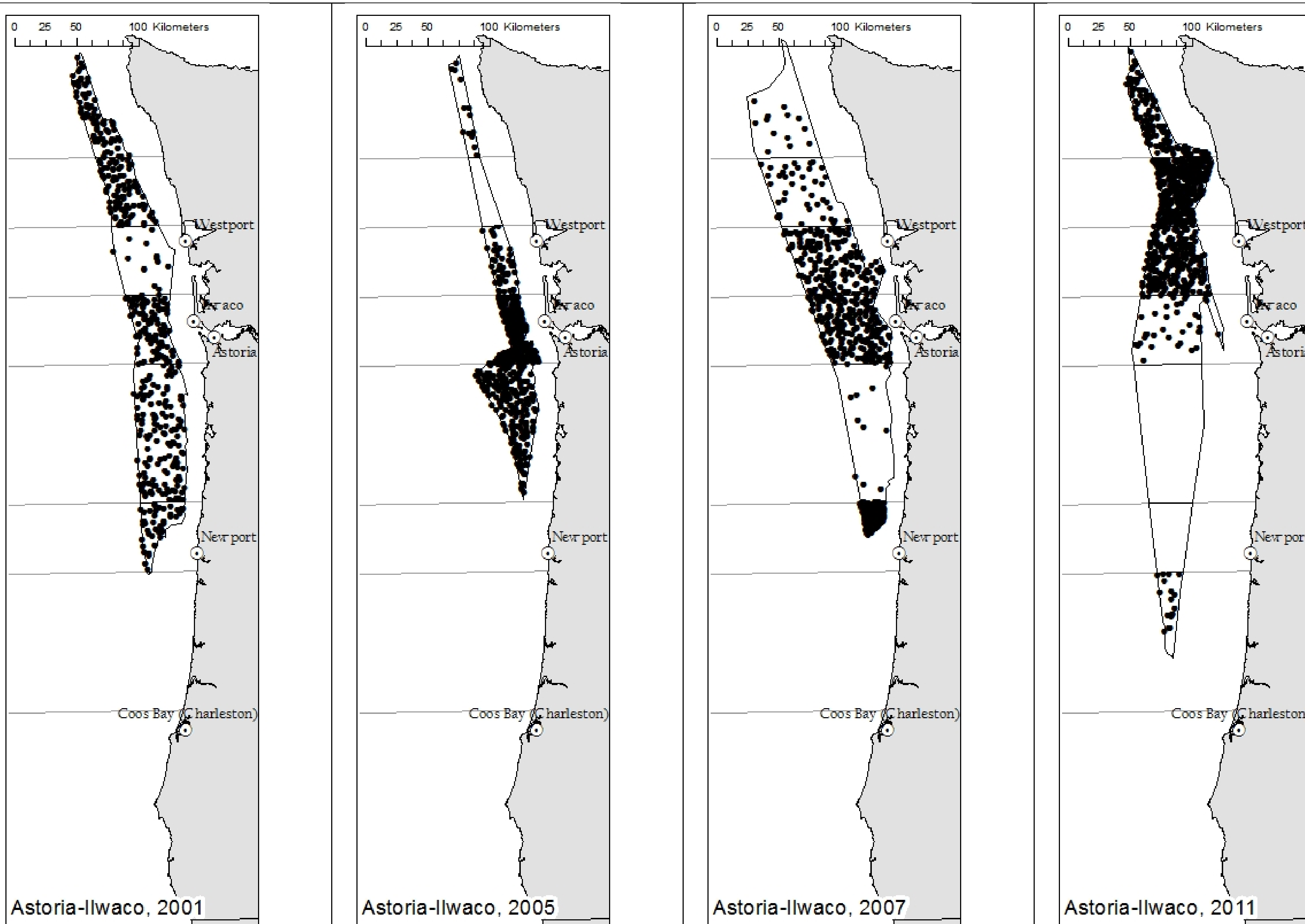


Figure 4-3. Astorial-Ilwaco: tows on trips for vessels departaing from and returning to the same port (one dot per tow, randomly distributed within the region in which the tow occured, blanks indicate confidential areas (arease where fewer than three vessels operated)

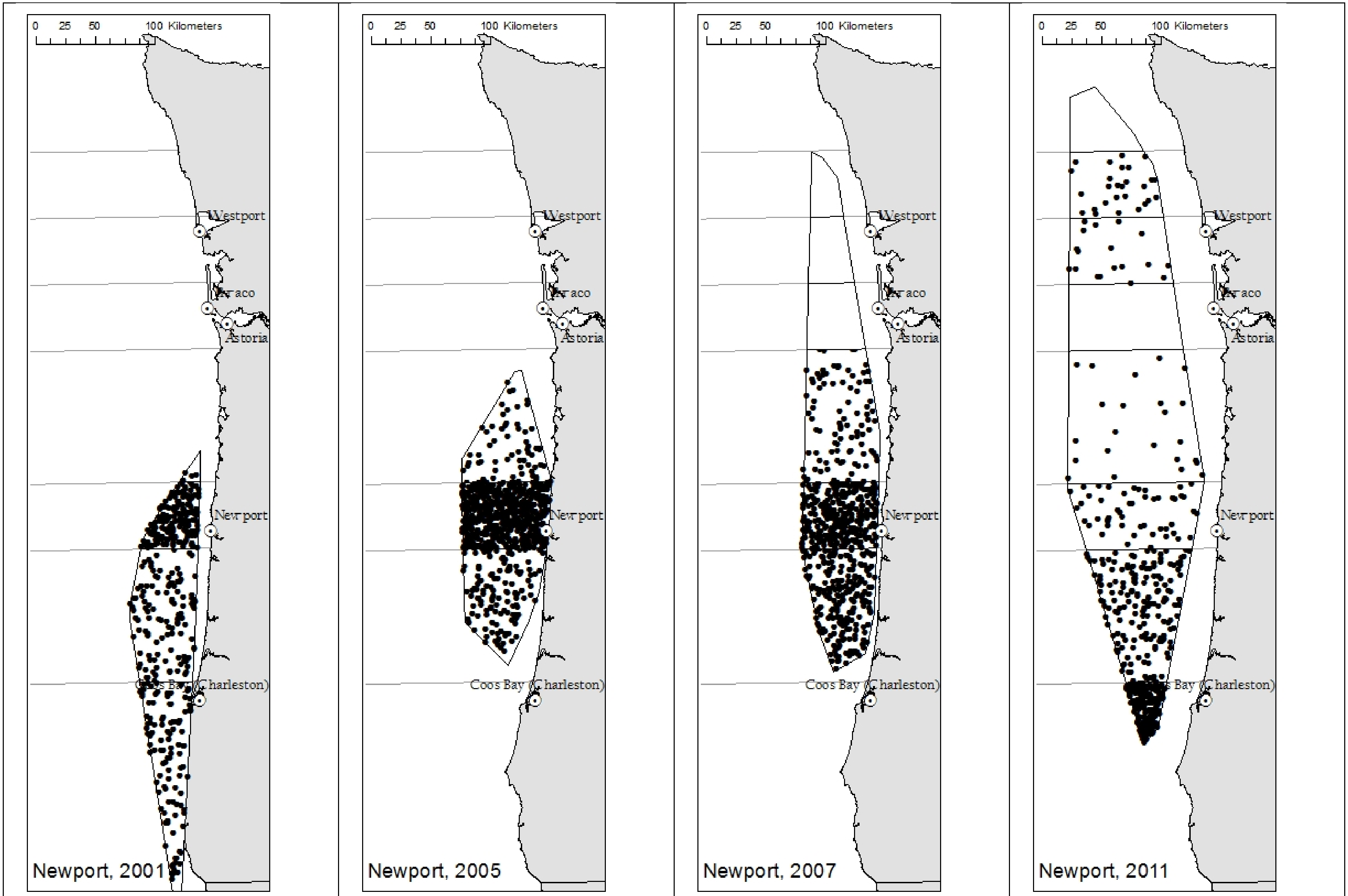


Figure 4-4. Newport: tows on trips for vessels departaing from and returning to the same port (one dot per tow, randomly distributed within the region in which the tow occured, blanks indicate confidential areas (arease where fewer than three vessels operated)

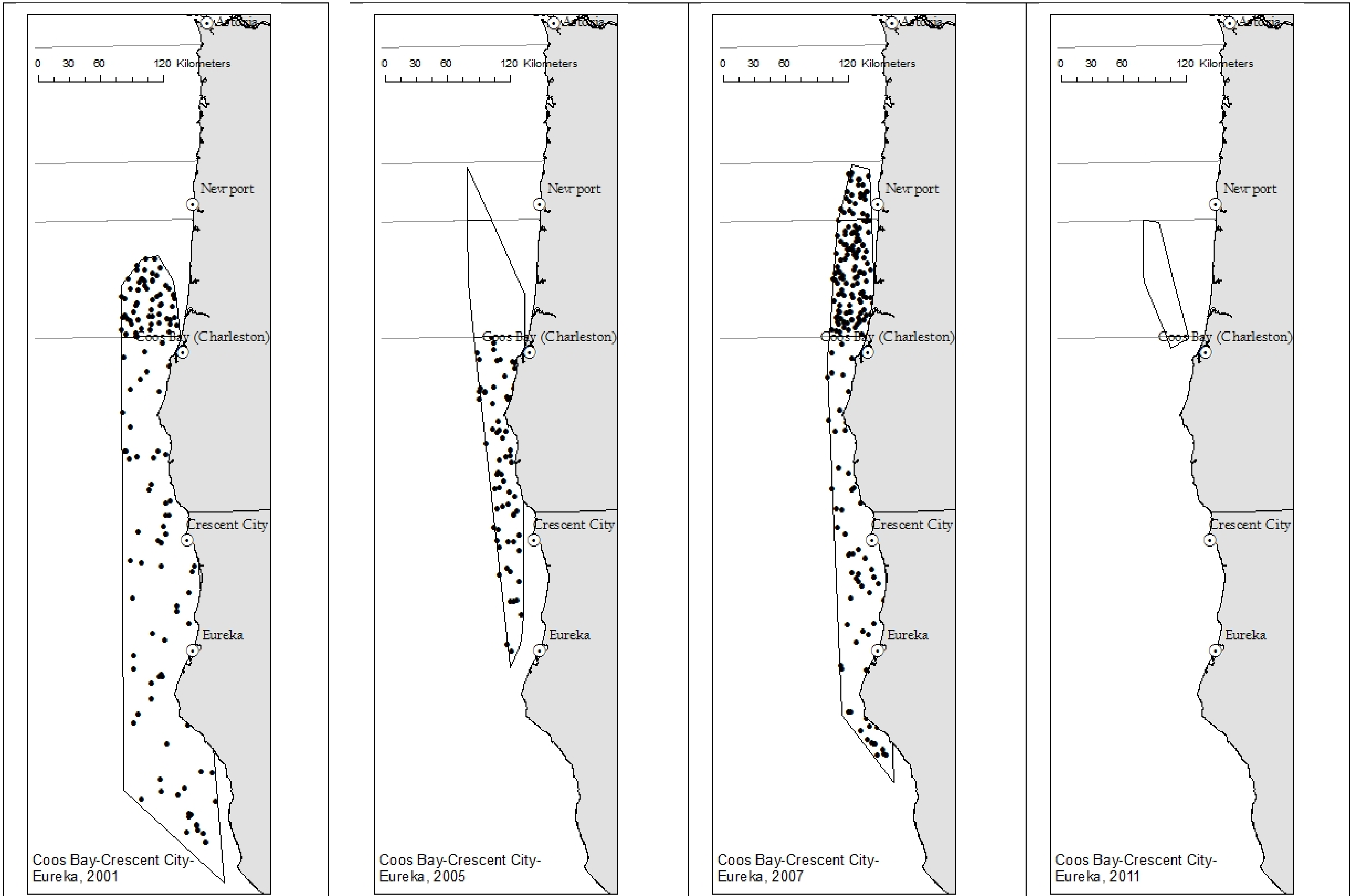


Figure 4-5. Coos Bay, Crescent City, Eureka: tows on trips for vessels departaing from and returning to the same port (one dot per tow, randomly distributed within the region in which the tow occured, blanks indicate confidential areas (arease where fewer than three vessels operated)

Table 4-3. Number of tows by fishing zone and year for Westport, WA. (Cells representing less than 3 vessels excluded.) See map below for key to fishing zones.

Fishing Zone	2001	2005	2007	2011
Departure/Return Port = Westport				
Neah Bay	187	282	134	51
Westport North	77	109	78	118
Westport South	9	52	272	72
Astoria North	15	8	4	
Total	**288**	**451**	**488**	**241**
Departure/Return Port = Astoria-Ilwaco				
Neah Bay	261	295	147	170
Westport North	172	109	111	512
Westport South	22	86	452	302
Astoria North	123	369	217	33
Astoria South	122	223	168	
Newport North	41		8	
Newport South				17
Total	**741**	**1082**	**1103**	**1034**
Departure/Return Port = Newport				
Westport North				27
Westport South				18
Astoria South	4	60	93	23
Newport North	176	593	286	50
Newport South	223	122	216	330
Total	**403**	**775**	**595**	**448**
Departure/Return Port = Coos Bay-Crescent City-Eureka				
Newport North			26	
Newport South	61		114	
South	82	78	86	
Total	**143**	**78**	**226**	

Given the relatively small amount of quota that may be reallocated among geographic regions, the QS trading that will change geographic distribution regardless of the initial allocations, and fleet mobility, the effects of the initial allocations on groundfish, including overfished species, ESA listed salmon, other protected species and other fish resources, the effect of the initial allocations on area of harvest is likely to be negligible.

With respect to the whiting fishery, if there were to be a biological effect it would most likely occur as a result of shifts in the size of the fish harvested through a change in the timing of the harvest or simply an increase in the amounts of larger sized fish caught.

The annual migratory pattern of whiting, along with the interannual variation in those patterns, are discussed in Section 3.2.1.2. The populations start the year in a southerly distribution and move to the north as the year progresses, with larger fish moving further to the north than smaller fish. The extent of northerly migration varies by year. The fish also grow as the season progresses. Because the fish take longer to reach more northerly areas, there might be some possibility that over the short term harvest would occur somewhat later in the year if quota is distributed and harvested in more northern regions. The additional opportunity for growth could lead to some increase in stock productivity. A 10% increase in productivity has been projected comparing a hypothetical scenario where 100% of the harvest is taken in April to one where 100% is taken in September (Council 1997[5]). Using this 10% hypothetical result as a maximum, and applying that result to the 8.2% maximum geographic reallocation, results in an upper bound on the impact on stock productivity of less than 1%. This would be further reduced by the fact that the difference in timing between more northern and southern fisheries is far less than the 5 month delay of the hypothetical example and reasons given above to expect that the geographic shifts would be substantially less than the 8.2% hypothetical maximum.

Whiting caught in more northerly areas also tend to be larger in size. Whether harvesting larger fish (independent of timing of harvest) has an effect on stock productivity depends on growth rates, fecundity, and natural mortality of fish of different sizes. For whiting, harvesting a larger proportion of older fish in any given year is likely to have an upward influence on stock productivity, relative to harvesting the same amounts of whiting with a smaller proportion of older fish. Again, over the long term the amount of any shift in geographic distribution of harvest is likely to be small.

4.3 Direct and Indirect Impacts to the Socioeconomic Environment

The impact on net benefits generated for the nation as a whole is expected to vary minimally among the alternatives. Alternatives that allocate to those most likely to use the allocation, rather than transfer it to another entity, will have lower transition costs. However the amount of these costs relative to the program as a whole is expected to be minimal and information is not available by which a determination can be made as to which allocation is likely to result in the lowest levels of post allocation transfers.

The primary effects are distributional and will be described in the following sections.

4.3.1 Harvesting Sector Impacts

4.3.1.1 Shoreside Whiting

Changing the allocation history periods will shift QS among recipients. How different allocation periods address policy goals is discussed in Chapter 5. Here the objective is to show the allocational results and discuss impacts.

In general, any permit owner that receives lesser or no initial allocation is on a par with those who will enter the fishery at a later time (having to acquire quota in order to enter the fishery). The initial allocation is essentially the granting of a capital asset that will affect harvester competitiveness and assist existing participants in the transition to the new management system.

[5] "Delaying all or part of the whiting harvest to later in the season allows the whiting to grow, and thus fewer would be caught to achieve the harvest guideline. This could equate to as much as a 10% increase in longterm yield if the entire harvest were delayed until September each year, compared to the entire harvest being taken in April" (Council, 1997).

To the degree that initial allocation match up with the harvesters that will use the quota, transition costs and disruption will be lessened.

Comparison of Allocations to Recent and Historic Shares of Harvest by Permit

One measure of a permit's likelihood of continuing in the fishery and the level of allocation it would need to acquire to minimize disruption to its operations is the permit's recent and historic share of the fleet harvest. Allocations in proportion to these amounts may reduce a fishing operation's need to acquire quota through purchase thereby minimizing disruption with implementation of the trawl rationalization program, or following the reallocation contained in the action alternatives covered in this document. In Figure 4-6, along the bottom of the graph permits are arrayed from those receiving the least allocation under status quo (No Action) to those receiving the most. The allocations to these permits are shown by the solid line marked by diamonds, increasing steadily from the left side to the right side of the graph. The highest allocation to any permit was under 4 percent (far right hand side). Since the allocation period for the No Action Alternative was 1994-2003, this line tracks fairly closely with the 1994-2003 history line, although the No Action allocation line is generally below the history line because 20 percent of the QS was allocated to processors. Note that the No Action allocation line is not exactly 20 percent below the permits' 1994-2003 average history because of the provision that dropped each permit's two worst years from the calculation. The 2007-20010 history for each permit is tracked by the dotted line. On the left hand side of the graph it can be seen that there were about five permits that had minimal history from 1994-2003 that had over a 1 percent share of the history from 2007-2010. Moving toward the right, a number of other permits can be seen which had substantially higher histories in recent years relative to their 1994-2003 history and relative to their initial allocations (No Action). Similarly, on the right hand side of the graph can be seen three permits which received initial allocations of over one percent of the QS that had no participation from 2007-2010. There are another five permits that did

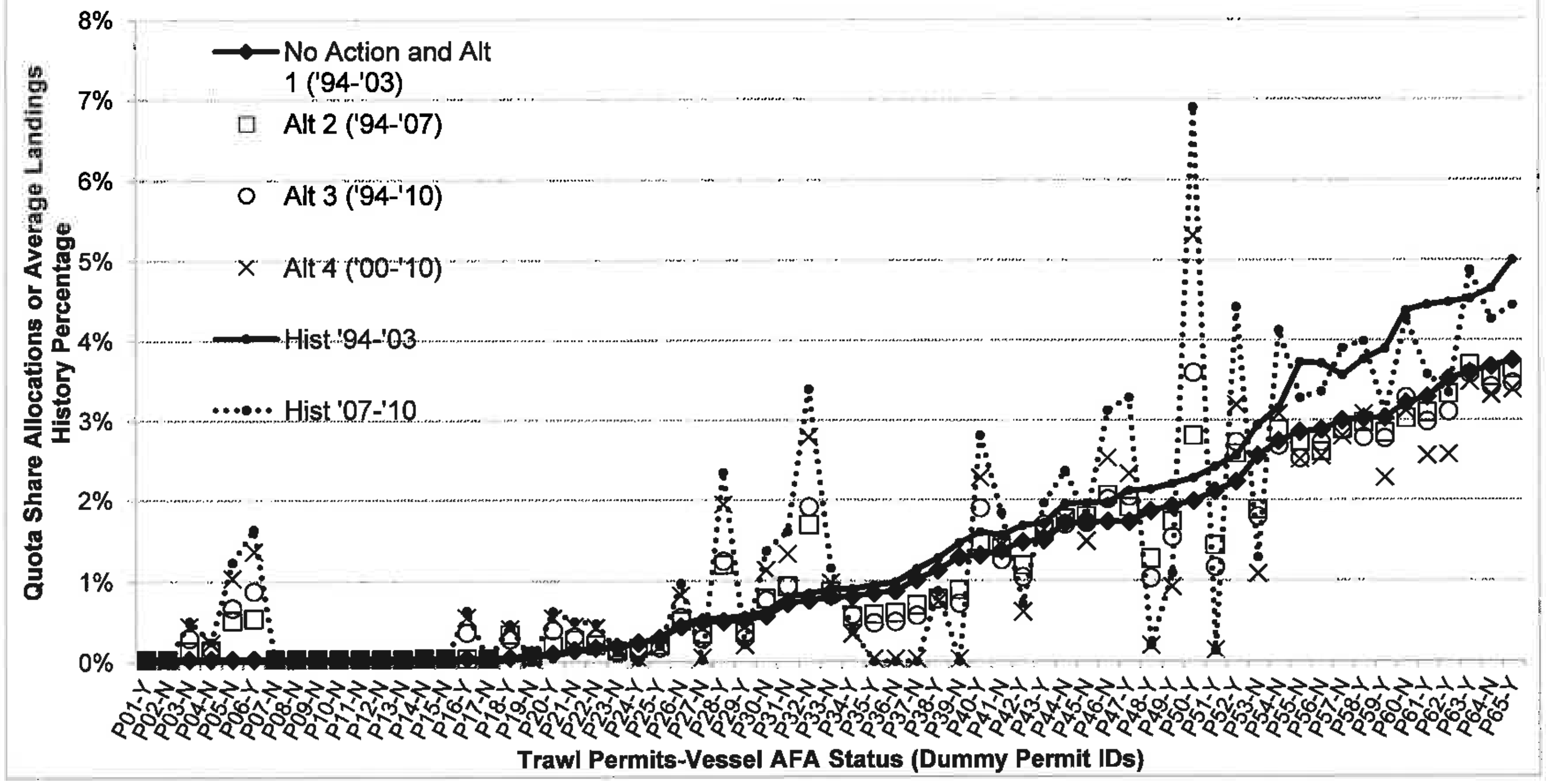


Figure 4-6. Shoreside whiting QS allocations to permits, by alternative, compared to each permit's share of shoreside whiting landings in recent and historic periods (permits ordered from lowest initial allocation to highest initial allocation under status quo (No Action) – permit numbers followed by an "N" were not associated with AFA vessel at any time from 1994 through 2011, those with a "Y" were. [a/]

a/ Excludes 102 permits that received only equal allocations of 0.04 percent each, for which the allocation does not change among the alternatives.

not participat from 2007-2010 that received initial allocation amounts of between about one half and one percent. The allocation results for the other alternatives are shown in the graph by different shape symbols. By picking individual permits and examining the allocational results, one can see that for permits with recent histories (2007-2010) that differ dramatically from their history during the initial allocation base period (1994-2003), the allocational result moves closer to their more recent history values as the allocation periods are extended to include more recent years. For example, the permit with the highest share of the 2007-2010 landings history (over 8.5 percent) received about a QS allocation of 2 percent under No Action but would receive a QS allocation of just under 3 percent if the allocation period is extended through 2007 (Alternative 2), between 3 percent and 4 percent if the allocation period is extended to 2010, and over 5 percent if the early years of the allocation period were eliminated (Alternative 4). A similar but inverse result can be observed for those permits with zero or minimal history in recent years (2007-2010).

What follows is a statistical summary of the information provided in Figure 4-6.

Statistical Summary of Figure 4-6: Comparisons to Status Quo. Relative to status quo, Alternatives 2, 3 and 4 would allocate QS to 6 permits that would not otherwise receive QS based on permit catch history (Table 4-4).[6] Alternative 4 would allocate the most to this group, a total of 3.0 percent to all permits in the group and a maximum of 1.3 percent to any one permit in the group. Alternative 2 would benefit 27 permits (6 newly qualifying permits and 21 previously qualifying permits) while reducing the allocation of 38 permits. A total of 6.3 percent of the QS would be redistributed under Alternative 2. Alternative 3 would benefit 25 permits (6 newly qualifying permits and 19 previously qualifying permits, while reducing the allocation of 40 permits. A total of 9.0 percent of the QS would be redistributed under Alternative 3. Alternative 4 would benefit 28 permits (6 newly qualifying permits and 22 previously qualifying permits, while reducing the allocation of 37 permits (25 permits with reduced allocations and 12 permits which would receive no allocation based on permit catch history[6]). A total of 17.4 percent of the QS would be redistributed under Alternative 4.

[6] However these permits would receive a quota share allocations of approximately 0.04% as part of equal sharing of the shoreside whiting allocation and may also receive some small amount to cover bycatch on the nonwhiting trips

Table 4-4. Changes in the amount of **shoreside** whiting QS allocated to permits under the alternatives relative to status quo (No Action) based on individual permit history of shoreside whiting trips (table excludes the 0.04 percent that each permit received as its share of the equal allocation and permits' share of the 0.1 percent allocated for nonwhiting trips).[a/]

	Alternatives		
	Alt 2: 1994-2007	Alt 3: 1994-2010	Alt 4: 2000-2010
Number of Permits **Not Previously Qualifying** for an Allocation based on Whiting Trip Permit History	6	6	6
Total Allocation Increases for Those Permits	1.2%	1.9%	3.0%
Maximum To Any Permit	0.5%	0.8%	1.3%
Max Increase as a Percent of Status Quo Allocation [b/]	1468.3%	2452.2%	3874.1%
Number of Previously Qualifying Permits With **Increased** Allocations Under the Alternative	21	19	22
Total Percent of Increase for Those Permits	5.1%	7.1%	14.4%
Maximum Increases to Any One Permit	0.9%	1.6%	3.3%
Max Increase as a Percent of Status Quo Allocation	123.1%	80.8%	167.1%
Previously Qualifying Permits with **Decreased** Allocations Under the Alternative	38	40	25
Total Percent of Decreases for Those Permits	-6.3%	-9.0%	-13.2%
Maximum Decreases to Any One Permit	-0.7%	-0.9%	-2.0%
Max Decrease as a Percent of Status Quo Allocation	-26.5%	-44.6%	-93.3%
Previously Qualifying Permits with **Zero** Permit History-Based Allocations Under Status Quo	-	-	12
Total Percent of Decreases for Those Permits	-	-	-4.2%
Maximum Decreases to Any One Permit	-	-	-1.3%
Max Decrease as a Percent of Status Quo Allocation	-	-	-97.4%

a/ Alternative 1 is identical to Status Quo for permits.
b/ Increase represent a percent change relative to the equal allocation amounts received by these permits under status quo.

Statistical Summary: Comparisons to Recent and Historic Periods. Relative to their 1994-2003 historic averages, under the No Action alternative 24 permits would receive allocations very slightly above their 1994-2003 average--amounts of about 0.03 percent each (Table 4-5). Because the permits are allocated only 80 percent of the total QS, most permits receive allocations that are below the long term average.[7] For all alternatives, the total amounts by which the QS allocations are below the 1994-2003 average is 15.1 percent (the sum of the increases plus the decreases). One might expect this amount to be zero (increases in shares would exactly balances decreases), however the effect of the 20 percent allocated to processors, the share taken by buyback permits from 1994-2003, and the QS allocated equally among all permits, leads to a different result.

[7] A total of 102 permits receiving only equal shares of the whiting QS and or whiting QS allocated to cover bycatch on non-whiting trips are not included in the figures or the summary tables.

Table 4-5. Differences in allocations of **shoreside** whiting QS to permits under the alternatives relative to 1994-2003 comparison years.[a/]

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	24	24	30	31	32
Total Differences Between Allocations and Comparison Period Shares for Those Permits	0.7%	0.7%	4.9%	7.6%	15.4%
Maximum Amount Above for Any One Permit	0.0%	0.0%	0.8%	1.3%	3.0%
Max Difference as a Percent of 1994-2003 Levels	1616.4%	1616.4%	100.5%	57.7%	133.0%
Number of Permits With Allocations **Lower** Than Comparison Period Share	41	41	35	34	33
Total Differences Between Allocations and Comparison Period Shares for All of Those Permits	-15.8%	-15.8%	-20.0%	-22.7%	-30.5%
Maximum Amount Below for Any One Permit	-1.3%	-1.3%	-1.4%	-1.5%	-2.3%
Max Difference as a Percent of 1994-2003 Levels	-25.1%	-25.1%	-27.3%	-30.8%	-94.1%
Sum of Deviations from Comparison Period (Total Absolute Value of Changes For Those With Higher and Lower Allocations)	16.5%	16.5%	24.9%	30.3%	45.9%

a/ The 1994-2003 averages are based on each permit's share of the entire fleet's landings, including those permits that were bought back.

Note that buyback permits were included in determining each permit's share of the historic harvest for the comparison to 1994-2003 historic shares of harvests. If the buyback permits were omitted from the calculation, the total amount by which the permits would be below their 1994-2003 averages would be 23.5 percent. This underage is the combined effect of the 20 percent of the QS allocated to processors and the 3.5 percent of the QS allocated equally among 102 permits not included in the tables (i.e., permits for which results do not vary among alternatives). The comparisons provided in Table 4-6 and Table 4-7 are for periods in which the buyback permits were not present. In both tables the total underage is 23.5 percent for all alternatives.

One measure of the amount by which the allocations vary from historic averages is the total amount allocated to each permit deviates from the averages summed across all permits. The closer the match between the averages and the allocations, the lower the deviations will be. The worse the match (i.e., with some permits receiving substantially more and others receiving substantially less than their long term averages), the greater the deviations will be.

For example, for the No Action Alternative and Alternative 1, the 24 permits receiving more than the 1994-2003 average receive a total of 0.7 percent more, and the 41 permits that receive less receive a total of 15.8 percent less (Table 4-5). The combined deviation from the long term average is 16.5 percent under these alternatives (last row of Table 4-5). The deviations increase to 24.9, 30.3, and 45.9 percent, for Alternatives 2, 3, and 4, respectively.

Using 2004-2006 as the comparison period (the base period used in the Amendment 20 analysis) it can be seen that the total deviation relative to the 2004-2006 average is 56.9 percent under No Action, decreasing to 34.9 percent under Alternative 4 (Table 4-6). The number of permits receiving greater allocations (between 34 and 36 permits) and lesser allocations (between 29 and 31 permits), relative to the 2004-2006 comparison period, remains relatively stable among the alternatives.

Table 4-6. Differences in allocations of **shoreside** whiting QS to permits under the alternatives relative to 2004-2006 comparison years.

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	35	35	34	36	36
Total Percent of Increases for Those Permits	16.7%	16.7%	11.8%	10.8%	5.7%
Maximum Amount Above for Any One Permit	2.3%	2.3%	1.6%	1.5%	0.8%
Max Difference as a Percent of 2004-2006 Levels	833.2%	833.2%	586.3%	554.9%	296.1%
Number of Permits With Allocations **Lower** Than Comparison Period Share	30	30	31	29	29
Total Percent of Decreases for Those Permits	-40.2%	-40.2%	-35.3%	-34.4%	-29.2%
Maximum Amount Below for Any One Permit	-4.4%	-4.4%	-3.5%	-3.1%	-2.2%
Max Difference as a Percent of 2004-2006 Levels	-68.7%	-68.7%	-55.8%	-61.7%	-44.1%
Sum of Deviations from Comparison Period (Totals of the Absolute Value of Changes For Those With Higher and Lower Allocations)	56.9%	56.9%	47.1%	45.2%	34.9%

Using 2007-2010 as the comparison period it can be seen that the total deviation relative to the 2007-2010 average is 56.6 percent under No Action, decreasing to 32.2 percent under Alternative 4 (Table 4-7). The number of permits receiving greater allocations (between 33 and 36 permits) and lesser allocations (between 29 and 32 permits), relative to the comparison 2007-2010 comparison period, remains relatively stable among the alternatives.

Table 4-7. Differences in allocations of **shoreside** whiting QS to permits under the alternatives relative to 2007-2010 comparison years.

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	36	36	34	33	33
Total Percent of Increases for Those Permits	16.5%	16.5%	11.4%	8.6%	4.3%
Maximum Amount Above for Any One Permit	2.1%	2.1%	1.4%	1.2%	0.6%
Max Difference as a Percent of 2007-2010 Levels	a/	a/	a/	a/	33.0%
Number of Permits With Allocations **Lower** Than Comparison Period Share	29	29	31	32	32
Total Percent of Decreases for Those Permits	-40.0%	-40.0%	-34.9%	-32.2%	-27.8%
Maximum Amount Below for Any One Permit	-6.5%	-6.5%	-5.7%	-4.9%	-3.2%
Max Difference as a Percent of 2007-2010 Levels	-76.6%	-76.6%	-67.0%	-57.8%	-37.6%
Sum of Deviations from Comparison Period (Totals of the Absolute Value of Changes For Those With Higher and Lower Allocations)	56.6%	56.6%	46.3%	40.8%	32.2%

a/ Permit with maximum increase had no landings in the 2007-2010 base period.

Comparison of Allocations by Recent and Historic Years of Participation by Permit

The previous figures and tables viewed the allocations in the context of recent and historic participation based on each permit's initial allocations and harvest shares over several different periods. In this section, performance of the alternatives with respect to recent and historic participation is examined in terms of the number of years of activity in the fishery, independent of the level of activity in any particular year. There are a total of 17 years of pre-2011 history being considered as part of the allocation period. Table 4-8 compares the QS allocations that would be received by permit holders, grouped by the duration of their participation and recent participation. For example the first set of rows in Table 4-8 show that there were 16 permits with at least 15 years of participation and that the allocations to these permits decreases with each successive option, starting at 43.30% under Alternative 1 and ending at 41.8% under Alternative 4. The most allocated to any single permit declines from 3.7% under Alternative 1 to 3.5% under Alternative 4. This trend across the alternatives is generally the opposite of that observed for the mothership CHA allocations. The second grouping of data in the table show the allocations for permits with at least one year of participation in the allocation period which places greatest emphasis on more recent years (Alternative 4, 2000-2010) as compared to those permits with no participation inthe allocation period. The final grouping shows the allocations that would go to permits with some history after the 2003 control date, as compared to those with no history after the control date.

Table 4-8. **Shoreside** whiting QS allocations to permits under the reallocation alternatives.

	No Action- Alt 1 (1994-2003)	Alt 2 (1994-2007)	Alt 3 (1994-2010)	Alt 4 (2000-2010)
Permits with at least 15 yrs participation 1994-2010				
# of permits	16	16	16	16
Amount of QS allocated	43.3%	42.7%	42.5%	41.8%
Max QS allocation	3.7%	3.7%	3.6%	3.5%
Permits with less than 15 yrs participation 1994-2010				
# of permits	49	49	49	49
Amount of QS allocated	33.2%	33.8%	34.0%	34.7%
Max QS allocation	2.7%	2.9%	3.6%	5.3%
Permits with at least 1 yr participation 2000-2010				
# of permits	53	53	53	53
Amount of QS allocated	71.9%	73.2%	73.8%	76.1%
Max QS allocation	3.7%	3.7%	3.6%	5.3%
Permits with no participation 2000-2010				
# of permits	12	12	12	12
Amount of QS allocated	4.6%	3.2%	2.7%	0.4%
Max QS allocation	1.3%	0.9%	0.7%	0.0%
Permits with at least 1 yr participation 2004-2010				
# of permits	44	44	44	44
Amount of QS allocated	66.3%	69.4%	70.6%	75.0%
Max QS allocation	3.7%	3.7%	3.6%	5.3%
Permits with no participation 2004-2010				
# of permits	21	21	21	21
Amount of QS allocated	10.2%	7.1%	5.9%	1.5%
Max QS allocation	2.1%	1.4%	1.2%	0.2%

Allocations Among Permits Associated with AFA and Amendment 15 Vessels

Some of the discussion of the allocations have focussed on the issue of relative advantages and stratagems that may have been pursued by permits associated with AFA vessels compared with permits not associated with AFA vessels. Opportunities for vessels receiving Pacific Coast Whiting Vessel Licenses to participate in the whiting fishery under Amendment 15 has also been a concern. In Figure 4-6 the horizontal axis has been labeled to indicate permits that have been associated with AFA vessels. A total of 27 of the 65 permits receiving whiting QS based on whiting catch history have been associated with AFA vessels and 38 have not (Table 4-9). A total of 51 of the 65 permits have been associated with vessels that received an Amendment 15 Pacific Coast Whiting Vessel License (Amendment 15 vessels) and 14 have not.

Table 4-9. Total permits participating in the shoreside whiting fishery associated with AFA vessels and vessels with Amendment 15 Pacific Coast Whiting Vessel Licenses.

	Permits Associated with Amendment 15 Vessels	Permits Not Associated with Amendment 15 Vessels	Total
Permits Associated with AFA Vessels	27	-	27
Permits **Not** Associated with AFA Vessels	24	14	38
Total	51	14	65

The following table provides a statistical summary, showing for each alternative the total allocations for AFA vessels compared to non-AFA vessels. In general, the total allocations among permits grouped in this fashion does not fluctuate substantially among the alternatives.

Table 4-10. Changes in QS allocations among the permits associated AFA vessels as compared to permits not associated with AFA vessels.

	No Action (1994-2003)	Alt 1 (1994-2003)	Alt 2 (1994-2007)	Alt 3 (1994-2010)	Alt 4 (2000-2010)
Shorebased Whiting Quota Share:					
AFA Vessels	41.0%	40.8%	41.2%	40.5%	41.0%
Non-AFA Vessels	35.5%	35.8%	35.4%	36.1%	35.5%

The next table breaks the allocations down further, showing a split-out for the permits associated with Amendment 15 vessels. For the 14 permits not associated with Amendment 15 vessels, there is a decline in allocations as the emphasis on more recent years increases.

Table 4-11. Allocations among permits participating in the shoreside whiting fishery grouped by associated with AFA vessels and vessels with Amendment 15 Pacific Coast Whiting Vessel Licenses.

	Permits Associated with Amendment 15 Vessels				Permits **Not** Associated with Amendment 15 Vessels			
AFA	SQ - Alt 1	Alt 2	Alt 3	Alt 4	SQ - Alt 1	Alt 2	Alt 3	Alt 4
Permits Associated with AFA Vessels	41.0%	40.7%	41.2%	40.5%	0.03%	0.03%	0.03%	0.03%
Permits **Not** Associated with AFA Vessels	32.3%	33.4%	33.4%	35.5%	3.3%	2.4%	2.0%	0.6%
Totals	73.3%	74.2%	74.5%	75.9%	3.30%	2.41%	2.04%	0.65%

Allocations to Permits and Entities Relative to Accumulation Limits

The shoreside vessel limit is 15 percent of quota pounds, i.e., the maximum amount of quota pounds that can be used on a single vessel in any one year is 15 percent of the total for the shoreside whiting sector. Examination of Figure 4-6 shows that the maximum allocations to any single permit under No Action, and Alternatives 2 and 3 would be just over 3.5 percent. The maximum allocations to a permit under Alternative 4 would be just over 5 percent. The initial allocation to permits would therefore be well below the 15 percent maximum that could be used on any single vessel, leaving substantial room for consolidation through transfers of quota pounds.

A control limit of 10 percent applies to all QS owned by a single entity. Figure 4-7displays the total QS allocation going to entities holding permits. Whereas one point in Figure 4-6 represented a single permit, each point in Figure 4-7 represents a single permit-owning entity and the allocations to all permits held by that entity. This figure shows that for the portion of the QS allocations made to permits, the most a single entity is expected to receive is just over 8.5 percent under No Action, Alternative 1, Alternative 2 and Alternative 4 and just under 8 percent under Alternative 3. None of these amounts exceeds the 10 percent QS control limit. However, under the shoreside IFQ program, some entities receive QS for both their permit history and qualified processing activity. The performance of the alternatives with respect to QS issued to entities controlling both permits and processing history is addressed in Section 4.3.2.1.

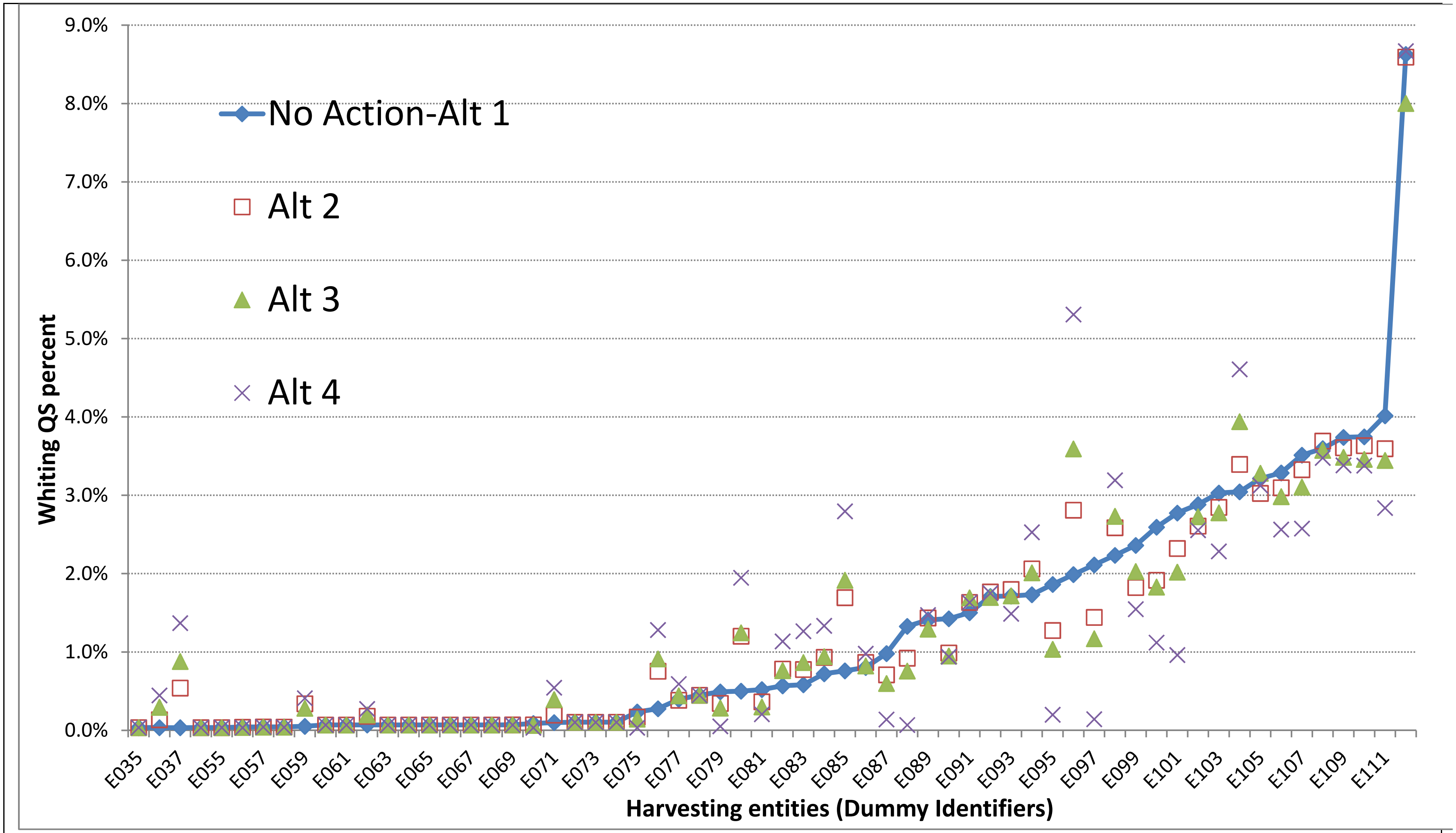


Figure 4-7. Concentration of shoreside whiting QS allocations among entities owning permits by alternative (results ordered from lowest to highest for the No Action alternative).[a/]

a/ Excludes 102 permits that received only equal allocations of 0.04 percent each, for which the allocation does not change among the alternatives

Allocations Relative to Permit Dependence

Permit dependence on whiting was assessed based on whiting exvessel revenue as a percent of total exvessel revenue. In 2007-20010, relative to 1994-2003 averages, 13 permits remained in the same dependence range, 15 permits increased their dependence, 9 permits decreased their dependence, 23 previously active permits became inactive, and 6 previously inactive permits became active. Of the fifteen permits increasing their dependence, three went from a dependence level of less than 25% to a level greater than 50%. Of the nine permits which decreased their dependence, only one permit went from a level of greater that 50% to less than 25%.

Table 4-12. Number of **shoreside** permits by level of dependence on shoreside whiting, 1994-2003 compared to 2007-2010.

1994-2003 Average Dependence	2007-2010 Average Dependence							
	>90%	75% to 90%	50% to 75%	25% to 50%	10% to 25%	>0 to 10%	Not Active	Total
>90%				1				1
75% to 90%			1				1	2
50% to 75%	1	2	2	5			1	11
25% to 50%			4	6	1		3	14
10% to 25%	1		2		5	1	4	13
>0 to 10%				2	3		14	19
Not Active		1		1	3	1	2	8
	2	**3**	**9**	**15**	**12**	**2**	**25**	68

Note: The “Not Active” category includes three permits motherhsip permits with no activity in the shoreside whiting fishery.

Vessels participating in Alaska fisheries would have a lesser level of dependence than indicated in these tables. Information on Alaskan fisheries indicates that most vessels that participate in Alaska likely rely on the West Coast whiting fishery for less than 50% of their gross revenue (i.e. it might be reasonable conjecture that for any vessel that participates in Alaskan fisheries estimates of whiting dependence provided based on West Coast fishery receipts could be reduced by at least 50%, Table 4-13). Due to confidentiality restrictions individual vessel data collected by the NWFSC from the cost earnings surveys could not be released but summarized results have been provided. Using 2003, 2004, 2007 and 2008 data based on 31 voluntary responses to cost earning surveys, the NWFSC calculated the percentage of annual revenue earned by a vessel in the West Coast whiting fishery for vessels which operated in both the West Coast whiting fishery and Alaska fisheries, denoted as the whiting dependency index. The NWFWC reports: “Revenue from operations in Alaska fisheries was relatively stable over the time period, ranging from $941,811 per vessel during 2004 to $1,027,782 per vessel during 2008. Revenue earned in the West Coast whiting fishery varied much more, ranging from $215,048 per vessel during 2003 to $612.671 per vessel during 2008.” (Personal Communication, August 9, 2012).

Table 4-13 Gross revenue dependence indicators (whiting dependency index) for whiting for vessels that participate in Alaska fisheries

	Gross Revenue from West Coast Whiting
Minimum (average of the lowest three values)	49.0%
Mean	26.9%
Maximum (average of the highest three values)	9.6%

The following tables separate out the permits which have been associated with AFA vessels from those which have not and provide the allocation estimates for permits grouped based on dependency levels. The dependence of these permits on West Coast whiting may be lower than indicated in these tables. Additionally, some of the permits which are not associated with AFA vessels were associated with vessels which participated in Alaskan fisheries.

In general permits showing more than 75% of their 1994-2003 West Coast revenue from shoreside whiting allocation revenue with increasing emphasis on more recent years and those with minimal 1994-2003 revenue (less then 10% or inactive) gain (Table 4-14). Non AFA vessels with 25% to 50% of their West Coast revenue from shoreside whiting also tend to lose with increasing emphasis on more recent years while those in the 10% to 25% tend to gain.

Table 4-14. Allocation for each alternative by level of **shoreside** whiting dependence of permits and affiliation with AFA vessels (**1994-2003**).

	Level of Dependence (**1994-2003** Average)						
	>75%	50% to 75%	25% to 50%	10% to 25%	>0 to 10%	Not Active	Totals
			Permits Associated With AFA Vessels				
			Number of Permits in Group				
	2	6	8	4	6	4	30
			Total Allocation for Group				
No Action & Alt 1	4.9%	13.1%	18.9%	3.3%	0.8%	0.1%	41.0%
Alt2	4.1%	13.0%	18.9%	3.1%	1.0%	0.6%	40.8%
Alt3	3.8%	13.1%	18.8%	3.1%	1.4%	1.0%	41.2%
Alt4	2.5%	12.8%	18.9%	3.1%	1.8%	1.5%	40.5%
			Permits Not Associated With AFA Vessels				
			Number of Permits in Group				
		4	8	8	14	4	38
			Total Allocation for Group				
No Action & Alt 1		9.8%	17.2%	7.4%	1.0%	0.1%	35.5%
Alt2		9.7%	15.7%	8.5%	1.1%	0.8%	35.8%
Alt3		9.7%	15.0%	8.4%	1.2%	1.2%	35.4%
Alt4		10.0%	13.5%	9.4%	1.4%	1.8%	36.1%
			Number of Permits in Group				
	2	10	16	12	20	8	68
			Total Allocation for Group				
No Action & Alt 1	4.9%	22.8%	36.2%	10.7%	1.7%	0.3%	76.6%
Alt2	4.1%	22.6%	34.7%	11.7%	2.1%	1.5%	76.6%
Alt3	3.8%	22.8%	33.8%	11.5%	2.5%	2.1%	76.6%
Alt4	2.5%	22.8%	32.4%	12.5%	3.2%	3.2%	76.6%

Note: Totals to less than 100% because amounts allocated to processors and amounts allocated equally among permits with no whiting history. The “Not Active” category includes three permits that were active only in the mothership sector.

Relative to 2007 to 2010 dependence levels, increasing the allocation formula emphasis on more recent years of history increases the allocation to those permits most dependent (greater than 50%) in more recent years (as measured by West Coast exvessel revenues). Permits with minimal 2007-2010 revenue (less then 10% or inactive) tend to lose QS with increasing emphasis on more recent years, along with those with 25% to 50% of their revenue from shroeside whiting. The pattern for the permits in the 25% to 50% range not associated with AFA vessels tends to be stronger than for those associated with AFA vessels.

Table 4-15. Allocation for each alternative by level of shoreside whiting dependence of permits and affiliation with AFA vessels (**2007-2010**).

	Level of Dependence (**2007-2010** Average)						
	>75%	50% to 75%	25% to 50%	10% to 25%	>0 to 10%	Not Active	Totals
Permits Associated With AFA Vessels							
Number of Permits in Group							
	5	5	9	1	1	9	30
Total Allocation for Group							
No Action & Alt 1	5.1%	11.3%	17.5%	0.1%	1.1%	6.0%	41.0%
Alt2	5.8%	11.9%	17.8%	0.3%	0.8%	4.2%	40.8%
Alt3	6.3%	12.7%	17.8%	0.3%	0.8%	3.4%	41.2%
Alt4	7.2%	13.7%	17.5%	0.4%	0.7%	0.9%	40.5%
Permits Not Associated With AFA Vessels							
Number of Permits in Group							
		4	6	11	1	16	38
Total Allocation for Group							
No Action & Alt 1		8.4%	15.8%	6.9%	0.0%	4.3%	35.5%
Alt2		9.3%	14.9%	8.5%	0.0%	3.1%	35.8%
Alt3		9.5%	14.5%	8.7%	0.0%	2.6%	35.4%
Alt4		10.7%	14.1%	10.6%	0.0%	0.7%	36.1%
All Permits							
Number of Permits in Group							
	5	9	15	12	2	25	68
Total Allocation for Group							
No Action & Alt 1	5.1%	19.7%	33.3%	7.0%	1.2%	10.3%	76.6%
Alt2	5.8%	21.2%	32.7%	8.8%	0.8%	7.3%	76.6%
Alt3	6.3%	22.2%	32.3%	8.9%	0.8%	6.0%	76.6%
Alt4	7.2%	24.4%	31.6%	11.0%	0.8%	1.6%	76.6%

Note: Totals to less than 100% because amounts allocated to processors and amounts allocated allocated equally among permits with no whiting history. The “Not Active” category includes three permits that were active only in the mothership sector.

Allocations Among Permits Associated With AFA and Amendment 15 Vessels

Table 4-16. Number of permits with shoreside history and AFA and Amendment 15 vessel affiliation.

	Permits Associated with Amendment 15 Vessels	Permits Not Associated with Amendment 15 Vessels	Total
Permits Associated with AFA Vessels	27	-	27
Permits **Not** Associated with AFA Vessels	24	14	38

Total	51	14	65

Table 4-17. QS allocation to permits by AFA and Amendment 15 vessel affiliation.

AFA	Permits Associated with Amendment 15 Vessels				Permits **Not** Associated with Amendment 15 Vessels			
	SQ - Alt 1	Alt 2	Alt 3	Alt 4	SQ - Alt 1	Alt 2	Alt 3	Alt 4
Permits Associated with AFA Vessels	41.0%	40.7%	41.2%	40.5%	0.03%	0.03%	0.03%	0.03%
Permits **Not** Associated with AFA Vessels	32.3%	33.4%	33.4%	35.5%	3.3%	2.4%	2.0%	0.6%
Totals	73.3%	74.2%	74.5%	75.9%	3.30%	2.41%	2.04%	0.65%

Exvessel Value Equivalents

To provide some perspective on the economic significance of the allocation levels, Table 4-18 translates a 0.1 percent allocation into an exvessel value equivalent for an array of possible exvessel prices and levels of allocation to the shoreside sector. The values provided in Table 4-18 range from $4,409 per 0.1 percent (for a price of $0.05 per pound and a sector allocation of 40,000 mt) to $24,251 per 0.1 percent (for a price of $0.11 per pound and an allocation of 100,000 mt). From 2006 through 2010, total landings in the shoreside fishery ranged from 40,300 mt to 97,300 mt and averaged 64,900 mt. Exvessel prices ranged from $0.06 per pound to $0.11 per pound and averaged $0.07 per pound (with inflation adjustments). QS typically trades from anywhere between 3.5 and 10 times exvessel value (CITE).

Table 4-18. Exvessel value equivalent of a 0.1 percent share of the shoreside whiting fishery for a range of prices and sector allocation levels ($).

Shoreside Sector Allocations (mt)	Whiting Exvessel Prices ($ per lb) 0.05	0.07	0.09	0.11
40,000	4,409	6,173	7,937	9,700
60,000	6,614	9,259	11,905	14,550
80,000	8,818	12,346	15,873	19,401
100,000	11,023	15,432	19,842	24,251

4.3.1.2 Mothership Catcher Vessels

Changing the allocational periods will shift catch history assignments (CHA) among recipients. How different allocation periods address policy goals is discussed in Chapter 5. Additionally, Section 5.4.2.3 (page 141) contains an evaluation of the effects of the 500 mt threshold that must be met for a permit to qualify for a mothership catcher vessel whiting endorsement. A permit must qualify for such an endorsement in order to receive an allocation. In this chapter, the objective is to show the allocational results and impacts.

In general, harvesters who receive lesser or no initial allocations are on a par with those who enter the fishery at a later time (having to acquire quota in order to enter the fishery). The initial allocation is essentially the granting of a capital asset that will affect harvester competitiveness and assist existing participants in the transition to the new management system. To the degree that initial allocation match up with the harvesters that will use the quota, transition costs and disruption will be lessened.

Comparison of Allocations to Recent and Historic Shares of Harvest

One measurement of a vessel's likelihood of continuing in the fishery and the level of allocation it would need to minimize disruption to its operations is the permit's recent and historic shares of the fleet harvest. Allocations in proportion to these amounts may reduce a fishing operations' need to purchase quota in order to achieve minimum disruption after implementation of the trawl rationalization program, or following the reallocation described in the action alternatives covered in this document. In Figure 4-8 permits are arrayed along the bottom of the graph from those receiving the least allocation under status quo (No Action) to those receiving the most. The allocations to these permits are shown by the solid line marked with diamonds, increasing steadily from the left side to the right side of the graph. The highest allocation to any permit was almost 10 percent (far right hand side). Since the allocation period for the No Action Alternative was 1994-2003, this line tracks the 1994-2003 history line fairly closely. The match is closer than for the shoreside permits shown in Figure 4-6 because there is no processor allocation (all of the catch history allocation goes to the permits). The 2007-20010 history for each permit is tracked by the dotted line. On the left hand side of the graph it can be seen that there was 1 permit that had minimal history from 1994-2003 but over 4 percent of the history from 2007-2010. Moving to the right a number of other permits are shown which had substantially higher histories in recent years relative to their 1994-2003 history and relative to their initial allocations (No Action). Similarly, on the right hand side of the graph can be seen between four and six permits that received initial allocations of one percent or more of the catch history but had no participation from 2007-2010. The allocation results for the other alternatives are shown by the different shape symbols. By picking individual permits and examining the allocational results, one can see that for permits with recent histories (2007-2010) that differ dramatically from their history during the allocation base period (1994-2003), the allocational result moves closer to the more recent values as the allocation periods are extended to include more recent years. For example, the permit with the highest percent of the 2007-2010 landings history (about 12 percent) and receiving a CHA allocation of about 10 percent under status quo, would receive about 12 percent under Alternative 2 (extending the allocation period to 2007) and Alternative 3 (extending the allocation period to 2010), and over 14 percent under Alternative 4 (dropping the early years of the allocation period). Permit P027 with no history in the 2007-2010 comparison period would receive close to 4 percent under No Action and Alternative 1, and would receive successively less as more emphasis is placed on more recent years.

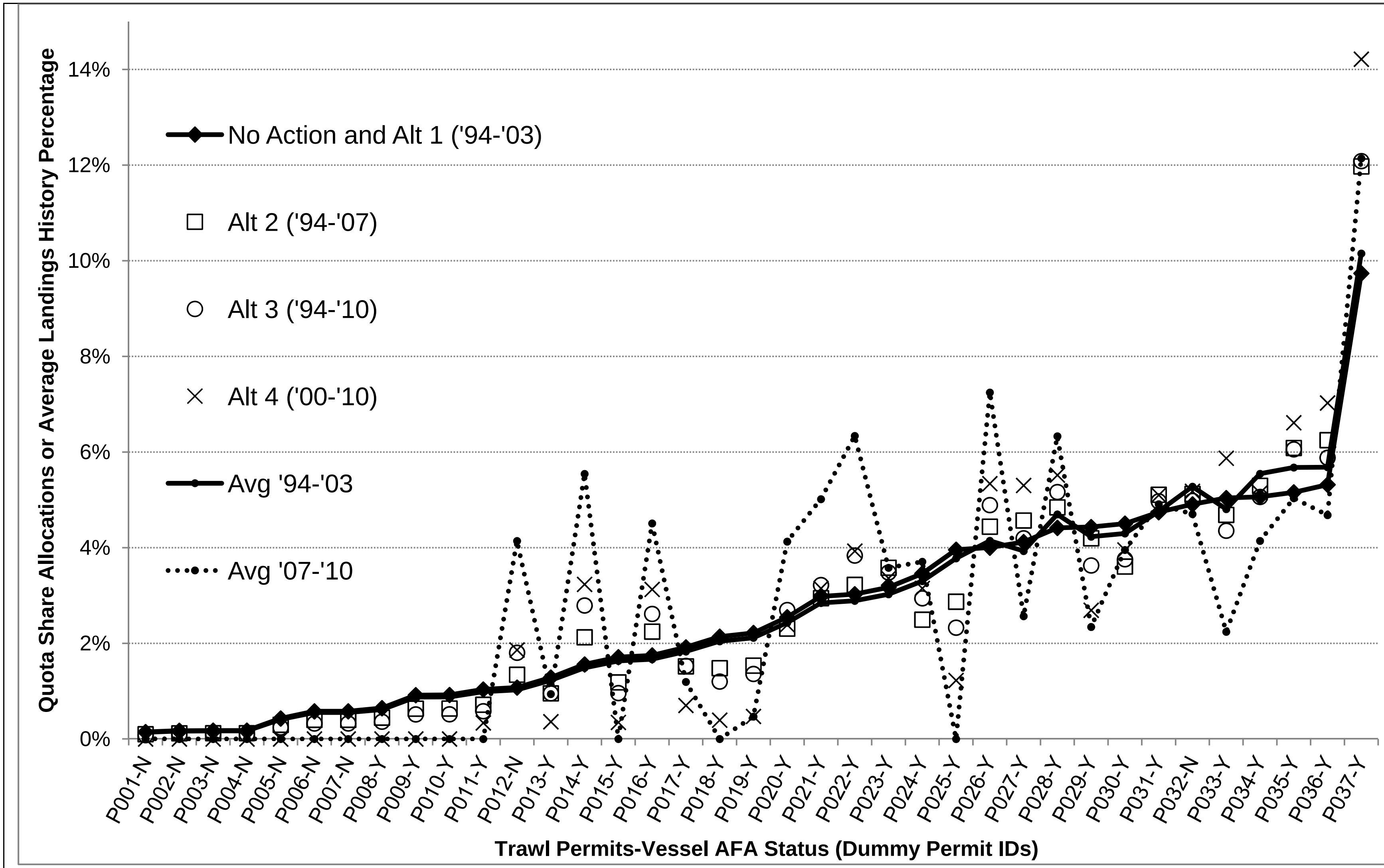


Figure 4-8. Mothership catcher vessel whiting catch history assignments to permits, by alternative, compared to each permit's share of shoreside whiting landings in recent and historic periods (permits ordered from lowest initial allocation to highest initial allocation under status quo (No Action) – permit numbers followed by an "N" were not associated with AFA vessel at any time from 1994 through 2011, those with a "Y" were.

What follows is a statistical summary of the information provided in Figure 4-6.

Statistical Summary: Comparisons to Status Quo. Alternatives 2, 3 and 4 would not allocate CHA to permits that would not otherwise receive CHA under No Action (Table 4-19). Elimination of the 1994-1999 qualifying years under Alternative 4 does not result in any permits dropping out of this group. Alternative 2 would benefit 14 previously qualifying permits while reducing the allocations of 23 permits. A total of 7.6 percent of the CHA would be redistributed under alternative 2. Alternative 3 would benefit 16 previously qualifying permits, while reducing the allocations of 21 permits. A total of 10.2 percent of the CHA would be redistributed under Alternative 3. Alternative 4 would benefit 16 previously qualifying permits, while reducing the allocations of 21 permits (11 permits with reduced allocations and 10 permits which would receive no allocation). A total of 17.9 percent of the CHA would be redistributed under Alternative 4.

Table 4-19. Changes in the amount of **mothership** whiting CHA allocated to permits under the alternatives relative to status quo (No Action) based on individual permit history of mothership sector whiting trips.

	Alternatives		
	Alt 2: 1994-2007	Alt 3: 1994-2010	Alt 4: 2000-2010
Number of Permits **Not Previously Qualifying** for an Allocation based on Whiting Trip Permit History	0	0	0
Number of Previously Qualifying Permits With **Increased** Allocations Under the Alternative	14	16	16
Total Percent of Increase for Those Permits	8.2%	10.2%	17.9%
Maximum Increases to Any One Permit	2.2%	2.3%	4.5%
Max Increase as a Percent of Status Quo Allocation	23.0%	24.1%	46.0%
Previously Qualifying Permits with **Decreased** Allocations Under the Alternative	23	21	11
Total Percent of Decreases for Those Permits	-8.2%	-10.2%	-13.2%
Maximum Decreases to Any One Permit	-1.1%	-1.6%	-2.7%
Max Decrease as a Percent of Status Quo Allocation	-27.5%	-41.2%	-69.0%
Previously Qualifying Permits with **Zero** Permit History Based Allocations Under Status Quo	-	-	10
Total Percent of Decreases for Those Permits	-	-	-4.7%
Maximum Decreases to Any One Permit	-	-	-0.9%
			-100.0%

Statistical Summary: Comparisons to Recent and Historic Periods. Relative to their 1994-2003 historic averages, under the No Action alternative 32 permits would receive allocations above their 1994-2003 average (Table 4-20 Under all the alternatives, the total amount by which the CHA allocations are above the 1994-2003 average is 5.9 percent (the sum of the increases plus the decreases). One might expect this amount to be zero (increases in shares would exactly balances decreases), however the effect of the shares of harvest taken by buyback permits during 1994-2003 results in a relative increase in CHA shares to those permits remaining. In the comparisons to 2004-2006 and 2007-2010 the sum of the increases and decreases comes to zero, since there was no buyback permit history in this period to confound the results.

Table 4-20. Differences in allocations of at-sea **mothership** sector whiting CHA to permits under the alternatives relative to 1994-2003 comparison years.[a/]

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	32	32	18	14	17
Total Differences Between Allocations and Comparison Period Shares for Those Permits	5.8%	5.8%	9.9%	12.1%	20.0%
Maximum Amount Above for Any One Permit	0.5%	0.5%	2.3%	2.5%	4.6%
Max Difference as a Percent of 1994-2003 Levels	10.4%	10.4%	24.3%	25.4%	47.6%
Number of Permits With Allocations **Lower** Than Comparison Period Share	5	5	19	23	20
Total Differences Between Allocations and Comparison Period Shares for All of Those Permits	-0.6%	-0.6%	-4.8%	-7.0%	-14.9%
Maximum Amount Below for Any One Permit	-0.2%	-0.2%	-0.7%	-1.3%	-2.4%
Max Difference as a Percent of 1994-2003 Levels	-4.2%	-4.2%	-19.9%	-35.0%	-65.8%
Number of Permits with No History in the Comparison Years and No Allocation Under the Alternatives [b/]	-	-	-	-	-
Sum of Deviations from Comparison Period (Totals of the Absolute Value of Changes For Those With Higher and Lower Allocations)	6.4%	6.4%	14.7%	19.0%	35.0%

a/ The 1994-2003 averages are based on each permit's share of the entire fleet's landings, including those of the permits that were bought back.
b/ 1 additional permits is screened out by the requirement for 500 mt of deliveries and is not included in this table.

One measure of the divergence between the allocations and historic average catch history is the total amount by which the allocations deviate from historical averages, summed across all permits. The closer the match between the averages and the allocation, the lesser the divergence. The worse the match (i.e., with some permits receiving substantially more and others receiving substantially less than their long term averages), the greater this divergence.

For example, for the No Action Alternative and Alternative 1 the 32 permits receiving more than their 1994-2003 average receive a total of 5.8 percent more and the 5 permits that receive less, receive a total of 0.6 percent less (Table 4-20). The combined deviation from the long term average is 6.4 percent under these alternatives (last row of Table 4-20). Those deviations increase to 15.7, 19.0, and 35.0 percent for Alternatives 2, 3 and 4, respectively.

Using 2004-2006 as the comparison period (the base period used in the Amendment 20 analysis) it can be seen that the total deviation relative to the 2004-2006 average ranges from 56.8 percent under No Action to 30.8 percent under Alternative 4 (Table 4-21). The number of permits receiving greater and lesser allocations relative to the comparison period remains relatively stable across the No Action Alternative and Alternatives 1 thru 3, but declines under Alternative 4 because a number of permits drop out with the elimination of the early qualifying years (1994-1999).

Table 4-21. Differences in allocations of at-sea **mothership** sector whiting CHA to permits under the alternatives relative to 2004-2006 comparison years.

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	24	24	25	25	16
Total Differences Between Allocations and Comparison Period Shares for Those Permits	28.4%	28.4%	21.5%	21.7%	15.4%
Maximum Amount Above for Any One Permit	3.4%	3.4%	2.3%	2.5%	2.7%
Max Difference as a Percent of 2004-2006 Levels	591.7%	591.7%	401.8%	572.5%	620.1%
Number of Permits With Allocations **Lower** Than Comparison Period Share	13	13	12	12	11
Total Differences Between Allocations and Comparison Period Shares for All of Those Permits	-28.4%	-28.4%	-21.5%	-21.7%	-15.4%
Maximum Amount Below for Any One Permit	-9.7%	-9.7%	-7.4%	-7.3%	-5.2%
Max Difference as a Percent of 2004-2006 Levels	-49.8%	-49.8%	-38.3%	-37.7%	-26.7%
Number of Permits with No History in the Comparison Years and No Allocation Under the Alternatives[a/]	-	-	-	-	10
Sum of Deviations from Comparison Period (Totals of the Absolute Value of Changes For Those With Higher and Lower Allocations)	56.8%	56.8%	42.9%	43.4%	30.8%

a/ 1 additional permits is screened out by the requirement for 500 mt of deliveries and is not included in this table.

Using 2007-2010 as the comparison period it can be seen that the total deviation relative to the 2007-2010 average ranges from 50.4 percent under No Action, decreasing to 33.2 percent under Alternative 4 (Table 4-22). The number of permits receiving greater and lesser allocations relative to the comparison period remains relatively stable across the No Action Alternative and Alternatives 1 through 3 but declines under Alternative 4 because several permits fail to qualify with the elimination of the early qualifying years (1994-1999).

Table 4-22. Differences in allocations of at-sea **mothership** sector whiting CHA to permits under the alternatives relative to 2007-2010 comparison years.

	Alternatives				
	No Action	1: 1994-2003	2: 1994-2007	3: 1994-2010	4: 2000-2010
Number of Permits With Allocations **Higher** Than Comparison Period Share	25	25	26	25	15
Total Differences Between Allocations and Comparison Period Shares for Those Permits	25.3%	25.3%	21.6%	17.5%	16.7%
Maximum Amount Above for Any One Permit	4.0%	4.0%	2.9%	2.3%	3.6%
Max Difference as a Percent of 2007-2010 Levels	a/	a/	a/	a/	162.0%
Number of Permits With Allocations **Lower** Than Comparison Period Share	12	12	11	12	12
Total Differences Between Allocations and Comparison Period Shares for All of Those Permits	-25.1%	-25.1%	-21.5%	-17.3%	-16.5%
Maximum Amount Below for Any One Permit	-4.0%	-4.0%	-3.4%	-2.8%	-2.4%
Max Difference as a Percent of 2007-2010 Levels					
Number of Permits with No History in the Comparison Years and No Allocation Under the Alternatives[b/]	-	-	-	-	10
Sum of Deviations from Comparison Period (Totals of the Absolute Value of Changes For Those With Higher and Lower Allocations)	50.4%	50.4%	43.1%	34.8%	33.2%

a/ Permits with maximum difference had no 2007-2010 history.
b/ 1 additional permits is screened out by the requirement for 500 mt of deliveries and is not included in this table.

Comparison of Allocations by Recent and Historic Years of Participation

The previous figures and tables compared the allocations in the context of recent and historic participation based on each permit's initial allocations and harvest share over several different periods. In this section, performance of the alternatives with respect to recent and historic participation is examined in terms of the number of years of activity in the fishery, independent of the level of activity in any particular year. There are a total of 17 years of pre-2011 history being considered as part of the allocation period. Table 4-22 compares the CHA that would be received by permit holders, grouped by the duration of their participation and recent participation. For example the first set of rows in Table 4-22 shows that there were 9 permits with at least 15 years of participation and that the allocations to these permits generally increase with each successive option, from 46.5% under Alternative 1 to 57.5% under Alternative 4. The maximum allocated to any single permit increases from 9.7% under Alternative 1 to 14.2% under Alternative 4. This trend among the alternatives is generally the opposite of that observed for the shoreside whiting QS allocations. The second grouping of data in the table shows the allocations for permits with at least one year of participation during the allocation period which places greatest emphasis on more recent years (i.e., Alternative 4, 2000-2010) compared with permits that had no participation during that allocation period. The final grouping shows the allocations that would go to permits with some history after the 2003 control date, compared with permits that have no history after the control date.

Table 4-23. Mothership whiting CV Catch History allocations to permits under the reallocation alternatives

	No Action- Alt 1 (1994-2003)	Alt 2 (1994-2007)	Alt 3 (1994-2010)	Alt 4 (2000-2010)
Permits with at least 15 yrs participation 1994-2010				
# of permits	9	9	9	9
Amount of QS allocated	46.5%	52.7%	52.6%	57.5%
Max QS allocation	9.7%	12.0%	12.1%	14.2%
Permits with less than 15 yrs participation 1994-2010				
# of permits	28	28	28	18
Amount of QS allocated	53.5%	47.3%	47.4%	42.5%
Max QS allocation	5.0%	4.7%	4.4%	5.9%
Permits with at least 1 yr participation 2000-2010				
# of permits	26	26	26	20
Amount of QS allocated	71.2%	69.8%	70.6%	69.9%
Max QS allocation	5.3%	6.2%	6.1%	7.0%
Permits with no participation 2000-2010				
# of permits	11	11	11	7
Amount of QS allocated	28.8%	30.2%	29.4%	30.1%
Max QS allocation	9.7%	12.0%	12.1%	14.2%
Permits with at least 1 yr participation 2004-2010				
# of permits	24	24	24	24
Amount of QS allocated	90.4%	93.3%	94.6%	98.9%
Max QS allocation	9.7%	12.0%	12.1%	14.2%
Permits with no participation 2004-2010				
# of permits	13	13	13	3
Amount of QS allocated	9.6%	6.7%	5.4%	1.1%
Max QS allocation	2.1%	1.5%	1.2%	0.4%

Allocations Among AFA and Non-AFA Vessels

Some of the discussion of the allocations has centered around the issue of relative advantages and strategems that may have been pursued by permits associated with AFA vessels compared with permits that are not associated with AFA vessels. In Figure 4-8 the labels on the horizontal axis indicate permits that have been associated with AFA vessels. For each alternative the following table summarizes total CHA allocations to permits associated with AFA vessels and to permits not associated with AFA vessels. The total CHA allocated to the 28 AFA-associated permits with mothership whiting history varies only slightly under the reallocation alternatives. There are 9 permits with mothership whiting history that are not associated with AFA vessels.

Table 4-24. Changes in CHA allocations among the permits associated AFA vessels as compared to permits not associated with AFA vessels.

	No Action (1994-2003)	Alt 1 (1994-2003)	Alt 2 (1994-2007)	Alt 3 (1994-2010)	Alt 4 (2000-2010)
Mothership Whiting Catch History Share:					
AFA Vessels	91.8%	91.8%	92.0%	91.9%	93.0%
Non-AFA Vessels	8.2%	8.2%	8.0%	8.1%	7.0%

Allocations Relative to Accumulation Limits

There is a 20 percent limit on the maximum amount of CHA that can be controlled by a single entity, and a limit of 30 percent on the share of CHA that can be harvested by a single vessel. Figure 4-9 displays the total CHA allocation going to entities holding permits. Whereas one point in Figure 4-8 represents a single permit, each point in Figure 4-9 represents a single permit-owning entity and the allocations to permits controlled by that entity. This figure shows that the most a single entity is believed to have received under the No Action Alternative is about 10 percent. Each of the action alternatives (except Alternative 1 which for permits is identical to No Action) would increase the maximum initial allocations to a single entity to just over 12 percent for Alternatives 2 and 3, and over 14 percent for Alternative 4.

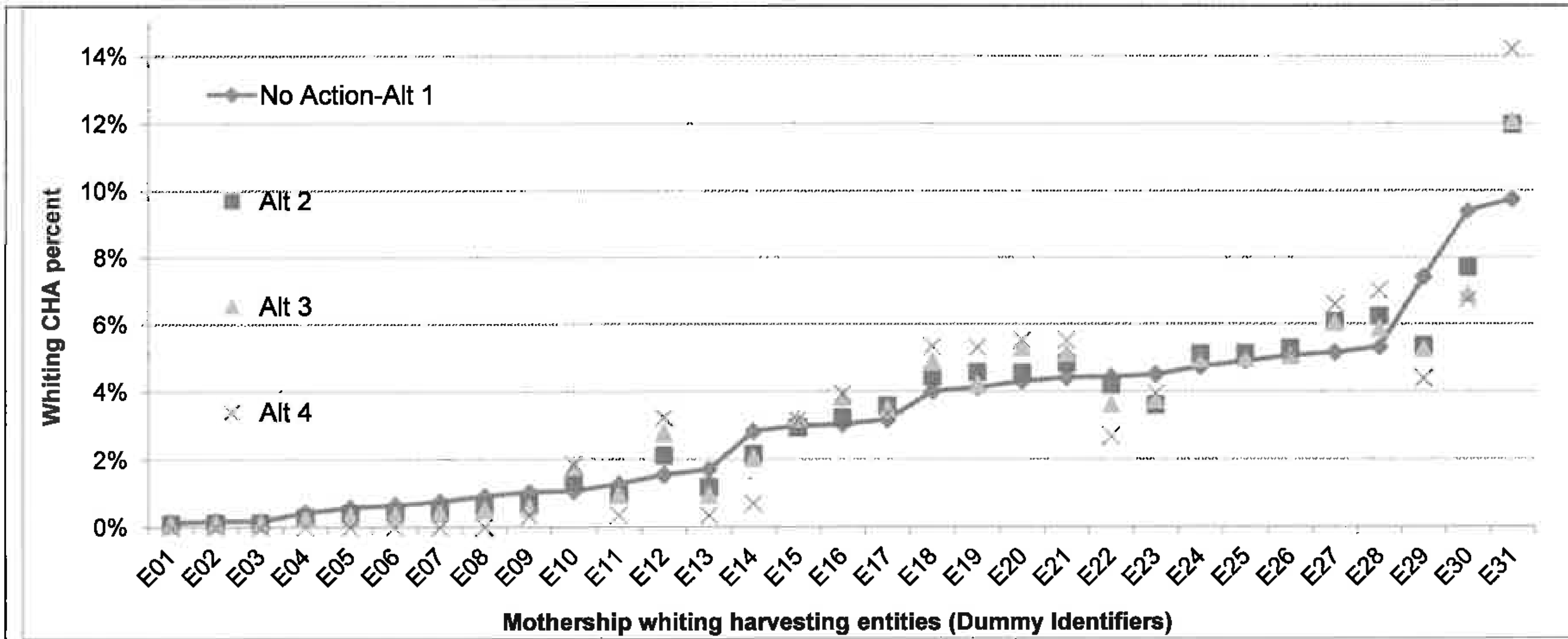


Figure 4-9. Concentration of **mothership** whiting CHA allocations among entities owning permits, by alternative (results ordered from lowest to highest for the No Action Alternative.

Allocations Relative to Dependence

In the section on "Allocations Relative to Dependence" in Section 4.3.1.1, the limitations of data based on West Coast landings receipts is discussed and indicators are provided of levels of dependence for vessels that participate in Alaska fisheries. For the mothership fleet, there are only two vessels with more than 10% of their West Coast revenue dependent on the mothership sector that were not AFA vessels. A split out is not provided on AFA vessels due to potential confidentiality concerns.

Relative to dependence for the 1994-2003 comparison period, the permits with the greatest dependence on West Coast fisheries generally receive greater allocations under the alternatives which place more emphasis on more recent years (with the exception of Alternative 3 for permits that received more than 75% of their revenue from mothership whiting deliveries). This pattern is the opposite of that seen for shoreside vessels, where vessels more dependent on the fishery in the 1994-2003 period tended to see reduced allocations as the emphasis on more recent years increases. For the most part, for permits with less than 50% of their revenue from the motherhship whiting fishery, on average allocations decline with increasing emphasis on more recent years.

Table 4-25. Allocation for each alternative by level of **mothership** whiting dependence of permits (**1994-2003**).

	Level of Dependence (**1994-2003** Average)						
	>75%	50% to 75%	25% to 50%	10% to 25%	>0 to 10%	Not Active	Totals
	Number of Permits in Group						
	9	6	8	5	11	29	68
	Total Allocation for Group						
No Action & Alt 1	42.3%	20.8%	22.7%	10.1%	4.2%	-	100.0%
Alt2	45.2%	20.4%	21.4%	10.0%	3.0%	-	100.0%
Alt3	43.7%	21.0%	22.1%	10.6%	2.6%	-	100.0%
Alt4	45.7%	23.6%	21.3%	9.1%	0.4%	-	100.0%

Note: Includes 29 permits with no mothership history and one permit with some history but less than the 500 mt required to qualify for CHA.

Increasing the allocation formula emphasis on more recent years of history increases the allocation to those permits with greater than 10% dependence in more recent years (2007-2010), with the exception of Alternative 2 for permits with between 10% and 25% dependence (Table 4-26). Permits with minimal 2007-2010 revenue (less then 10% or inactive) tend to lose QS with increasing emphasis on more recent years.

Table 4-26. Allocation for each alternative by level of **mothership** whiting dependence of permits and affiliation with AFA vessels (**2007-2010**).

	Level of Dependence (**2007--2010** Average)						
	>75%	50% to 75%	25% to 50%	10% to 25%	>0 to 10%	Not Active	Totals
	Number of Permits in Group						
	7	6	6	2	3	44	68
	Total Allocation for Group						
No Action & Alt 1	30.1%	24.5%	23.1%	5.6%	3.2%	13.6%	100.0%
Alt2	32.9%	25.6%	24.6%	5.0%	2.5%	9.5%	100.0%
Alt3	33.3%	26.2%	24.7%	5.6%	2.5%	7.7%	100.0%
Alt4	36.9%	28.5%	25.5%	5.8%	1.1%	2.3%	100.0%

Note: Includes 29 permits with no mothership history and one permit with some history but less than the 500 mt required to qualify for CHA.

Allocations Among Permits Associated With AFA and Amendment 15 Vessels

Table 4-27. Number of permits with mothership history and AFA and Amendment 15 vessel affiliation.

	Permits Associated with Amendment 15 Vessels	Permits Not Associated with Amendment 15 Vessels	Total
Permits Associated with AFA Vessels	28	1	29
Permits **Not** Associated with AFA Vessels	9	1	10
Total	37	2	39

Table 4-28. CHA allocation to permits by AFA and Amendment 15 vessel affiliation.

	Permits Associated with Amendment 15 Vessels				Permits **Not** Associated with Amendment 15 Vessels			
AFA	SQ - Alt 1	Alt 2	Alt 3	Alt 4	SQ - Alt 1	Alt 2	Alt 3	Alt 4
Permits Associated with AFA Vessels	90.8%	91.3%	91.4%	93.0%	0.9%	0.6%	0.5%	0.0%
Permits **Not** Associated with AFA Vessels	7.8%	7.7%	7.8%	7.0%	0.4%	0.3%	0.2%	0.0%

Exvessel Value Equivalents

To provide some perspective on the economic significance of differences in the allocation levels, Table 4-29 translates a 0.1 percent allocation into an exvessel value equivalent for an array of possible exvessel prices and levels of allocation to the mothership sector. The values provided in Table 4-29 range from $4,409 per 0.1 percent (for a price of $0.05 per pound and an allocation level of 20,000 mt) to $21,164 per 0.1 percent (for a price of $0.12 per pound and an allocation level of 60,000 mt). From 2006 through 2010, total whiting deliveries in the mothership fishery ranged from 24,100 mt to 57,500 mt and averaged 44,100 mt. Exvessel prices ranged from

$0.05 per pound to $0.12 per pound and averaged $0.08 per pound (with inflation adjustments). QS typically trades from anywhere between 3.5 and 10 times exvessel value (CITE).

Table 4-29. Exvessel value equivalent of a 0.1 percent share of the mothership whiting fishery for a range of prices and allocation levels ($).

Mothership Sector Allocations (mt)	Whiting Exvessel Prices ($ per lb)				
	0.05	0.06	0.08	0.10	0.12
20,000	4,409	5,291	7,055	8,818	10,582
40,000	6,614	7,937	10,582	13,228	15,873
60,000	8,818	10,582	14,110	17,637	21,164

4.3.1.3 Combined Shoreside and Mothership Allocations

Some permits have participated in both the shoreside and mothership fishery and would receive an adjustment in their allocations for both sectors as a result of a change in the allocation periods. Figure 4-10 shows the combined effect of the alternatives in terms of the total whiting received by each permit. Note that the dummy permit numbers in the figures in this document do not necessarily correspond to one another. In this figure it can be seen that there are a few permits on the far right hand side that would receive no allocation from either fishery under a continuation of status quo. In the section on cumulative impacts there is a figure that shows the value of allocations to permits, including the nonwhiting allocations. Also of note is that the amount of benefit any permit receives from an increasing emphasis on more recent years appears to be greater the greater their allocation under status quo (the amount by which alternatives are above the no action lines increases as the total allocations to permits increase). Conversely, moving from right to left, the amount of the reduction (distance to points below the no action line) tends to increase moving from right to left (until the decreases appear to become constrained by the horizontal axis).

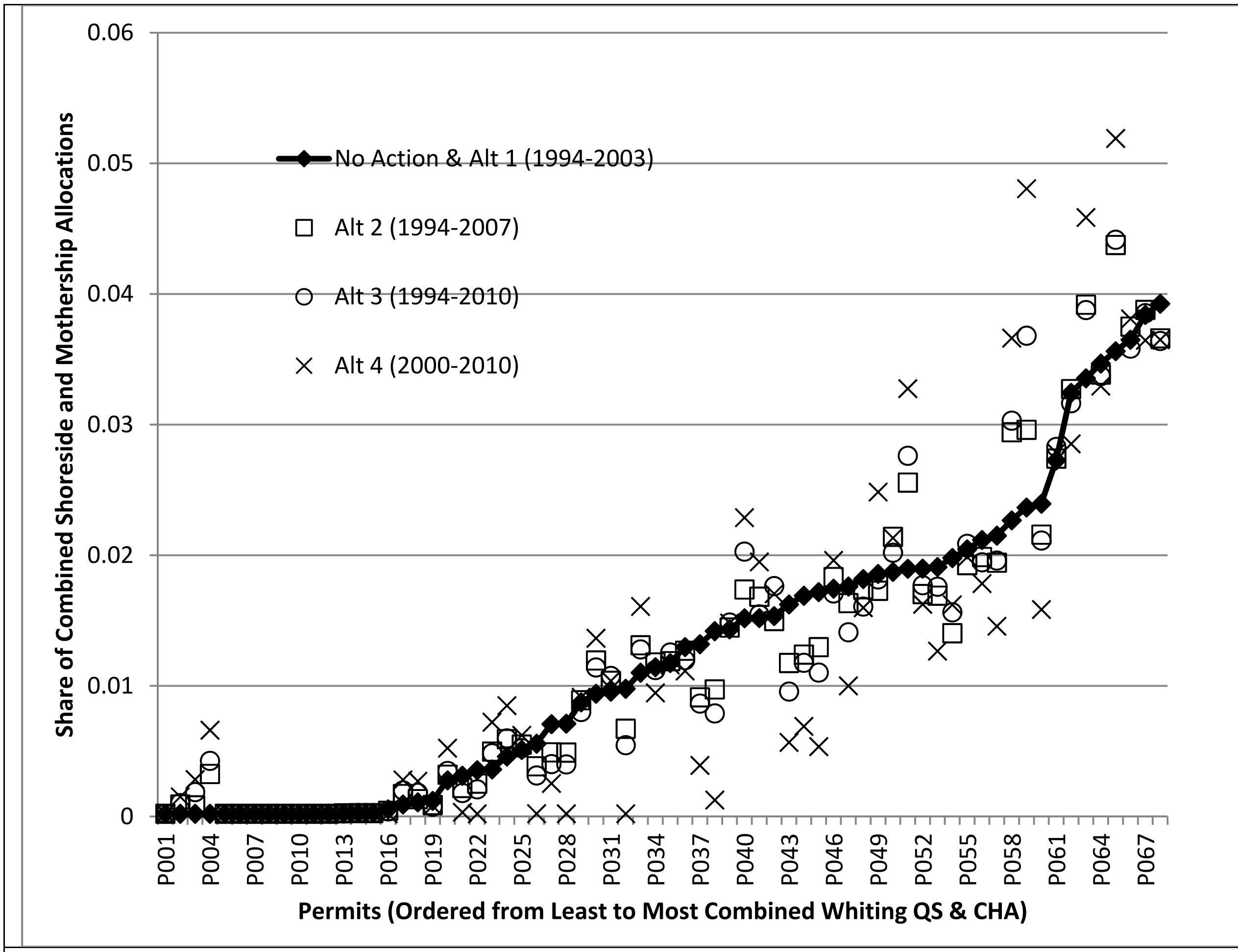


Figure 4-10. Combined shoreside and mothership allocations to permits under each alternative (dummy permit numbers are different from other figures).

The following figure examines these dynamics from the perspective of the shoreside allocations. The permits in the previous figure have been reordered from the least to the most shoreside allocation and a line added to show the status quo and Alternative 4 shoreside allocations. The following figure examines these dynamics from the perspective of the shoreside allocations.

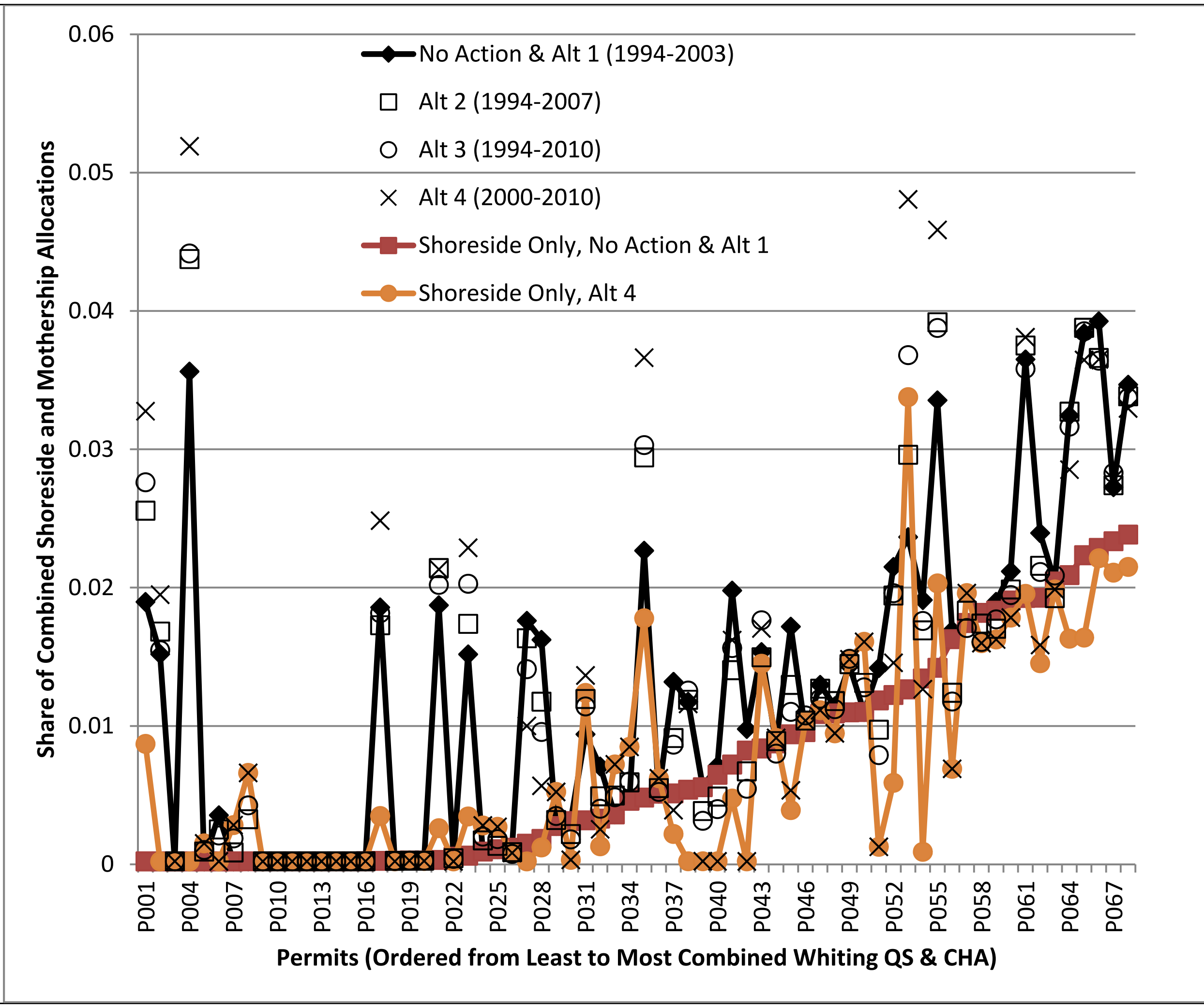
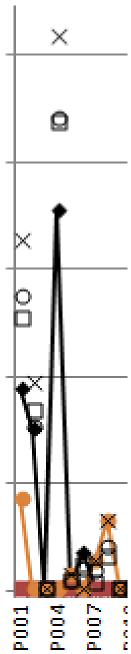


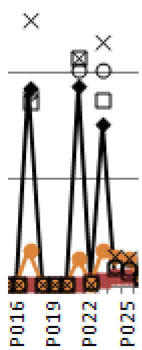
Figure 4-11. Combined mothership and shoreside allocations to permits, except as noted (permits ordered from least to most shoreside allocation under No Action and Alternative 1).

The permits in the previous figure have been reordered from the least to the most shoreside allocation and a line added to show the status quo and Alternative 4 shoreside allocations. The following figure examines these dynamics from the perspective of the shoreside allocations. The permits in the previous figure have been reordered from the least to the most shoreside allocation and a line added to show the status quo and Alternative 4 shoreside allocations. The following figure examines these dynamics from the perspective of the shoreside allocations. The permits in the previous figure have been reordered from the least to the most shoreside allocation and a line added to show the status quo and Alternative 4 shoreside allocations.



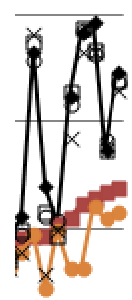
←Starting on the far left hand side of the figure the first permit shows minimal shoreside history under status quo and a substantial increase under Alternative 4. The status quo line for the combined allocation amount shows that this permit, while receiving minimal shoreside allocation received a more substantial mothership allocation. That allocation would be increased further under options that emphasize more recent years. The second and fourth permits over receives no benefit from additional emphasis on more recent years, in terms of its shoreside allocation, but recieve a mothership allocation and benefit from that.

Next comes a few points which receive minimal shoreside allocation, that might have some benefit from an emphasis on more recent years. →



←Toward the center of the graph are another three permits with minimal shoreside allocations that receive a bump in shoreside allocation as a result of an increased emphasis on more recent years and also receive allocations as a result of participating in the mothership fishery.

On the far right hand side it can be seen that the permits receiving the highest shoreside allocations under status quo generally experience reductions in both their shoreside and mothership allocations with increased emphasis on more recent years. →



The following figure is similar to the previous but provides mothership sector only allocations and orders the permits according to the status quo mothership sector allocations.

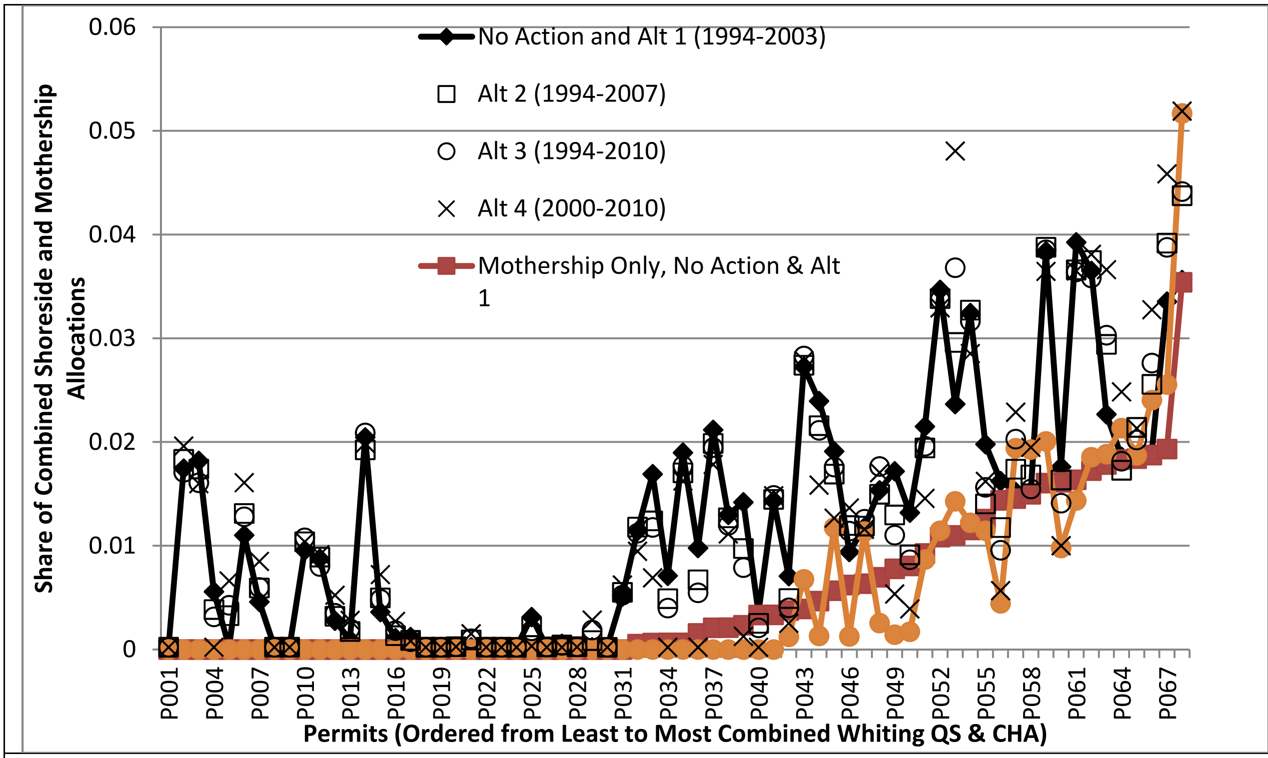


Figure 4-12. Combined mothership and shoreside allocations to permits, except as noted (permits ordered from least to most mothership allocation under No Action and Alternative 1)

Allocations Among AFA and Non-AFA Vessels

Some of the discussion of the allocation alternatives has centered on the issue of relative advantages and strategems that may have been pursued by permits associated with AFA vessels compared with permits not associated with AFA vessels. The following table summarizes the total allocations for permits associated with AFA vessels compared with allocations to permits not associated with AFA vessels for shoreside whiting and mothership whiting allocations combined. The total CHA allocated to the 30 AFA-associated permits varies only slightly under the reallocation alternatives. There are 34 catcher vessel permits with west coast whiting history that are not associated with AFA vessels.

Table 4-30. Changes in allocations among the permits associated AFA vessels as compared to permits not associated with AFA vessels (shoreside and mothership combined).

	No Action (1994-2003)	Alt 1 (1994-2003)	Alt 2 (1994-2007)	Alt 3 (1994-2010)	Alt 4 (2000-2010)
Combined Shorebased-Mothership Whiting (weighted) "Quota":					
AFA Vessels	59.5%	59.5%	59.4%	59.7%	59.6%
Non-AFA Vessels	27.8%	27.8%	27.9%	27.6%	27.7%

4.3.1.4 Other Harvesting Sectors, Including Tribes and Recreational Fisheries

There is a possibility that other commercial sectors might be affected if the initial allocation of QS among shoreside whiting processors increases the probability that a processor serving those fisheries goes out of business. For this result to occur, the lack of an initial allocation (or a low initial allocation relative to other processors) would have to be a severe enough disadvantage that the processor became unable to compete with other processors and hence could not remain in business. The effect on any particular firm will ultimately depend on the fiscal strength of the business. Those who receive an initial allocation may experience a boost in their competitive advantage due to the infusion of new wealth (the value of the QS received). Those who receive lesser amounts relative to other processors or no allocations will be on a competitive par with newly entering processors (i.e., need to offer competitive prices to fishermen without the benefit of the leverage that processor owned QS might provide, or need to purchase QS to use in leveraging more deliveries from harvesters). Ultimately, the effect on other sectors would likely be geographic. If a processor goes out of business and there is not another processor within the community to pick up the slack, then it is likely that landings would shift to other communities, and possibly to harvesters in those other communities, depending on fleet mobility. The distributions of the allocations among processors and potential effects on communities are discussed in Sections 4.3.2 and 4.3.3.

Another potential effect on other sectors concerns the impact of the selected alternative on the effectiveness of control dates which may be used when limited access systems are considered for other fisheries in the future. The effect may be on both fairness and equity considerations for those fisheries and on the fishery conditions that develop during those deliberations. This issue is discussed further in Sections 5.4.5.3 and 5.5.3.

4.3.1.5 Adjacent Council Fisheries

Certain segments of the West Coast groundfish fleet move between Alaskan (North Pacific Fishery Management Council) area fisheries and the West Coast. This is particularly true of the catcher and processing vessels in the West Coast whiting fishery. A reduction in opportunities for participants on the West Coast may cause increased effort in other fisheries and conversely an increase in opportunity for participants on the West Coast may decrease their effort elsewhere. None of the alternatives will affect the fleet's overall opportunity on the West Coast. To the degree that a change in allocations results in a net increase or decrease in opportunities for those West Coast vessels that participate in Alaskan fisheries, the effect is likely to be minor because of the relatively small size of West Coast fisheries relative to those in Alaska.

The issue of reliability of control dates may also affect fisheries in other Councils, as identified in the previous section and discussed in greater in Sections 5.4.5.3 and 5.5.3.

4.3.2 Processing Sector Impacts

4.3.2.1 Shoreside Processors

Allocations to Shoreside Processors for Processing History

Those processors who receive an initial allocation may experience a boost in their competitive advantage due to the infusion of new wealth (the value of the QS received). Whiting processors receiving an initial allocation of QS are advantaged by the value of the asset provided in one of several ways: (1) as an alternative to offering higher prices, processors can use the QP they are issued annually as leverage with harvesters to attract additional landings; (2) the annually issued QP can be sold to harvesters and the revenue used to augment prices offered to harvesters, to offer processed product at lower prices, or to otherwise cover costs, augment profit, or improve competitiveness; (3) the QS may be sold for a one time capital infusion that may be used for a variety of business purposes or to augment profits. Those processors who receive lesser amounts relative to other processors or no allocations will be on a competitive par with newly entering processors (i.e., need to offer competitive prices to fishermen without the benefit of the leverage that processor-owned QS might provide, or need to purchase QS to use in leveraging more deliveries from harvesters).

This section includes figures that show for each alternative the expected distribution of the 20 percent of QS allocated to processors in comparison to recent year and historic deliveries (Figure 4-13 and Figure 4-14). Note that because processors receive only 20 percent of the QS, initial allocations for all processors are well below their recent year production levels (Figure 4-13).

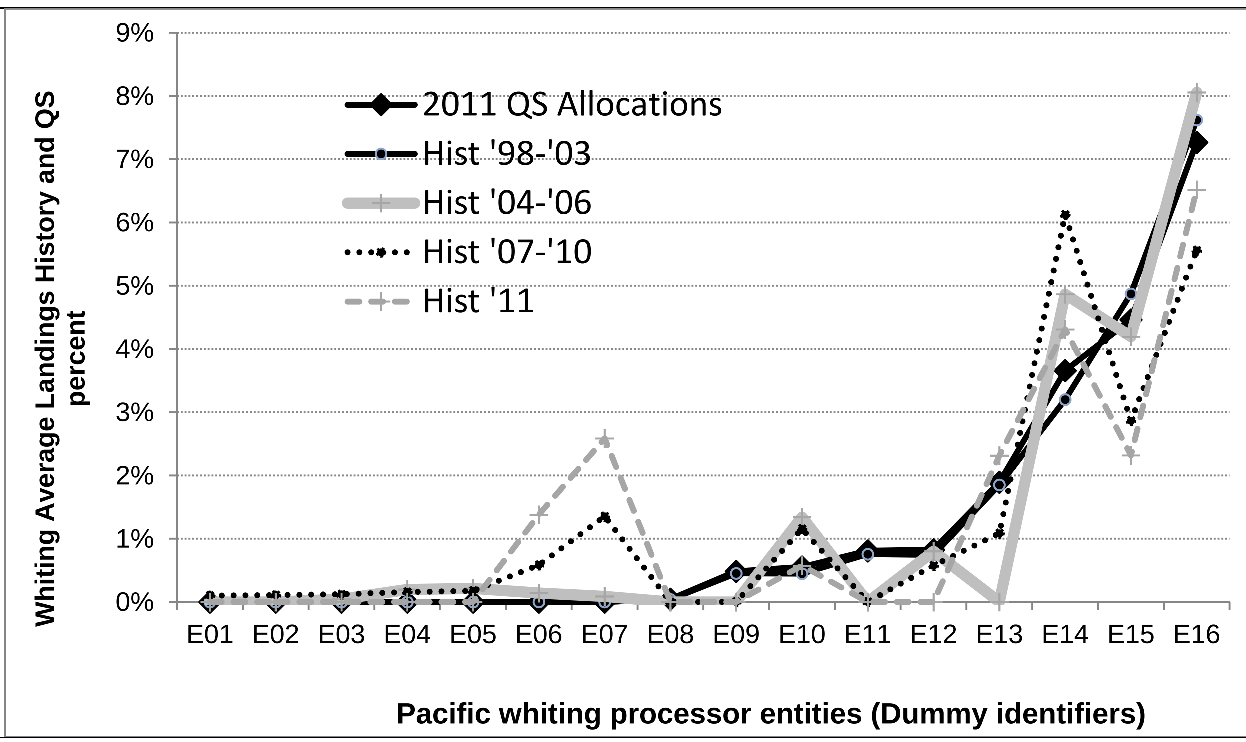


Figure 4-13. Alternatives compared to recent years deliveries to processing companies (the percents displayed for deliveries has been reduced to 20 percent of actual amounts to provide a scaled

comparison with the whiting QS allocated to processors – processors are allocated 20% of the total QS).

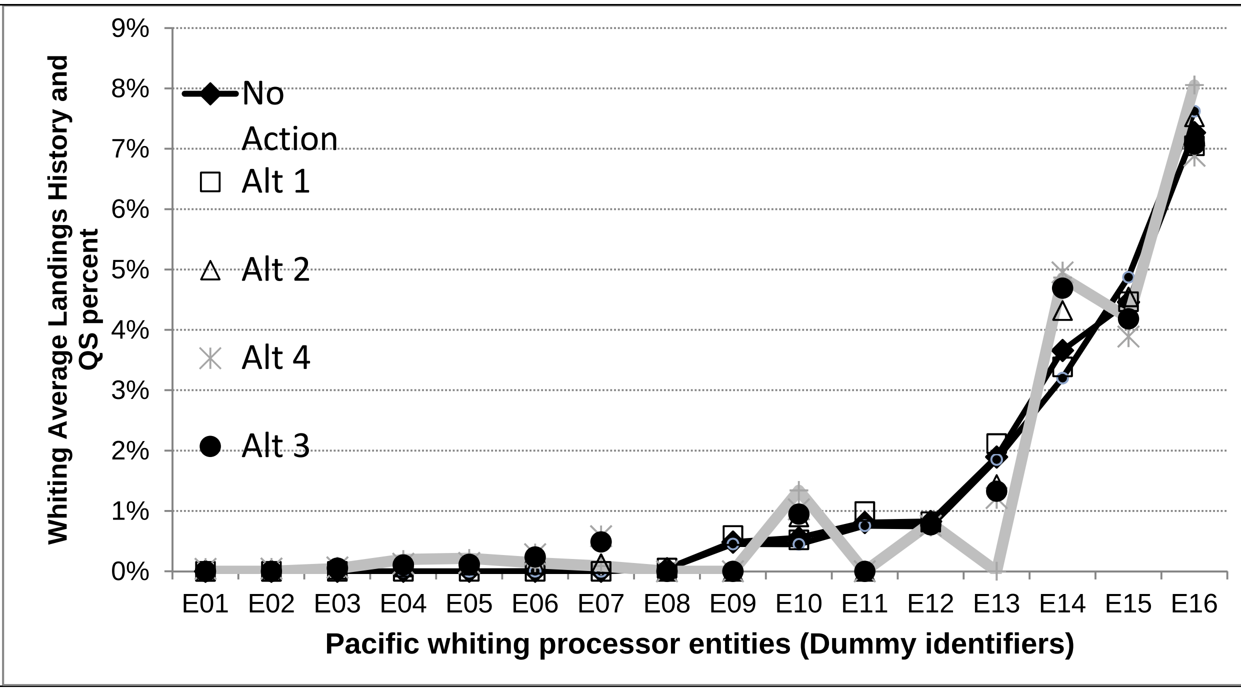


Figure 4-14. Alternative allocations compared to historical deliveries to processing companies (1998-2004 and 2004-2006) (the percents displayed for deliveries has been reduced to 20 percent of actual amounts to provide a scaled comparison with the whiting QS allocated to processors – processors are allocated 20% of the total QS).

In the previous figures it is difficult to discern the differences among the alternatives because of the scale of the graphs. The following two figures provide a magnification of the allocational results displayed in the lower and upper range of the graphs. A statistical summary of the graph is provided in

In Figure 4-13 and Figure 4-14, a QS allocation equal to 20 percent of a processor's history for a particular period would fall on the history line for that period. An allocation for a processor falling below the history line indicates a processor would be able to cover less than 20 percent of its historical landings with its initial allocation, and an allocation above the history lines indicates a processor would be able to cover more than 20 percent of its landings with QS received at initial issuance. Figure 4-13 shows that under the No Action alternative, four processors (E06, E07, E10, and E14) received allocations that would have covered far less than 20 percent of their 2007-2010 deliveries. Despite the challenges that these low allocations may have created, in 2011 two of the smaller of these processors increased their deliveries to above their 2007-2010 averages (E06 and E07). Another of the processors did not sustain its 2007-2010 share in 2011 but did receive deliveries at a higher level than would be expected if it had to cover 20 percent of deliveries with its own QS (E14). The fourth of these processors (E10) received deliveries in 2011 at a level that it was able to cover 20 percent of its deliveries with the QS received from the initial allocation. Those processors which had participated at relatively low levels or not at all in 2007-2010 (E01 through E05, E08, E09, and E11) did not participate in 2011. Another processor that received a moderate initial allocation, one that was equivalent to more than 20 percent if its 2007-2010 participation level, dropped out (E12).

Alternative 1 would roll back the end of the qualifying period from 2004 to 2003. This one year change appears to make a relatively minor difference in the allocations for most processors, giving a small benefit to some of those receiving lesser allocations (E09, E11, and E13, Figure 4-15) and reducing the allocations to a few of those receiving larger allocations (E14 and E16, Figure 4-16). Alternatives 2, 3 and 4 would progressively move the allocations in the favor of those with stronger recent history and away from those with a weaker recent history. The degree of change in going from Alternative 3 to Alternative 4 is not as great among the processors as for permits because for processors there are fewer earlier years (for permits, Alternative 4 drops six years, 1994-1999, and for processors it drops only the two years, 1998 and 1999).

In Figure 4-14, comparisons are provided to historic periods (1998-2003 and 2004-2006). This figure shows that the No Action allocations (based on 1998-2004 history) closely track the 1998-2003 history (as would be expected). The figure also shows that for five out of the six mid-range QS recipients (E09, E10, E11, E13, and E14) the 2004-2006 history deviated substantially from 1998-2003 history. For most of these that shift held into more recent years (as reflected by the data for the same processors in 2007-2010 Figure 4-13.

A statistical summary of the information provided in the preceding figures is provided in Table 4-31, similar to those statistical summaries provided for the permits.

Table 4-31. This table shows that under the action alternatives, depending on the alternative, up to seven additional processors may qualify for an initial allocation of QS and between two and five processors that qualified under status quo would receive an increase under one of the action alternatives. Also, between four and seven processors would loose QS. The total amount of QS reallocated among processors would run between 0.5 and 3.1 percent. The maximum change for any one processor would be an increase 1.3 percent of the QS (under Alternative 4).

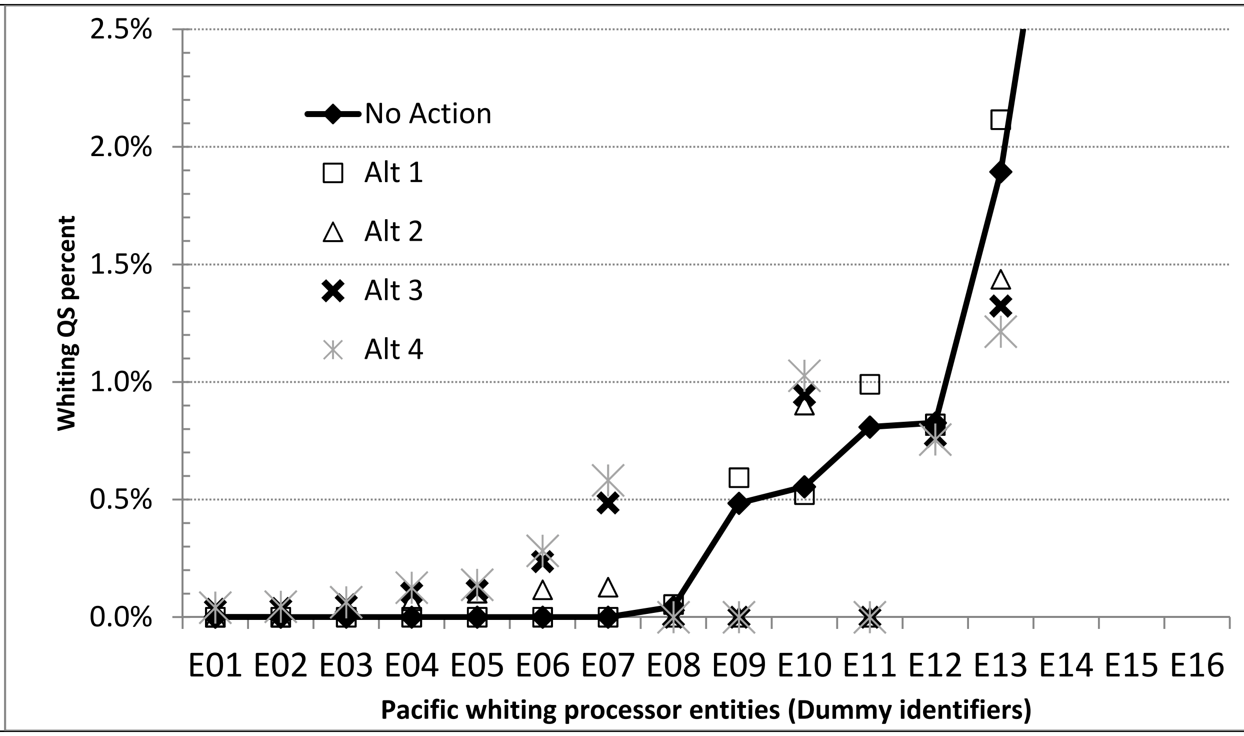


Figure 4-15. Magnification of the allocational results displayed on the left side of Figure 4-13 and Figure 4-14.

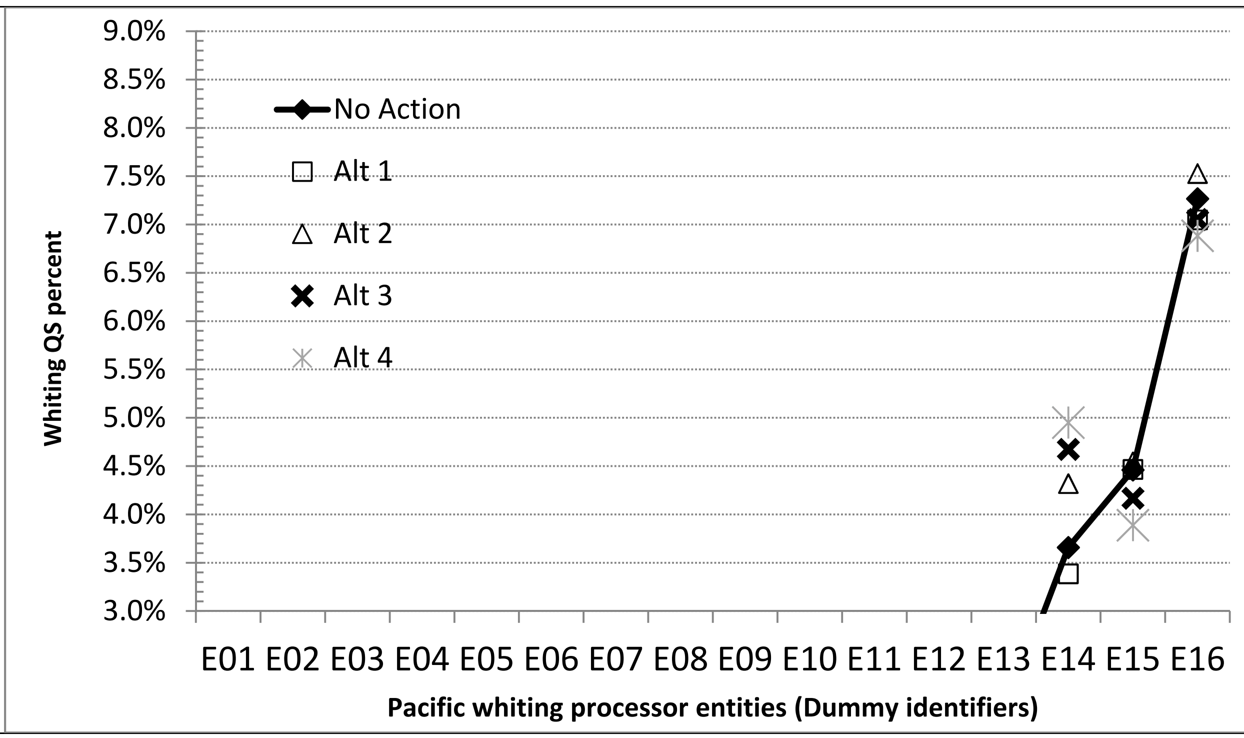


Figure 4-16. Magnification of the allocational results displayed on the right side of Figure 4-13 and Figure 4-14.

In Figure 4-13 and Figure 4-14, a QS allocation equal to 20 percent of a processor's history for a particular period would fall on the history line for that period. An allocation for a processor falling below the history line indicates a processor would be able to cover less than 20 percent of its historical landings with its initial allocation, and an allocation above the history lines indicates a processor would be able to cover more than 20 percent of its landings with QS received at initial issuance. Figure 4-13 shows that under the No Action alternative, four processors (E06, E07, E10, and E14) received allocations that would have covered far less than 20 percent of their 2007-2010 deliveries. Despite the challenges that these low allocations may have created, in 2011 two of the smaller of these processors increased their deliveries to above their 2007-2010 averages (E06 and E07). Another of the processors did not sustain its 2007-2010 share in 2011 but did receive deliveries at a higher level than would be expected if it had to cover 20 percent of deliveries with its own QS (E14). The fourth of these processors (E10) received deliveries in 2011 at a level that it was able to cover 20 percent of its deliveries with the QS received from the initial allocation. Those processors which had participated at relatively low levels or not at all in 2007-2010 (E01 through E05, E08, E09, and E11) did not participate in 2011. Another processor that received a moderate initial allocation, one that was equivalent to more than 20 percent if its 2007-2010 participation level, dropped out (E12).

Alternative 1 would roll back the end of the qualifying period from 2004 to 2003. This one year change appears to make a relatively minor difference in the allocations for most processors, giving a small benefit to some of those receiving lesser allocations (E09, E11, and E13, Figure 4-15) and reducing the allocations to a few of those receiving larger allocations (E14 and E16, Figure 4-16). Alternatives 2, 3 and 4 would progressively move the allocations in the favor of those with stronger recent history and away from those with a weaker recent history. The degree of change in going from Alternative 3 to Alternative 4 is not as great among the processors as for permits because for processors there are fewer earlier years (for permits, Alternative 4 drops six years, 1994-1999, and for processors it drops only the two years, 1998 and 1999).

In Figure 4-14, comparisons are provided to historic periods (1998-2003 and 2004-2006). This figure shows that the No Action allocations (based on 1998-2004 history) closely track the 1998-2003 history (as would be expected). The figure also shows that for five out of the six mid-range QS recipients (E09, E10, E11, E13, and E14) the 2004-2006 history deviated substantially from 1998-2003 history. For most of these that shift held into more recent years (as reflected by the data for the same processors in 2007-2010 Figure 4-13.

A statistical summary of the information provided in the preceding figures is provided in Table 4-31, similar to those statistical summaries provided for the permits.

Table 4-31. Changes in the amount of whiting QS allocated to processors under the alternatives relative to status quo (No Action) based on individual processor history of shoreside sector whiting trips.

	Alternatives			
	Alt 1: 1998-2003	Alt 2: 1998-2007	Alt 3: 1998-2010	Alt 4: 2000-2010
Number of Processors **Not Previously Qualifying** for an Allocation	0	5	5	7
Total Allocation Increases for Those Processors	0.0%	0.5%	1.0%	1.3%
Maximum To Any Processor	0.0%	0.1%	0.5%	0.6%
Number of Previously Qualifying Processors With **Increased** Allocations Under the Alternative	5	4	2	2
Total Percent of Increase for Those Processors	0.5%	1.4%	1.4%	1.8%
Maximum Increases to Any One Processor	0.2%	0.7%	1.0%	1.3%
Max Increase as a Percent of Status Quo Allocation	11.7%	18.1%	28.2%	35.3%
Previously Qualifying Processors with **Decreased** Allocations Under the Alternative	4	2	4	4
Total Percent of Decreases for Those Processors	-0.5%	-0.5%	-1.1%	-1.7%
Maximum Decreases to Any One Processor	-0.3%	-0.5%	-0.6%	-0.7%
Max Decrease as a Percent of Status Quo Allocation	-7.4%	-24.1%	-29.9%	-35.9%
Previously Qualifying Processors with **Zero** Allocations Under Status Quo	0	3	3	3
Total Percent of Decreases for Those Processors	0.0%	-1.3%	-1.3%	-1.3%
Maximum Decreases to Any One Processor	0.0%	-0.8%	-0.8%	-0.8%
Max Decrease as a Percent of Status Quo Allocation	#N/A	-100.0%	-100.0%	-100.0%

Allocations and Processor Involvement and Dependence

Average annual processor dependence is indicated by the icons in Table 4-32. No bars indicate no history for the period, bars without shading indicate history with a very low amount of dependence relative to other processors. The more bars that are shaded the greater the dependence relative to other processors. Also shown in the table are the processor shares of total purchases for several historic periods (an indicator of "involvement" in the fishery). These values can then be compared with the allocations shows on the right hand side of the table. In general of note is that processors with higher involvement would be expected to receive a greater share of the amount of QS going to processors, as would be expected. One processors (P12) shows very low levels of involvement but increasingly higher levels of dependence and would receive a slightly lower allocation under the alternatives placing more emphasis on recent years.

Table 4-32. Processor dependence on whiting (as measured by purchases), average annual percent involvement, and initial allocations.

Business ID	Average Annual Percent Dependence (based on Exvessel Value of West Coast Landing Receipts)			Average Annual Percent Involvement for Remaining Participants (Share of Harvest)			Whiting QS Allocations (SCALED TO 100% for comparison to historic data- actual allocations would be 20% of these values)				
Dummy	Avg 94-03	Avg 04-06	Avg 07-10	Avg 94-03	Avg 04-06	Avg 07-10	No Action	Alt 1	Alt 2	Alt 3	Alt 4
P01				0.28	0.17	0.11	22.3%	22.3%	22.7%	20.9%	19.4%
P02	-			-	0.01	0.01	0.0%	0.0%	0.4%	0.5%	0.6%
P03				0.13	0.00	0.05	9.5%	10.6%	7.2%	6.6%	6.1%
P04		-		0.00	0.01	0.03	0.0%	0.0%	0.6%	1.2%	1.4%
P05				0.31	0.36	0.25	36.3%	35.2%	37.6%	35.4%	34.4%
P06		-		0.00	-	0.00	0.0%	0.0%	0.0%	0.0%	0.2%
P07	-	-		-	0.00	0.06	0.0%	0.0%	0.6%	2.4%	2.9%
P08		-		0.00	0.00	0.01	0.0%	0.0%	0.2%	0.3%	0.3%
P09		-	-	0.00	-	-	0.2%	0.3%	0.0%	0.0%	0.0%
P10				0.04	0.06	0.05	2.8%	2.6%	4.5%	4.7%	5.1%
P11	-	-		-	-	0.00	0.0%	0.0%	0.0%	0.0%	0.2%
P12				0.05	0.04	0.03	4.1%	4.1%	4.1%	3.9%	3.8%
P13				0.12	0.34	0.40	18.3%	16.9%	21.6%	23.5%	24.8%
P14		-	-	0.03	-	-	4.0%	5.0%	0.0%	0.0%	0.0%
P15	-			-	0.01	0.01	0.0%	0.0%	0.5%	0.6%	0.7%
P16		-	-	0.04	-	-	2.4%	3.0%	0.0%	0.0%	0.0%

Exprocessor Value Equivalents

Ex-processor prices are not available to provide a sense of the magnitude of the economic impact of changing production levels on processors. However, the QS to be allocated is used to cover vessel deliveries and therefore exvessel prices may provide an indicator of the magnitude of the financial benefit that is provided to processors by the QS they are issued [8]. A range of possible exvessel value per 0.1 percent of the QS is provided in Table 4-18. Export prices might also be used to provide a sense of the economic importance a processor might place on the amounts of QS to be allocated. In 2011, the reported export price per pound of head-and-gut whiting was $0.889. Using a product recovery rate of 0.65 yields a round pound equivalent price of $0.57 per pound. This price applies to the same range of shoreside whiting allocations covered in Table 4-18.

Table 4-33. Export value equivalent for 0.1 percent whiting QS (assuming the 2011 price of $0.57 per pound and a product recovery rate of 0.65) ($).

Shoreside Sector Allocations (mt)	Whiting Export Price per lb 0.58
40,000	51,147
60,000	76,721
80,000	102,294
100,000	127,868

Allocations to Shoreside Processors for Processing and Permit History

Combining QS allocated for permit history along with the QS allocated for processing history shows that only one processor receives a larger whiting allocation as a result of also owning permits (see entity E15 in Figure 4-17 as compared to E-15 in Figure 4-14). The overall control limit for whiting QS is 10 percent. When permit and processor allocations are combined, under no alternative would the amount of whiting allocated to a single entity be expected to exceed the control limits.

[8] The actual financial value of the QS would depend on the present value of the stream of net revenue in excess of normal profit levels that might be associated with whiting deliveries.

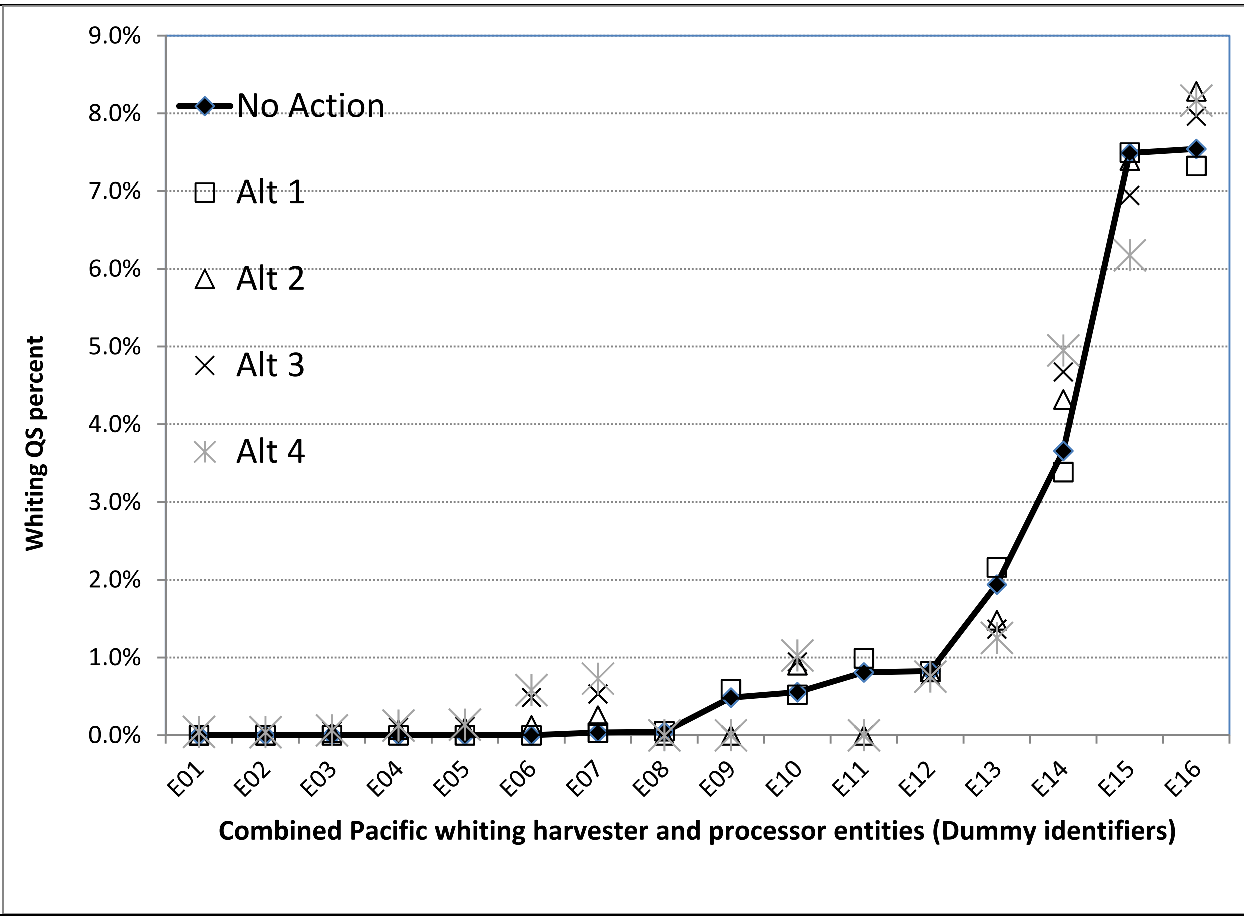


Figure 4-17. Concentration of shoreside whiting QS allocations among processing entities, including allocations of QS to processors owning permits, by alternative (results ordered from lowest to highest for the No Action alternative).

Effect of Adjusting the Recent Participation Period (Alternative 3)

All of the Alternatives, except Alternative 3, have a recent participation requirement the end of which coincides with the end of the allocation period. For Alternative 3, the allocation period ends in 2010 (1998-2010) but the recent participation period ends in 2007 (2004-2007). By not including the last three years of the allocation period (1998-2010) in the recent participation period (not including 2008-2010), the two processors which would have received the lowest allocations are screened out. As a result a total of 0.071% of QS is reallocated among the 11 processors receiving an allocation, with each of the remaining processors receiving an increase of just over one third of one percent (0.36%) relative to the allocation they would have received if the Alternative 3 recent participation period were 2004-2010.

4.3.2.2 Mothership Processors

To the degree that there is an alliance between certain MS/CV permit owners and mothership processors, an increase or decrease in the CHA assignments to the catcher vessel permits may increase or decrease the processing opportunities of allied motherships. The data on mothership obligations for 2011 (Table 4-34) compared to the date for 2012 (Table 4-35) show that the start-of-year obligations have shifted somewhat with some permits moving their CHA obligations from one company to another (in 2012, Company 1 picked up 4.4% from Company 2). Using either the 2011 or 2012 distributions, Company 2 is most adversely affected, to the benefit of Companies 1 and 3.

Table 4-34. Change from No Action in Permits' CHA assignments to Mothership coops under the reallocation alternatives based on 2011 coop agreements.

		Change relative to No Action (Alt 1)		
Mothership Coop	No Action - Alt 1	Alt 2	Alt 3	Alt 4
Company 1	25.5%	+0.5%	-0.0%	+1.4%
Company 2	26.0%	-2.0%	-2.3%	-5.3%
Company 3	38.3%	+1.8%	+2.5%	+4.8%
Company 4	10.3%	-0.3%	-0.2%	-0.9%
TOTAL	100.0%			

Table 4-35. Change from No Action in Permits' CHA assignments to Mothership coops under the reallocation alternatives based on 2012 coop agreements.

		Change relative to No Action (Alt 1)		
Mothership Coop	No Action - Alt 1	Alt 2	Alt 3	Alt 4
Company 1	21.1%	+1.9%	+1.8%	+4.9%
Company 2	30.4%	-3.3%	-4.1%	-8.8%
Company 3	38.3%	+1.8%	+2.5%	+4.8%
Company 4	10.3%	-0.3%	-0.2%	-0.9%
TOTAL	100.0%			

4.3.3 Impacts on Communities

Distribution of the 80 percent of QS to ports based on permit landings history for 2007-2011 is shown in Figure 4-18. Because of consolidation of landings on fewer vessels in 2011 it is difficult to provide a geographic association of QS to ports based on 2011 permit history alone. Based on average 2007-2011 landings patterns, the No Action Alternative tends to favor Newport while the alternatives incorporating more recent history tend to favor ports further north, though the exact strength of this trend is difficult to discern with certainty because of permits that were inactive (“Unknown”). Geographic distribution of quota in terms of the delivery ports of associated vessels is likely to indicate where expenditures will be made to cover production costs (e.g. fuel, supplies, processing costs, etc.). Distributions of QS among regions based on the limited entry permit holder’s address of record may indicate where the profits from quota ownership are spent. This information is provided in Figure 4-19 for QS Figure 4-20 for CHA. In general, for QS permit owners with addresses in Oregon communities tend to benefit from on increased emphasis on more recent years. For CHA the communities that benefit the most appear to be in the Seattle and Portland metropolitan areas. The combined results for both QS and CHA is provided in Figure 4-21.

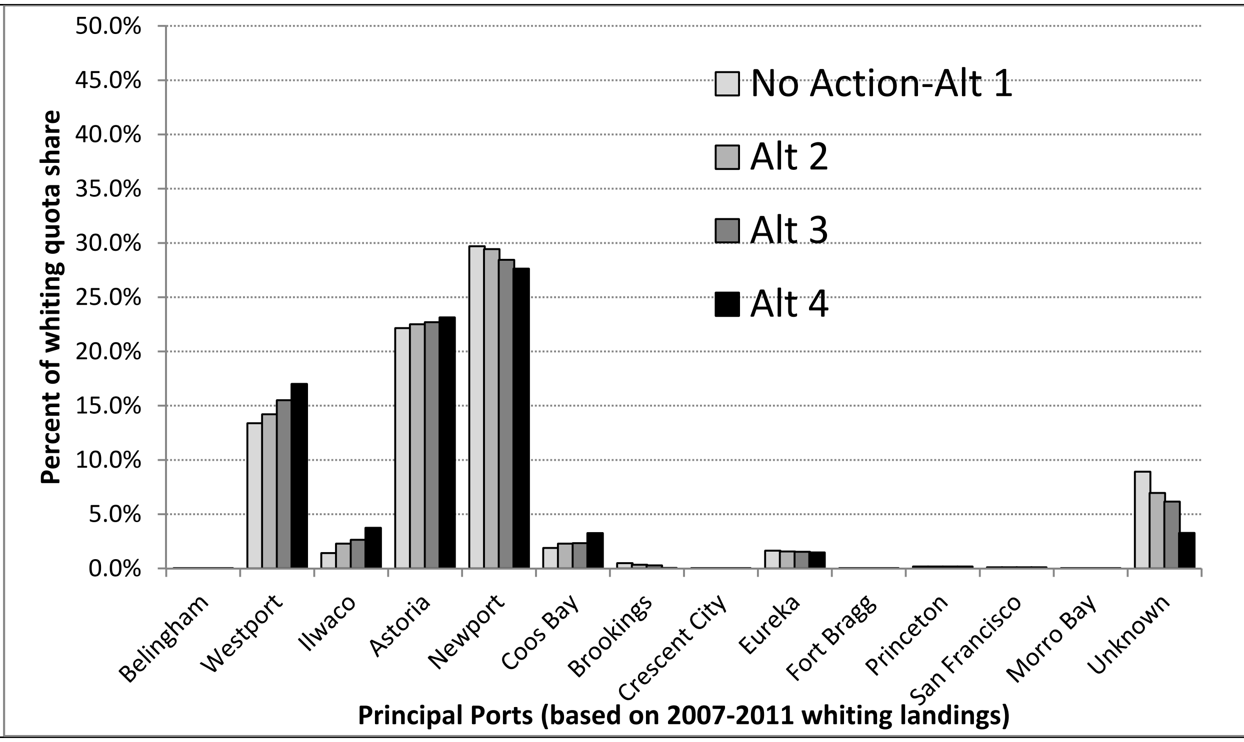


Figure 4-18. Distribution of permits' QS among **ports** based on principle ports to which permits made deliveries from 2007-2011 (permits not participating during that time are placed in the unknown category).

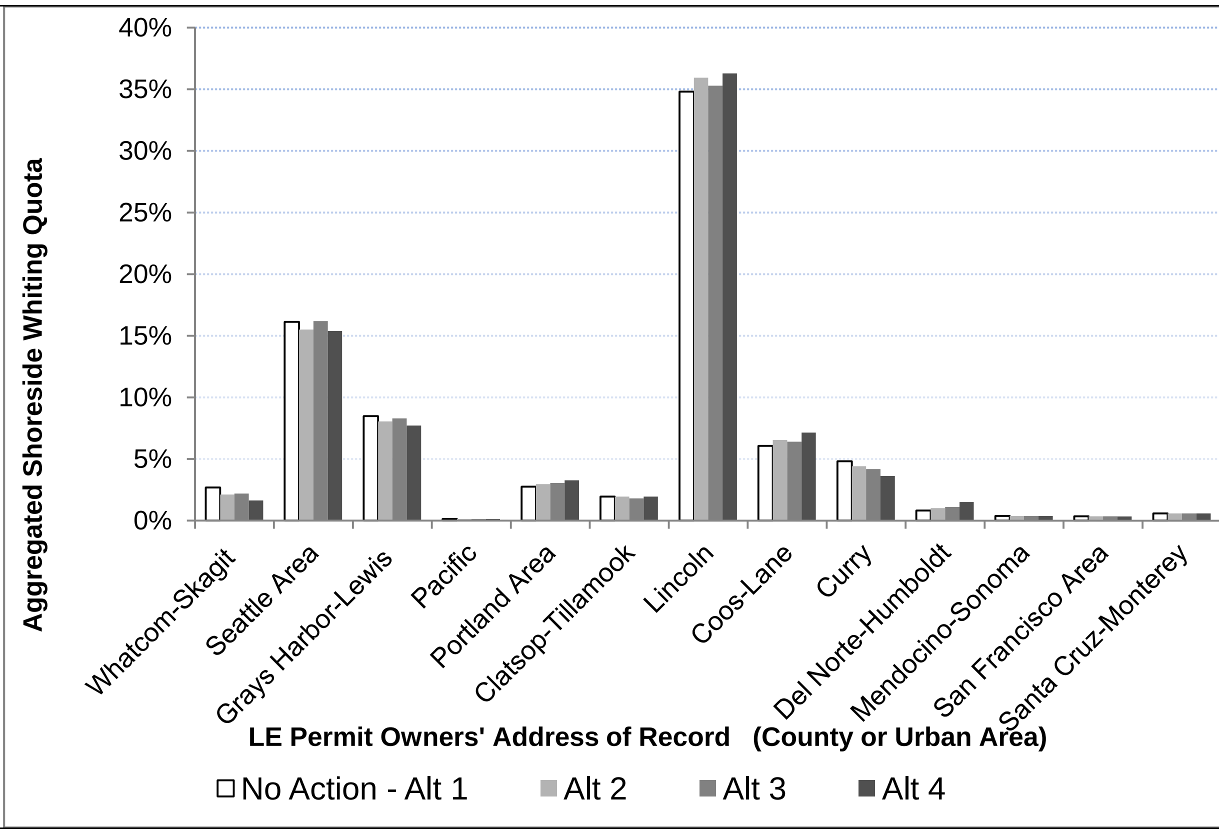


Figure 4-19. Distribution of permits' QS among **communities** based on permit owners' addresses.

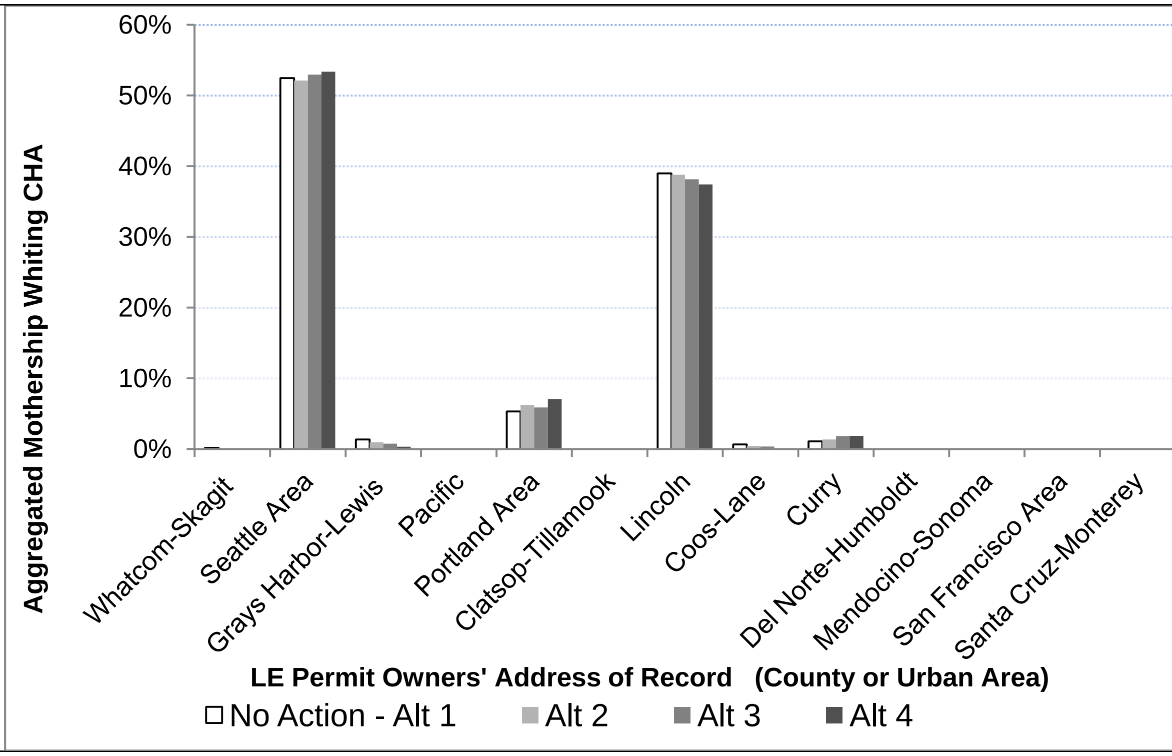


Figure 4-20. Distribution of permits' CHA among **communities** based on permit owners' addresses.

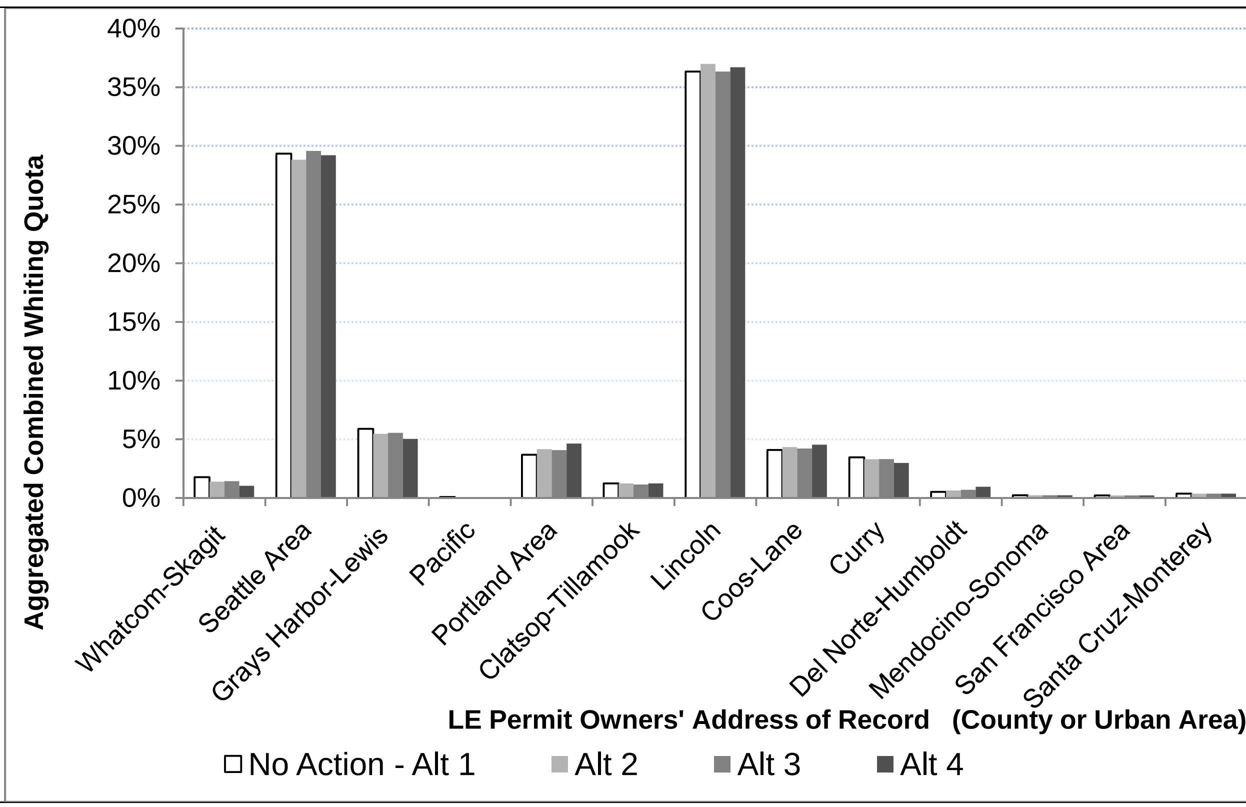


Figure 4-21. Distribution of permits' combined QS and CHA among **communities** based on permit owners' addresses.

The 2011 fishery showed a substantial shift in landings with the share of landings in Astoria increasing substantially while the share of landings in Westport and Newport decreased (Figure 4-22.). Of the 20 percent of the QS allocated to processors just over 30 percent went to Astoria under the No Action alternative, nevertheless processors in Astoria were able to attract over 45 percent of the coastwide landings in 2011(Figure 4-23). In terms of the QS distributed among processors, allocation formulas that emphasize more recent years appear likely to shift allocation toward West Port and Ilwaco and away from Astoria and Newport (Figure 4-23).

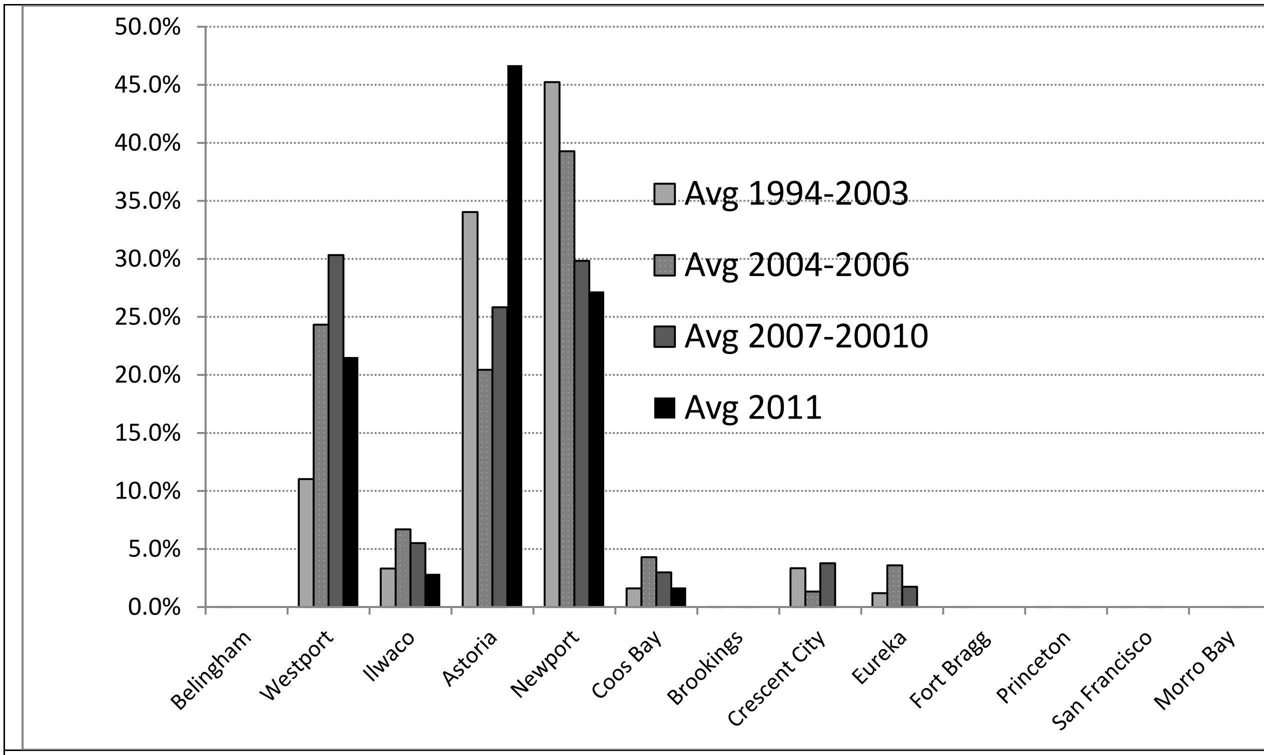


Figure 4-22. Historic distribution of whiting landings among ports (port involvement in the fishery).

Each port's share of the allocation is indicated in Figure 4-23. Figure 4-24 provides this information in context of port historic shares of harvest, scaling the results such that the allocations total to 100% (the bars in Figure 4-23 total to 20 percent, the actual amounts of QS allocated to processors.)

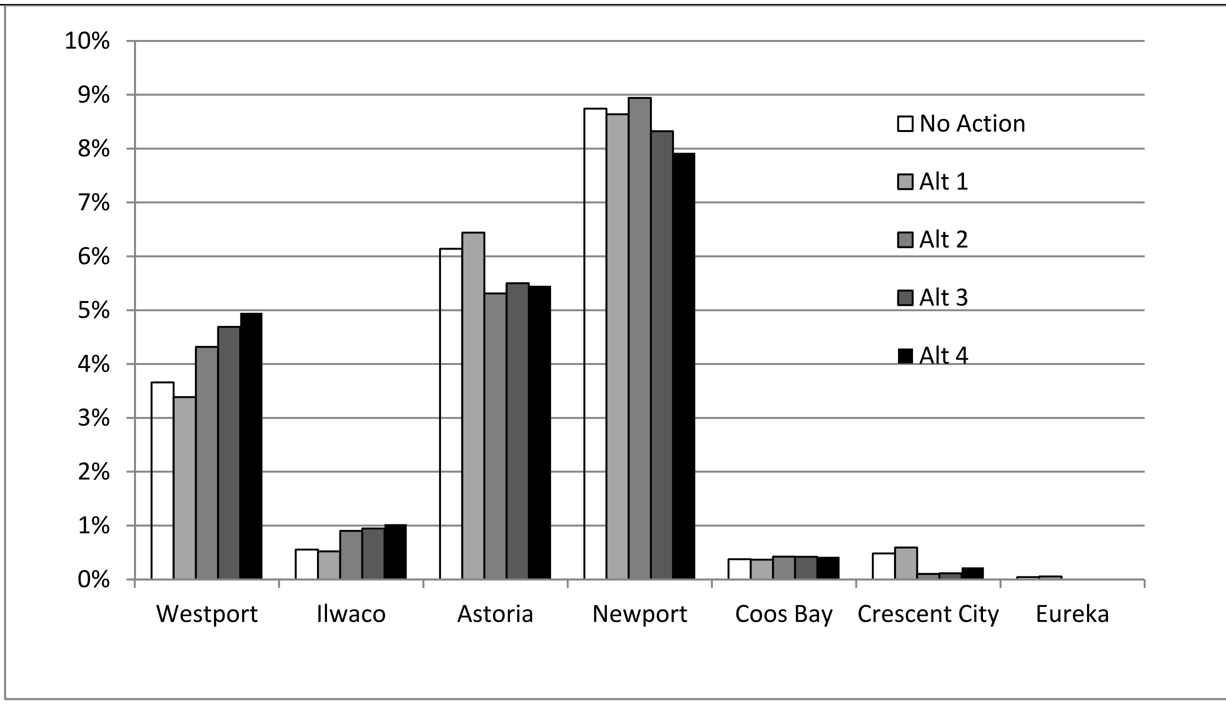


Figure 4-23. The QS allocated to processors associated with each port based on the location of processors receiving the shares and the distribution of each processor's 2011 deliveries among ports.

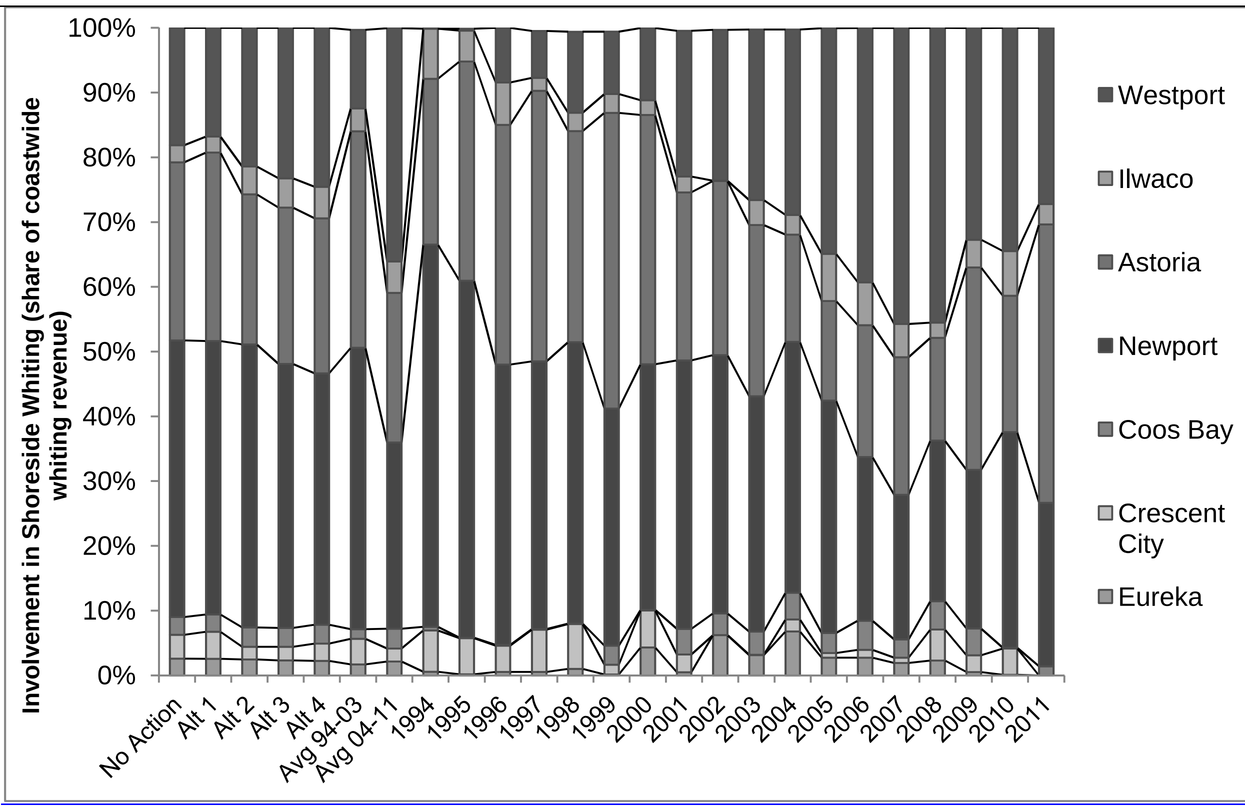


Figure 4-24. Projected whiting quota allocations to processors by port (scaled to 100%) compared with historical involvement in the whiting fishery. 2012 QPs distributed based on processor QS and 2011 landings only (for processors with more than one landing port).

Information on port dependence on whiting, in terms of whiting as a percent of total exvessel revenue of all West Coast fish that harvesters delivered to the port, is provided in Figure 4-25. Dependence is likely more a function of multiple years of deliveries at a particular level than a single year. This is because dependence is a function of investments and investments are usually made based on longer term patterns and prospects. For example, Astoria dependence on whiting is likely reflected more that the long term averages than the single year high of about 23% in 2011. Looking at the longer term averages, it appears that historically Westport and Newport have been more dependent on the fishery than Astoria (with Westports average dependence increasing substantially in the more recent historic period).

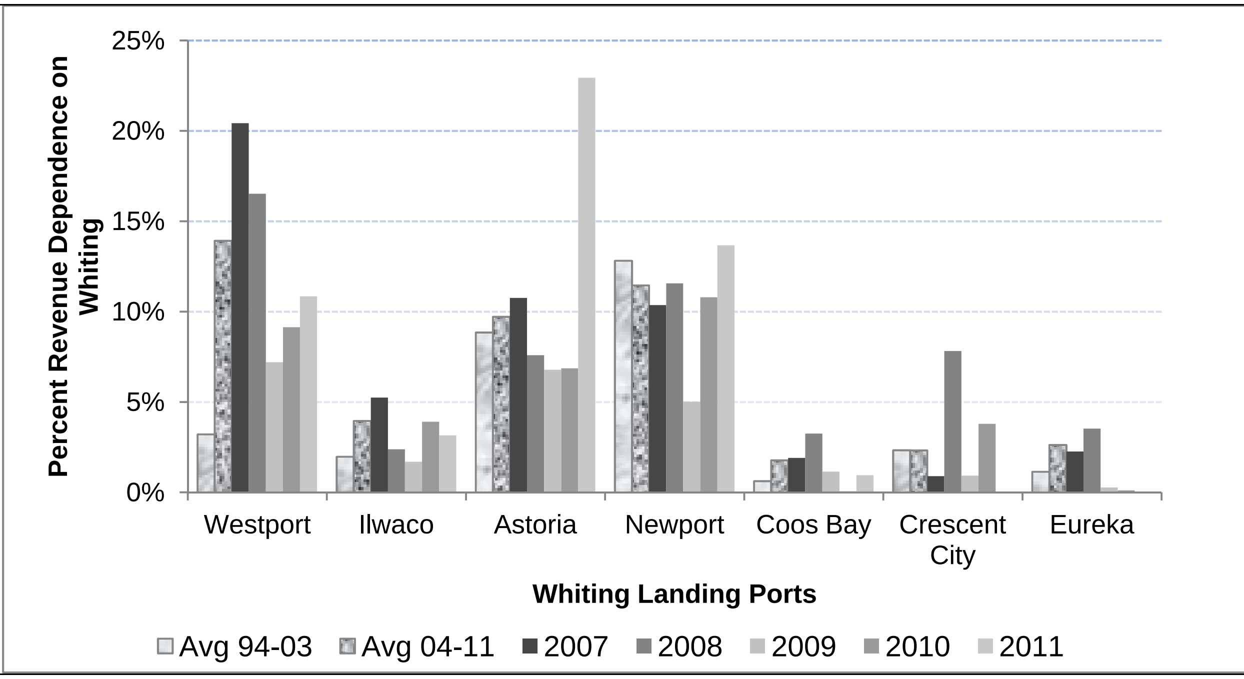


Figure 4-25. Port dependence on Pacific whiting landings revenues over historical averages and during recent years.

Table 4-36 summarizes the projected distribution of processors' whiting QS among west coast ports under the reallocation alternatives, and compares those with historic dependence and involvement of processors in those ports over historic periods. For processors with whiting landings in more than one port, the table uses two methods to apportion QS among those ports (1) using the distribution of landings recorded in 2011, and (2) using the average distribution of landings over 2007-2010. The table shows that QS associated with processors in Wesport increases steadily moving from Status Quo toward Alternative 4, consistent with Westport's increased involvement in the whiting fishery over time. Ilwaco's QS also increases moving from Status Quo toward Alternative 4, but from a much lower base. The increase in Westport's QS comes at the expense of QS associated with Astoria and Newport, especially under Alternative 4.

Table 4-36. Port dependence on whiting, involvement (port historic share of the whiting deliveries), and estimated geographic distribution of the shoreside whiting QS allocated to processors based on processor delivery patterns in 2007-2010 and 2011 2011 (for processors with more than one landing port for whiting).

							Processor Shares Allocations Associated with Each Port									
							Status Quo		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dependence			Involvement			Years used to distribute whiting QS among ports (for processors with whiting landings in multiple ports)									
	Avg 94-03	Avg 04-06	Avg 07-10	Avg 94-03	Avg 04-06	Avg 07-10	'07-'10	'11	'07-'10	'11	'07-'10	'11	'07-'10	'11	'07-'10	'11
Westport	3.2%	15.7%	13.3%	12.2%	34.3%	39.6%	3.6%	3.7%	3.4%	3.4%	4.3%	4.3%	4.6%	4.7%	4.9%	5.0%
Ilwaco	2.0%	5.1%	3.3%	3.5%	5.7%	4.7%	0.5%	0.6%	0.5%	0.5%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%
Astoria	8.8%	7.6%	8.0%	33.5%	17.5%	22.4%	5.5%	6.1%	5.8%	6.4%	4.6%	5.3%	4.8%	5.5%	4.8%	5.5%
Newport	12.8%	13.4%	9.4%	43.6%	33.3%	26.2%	8.5%	8.7%	8.4%	8.6%	8.7%	8.9%	8.2%	8.3%	7.8%	7.9%
Coos Bay	0.6%	2.3%	1.6%	1.5%	3.9%	2.9%	0.5%	0.4%	0.5%	0.4%	0.6%	0.4%	0.6%	0.4%	0.6%	0.4%
Crescent City	2.3%	0.9%	3.4%	4.0%	1.3%	3.1%	0.7%	0.5%	0.8%	0.6%	0.4%	0.1%	0.4%	0.1%	0.5%	0.2%
Eureka	1.1%	4.1%	1.5%	1.7%	4.1%	1.2%	0.5%	0.0%	0.5%	0.1%	0.5%	0.0%	0.5%	0.0%	0.5%	0.0%

4.3.4 Impacts on Agencies and Public Decision Processes

The cost of reallocating QS has been estimated as the equivalent of the efforts of a single full time employee for three to six months, depending on complexity and extent of changes.

No Action and Alternatives 2, 3 and 4 would not use the control date to establish the end of the allocation period. Alternative 1 would use 2003 as the end of the allocation period. Implications of the choice among the alternatives for the utility of setting control dates in the future are discussed in Section 5.5.

4.4 Cumulative Impacts

The primary effects of these alternatives are socio-economic and so the focus of the cumulative impact assessment is on socio-economic issues.

Future Actions and Events

The levels of whiting harvests will be declining in the near future for the short term (see 2013-2014 biennial specifications for the groundfish fishery). The evaluation in this chapter is primarily a long term evaluation in that it looks at the impacts on percents of total harvest allocated to entities rather than the allocation poundage going to entities. For the short term, with a declining harvest level (assuming prices do not increase), the degree of impact from any decreases in allocations will be greater and the amounts of increases lesser than indicated by the evaluations based on shares of harvest.

The Council is also in the process of evaluating a change in the allocation of widow rockfish QS. Like whiting, widow rockfish the directed widow rockfish fishery is conducted primarily with midwater gear. The reallocation is being considered because of the newly rebuilt status of widow rockfish. Up through recent years and in the Amendment 20 QS allocation, widow has been used primarily to cover bycatch. If widow is reallocated to provide quota to permits for vessels that targeted it historically, there is likely to be an overlap with the permits with vessels which target whiting and a potential benefit to those permits from the reallocation of widow.

Concurrent Actions

The primary concurrent actions are the reallocations of both shoreside and mothership quota among many of the same permits. Additionally, some of the shoreside processors receiving QS also receive some allocation based on their ownership of permits. Figures and tables in this document show the combined allocational effects for shoreside processors owning permits receiving QSFigure 4-17and for permits receiving both QS and CHA Figure 4-10, Figure 4-11, and Figure 4-12.

Whiting and Non-whiting Groundfish Revenue-Share Analysis and Allocational Implications

Linking the allocation periods for the shoreside and mothership fisheries together, as tentatively proposed by the Council in June, would eliminate the possibility that vessels moving between fisheries from one year to the next would have moved between the fisheries in such a way that they would receive a particularly strong allocation (sometimes termed “double dipping”) or a particularly week allocation (by moving between fisheries in such a way that they were in the wrong fishery at the wrong time). Eight permits decreased activity in the mothership whiting fishery after 2003 and increased activity in the shoreside fishery; and eight permits increased activity in the mothership fishery after 2003 and decerased activity in the shoreside fishery.

After 2003, 7 permits increased their share of the whiting revenue (mothership and whiting combined) while decreasing their share of the non-whiting groundfish revenue (Table 4-37). At the same time, 13 permits decreased their activity (share of revenues) in the combined whiting fisheries while increasing their revenues in the nonwhiting fisheries.

Table 4-37. Number of permits by changes in share of revenue comparing 1994-2003 average revenue to 2004-2010 average revenue.

Percentage Change in Share of Whiting Revenue (Combined Shoreside and Mothership)	Percentage Change in Share of Nonwhiting Revenue												
	>100%	75% to 100%	50% to 75%	25% to 50%	10% to 25%	>0% to 10%	-10% to <0%	-10% to - 25%	-25% to - 75%	-75% to - 100%	=- 100%	Not Active	Total
	Number of permits												
>100%	10									1		10	11
75% to 100%	1					1				1		1	3
50% to 75%	1											1	1
25% to 50%	2		1				1	2			1	2	7
10% to 25%	1									1		1	2
>0% to 10%	4	1			1							4	6
-10% to <0%	2	2						1				2	5
-10% to - 25%	5	1						1		1		5	8
-25% to -75%	1			1					1	1		1	4
-75% to -100%	1					1				1		1	3
=-100%							1			16	1		18
Total	28		4	1	1	1	2	2	4	1	22	2	68

Orange (upper right): Permits decreasing activity in the nonwhiting fishery after 2003 and increasing activity in the whiting fishery (7 permits).
Yellow (lower right): Permits increasing activity in the nonwhiting fishery after 2003 and decreasing activity in the whiting fishery (13 permits).

Table 4-38. Number of permits by changes in share of revenue comparing 1994-2003 average revenue to 2004-2010 average revenue.

Percentage Change in Shoreside Whiting Revenue	Percentage Change in Share of Mothership Whiting Revenue: >100%	75% to 100%	50% to 75%	25% to 50%	10% to 25%	>0% to 10%	-10% to <0%	-10% to - 25%	-25% to -75%	-75% to -100%	=-100%	Not Active	Total
	Number of permits												
>100%			2	1	1	1	1			1	1	7	15
75% to 100%													
50% to 75%					1						1		2
25% to 50%												3	3
10% to 25%	1							1		1	2		5
>0% to 10%				1								1	2
-10% to <0%					1						1		2
-10% to - 25%	1		1	2					1		2	3	10
-25% to -75%	1											2	3
-75% to -100%											2		2
=-100%	2						1		1		4	13	21
Not Active				1			1				1		3
Total	5		3	5	3	1	3	1	2	2	14	29	68

Orange (upper right): Permits decreasing activity in the mothership whiting fishery after 2003 and increasing activity in the shoreside whiting fishery (8 permits).
Yellow (lower right): Permits increasing activity in the mothership whiting fishery after 2003 and decreasing activity in the shoreside whiting fishery (8 permits).

Past Actions

One of the primary related past actions is the allocation of QS for nonwhiting to the same permits receiving whiting QS and CHA. This past action is particularly important with respect to the overall balance of equity in the trawl rationalization program. Figure 4-26 shows that the lowest initial allocations to any single permit (all groundfish species combined) were equivalent to around $200 thousand in terms of exvessel value (using 2011 harvest values and prices). QS typically trades from anywhere between 3.5 and 10 times exvessel value (CITE). At the same time, the value of some QP in the groundfish fishery is likely to be quite low because of the difficulty accessing the quota due to constraining bycatch species. The preliminary estimate for 2011 is that roughly half the value of the potential exvessel value went unharvested due to such constraints. The equal allocation component of the program provided a minimum base allocation of substantial value to every permit. For permits with no need for the equally allocated species, the equal allocation provided an asset that could be traded and used to rebalance their allocation and make up for a portion of any shortfalls in allocation relative to their recent participation levels. These issues are discussed further in Section 5.4.

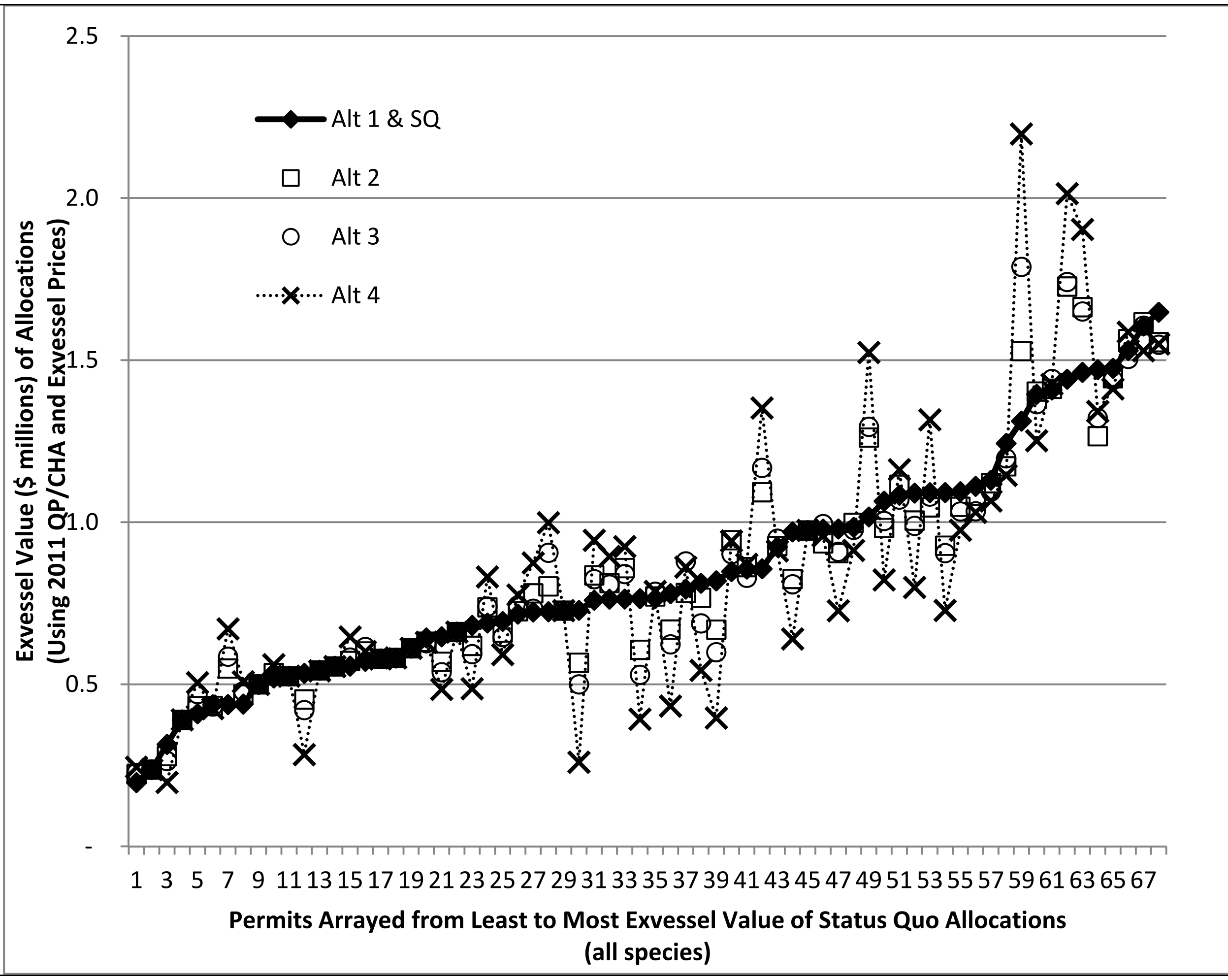


Figure 4-26. Exvessel value equivalent (millions of dollars) of all QP and CHA issued under the trawl rationalization program to permits with some directed catch history of whiting.

CHAPTER 5 CONSISTENCY WITH THE WEST COAST GROUNDFISH FMP AND MSA NATIONAL STANDARDS AND REQUIREMENTS

"There are literally an infinite number of allocation formulae that are acceptable under the MSA." (NOAA, 2007, p. 71). There are a variety of competing and conflicting criteria against which the allocation formulae must be assessed; in the end, the choice is to select an allocation that is fair and equitable, and that meets the various requirements of the MSA and other applicable law. The management challenge is to select an alternative based on an appropriate balance of these criteria, given the expected performance of the fishery under each allocation alternative. The criteria to be assessed are primarily derived from the MSA, including those contained in the FMP. Those criteria include:

- MSA
- MSA National Standards
- NMFS National Standard Guidelines
- Goals and Objectives of FMP
- Goals and Objectives of Amendment 20 to the FMP (Trawl Rationalization)
- Other Council Statements of Intent.

In this chapter, impacts are summarized by the topic areas covered by these criteria. Many of the requirements of the MSA and National Standard Guidelines are already achieved by the trawl rationalization program as a whole and are not affected by the different alternatives considered here.

5.1 Conservation

The following are some of the main conservation criteria in the MSA that directly pertain to the establishment of a catch shares program.

> SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT. (a) . . . . national standards for fishery conservation and management: . . . . (4) If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be . . . (B) reasonably calculated to promote conservation
>
> 303A (c) REQUIREMENTS FOR LIMITED ACCESS PRIVILEGES.— (1) IN GENERAL.— Any limited access privilege program to harvest fish submitted by a Council or approved by the Secretary under this section shall—(A) if established in a fishery that is overfished or subject to a rebuilding plan, assist in its rebuilding;. . . . (C) promote—. . . (ii) fishery conservation and management; . . .

With respect to conservation and management and the allocation of fishing privileges, the National Standard Guidelines state:

> Numerous methods of allocating fishing privileges are considered “conservation and management” measures under 303 of the Magnuson-Stevens Act. An allocation scheme may promote conservation by encouraging a rational, more easily managed use of the resource. Or, it may promote conservation (in the sense of wise use) by optimizing the yield in terms of size, value, market mix, price, or economic or social benefit of the product. (Section 600.325(c)(3)(ii))

The Council’s Allocation Framework (Section 6.3.1 of the groundfish FMP) requires that when recommending the direct allocation of resources that the Council consider “Potential biological yield of any species or species complex affected by the allocation.”

The trawl rationalization program assists the Council in meeting conservation and management objectives in a number of ways, including:

- providing a greater disincentive for harvest of overfished species.
- providing a disincentive for bycatch waste.
- rationalizing the fishery so it can support the costs of 100 percent monitoring of catch.
- eliminating the continual erosion of management measures based on input control, which occurs as fishers try to increase harvests by finding ways around the input controls.

Modifying the trawl rationalization program by reallocating QS among vessels and processors is not expected to change total removals; nor alter the gears used, selectivity, harvest areas or targeting strategies. On this basis, a change in allocations would likely not impact on the performance of the management system in meeting conservation objectives.

5.1	Conservation
Effect	No impact on conservation objectives.

5.2 Net Benefits and Efficiency

The following are some of the main economic benefit criteria in the MSA that directly pertain to the establishment of a catch shares program.

> SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT. (a) . . . . national standards for fishery conservation and management: . . . . (5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.
>
> 303A (c) REQUIREMENTS FOR LIMITED ACCESS PRIVILEGES.— (1) IN GENERAL.— (B) if established in a fishery that is determined by the Secretary or the Council to have over-capacity, contribute to reducing capacity; . . . . (C) promote— . . . . (iii) social and economic benefits;

The Council's Allocation Framework (Section 6.3.1 of the groundfish FMP) requires that when recommending the direct allocation of resources that the action should achieve at least one of a number of benefits, among which is included: "Increase economic yield."

In addition, the groundfish FMP includes the following related general goals and objectives.

Goal 2 - Economics. Maximize the value of the groundfish resource as a whole. Objective 6. Within the constraints of the conservation goals and objectives of the FMP, attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Similar goals and objectives were included in Amendment 20.

> Goal: Create and implement a capacity rationalization plan that **increases net economic benefits,** creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch.
>
> Objectives:
> 2. Provide for a viable, profitable, and efficient groundfish fishery.
> 6. Promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry.

The goals related to efficiency, net economic benefits, etc., discussed above will be achieved under any of the alternatives. The expectation is those quota shares allocated to the least efficient harvesters will be traded to those who are able to generate greater profits from the QS. Some alternatives may achieve these goals more quickly than others if, for example, the majority of quota shares are allocated to those who are relatively more efficient as opposed to allocating the majority of quota share to holders who are less efficient. However, given the absence of information on the relative efficiency of harvesters, there is no explicit way to determine which of the alternatives leads to the best long term situation most quickly.

5.2	Net Benefits and Efficiency
Effect	No long-term effect. Information not available to discern differences in short term effects.

5.3 Excessive Shares

The accumulation of control over an excessive proportion of shares in a catch share program can have negative impacts on both net benefits to the nation, and fairness and equity. The following are the MSA criteria on excessive shares that directly pertain to the establishment of a catch shares program.

> SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT. (a) . . . . national standards for fishery conservation and management: . . . . (4) . . . . If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocations shall be .... (C) carried out in such a

manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

303A (c) REQUIREMENTS FOR LIMITED ACCESS PRIVILEGES.— (5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall— . . . . (B) consider the basic cultural and social framework of the fishery, especially through— . . . (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery; . . . (D) ensure that limited access privilege holders do not acquire an excessive share of the total limited access privileges in the program by— (i) establishing a maximum share, expressed as a percentage of the total limited access privileges, that a limited access privilege holder is permitted to hold, acquire, or use; and (ii) establishing any other limitations or measures necessary to prevent an inequitable concentration of limited access privileges;

Additionally, Amendment 20 specified as a program constraint in developing the program: "Avoid excessive quota concentration" (Constraint 6).

The Council has accumulation limits for QS and QP to prevent the acquisition of excessive shares in the fishery by any one entity. These limits are likely sufficiently constraining to prevent antitrust violations and achieve other socio-economic goals related to the prevention of excessive concentration. After the initial allocation any individuals receiving QS in excess of the accumulation limits for QS are required to divest themselves of that QS by the end of calendar year 2014. The alternatives considered here would not change the accumulation limits but could result in greater or lesser degrees of QS concentration of, including the possibility of affecting initial allocations in excess of the accumulation limits. Any change in the amount allocated to a single entity in excess of the accumulation limits would be a short-term effect owing to the requirement for divestiture down to limits by the end of 2014. The impact is essentially the selling off of excessive shares from one entity to another. The impacts below indicate the number of entities and amount of quota that may have to be divested.

<table>
<tr><td>Effect</td><td colspan="5">A short term impact may result if there is a change in the amount of quota held in excess of the accumulation limits (divesture down to the limits is required by 12/31/2014).</td></tr>
<tr><td>Metric</td><td colspan="5">Amount of quota allocated in excess of accumulation limits and number of entities holding amounts in excess (Number of entities effected.)</td></tr>
<tr><td></td><td colspan="5">Alternatives</td></tr>
<tr><td></td><td>No Action</td><td>1: 2003</td><td>2: 2007</td><td>3: 2010</td><td>4: More Recent</td></tr>
<tr><td>Catcher Vessel Permits – Shoreside History</td><td colspan="5" rowspan="3">None of the alternatives would allocate amounts In excess of QS control limits.
(See Sections on Accumulation Limits in Sections 4.3.1.1, 0, and 4.3.2.1</td></tr>
<tr><td>Whiting Processors – Shoreside History</td></tr>
<tr><td>Catcher Vessel Permits – Mothership History</td></tr>
</table>

5.4 Fairness and Equity

Evaluation of the fairness and equity involves weighing numerous countervailing criteria. Deriving measures for these factors and their relative importance is very difficult. Unlike the economic criterion of "efficiency," for which there are standard, generally agreed upon, quantitative measures that can be objectively evaluated, there is little consensus regarding choice of criteria for evaluating fairness and equity, and even less agreement on yardsticks for measuring those criteria. The fairness and equity issue concerns decisions determining who is allocated a valuable asset (QS and mothership sector history) versus who must, like all other future entrants, purchase their allocations in order to participate. Those receiving initial allocations may be placed at a competitive advantage over new entrants or existing participants who must purchase more QS if they desire to maintain their recent harvest levels.

The following contain the primary legal and policy guidance on fairness and equity.

The National Standards of MSA address fairness and equity issues:

> SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT. (a) . . . . national standards for fishery conservation and management: . . . **(4)** Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocations shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

Items (B) and (C) of this national standard are addressed in Sections 5.1 and 5.3, respectively. The remaining criteria of this standard are addressed in this section.

The guidelines for National Standard 4 on fairness and equity state that

An allocation of fishing privileges should be rationally connected to the achievement of OY or with the furtherance of legitimate FMP objectives. Inherent in an allocation is the advantaging of one group to the detriment of another. The motive for making a particular allocation should be justified in terms of the objectives of the FMP; otherwise, the disadvantaged user groups would suffer without cause. (600.325(c)(3)(i)(A)).

This chapter shows how each of the alternatives relates to the goals and objectives of the FMP. In this section, issues related to fairness and equity are discussed directly.

There is also an MSA requirement for the consideration of fairness and equity in the development of any limited access programs, which includes LAPPs such as the trawl rationalization program.

> 303 (b) DISCRETIONARY PROVISIONS.—Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, may—. . . (6) establish a limited access system for the fishery in order to achieve optimum yield if, in

> developing such system, the Council and the Secretary take into account— (A) present participation in the fishery; (B)historical fishing practices in, and dependence on, the fishery; (C) the economics of the fishery; (D) the capability of fishing vessels used in the fishery to engage in other fisheries; (E) the cultural and social framework relevant to the fishery and any affected fishing communities; **(F) the fair and equitable distribution of access privileges in the fishery;** and (G) any other relevant considerations.

With respect to LAPP programs in particular, Section 303A of the MSA provides additional more specific guidance on factors to be considered to ensure that allocations are fair and equitable:

> (c)(5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall—
>
> (A) establish procedures to ensure fair and equitable initial allocations, including consideration of—
>
> (i) current and historical harvests;
> (ii) employment in the harvesting and processing sectors;
> (iii) investments in, and dependence upon, the fishery; and
> (iv) the current and historical participation of fishing communities;

Both of these sections include concepts such as harvests, participation, dependence, and current and historical activities as part of fairness and equity considerations. Other parts of the MSA (303 (b) in particular) also mention some of these concepts as considerations to be taken into account, without specifically linking them to fairness and equity.

Additionally, Section 303A includes the concept of participation specifically in the context of allocation.

> (c)(5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall— (E) authorize limited access privileges to harvest fish to be held, acquired, used by, or issued under the system to persons who substantially participate in the fishery, including in specific sector of such fishery, as specified by the Council.

The objectives of the groundfish FMP re-enforce the importance of equity in the development of management measures:

> <u>Objective 12</u>. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

And, Amendment 20 contains some further guidance in the form of a constraint on action related to fairness and equity: "Avoid provisions where the primary intent is a change in marketing power balance between harvesting and processing sectors" (Constraint 5).

5.4.1 Allocations and Imposition of Hardships

Guidelines for National Standard 4 state:

> An allocation may impose a hardship on one group if it is outweighed by the total benefit received by another group or groups. An allocation need not preserve the status quo in the fishery to qualify as "**fair and equitable,"** if a restructuring of fishing privileges would maximize overall benefits. The Council should make an initial estimate of the relative benefits and hardships imposed by the allocation, and compare its consequences with those of alternative allocation schemes, including the status quo. (Section **600.325**(c)(3)(i)(B))

The analysis provided in Section 5.2 indicates that there is no substantial difference between the alternatives with respect to the expected generation of net benefits. At the same time, the program as a whole is generating substantial conservation and economic benefits for the nation (Council, 2010), and some initial allocation must be in place in order to continue to achieve those benefits. As described in Section 600.325(c)(3)(i)(B) of the guidelines "Inherent in an allocation is the advantaging of one group to the detriment of another." Regardless of which alternative is selected there will be some group that is advantaged over another. Those who are advantaged and disadvantaged by the alternatives are described in Chapter 4. Overall, the benefits of the program are sufficient to justify an allocation that may impose relative hardships on certain participants.

5.4.1	Allocations and Imposition of Hardships
Effect	All alternatives would be part of a program that generates sufficient benefits to warrant the imposition of unavoidable hardships on one group over another in order to achieve the greater overall benefit.

5.4.2 Investment and Dependence

5.4.2.1 Policy Guidance

In the development of LAPP programs, the MSA relates investment and dependence to fairness and equity (303A(c)(5)(A)(iii), see page 135). With respect to investment and dependence and the development of limited access systems (of which a LAPP is a type) the MSA requires that the Council take into account historical fishing practices in, and dependence on, the fishery as well as the capability of fishing vessels used in the fishery to engage in other fisheries 303(b)(6)(B)&(D) , see page 134). The NOAA LAPP guidelines (NOAA, 2007) include among the attributes that may be used in allocation formulas:

> various measures of dependence on the fishery including percent of revenue or opportunities to participate in other fisheries, and inter-relations with other fishery related business especially with respect to employment. (p. 62)

Prior to the most recent reauthorization of the MSA, formal allocations to fishing communities (FCs) and participation by regional fishing associations (RFAs) were not covered in the MSA.

NOAA LAPP guidelines begin to address the allocation complexities potentially created by adding FCs and RFAs into the mix of participants by first outlining the factors considered in initial allocations. The following discussion from the NOAA LAPP guidelines addresses issues related to investment and dependence and relates them to disruption.

> Given the laws and accepted views on who were potential recipients, historically the main concern was to set up an allocation that would change the fishery from the *status quo* to an IFQ fishery with a *minimum disruption of the current distribution* between the recipients. When that was the goal, the question became what sorts of things could be used to quantitatively compare allocations among the potential recipients? Looking at participation characteristics was a good way to do this. *Catch histories are a way to compare the relative success of various participants. Comparing the financial investments shows, albeit imperfectly, relative commitments to a fishery*, and at the same time, relative differences in amounts that will have to be earned to support the capital equipment. It is interesting to note that the two measures will provide different rankings. A smaller older boat operated by a high-liner could have a very good catch record but could be way low on the financial investment ladder. Which measure is best? That is a judgment call. At the same time, others may not like either of these measures and would argue for years of participation. Finally, others would suggest that the notion of maintaining the existing distribution is not appropriate and would argue for an equal distribution. The allocation formulae actually used in U.S IFQ programs were usually based on more than one of these measures. (emphasis added, NOAA, 2007, pp. 63-64)

This discussion indicates that consideration of investment and dependence is a way to minimize disruption, but that the balance of emphasis between investment and dependence is a judgment call. While not explicitly evaluating amounts of financial investment, the allocation formulas take financial investments and related dependence into account as described below. After describing in general how investment and dependence are taken into account, the analysis will assess how the alternatives may vary in terms of the weight placed on dependence and investment.

5.4.2.2 Relation of Rationalization Program Provisions to Policy

Harvesters: Allocation to Vessel Limited Entry Permits. In the analysis of the decision to allocate QS to harvesters on the basis of permits (rather than allocating on the basis of vessels or other types of investments in harvesting) it was noted that "limited entry permits are highly specific assets, the value of which is likely to decline substantially with the implementation of an IFQ program" (Council FEIS, 2010, p. A-74). Because permits only have value when used in the limited entry groundfish fishery, the owners of the permits are entirely dependent on that fishery for recovery of their investment. Other harvesting capital assets, such as vessels, usually have some degree of mobility and alternative uses in other fisheries, though in worst case scenarios that alternative use might be only for scrap metal. The decision to allocate shoreside QS and mothership catch history assignments to permit owners emphasizes the specificity of these investments and their dependence on the fishery. The equal allocation component of the shoreside QS allocation formula ensures some protection of that investment in that current ownership of the permit alone (without regard to its level of participation) will be sufficient to garner a substantial portion of the allocation based on the equal sharing of the buyback history (43 percent of the nonwhiting QS and 7 percent of the whiting QS is shared equally among all permits), regardless of the level of fishing activity associated with the permit.[9]

Under all alternatives considered here, the decision to allocate to harvesters based on permit ownership and the amount of QS equally divided among permit owners would remain unchanged. The portion of the allocation made to permits based on their landing history varies by the alternatives being considered and is discussed below.

For catcher vessel permits in the mothership fishery, a threshold amount of participation in the fishery is required in order for the permit to qualify for an initial allocation. The assignment under status quo of catch history for mothership permits requires that a permit qualifying for a mothership endorsement must have at least 500 mt of deliveries to motherships during the 1994-2003 allocation period (see discussion Section 2.1). If the endorsement requirement is modified to match the new allocation periods, some permits with pre-2004 catch history that did not meet the threshold might acquire an endorsement and allocation under the alternative allocation period. Conversely, some permits that received an allocation under status quo may not meet the qualifying threshold if some of the earlier years of the allocation period were eliminated (Alternative 4). This change would further increase the emphasis on more recent years of harvest.

Processors: Allocation to Buyers as Recorded on Fish Tickets. The decision to allocate 20 percent of whiting QS to processors relates to processors' dependence and investment. For the whiting fishery, there was concern that the switch from the derby fishery to the IFQ program would substantially reduce peak processing demand, thereby resulting in some processing capacity becoming redundant (Council FEIS, 2010, p. 58). Lengthening the season would result in some capacity being used more intensely and other capacity being completely unemployed. The effects on investment recovery would depend on the distribution of landings among processors and whether or not all processors were able to maintain enough product flow to recover their investment over the long term. The allocation to processors was intended to increase the probability that whiting processors would be able to maintain some product flow and ability to recover their investment in whiting-specific plants and equipment.

For the nonwhiting fishery, the Council found that while processors are dependent on and invested in the fishery, that dependence and the security of their investments were not contingent on receiving an initial allocation of quota. Prior to IFQs, management of the nonwhiting groundfish fishery was under bimonthly cumulative limits which effectively distributed the harvest of nonwhiting species throughout the year. Therefore there was not the kind of overinvestment in processing equipment to meet peak demand as occurred in the whiting fishery, and hence not the same concern about stranded processing capacity in the nonwhiting fishery.

Another reason for allocating QS to processors in the whiting fishery but not the nonwhiting fishery was the difference in the expected balance of market power between these two fisheries.

[9] Permits that participate primarily or only in the at-sea whiting fishery also receive a portion of the shoreside equal allocation of QS, providing value to the permit owner which may be sold or traded to acquire allocations in the sector in which it participates.

There are substantially fewer harvesters in the whiting fishery than in the non-whiting fishery, therefore it was anticipated that an initial allocation of QS solely to whiting harvesters might be more disruptive of the balance of market power between processors and harvesters than would be the case in the nonwhiting fishery.[10] A 20 percent allocation of whiting QS to processors was believed to be appropriate to address the issues of surplus investment in the processing sector and the market power concerns. Under all alternatives considered here, the decision to allocate 20 percent to processors based on receiving history (with recognition for successors in interest) would remain unchanged.

Criteria for evaluating investment and dependence of specific processors are more difficult to construct than for harvesters. The first challenge is simply identifying the entity which should qualify. There is no limited entry permit requirement for processors and there may be multiple parties with interest in the processing assets (e.g. the owner of the land and buildings used by the processing company may differ from the owner of the processing company). The Council decided that the entity listed as the buyer on state fish tickets should receive the initial allocations, as opposed to, for example, the entity that actually owns the processing facility land and buildings (in many cases this belongs to the Port). The specific criteria used for attributing history to processors are discussed below in the section "Investment and Dependence of Recent Entrants - Processors."

Length of Allocation Period and Level of Participation. One indicator of the degree to which a fishing operation is dependent on a particular fishery is its level of participation on a continuing basis. Fishing operations that participate sporadically and/or at low levels are likely to be less dependent on the fishery than ones participating at higher levels over long periods. Moreover, major investments are generally made and based on long term participation levels rather than temporary fluctuations that occur over the course of a few years. Therefore counting participation over a longer allocation period may tend to provide a better, albeit imperfect, measure of dependence than does focusing on shorter allocation periods.[11] However, a long allocation period does not address the investment and dependence that may be established by entities entering toward the end or after the allocation period but prior to initial allocation. As the number of years between the end of the allocation period and implementation of the initial allocation increases, the degree to which the allocation period alone gives weight to current participation and harvests diminishes (as discussed above there are other program provisions that also address current participation).

Investment and Dependence of Recent Entrants - Harvesters. Longer allocation periods may fail to measure dependence for fishing operations that have very recently invested in and entered the fishery. For harvesters this situation is compensated for by allocating to current participants who have purchased trawl permits, and thereby made a highly specific investment in the groundfish fishery. As discussed above, just by virtue of owning a permit harvesters received an equal share of a significant portion of the total QS allocated: roughly 43 percent of nonwhiting groundfish QS and 7 percent of whiting QS. The equal share allocation provided substantial

[10] The issue of stranded capital is one of compensating for loss, whereas the balance-of-power issue takes into account fishery dependence and affects the security of investment going forward into the future.

[11] The drop year provision (e.g., drop two or three worst years) was intended to take into account operations which due to mechanical or personal difficulties may have had low levels of participation for a period of time.

value to all who had invested in a permit, regardless of the participation of the permit owner or the landings history underlying the permit. Thus, even though the equally-divided portion of whiting QS was relatively small, permits that participated primarily in the whiting fishery also received a substantial allocation of nonwhiting species QS. Equally-allocated QS provided substantial value to all participants which, once QS trading starts, can be used to tailor QS portfolios for their particular operations.

The remainder of the QS was allocated based on permit landings history. Using permit history as the basis for the allocations, rather than a fisherman's or a vessel's history, provided a second means by which the investments of recent entrants was taken into account. The requirement to hold a limited entry permit means that any new entrant must displace an existing participant. This creates a chain of events by which a recent entrant in the fishery can be linked back to the history of the entity it displaces, and the new entrant is given credit for the historical landings of the displaced entity. This treatment places some weight on investment and dependence by an operation recently entering the fishery just before or after the end of the allocation period.

Finally, the Council's precedent of allocating quota based on permit history (e.g., the fixed gear sablefish program, Council, 1996) and the allocation options developed early on in the Amendment 20 process which were based on permit history (Council, 2010), resulted in permit prices in the years leading up to the implementation of the program being affected by permits' landings histories. Thus, following through with the allocation to permits based on permit landings history also took some account of the issue of investment and dependence of current participants in the fishery (including recent entrants) up through the time the initial allocation process started in mid-2010.

The formula used for assigning catch history to vessel permits in the mothership sector is similar to the one used in the shoreside fisheries except that there was no equal allocation element for the mothership sector catch history assignments. However owners of catcher vessel permits participating in the mothership sector did also receive an allocation of the portion of shoreside fisheries QS that was equally divided among all permits. Thus although a permit entering the mothership sector toward the end or after the allocation period did not receive a minimum allocation in the mothership fishery (e.g., an equally-shared portion of the mothership sector catch history), the permit <u>did</u> receive some compensation in the form of an allocation of the equally-shared portion of shoreside QS.

Another way to account for more recent entry (current harvest) is to allocate based on periods that include years very close to the year the initial allocation is made. However, even including in the allocation period the year immediately prior to when the allocation occurred could potentially place little emphasis on recent investment and dependence without the existence of other provisions which take into account recent investments. For example, if there were not also the opportunity to acquire credit for earlier years of harvest through acquisition of an existing permit, a harvester entering in the last year of the allocation period would receive credit for only one out of the many years of the allocation period.. Nevertheless, including more recent years of harvest history would tend to scale the allocations toward the level of harvest of a more recent entrant (whether that level is greater or lesser than that of the harvester the new entrant displaced).

Investment and Dependence of Recent Entrants - Processors. For processors it is more difficult to take into account investments and dependence established just before the end or after the allocation period. In contrast to harvesters, the entry of one processor is not necessarily linked to the exit of another. There is also no key asset, such as a limited entry permit, whereby one processor can be traced to its predecessor, and hence there is no consistent way to link a current processor to its predecessors' histories. Furthermore, it is difficult to identify a specific act which marks the investment of a new processor in a particular fishery, since so many of a processor's assets may serve multiple purposes. The only consistent and definitive signal for entry of a processor into the groundfish fishery is the purchase of groundfish as documented on landings receipts or state fish tickets. Despite these challenges, Council policy included a provision for recognizing a "successor in interest" for processing businesses in cases where successorship could be clearly identified (note: this only occurred in one instance).

The absence of a requirement for new entrants to displace existing participants and the limited cases in which successorship allocation rules applied set up a situation in which use of the same allocation history period for processors and harvesters had a differential effect with respect to the weight the allocational approach places on current investment and dependence.[12] For harvesters, allocations went to current participants at the time the allocation was made (as defined by permit ownership). For processors, a processing company which had exited the whiting fishery (not received whiting since the allocation period) would still receive an allocation while a company which began receiving and processing whiting after the end of the allocation period would not receive any allocation. Therefore, as the time between the allocation period and initial allocation increases, a greater disjunct between initial allocation recipients and current participation is created for processors than is created for harvesters.[13]

The decision to provide an allocation to processors potentially creates a competitive differential between processors, such that those who receive an initial allocation will be at a competitive advantage over those which do not receive an initial allocation. Those who entered after the allocation period but prior to the initial allocation will be on par competitively with entities which seek to enter as processors after the initial allocations are completed.

5.4.2.3 Analysis of Effects of Alternatives

As discussed above, the alternative allocation formulas for harvesters take into account

[12] Amendment 6 (license limitation) provides an example of another way in which investments made just prior to the end of an allocation period have been taken into account. Under Amendment 6, vessels were given a permit based on landing history. Investments made prior to the end of the qualification period which were not yet operational were given an opportunity to "prove-up" via a provisional permit system. For example, if an individual had recently laid a keel they could qualify for a permit by finishing vessel construction within a certain time frame and then meeting certain minimum participation requirements over a number of years.

[13] For processors, the situation is more akin to that which occurred with the sablefish and halibut IFQ program in Alaska. In that program, allocations were given to the entities that owned the vessels at the time of harvest. As the time between the allocation period and implementation of the program increased the relevance of the allocation period to current participation decreased. Since the allocation period was the primary way that current participation was taken into account, this raised questions as to whether the program had adequately accounted for current participation.

dependence and investment by crediting permit ownership and historical landings, while the formulas for processors takes dependence and investment into account almost solely[14] by including purchase history criteria throughout the allocation period. The action alternatives vary in the number and recency of the years included in the allocation formulas.

Relationship Between Dependence and Inclusion of More Recent Years' Harvest. Given an allocation based on participation levels and a period of sufficient length to demonstrate reliance on the fishery, the more recent the years of harvest included in the allocation formula, the more likely it is that allocations will reflect current dependence on the fishery. Elimination of earlier years in the allocation period (Alternative 4) increases the influence of more recent years history on the initial allocations.

Inclusion of more recent years' landings in the allocation formula would have a greater differential effect on the initial allocations for processors than for harvesters. As described in the introduction to this section, for harvesters, recent entry and related dependence and investment is accommodated by linking the initial allocation to permit ownership, while for processors entry just prior to the end or after the allocation history period is accommodated only in situations where there is a clear successor in interest, i.e., when a newly entering processor purchased and replaced an existing facility operated by a prior owner. Thus, allocation periods that include more recent years would have a greater effect in aligning the allocation with current investment and dependence for processors than would be the case for vessels.

The following table displays the allocation formula alternatives in order of increasing weight placed on current or recent levels of investment and dependence:

Table 5-1. Alternatives ordered from least to most emphasis on current investment and dependence.

Initial Allocation Group	Years Used for Allocation Formula				
	Alt 1: 2003	No Action	Alt 2: 2007	Alt 3: 2010	Alt 4: More Recent
Shoreside Harvesters	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010
Shoreside Whiting Processors	1998-2003	1998-2004	1998-2007	1998-2010	2000-2010
Mothership Catcher Vessels	1994-2003	1994-2003	1994-2007	1994-2010	2000-2010

Actual Effect – Projected Alternative Allocations in Comparison to Levels of Investment and Dependence. Effects under the allocation alternatives are analyzed by comparing resulting allocations against participation and dependence in comparison period (percent of revenue or purchases from West Coast groundfish trawl fisheries. These comparisons are provided for harvesters and processors in Chapter 4.

The threshold level of involvement in the fishery required to qualify for an assignment of mothership sector catch history (qualify for an endorsement) is 500 mt. That threshold has been applied to each of the allocation periods. There are two permits that do not meet the 500 mt threshold under any of the alternatives. Under Alternative 4, permits that only have earlier

[14] The exception being the single instance in which a processing company qualified for delivery history through the successor-in-interest provision.

history are eliminated, reducing the total number of permits receiving an allocation by 10 compared with other alternatives but no permits with history from 2000-2010 were eliminated due to the 500 mt threshold.

5.4.3 Harvests and Participants – Current and Historic

Policy Guidance

The MSA provides the following direction regarding considering current and historical participation and harvests when developing a limited access program, including limited access privilege programs.

> **[**Any FMP may] establish a limited access system for the fishery in order to achieve optimum yield if, in developing such a system, the Council and the Secretary take into account—
> (A) present participation in the fishery;
> (B) historical fishing practices in, and dependence on, the fishery;
> (MSA Section 303(b)(6))
>
> (c)(5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall—
> (A) **establish procedures to ensure fair and equitable initial allocations, including consideration of—**
> **(i) current and historical harvests;**
> **(iv) the current and historical participation of fishing communities;**
> (E) authorize limited access privileges to harvest fish to be held, acquired, used by, or issued under the system to persons who substantially participate in the fishery, including in specific sector of such fishery, as specified by the Council.
> (MSA Section 303A)

Relation of Rationalization Program Provisions to Policy

In subsections below, current and historic harvests and participation are considered separately. Subsequent to considerations of current and historic harvests, a determination must be made as to the manner and degree of emphasis that each will be given in the approach to allocation. The following excerpt from the Amendment 20 EIS discusses the consideration of current and historic participation, the trade-offs between the two, and mitigating provisions of the shoreside IFQ program.

> This section [of the Amendment 20 EIS] will focus on the relevance of history during the allocation period to the current needs of participants in the fishery and customary standards for establishing resource allocations. To the degree that the QS allocation deviates from the current needs of participants, there is likely to be more disruption, which may also affect the distribution of job opportunities on vessels and possibly the distribution of activity among communities. Greater disruption decreases the likelihood that the allocation will be considered fair and equitable. At the same time, longtime

participants in the fishery may view it as appropriately fair and equitable that they should receive recognition for the seniority of their participation and thus claim the privilege to use the resource. Seniority of use is often a factor considered in deliberation over who should have claim to future use of a resource (e.g., issues of "beneficial use" and "first-in-time" related to how surface and ground water use rights are assigned) (NRC 1999). Additionally, the MSA requires consideration of both current and historic harvests in determining the initial allocation of QS (MSA 303A(c)(5)(A)(i) and (iv).

Longer allocation periods take more account of seniority and reduce the need for consideration of hardship provisions. At the same time, use of a longer allocation period implies reliance on long-term averages. If there has been a trend in the change from the start to the end of the allocation period, then the average will not reflect recent conditions in the fishery as well as would a shorter period of more recent years. Additionally, in a changing fishery, the amount of change that the initial allocation will induce will increase as the time between the allocation period and the actual allocation increases. Certain features of the IFQ program will mitigate some of these concerns. They include dropping worst years to address hardship (Section A-2.1.3.a, "Drop Years Provision"), using relative history to address changing fishery conditions across time (Section A-2.1.3.a, Relative History"), and the attribution of landing history to a permit to facilitate entry and exit and reduce the disruption that might otherwise occur through the initial allocation (Section A-2.1.1.b).

Longer allocation periods help to address hardships. Temporary circumstances may interfere with a particular vessel's operations such that its harvests over a certain period do not reflect its level of investment and dependence on the fishery. There are number of ways to deal with such hardship circumstances. One is to provide hardship exceptions and an appeals process, another is to allow vessels to drop their worst years, and a third is to provide a longer period of time over which level of involvement and dependence is determined. The Council's [F]PA relies on a combination of the latter two mechanisms (the opportunity to drop worst performance years and a long period across which to demonstrate performance).

In the context of a longer allocation period, relative history helps adjust for the variation in fishing opportunity among years. When a longer allocation period is used, it is more likely that it will encompass changes in the fishery such that conditions at the end of the period may vary substantially from those at the start as well as from the average over the period. The use of "relative history" is intended to adjust for changes in the fleet harvest opportunity by measuring each year's landing history for a permit as a percent or share of the total for the fleet rather than in pounds caught (also termed "catch over catch"). This compensates for changing opportunity across time but does not address changes in participants.

The long allocation period and associating the allocation with the permit provides for "seniority" of use, while at the same time new entrants receive an allocation that helps protect their more recent investment. By attributing and accruing landing history to a permit, those who have made investments to enter the fishery more recently do not

> necessarily lose out to those who made their investments earlier in time. This also allows longtime participants to receive more value for the business that they have built, if they choose to leave the fishery before a privilege system such as IFQs has been developed.
>
> A shorter allocation period would provide less credit for seniority in use while still allocating to those who have invested more recently, according to their level of participation. A shorter period would potentially raise more issues of hardship by making it more difficult to allow an entity to drop enough years to cover hardship issues. Some may experience no hardships during the allocation period while others may have circumstances that affect production for a number of years. Allowing permits to drop any more than their one worst year from a four year allocation period would substantially dampen the amount of QS received by those with a consistent participation history (evening out the allocation). On the other hand dropping the worst 2 or 3 years from an 11-year allocation period can be done with much less impact on the allocation to those with consistent participation. (Council 2010, pp. A-150 – A-151).

5.4.3.1 Current Harvest and Current Community Participation

Policy Guidance

Current harvest level is one of several participation criteria which must be considered and may be used in the initial allocation of quota shares. Other participation-related criteria that must be considered include historic harvests, employment, and investment and dependence (MSA Section 303A(c)(5)).

The NOAA LAPP guidelines mention "current harvest" only three times in the context of initial allocation, twice when directly quoting the act and once when discussing an auction approach to initial allocation and the need to take into consideration current harvests (p. 65). However, the guidelines document inferentially references the current harvest distribution when it notes with respect to LAPP programs such as that implemented here (i.e., ones that do not include FCs and RFAs):

> ... the main concern was to set up an allocation that would change the fishery from the *status quo* to an IFQ fishery with a minimum *disruption of the current distribution* between the recipients. When that was the goal, the question became what sorts of things could be used to quantitatively compare allocations among the potential recipients? Looking at participation characteristics was a good way to do this. Catch histories are a way to compare the relative success of various participants. (NOAA, 2007, p. 63)

Here it is inferred that the goal of taking into account current harvest is to minimize disruption in the fishery as measured against the current distribution of harvest among participants.

Relation of Rationalization Program Provisions to Policy

The allocation formulas directly reflect the distribution of current harvests to the degree that more recent years are included in the allocation formula (years that are reasonably construed to be “current” for purposes of allocation).

Harvesters. Current *participation* of harvesters is taken into account by the allocation to current owners of permits (as of 2010) based on the assumption that current permit owners are current participants. Current *harvest* is taken into account indirectly, again based on the assumptions that those with permits are currently harvesting in the fishery (see Section 5.4.2 for a detailed description of the link between permit ownership and the QS allocation that an individual will receive). While some current permit owners may not take part in the fishery, from a perspective of economic rationality the expectation is that, on average, those owning permits will have sought to use them in order to earn a return on their investments. At the same time, the scale of an entity’s current harvest directly determines the initial allocation only to the degree that current years are included in the allocation formulas.

One of the substantial changes occurring in the fishery in more recent years is the imposition of management measures to eliminate targeting on overfished species. Trip limits were reduced substantially in 2000 when 5 stocks were declared overfished. By 2002 a total of seven stocks were declared overfished. In that year rockfish conservation areas were implemented to close the continental shelf to bottom trawling, substantially altered harvest patterns beginning in 2002.

To address these changes, the program includes an allocation adjustment based on post-2002 harvests (2003-2004 harvest), but only with respect to the allocation of overfished species to permits in the shoreside fishery (allocations of non-whiting species QS are not provided to processors and the permits in the mothership fishery are assigned catch history only for whiting and not other species). The post-2002 data used was only geographic harvest pattern data, not data on harvest levels. Permit harvest level information from 2003 and earlier was used to determine the allocations for all non-overfished species, including the amounts allocated equally (shapes 1 and 2 in Figure 5-1). QS for overfished species was allocated proportionally to the allocation of non-overfished species QS (shape 3). The proportional allocation was achieved using fleet average bycatch rates by area for 2003-2006 (shape 4). The average rates used for any particular permit were determined based on the areas in which that permit fished from 2003-2006 (shape 5). These elements of the allocation formula then combine (shape 6) to result in the QS allocation for overfished species (Shape 7).

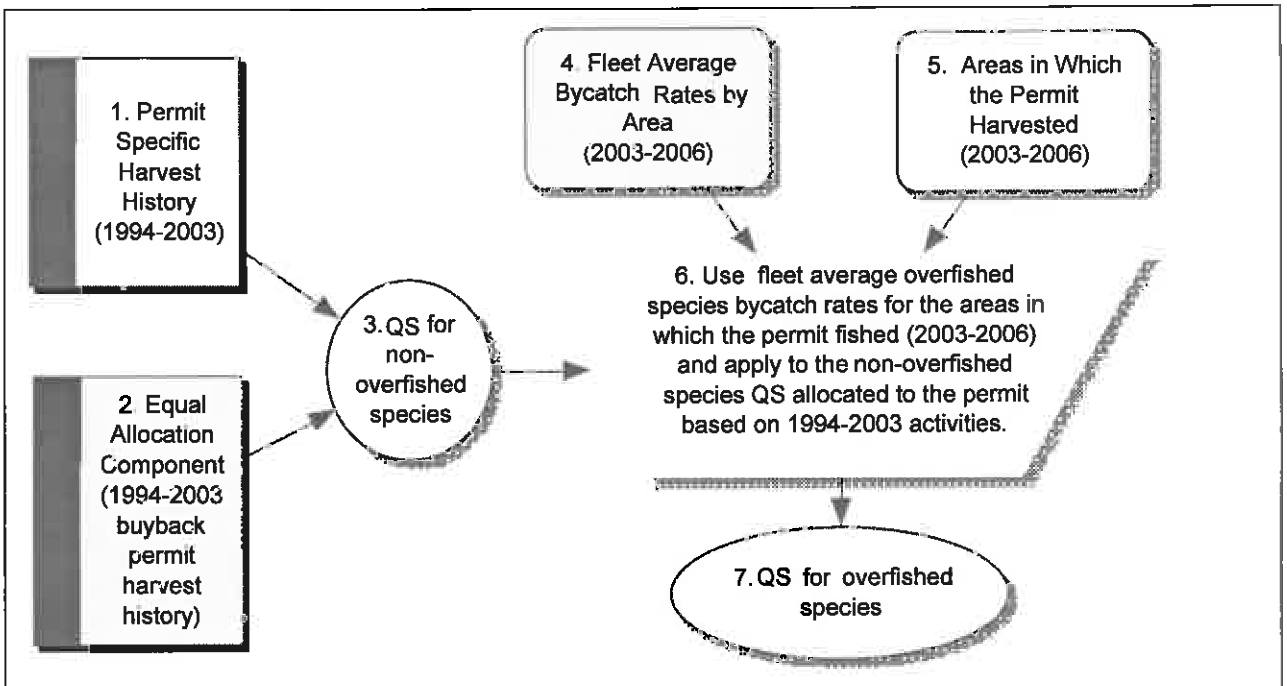


Figure 5-1. Flow chart of steps used to determine the allocation of overfished species (shaded boxes indicate the use of fleetwide data, unshaded boxes indicate permit-specific data and calculations.

Some examples of the importance of the distinction between the way 1994-2003 information was used and the way 2004-2006 information was used (as part of the 2003-2006 data set used for overfished species distributions) are as follows.

- If two permits had identical 1994-2003 history, but after 2003 (2004-2006) one landed 1,000,000 pounds and the other only 1,000 pounds, the two permits could receive identical allocations of overfished species as long as the latitudinal and depth distribution of their 2003-2006 harvests were the same.
- If two permits had 2003-2006 history that was identically distributed geographically, but one permit had 10 times the 1994-2003 history of the other permit, then (with respect to the QS allocated based on permit history) one permit would generally receive 10 times the allocation of overfished species than the other permit.
- Regardless of how much a permit harvested from 2004 through 2006, if it had no 1994-2003 history it would receive no allocation of overfished species except for the equal allocation component of the allocation formula for canary rockfish.

Thus, using 2004-2006 history in this manner did not reward higher levels of 2004-2006 harvest with increased allocations.

The Amendment 20 EIS also discusses the fact that the buyback program implemented in 2003 would have substantial effects on patterns of harvest in the fishery which would not be picked up in allocation formulas that did not take into account harvest levels after 2003.

> One of the major factors that will result in differences between the pattern of initial QS allocation and the patterns of fishery harvest in more recent years will be the effects of the buyback program. The buyback program occurred just after the 2003 control date. It

> substantially expanded fishing opportunity for all vessels, as reflected by higher trip limits, and initially resulted in a change in the proportional distribution of permits along the coast. The most effective way to address these changes would be to include years after 2003 in the allocation period. However, doing so would reward those who disregarded the control date announcement, create perceptions of inequity, and encourage fishermen to ignore such dates in the future, negatively affecting the Council's ability to credibly use control dates.

As indicated in this paragraph, at that time, the Council considered the post 2003 conditions created by the buyback program but chose not to make a change to the allocation period for the indicated reasons.

Chapter 3 documents changes which have occurred in the whiting fishery after 2003. One of the purposes of this EA is to assist the Council in considering shifts in the fishery that occurred after 2003 and determining whether or not those shifts warrant a change in the allocation period to include more recent years (Alternatives 2 and 3) and potentially increase the emphasis on those later years (Alternative 4).

Processors. The MSA identifies the need to consider current and historic harvests for allocations to harvesters; however for allocations to processors the emphasis placed on current participation is less clear. Processing history is not mentioned *per se* but processing employment, investment and dependence, and the current participation of communities (of which processors are a part) are directly mentioned. Together, given that allocations are being made to processors, these factors might indicate that current participation levels for processors (e.g., purchasing or processing activity) have relevance for decision-making. For a processor entering the whiting sector after the allocation period, the only ways to qualify for an initial allocation are through buying out an existing processor (i.e., becoming a successor in interest)[15] or through the acquisition of a limited entry permit (accessing a portion of the initial allocation to harvesters). A whiting processor with history during the initial allocation period that expands operations after the initial allocation may increase its share of the allocation through similar avenues. However, as with harvesters, the scale of a processor's current activities directly determines initial allocations only to the degree that current years are included in the allocation formulas.

In addition to changing the allocation period, the recent participation requirement may also be shifted. For status quo, the recent participation period included the 7 years of the allocation period. For each alternative, the recent participation period has been respecified to cover the most seven six years of the allocation period, or six years in the case of Alternative 2 (1998-2003). As a result, some processors that may have qualified based on their earlier years of activity may be eliminated, thereby increasing the allocation going to those processors with more recent activity.

Communities. No separate allocation is made to communities. Current community participation is taken into account via the allocations to harvesters and processors that are members of the communities. In the analysis, information on current participation is presented for communities and the initial allocations to entities in the communities, in order to allow

[15] Only in one instance did a processor qualify for initial allocation based on the successor in interest provision.

decision makers to assess the likely impacts of the initial allocations on currently-participating communities. The dependence of communities on the viability of the entities receiving the initial allocations is indicated by displaying the amount of fishing activity (processing and harvesting) supported by those entities involved in the directed whiting fishery as compared to those entities not involved.

Analysis of Effects of Alternatives

As was discussed in the Section 5.4.2 on investment and dependence, as the time between the end of the allocation period and the initial allocation increases, there is increased potential for a disconnect between the distribution of activity in years immediately prior to the allocation and the distribution of the initial allocation. This disconnect creates a potential for disruption. There are two factors that help to reduce the degree of disruption that occurs as a result of the initial allocation (whether the distance between the end of the allocation period and the distribution is a few months or many years): (1) the January 2004 advance notice of proposed rule making, and (2) allocation to current owners of permits based on history of the permit. Opportunities to acquire a share of the initial allocation through acquisition of a limited entry permit provide all participants with an opportunity to plan and adjust for the initial allocation.[16] These mitigating factors affect the amount of potential disruption; nevertheless the amount of disruption would decrease as more recent (current) years are included in the initial allocation.

One measure of disruption is the difference between the distribution of harvest for a comparison period and the initial QS allocation. Three comparison periods are presented here: 2004-2006, 2007-2010, and 2011. The 2011 comparison is included because under NEPA all effects of an action must be assessed. However, at issue is whether or not the 2011 allocation (status quo) should have been implemented. The appropriateness of the 2011 baseline for assessing disruption should be considered in this light. A measure of the difference between the comparison periods and the allocations for each entity receiving an allocation is provided in Section 4.3.1.1 (shoreside harvesters), 4.3.1.2 (mothership catcher vessels), and 4.3.2.1 (shoreside processors). One measure of the total amount of disruption is the sum of the distances between entities' shares of the base period harvests and the initial allocations they receive (sum of the absolute values of the differences). The greater the sum, the greater the degree of disruption relative to the baseline. In the referenced sections of Chapter 4, these differences were calculated in terms of shares of harvest in comparison to shares allocated.

Table 5-2 summarizes the number of entities not qualifying for any allocation and the amount of history (average per year of activity) for the base periods (for processors, at least 1 mt of whiting deliveries are required to be included in this table).

[16] This opportunity is similar to that afforded new entrants after the program is implemented (the opportunity to buy quota).

Table 5-2. For entities active during comparison periods, the number receiving no allocation and total whiting deliveries or receipts by those entities in the comparison periods.

	Alternatives				
Comparison Periods	**No Action**	**Alt 1: 2003**	**Alt 2: 2007**	**Alt 3: 2010**	**Alt 4: More Recent**
Catcher Vessel Permits – Shoreside History					
2004-2011	All permits received some initial allocation---				
Whiting Processors – Shoreside History					
2004-2006	6 (3.7%)	6 (3.7%)	1 (0.3%)	1 (0.3%)	1 (0.3%)
2007-2010	9 (13.2%)	9 (13.2%)	4 (1.2%)	4 (1.2%)	2 (0.2%)
2011	5 (19.8%)	5 (19.8%)	3 (0.0%)	3 (0.0%)	2 (0.0%)
Catcher Vessel Permits – Mothership History					
2004-2006	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
2007-2010	1 (0.1%)	1 (0.1%)	1 (0.1%)	1 (0.1%)	1 (0.1%)
2011	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.2%)

Note: Permits with history in 2011 but no allocation associated are those which received an inseason transfer of allocation from an initial recipient.

The recent participation requirement for shoreside processors also screens out some entities that would otherwise qualify for allocations. By alternative, the number of processing entities screened out by the recent participation requirement, maximum aggregate annual total whiting harvest, and share of harvest is as follows.

Table 5-3. Processing entities screened by recent participation requirements, by alternative.

	Alternatives				
	No Action" 1998-2004	**1: 1998-2003**	**2: 1998-2007**	**3: 1998-2010**	**4: 2000-2010**
Recent Participation requirement (RP): received at least 1 mt in each of two years during	**1998-2004**	**1998-2003**	**2001-2007**	**2004-2010**	**2004-2010**
Total Processors during the Period	17	16	20	20	20
Number Screened Out by RP	8	7	9	9	7
Share of History Screened Out	0.294%	0.054%	3.857%	1.757%	1.378%
Number of Processors Receiving an Allocation	9	9	11	11	13
	Effects on Status Quo QS Recipients				
Number Screened Out	-	0	3	3	3
No Action Allocation	-	0.000%	1.337%	1.337%	1.337%

Note: Only those whiting processors with at least 1 mt in a single year during the period under consideration are included. Processors receiving less than 1 mt are considered to be receiving incidentally caught whiting, to which this allocation does not apply.

The recent participation period under Alternative 3 (ends in 2007) does not go through the end of the allocation period (ends in 2010). The effect of not including 2008-2010 is the elimination of two processors that together would have qualified for of 0.071% of the quota shares. As compared to a version of Alternative 3 in which the recent participation period extended to 2010, under the current version of Alternative 3 the 11 processors qualifying would each see their allocation increase by one-third of one percent.

Communities depend on some whiting processors to serve not only the whiting fishery but also other fisheries which support the community. Chapter 3 provides information on the dependence of communities on processors handling whiting. If the allocation among processors is such that some are disadvantaged and so as a result go out of business, and if no other buyers move in to take the place of those processors, then other fisheries in a community and the community as a whole may be adversely impacted. Section 4.3.3 provides estimates of how quota may be distributed among communities at the time of initial allocation and Section 5.8.3 discusses the how the initial allocation might affect economic activity in a community.

5.4.3.2 Historic Harvests and Historic Community Participation

Policy Guidance

At the start of Section 5.4.3, the MSA provisions relevant to historic participation are listed. Historic fishing practices and dependence are relevant in the development of limited access systems (MSA 303(b)(6), see page 134) and with respect to LAPP programs, historical harvests and historical participation by communities are cited as being particularly relevant to the fairness and equity of the programs (MSA 303A(c)(5)(A)(i) and (iv), see page 135). One reason for the pertinence of historic harvest to fairness and equity may be our culture's historic reliance on "seniority of use" as "a factor considered in deliberation over who should have claim to future use of a resource (e.g., issues of 'beneficial use' and 'first-in-time' related to how surface and ground water use rights are assigned)" (NRC 1999, as cited in Council, 2010, p. A-150).

Historic harvests and participation are also important from other economic and social perspectives. From an economic perspective, fishing handling and support businesses and infrastructure are developed and positioned based on long-term patterns of activity. Concurrent with the development of the economic relations and infrastructure are the development of the social networks and infrastructure. Historic patterns are therefore an indicator of structures in the human environment which are deeply embedded and difficult to evaluate but nevertheless important to the quality of human life.

Relation of Rationalization Program Provisions to Policy

The existing allocation formulas give a weight to historic participation by extending the allocation period back to 1994 for vessels and to 1998 for processors. The period goes back to 1994 for permits because it is the first year of the license limitation period, which started a new era altering who was able to participate in the fishery and delivery patterns (see Council, 2010, p. 148). For processors there is no limit on new entry. The whiting processor allocation period starts with 1998, the first year after the establishment of the whiting allocation framework which established a 3-way split in the whiting sector allocation (shoreside, mothership, and catcher-processor sectors) and a framework for modifying the allocation. The allocation among these sectors has not changed since that time.

With respect to the importance of historic harvest from other social and economic perspectives, on the one hand, allocation formulas which rely on longer time periods may better reflect some of the patterns within the industry and communities that are established based on long term conditions in the fishery. On the other hand, recent developments in the fishery may cause major disruptions in those patterns. Under such circumstances, if policy adjustments are made that are conducive to their continuation, short term patterns may be able to survive over the long term; or they may no longer exist and attempts to support them may result in further disruption. Assessing these patterns and their dynamics is difficult. The existence of physical infrastructure is amenable to some degree of documentation but the economic and social relations built around the fishery are difficult to document and summarize in a manner and with timeliness that is helpful to decision makers. Further the effects of a particular allocation on relational patterns and infrastructure that are indirectly related to fishing are difficult to project in the context of other changing social and economic conditions. This paucity of information creates a challenge in assessing the appropriate balance of emphasis between current and historical participation and harvests in developing allocation formulas.

Analysis of Effects of Alternatives

For the portion of the QS allocation formula related to individual permit history, Alternative 1 emphasizes entirely historic years (current as of the control date). For processors, No Action (status quo) adds one post-control date year to the allocation period. Other alternatives include more recent years and decrease the emphasis on earlier years in the allocation period. Alternative 4 places the most emphasis on recent years by eliminating the earlier years of the allocation periods (1994-1999). The relative emphasis on each year of the allocation period and different historically important segments is shown in Table 5-4. For example, it is shown that the pre-AFA years have a relative weighting of 50 percent under No Action, 29 percent under Alternative 3, and 0 percent under Alternative 4. Conversely, it is shown that post-AFA implementation years receive a weighting of 30 percent under status quo, 59 percent under Alternative 3, and 91 percent under Alternative 4.

Table 5-4. Relative weighting of historic periods by allocation alternative for permits

		No Action	Alt 1	Alt 2	Alt 3	Alt 4
Allocation Period:		1994-2003	1994-2003	1994-2007	1994-2010	2000-2010
Number of years in the allocation period.		10	10	14	17	11
Weight Per Year		10%	10%	7%	6%	9%
Pre AFA Years	(1994-1998)	50%	50%	36%	29%	0%
AFA Implementation Years	(1999-2000)	20%	20%	14%	12%	9%
Post AFA Years – Pre-buyback	(2001-2003)	30%	30%	50%	59%	91%
Post Buyback Years	(2004-2010)	0%	0%	29%	35%	55%

Note: The allocation formula uses a relative measure of landings history. Under a relative measure, history for any particular year is measured as a share of all history in that year. Consequently, performance in any given year is measured in comparison to other participants during the year and not affected by changes in total harvest or the OY.

Table 5-5. Relative weighting of historic periods by allocation alternative for processors.

		No Action	Alt 1	Alt 2	Alt 3	Alt 4
Allocation Period:		1998-2004	1998-2003	1998-2007	1998-2010	2000-2010
Number of years in the allocation period.		7	6	10	13	11
Weight Per Year		14%	17%	10%	8%	9%
Pre AFA Years	(1994-1998)	14%	6%	10%	8%	0%
AFA Implementation Years	(1999-2000)	29%	33%	20%	15%	9%
Post AFA Years	(2001-2010)	57%	50%	70%	77%	91%
Post Buyback Years	(2004-2010)	14%	0%	40%	54%	64%

Note: The allocation formula uses a relative measure of landings history. Under a relative measure, history for any particular year is measured as a share of all history in that year. Consequently, performance in any given year is measured in comparison to other participants during the year and not affected by changes in total harvest or the OY.

Community historic participation in the shoreside whiting fishery is documented in Chapter 3. Section 4.3.3 provides estimates of how quota may be distributed among communities at the time of initial allocation as well as additional information on community dependence and involvement in the fishery and Section 5.8.3 discusses the how the initial allocation might affect economic activity in a community

5.4.3.3 Employment (processing and harvesting)

The MSA requires consideration of employment in the harvesting and processing sectors when establishing initial allocation for LAPP programs. In general, the provisions have been developed to account for current and historic participation in the fishery while at the same time transitioning to a rationalized fishery. Rationalization inevitably implies a change in the nature and patterns of employment in the processing and harvesting sectors. There is no reason to believe that allocation to certain harvesters or certain processors is more likely to result in more stable or higher employment than allocating to other harvesters or processors. Consequently account is taken of processing and harvesting labor by distributing allocations based on the current and historic harvest patterns in the fishery. As discussed in the previous sections, both current and historic harvest patterns are relevant to existing economic and social networks, and the labor force is positioned within these networks. It is also difficult to predict the effect on labor because of the post-implementation quota trading and consolidation that is likely to occur under rationalization. Overall, it is likely that allocations that are least disruptive to harvesters and processors, as discussed in previous sections, would also be the least disruptive to employment.

5.4.4 Discrimination Between Residents of Different States

MSA National Standard 4 requires that management measures not discriminate between residents of different states. While the alternatives may result in differing distribution of initial allocations among the states (see Section 5.4.3), none of the allocations explicitly discriminate in favor of or against residents of a particular state.

5.4.5 Stability and Minimizing Disruption – Fairness and Equity Considerations

5.4.5.1 Policy Guidance

Section 303(a)(c)(5)(A) of the MSA requires that the Council "establish procedures to ensure fair and equitable initial allocations" and then it lists a number of specific factors related to fairness and equity that should be included in the Council's considerations (see page 135 for the list of factors cited in the section). There are other fairness and equity considerations to be taken into account, including those related to "arbitrary and capricious" actions. In this section, stability and disruption are considered as a fairness and equity issue directly related to concerns about arbitrary and capricious actions. In the following section, other issues related to stability and disruption are addressed.

The introduction to the goals and objectives of the groundfish FMP states:

> The Council is committed to developing long-range plans for managing the Washington, Oregon, and California groundfish fisheries that will promote a ***stable*** planning environment for the seafood industry, including marine recreation interests, and will maintain the health of the resource and environment. (emphasis added Council, 2011, p. XX).

The LAPP guidelines (NOAA, 2007) draw connections between requirements to take into account investment and dependence in a fairness and equity context and minimizing disruption, specifically with respect to allocations among current participants (see page 137). Objective 14 to the groundfish FMP also addresses disruption: "When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment." The issue of recognizing seniority of use also engages fairness and equity sensibilities. The concept of deference to "seniority of use" in allocation decisions (discussed in the Policy Guidance section of Section 5.4.3.2) is also one that tends to reduce disruption (depending on the context in which it is applied) and provide stability.

The concepts of stability and disruption are also closely related to the terms "arbitrary and capricious." The definitions of "arbitrary" which may apply in the current contexts are "based on or determined by individual preference or convenience rather than by necessity or the intrinsic nature of something" and "existing or coming about seemingly at random or by chance as a capricious and unreasonable act of will." The relevant definitions of "caprice" may be **"**a sudden, impulsive, and seemingly unmotivated notion or action" and "a sudden usually unpredictable condition, change, or series of changes" Decision that are not based on necessity, and are random, sudden, seemingly impulsive, and unpredictable are likely to be destabilizing and disruptive.

5.4.5.2 Relation of Rationalization Program Provisions to Policy

Issues related to stability and disruption as reflected in considerations of current and historic participation have been addressed in previous sections. This section focuses on other fairness and equity-related aspects of destabilizing or disruptive results of alternatives under consideration, as well as other fairness and equity issues.

In this regard, one of the primary of issues of concern to participants and fishery managers are the control dates that are announced when consideration of a new limited entry program is announced. Legally, these control date announcements are intended to reduce the chances of a takings argument, i.e., that those who do not receive an initial allocation and who can only enter by acquiring permits from others will argue that they had an established right of access which was denied them without compensation. A concern from a management perspective is that the act of considering a limited access system can exacerbate management problems in the fishery during the period while the system is under consideration. These problems can arise either from new entry (where limited entry programs do not already exist or do not prevent shifts between sectors within a program, e.g., a shift from nonwhiting harvest to whiting harvest within the groundfish program), or from the expansion of effort by participants already in the program. Given that control dates have been used in the past and are likely to be used in the future, there are a number of fairness and equity concerns around their use. Particularly, if a control date is announced but not relied on (i.e., fishing activities after the control date augment allocations):

- those who increased their investments and activities despite the caution provided by the control date are rewarded to the disadvantage of those who refrained from increasing investments or activities,
- participants in other segments of the fishery or in other fisheries will be penalized because, in the absence of a credible control date, their fisheries may be destabilized if the Council considers managing those fisheries with a limited access system.

The degree of destabilization of <u>not</u> using a control date depends on whether participants in other fisheries believe that the actions taken in one situation indicate a precedent for the future.[17] If a

[17] This effect could be cross-regional to the degree that fishermen in other regions believe the action taken here sets a precedent that will be followed elsewhere.

fishery is destabilized as a result of the consideration of a limited access system, the act of consideration by itself increases the likelihood that the system will be implemented. Such a result would likely seem unfair to those who oppose the new system. Additionally, this dynamic may result in new systems that might not otherwise have been necessary, or in premature implementation of such systems.

For processors, the effect of control dates is different than for harvesters. A processor interested in increasing its allocation during Council consideration of a limited access program might offer higher prices than it might otherwise in order to garner a greater share of deliveries. On the one hand, the direct effect would be beneficial to harvesters. On the other hand, such activities could have adverse effects. First, offering higher prices might have a predatory pricing effect, weakening other processors and inhibiting entry of new processors. Second, higher prices might encourage more activity on the part of harvesters despite the control date, undercutting the effectiveness of the control date with respect to fishery participation.

When the Council implements a new limited access system it generally relies on control dates. The history of use of such control dates is shown in Table 5-6. Note that the Council has also at times announced a control date but then decided not to move forward with programs based on the control date.

Table 5-6. Qualifying dates and control dates for rationalization programs announced in the Federal Register.

Program	Related Program Provision and date	Announced Control Date
Amendment 6, Groundfish License Limitation Program (**Implemented 1994**)	End of qualifying period – **August 1, 1988** (allocations to current owner of vessel based on vessel history)	**August 1, 1988**
Amendment 6, Vessel Construction Cutoff (**Implemented 1994**)	For newly constructed vessels, fishing must commence by **September 30, 1990** in order to qualify for a license. (allocations to current owner of newly constructed vessel)	**September 30, 1990**
Amendment 9, Fixed Gear Sablefish Endorsements (**Implemented 1997**)	End of allocation period – **December 31, 1994** (allocations to current owner of permit based on permit/vessel history)	**June 29, 1995** (there was no substantial fixed gear sablefish fishery between December 31, 1994 and June 29, 1995 therefore the earlier date was used for the end of the allocation period)
Fixed gear sablefish tier assignments. (**Implemented 1998**)	End of allocation period – **December 31, 1994** (allocations to current owner of permit based on permit/vessel history)	**June 29, 1995**
Limitation on new entry into the whiting fishery. (Amendment 15)	End of qualifying period December 31, 2006 (designation based on vessel history)	**a/**

a/ Amendment 15 was originally formulated under the authority provided by the American Fisheries Act but later implemented solely under the Council's MSA authority. Initially, AFA-related control dates were announced: September 16, 1999 (for vessels) and June 29, 2000 (for permits). The Council tabled action on Amendment 15 in 2001 and did not resume action until the fall of 2006—a four year hiatus during which the November 6, 2003 trawl rationalization control date was announced and work on the trawl rationalization program began. At its June 2007 meeting, the Council rejected taking action under the AFA and relied instead on its authority under the MSA. "By rejecting action under the AFA, the Council also rejected participation dates relative to the AFA control dates previously specified by the Council (64 FR 66158 and 65 FR 55214) or the passage of the AFA (1999)" (PFMC 2007, p. 20). The Council took final action on Amendment 15 in September 2007 and the program was implemented beginning in 2009. During Council presentations, public testimony and in description of its actions, the Council made clear that Amendment 15 would be superceded by Amendment 20 with its 2003 control date (e.g., Vessels that qualify for whiting fishery participation under Amendment 15 were not guaranteed future participation or inclusion in the Pacific whiting fishery under Amendment 20 http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-15/).

The Council has also announced control dates but then after deliberation decided not to recommend implementation of the following programs:

- Limiting Entry to the Open Access Groundfish Fishery – November 5, 1999 and September 13, 2006
- Highly Migratory Species – March 9, 2000
- Spiny Dogfish – April 8, 2005

While there are fairness and equity reasons for relying on a control date (as well as other reasons, see following section), there are also reasons for not relying on a control date. In the current program, the Council explicitly did not rely on the control date with respect to the allocation period for processors. Information was also used from post-control date activities for the allocation of overfished species to permits participating in nonwhiting trips. The reasons for using the post-control date activities for allocation of overfished species are discussed on page 134. The Council discussion of the use of a post-control date qualifying year for allocation to processors included the points that the year 2004 was used because it was part of an industry group compromise to recognize more recent capital investment while staying as close as possible to the control date.[18] Section 5.4.3.1 discusses consideration of current participation and harvest and includes a summary of changes in the fishery occurring after 2003 (This information is fully presented in Chapters 3 and 4).

5.4.5.3 Analysis of Effects of the Alternatives

The No Action alternative, by using 2004 as the end of the allocation period for processors, does not incorporate the control date in the final allocation criteria. This creates fairness and equity issues for those who, based on the control date, chose not to enter or invest in the fishery and thus may degrade the effectiveness of any future control dates, thereby creating fairness issues *vis a vis* other sectors of the groundfish fishery or other fisheries. Additionally, it raises a concern of fairness with respect to those who entered the fishery after 2004 and questions the rationale for extending to 2004 but not beyond.

Alternative 2 uses allocation periods that end with the control date for all sectors. Such an alternative imposes a heavy weight on the importance of the control date with respect to discouraging speculative increases in participation. However, Alternative 2 still leaves in place the use of the 2004-2006 permit catch distributions for the purpose of determining the spatial distribution of effort for allocation of overfished species quota share. While the use of this post-2003 harvest information does not reward increased participation, it does alter initial allocations depending on on how an entity's harvesting effort was distributed geographically, thereby potentially rewarding participants who increased their targeting activity in areas of higher contact with overfished species (again, regardless of the actual level of that harvest).

Alternatives 3, 4 and 5 place progressively more importance on factors other than the control date in determining the allocations that participants receive. Specifically, increasing credit is given for more recent years of participation. The effect is to decrease fairness and equity with respect to factors discussed in this section, but there might also be an increased perception of fairness in equity with respect to factors discussed in other sections.

5.5 Stability and Minimizing Disruption – Other Considerations

5.5.1 Policy Guidance

With respect to the effect of a control on limiting capacity, groundfish FMP objective 2 states that the desired outcome is a fishery that is diverse, *stable*, and profitable (emphasis added Council, 2012, p. XX). As mentioned previously, Objective 14 to the groundfish FMP addresses stability from the standpoint of minimizing disruption: "When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment." The goal of Amendment 20 includes "create individual economic stability."

[18] Concern was also expressed that there had been some very poor years at the end of the allocation period which limited the opportunity to establish history. However, it should be noted that the relative share approach to allocation measures each entity's performance relative to all others active in that year, reducing the significance of between-year variation in participation levels.

While an objective in itself, stability (minimizing disruption) contributes to other FMP objectives related to total economic benefits and community and sector health, as well as equity (discussed in the previous section).

5.5.2 Relation of Rationalization Program Provisions to Policy

With respect to stability and minimizing disruptions, the effects pertaining to the current action discussed here relate to adopting an allocation period that does not include the control date. Other issues related to stability and minimizing disruption, such as changes imposed on the fishery in 2011 relative to conditions just prior to program implementation and changes from the 2011 allocation (No Action) to a different allocation (Alternatives 2-5) are addressed in the section on current participation and harvest (Section 5.4.3.1).

As identified in the previous section, not using a control date may create more potential for future disruptions in this and other fisheries if the development of limited access systems are taken up for those communities. These disruptions are not only important with respect to the fairness and equity considerations discussed previously but may have other adverse effects as well, depending on the management system in place. In general, conservation objectives will be met regardless of the amount of fishing effort, but an influx or increase of effort may require increased attention on the part of fishery managers, thereby detracting from the resources available to consider the new limited access system proposal or to attend to other needs of the management system. Additionally, constantly changing and increasingly restrictive management measures could have adverse affects on the industry and communities. For a program where effort is controlled primarily through two-month cumulative limits (such as the open access groundfish fishery), heightened fleet effort would be economically disruptive, with the increased effort reducing cumulative limits and reducing profitability of current participants. For a program controlled with season closures, safety concerns might arise with shorter seasons and increased crowding on the fishing grounds. Product quality could suffer as well. Instability and disruptive impacts in the harvest sector would affect overall sector health and reverberate to processors and communities.

5.5.3 Analysis of Effects of Alternatives

As discussed in the previous section, only Alternative 1 incorporates the control date into all of the qualifying periods. No Action incorporates the control date for harvesters but not for processors, for which the end of the allocation period would be 2004. Alternatives 3, 4, and 5 do not incorporate the control date in the allocations periods and are differentiated based on other factors having to do with the recency of the years included. These effects are described above in Section 5.4.3. The effects of not incorporating the control date into the allocation period are discussed in Section 5.5.2.

5.6 Sector Health

5.6.1 Policy Guidance

The following objectives from the groundfish FMP have been categorized as relating to sector health.

> Provide for a viable, profitable . . . groundfish fishery (Amendment 20, Objective 2)
>
> Promote measurable economic . . . benefits through the seafood catching, processing, distribution elements, and support sectors of the industry (Amendment 20, Objective 6)
>
> Maximize the value of the groundfish resource as a whole (Groundfish FMP Goal 2)
>
> Promote year-round marketing opportunities and extend those opportunities as long as practicable during the fishing year (Groundfish FMP Objective 7)
>
> Avoid unnecessary adverse impacts on small entities (Groundfish FMP Objective 15)
>
> Include measures to assist… entry-level and small vessel owner-operators, … through set-asides of allocations… or economic assistance in the purchase of quota. (MSA - 303A(c)(5)(C))

In general, long-term overall health of the sectors is not expected to be substantially affected by a redistribution of QS and CHA within the ranges considered here.

5.7 Labor

The following MSA sections and objectives from the groundfish FMP have been categorized as relating to labor interests.

> Include measures to assist… captains, crew… through set-asides of allocations… or economic assistance in the purchase of quota. (MSA - 303A(c)(5)(C))
>
> Amendment 20. Promote measurable… employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry (Amendment 20, Objective 6)
>
> Promote the safety of human life at sea (MSA - National Standard 10, Groundfish FMP Objective 17)

The Trawl rationalization program is expected to result in fewer but more stable job opportunities and a possible shift in the nature of compensation to crew members (traditionally compensation is based on crew shares). Additionally, a number of new jobs have been generated for observers. Safety in the shoreside non-whiting fishery was not expected to be substantially affected (because that segement of the fishery was managed under two month cumulative trip limits), but a safety benefit for the whiting components of the fishery was expected (since those fisheries were managed as a "derby" or a race to catch fish). Some safety benefits were also expected to the degree that the fishery is more profitable and more money is put into vessel maintenance. The ultimate geographic distribution of jobs was uncertain given the tradability of quota and uncertainty about which ports and vessels the quota would flow to over time.

The initial allocations might impact the geographic distribution of processing employment opportunities over the short term and could have some impact on the income available from employment on vessels (increasing income on some while decreasing income on others). See sections on vessels, processors, and communities for a description of the expected distributional effects. The total number of jobs and total levels of payments to labor are not expected to be affected by the reallocation of quota. The reallocation of quota among permits and among processors is not expected to impact safety.

5.8 Communities

5.8.1 Policy Guidance

The following MSA sections and objectives from the groundfish FMP have been categorized as relating to community interests.

> Consider importance of fishing to communities in order to provide sustained participation and to minimize adverse impacts (MSA - National Standard 8, Groundfish FMP FMP Objective 16, Amendment 20 Objective 5)
>
> 303A(c)(5)
> (B) Consider basic cultural and social framework of the fishery through
> (i) the development of policies to promote sustained participation of… fishing communities that depend on the fisheries, including regional or port-specific landing and delivery requirement;
> (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery
> (C) Include measures to assist, when necessary and appropriate… fishing communities through set-asides of harvesting allocations… or economic assistance in the purchase of quota (MSA)
>
> Minimize negative impacts resulting from localized concentrations of fishing effort (this constraint is also listed under "Conservation") Groundfish FMP, Amendment 20 Constraint 3

5.8.2 Relation of Rationalization Program Provisions to Policy

The trawl rationalization program is expected to affect communities through a variety of mechanisms. On the one hand, it is expected to make the fishing and processing activities associated with communities more stable and safe. On the other hand, the commoditization of fishing opportunities into tradable harvesting privileges was expected to result in increased flexibility, and there has been much uncertainty about where the quota would eventually be landed. A number of provisions were intended to encourage a broader geographic distribution (accumulation limits) and allow communities to participate to a greater degree in their own economic futures (e.g., communities are allowed to own quota). Additionally, 10% of the nonwhiting QS for the shoreside fishery was set aside for use in possible incentive programs (the Adaptive Management Program) to compensate for any unexpected undesirable consequences of the program; and 20% of the QS was allocated to whiting processors, in part because of the higher levels of overcapitalization in that sector due to the fact that the fishery was managed as a derby. Because 20% of whiting QS was allocated to processors, who tend to be more tied to specific communities than are harvesters, there was not a set aside of shoreside whiting QS for the adaptive management program.

5.8.3 Analysis of Effects of the Alternatives

Indicators of the shifts in geographic distribution of QS are provided in Section 4.3.3.

There are two significant considerations in determining the effects of the shifts in allocation on communities. First, “What actions would members of the communities take in the absence of receiving an initial allocation?” Would processors and harvesters in a particular community cease or reduce their activity, continue at a similar level but at lower profitability (i.e., lease quota every year), or acquire quota on the market to make up for shortfalls. In the latter case, the impact on the communities would be the reduction in profit and spending in the community amounting to at most the cost of the QS purchased. Chapter 4 provides estimates of impacts on harvesters and processors in terms of the exvessel and exprocessor equivalent value of QS allocated under the alternatives. QS typically trades from anywhere between 3.5 and 10 times exvessel value. Assuming a shoreside allocation of about 60,000 mt and an average exvessel price of just over $0.07 per pound, the exvessel value equivalent of a 0.1 percent share is about $10,000. Based on typical value ratios, this might translate to a QS value of $35,000 to $100,000 for 0.1 percent share, and $350,000 to $1,000,000 for a 1 percent share of the shoreside whiting allocation. Assuming that QS must be purchased from individuals in other communities (i.e., there is not just a wealth transfer within the community), then this range of values is an indicator of the one-time costs required to make up for a shortfall in an entity’s initial allocation (Also note that these values illustrate the costs that prospective new entrants who did not receive an initial allocation would face in order to acquire whiting quota).

The second closely related consideration is “What is the effect of QS trading on the geographic distribution of QS and landings?” While QS may be initially distributed in one geographic pattern it is very likely that market forces will affect its distribution over the long-term, relatively independent of the initial allocation. At the same time there is likely to be some “stickiness” in the initial allocations (i.e., a tendency for allocations to stay put until incentives to trade high are great enough to cause movement). This stickiness is due to factors such as sunk costs (costs that are not recoverable by an existing entity that a new entity will also have to incur), and transaction costs (costs and risks of seeking exchange partners and executing QS transactions).

5.9 Other Goals and Objectives

There are numerous other standards, goals, and objectives for fishery managment actions that are not implicated in the current action. For reference, a complete list of the MSA National Standards, sections of the MSA pertinent to initial allocations in LAPP programs, groundfish FMP goals and objectives, FMP allocation criteria, and Amendment 20 goals and objectives are provided in Chapter 6 (see Agenda Item H.7.a, Attachment 2 of the September 2012 briefing book).

CHAPTER 6 Appendix Amendment 20 EIS Discussion of Rationale for Allocation Periods

Allocation Periods

Rationale and Options Considered But Not Included

The Council's final preferred alternative specifies 1994 to 2003 as the period for allocating QS based on landings history for processors (1994 to 2004 for shoreside whiting processors). This allocation period for permits runs from the inception of the license limitation program (1994) through the year of the Council's control date (2003). The 10-year span for the IFQ allocation is similar in length to the fixed gear sablefish tier program that used 1984 to1994, an 11-year period. When adopting its final preferred alternative for shoreside whiting processors, based on a compromise arrived at during industry negotiations, the Council extended the allocation period to 2004.

The allocation period that would most likely minimize dislocation and the attendant costs would be the few years just prior to the initial allocation. That period is not used, in part, because of issues related to the need to establish credible control dates to effectively manage the fishery while deliberations on new LE programs are underway.

A number of different periods were considered for different parts of the trawl rationalization program and different sectors (Table A-63). At its November 2007 meeting, the Council narrowed the options and standardized the periods to end in 2003. However, as noted above, the Council extended the period used for the shoreside whiting processors to 2004. The periods are detailed in Table A-64. For many sectors, there is a qualifying period to determine eligibility and a period on which the amount of the allocation is based. The primary purpose of this section is to focus on the periods used for the trawl IFQ program, however, the section also covers the rationale for each year considered as a start date or end date for all of the periods considered for both IFQ and co-op management.

Table A-63 Rationale for periods considered for various qualifying and allocation period provisions during development of the IFQ and co-op alternatives.

Time Period	Sector and Provisions (permit qualification/recent participation and allocation)	Summary of Rationale
1994-1999	IFQ – QS allocation, all sectors.	Emphasizes status of fishery prior to constraints to protect overfished species.
1994-2003	IFQ - QS allocation, all sectors. Co-op – Shoreside and mothership CV permits and allocations.	From the beginning of L (1994) to the control date (2003).
1994-2004	IFQ – Shoreside processor QS allocations. Co-op – Shoreside CV permits and allocations. Mothership CV allocations.	From the beginning of LE (1994) to a year that includes more recent participation, as compared to a period ending in 2003. For shoreside processors 2004 was included as a compromise that developed during negotiations leading to an industry consensus.
1997-2003	IFQ – Mothership processor recent participation and QS allocation. Co-op – Shoreside and mothership CV permits and allocations. Mothership processor permits. Catcher-processor endorsements.	A block of years that starts with the period in which there was a 3-way split of the whiting allocation and ends with the control date.
1997-2004	Co-op – C/P endorsement.	A block of years that starts with the period in which there was a 3-way split of the whiting allocation and adds a year beyond the control date to include more recent participation.
1998-2003	IFQ – Recent participation, all sectors. Co-op – Shoreside CV permits and allocations. Mothership CV allocations.	A block of years that reflects the fishery before and the disaster declaration in 2000, and acknowledges the control date (2003).
1998-2004	IFQ – Mothership recent participation qualification. Shoreside processor recent participation and allocation. Co-op – Shoreside and mothership CV permits and allocations. And Mothership processor permits. Shoreside processor permits.	A block of years that reflects the fishery before and after the disaster declaration in 2000, and adds a year beyond the control date (to include more recent participation). For shoreside processors 2004 was included as a compromise that developed during negotiations leading to an industry consensus.
1999-2004	IFQ – Recent participation, all sectors.	A block of years that includes one year just before the disaster declaration and an end date that includes more recent participation (increases emphasis on post disaster conditions relative to periods with earlier start dates)
2000-2003	IFQ – Recent participation, all sectors. QS allocation, all sectors.	A block of years starting with the year of the groundfish disaster declaration and covering four years (a period length similar to LEP allocation period).
2001-2003	IFQ – Allocation period, all sectors. Co-op – Shoreside CV permit.	A block of years that most closely reflects the current conditions for the fishery and at the same time acknowledges the control date (2003).

CV = Catcher Vessel.

Table A-64. Periods used in various qualifying and allocation provisions that remain as options in the trawl rationalization program alternatives.

	Qualifying for Participation		Allocation	
Sector	IFQ Recent Participation	Co-op Alt Endorsement/ Permit	IFQ Allocation	Co-op Landing history
Catcher Vessel Permit Owners				
o Nonwhiting Shoreside Catcher Vessels	None	N/A	’94-’03 (drop 3 worst years)	N/A
o Whiting Shoreside Catcher Vessels	None	’97-’03 (>500 mt)	’94-’03 (drop 2 worst years)	97-’03 (drop worst year)
o Whiting Mothership Catcher Vessels	None	Options: 1) 94-’03 (>500 mt) (FPA) 2) 97-’03 (>500 mt)	’94-’03 (drop 2 worst years)	Options: 1) 97-’03 (drop worst year) 2) 94-’03 (FPA) (drop 2 worst years)
Catcher-Processor Permit Owners	None	97-’03 (at least 1 delivery)	’94-’03 (drop no years)	N/A
Mothership	’97-’03 (>1,000 mt in 2 yrs)	97-’03 (more than 1,000 mt in each of 2 years)	97-’03 (drop no years)	N/A
Shoreside Processing Companies	Qualifying Period Options: 1) ’98-’03 2) ’98-’04 (FPA) Options for shoreside nonwhiting: 1) 1 delivery option, and 2) 6 mt in each of 3 years, Options for shoreside whiting 1) 1 delivery of any size 2) 1 mt of whiting in any 2 of years (FPA).	98-’03 (more than 1,000 mt in each of 2 years)	Allocation Period Options: 1) ’94-’03 2) ’98-’04 (FPA) (drop 2 worst years)	N/A

N/A = Not applicable
FPA = Council final preferred alternative.

1994. The earliest year for the allocation period options was set at 1994 because this was the first year of the license limitation program, which substantially changed participation in the fishery and altered delivery patterns. If the program is to allocate based on permit history, there would be no permit history before 1994 unless it is determined that permit history includes vessel history prior to that time. However, given the complexities of the qualification requirements for the original license limitation program, history prior to 1994 may be difficult to track and treat in an equitable fashion.[19] An initial year of 1994 implies a long allocation period. An allocation period from 1994 to 2003, 10 years, would not be unprecedented. The fixed-gear sablefish tier program used 1984 to 1994 as the allocation period, an 11-year period. An initial allocation covering this long period may give more weight to those who have long-term investment and participation in the fishery (and their successors in interest) as compared to those who may have made their investment in more recent years.

1997. The first year in which there was a fixed allocation among the three whiting sectors was 1997. The co-op portion of the rationalization program initially used 1997 to 2004 as the

[19] For example, LE permits were issued to vessels that replaced qualifying vessels prior to the start of the license limitation program. Additionally, for vessels under construction or conversion LE permits were granted on a par with vessels that qualified based on 1984 to 1988 landings history. The use of vessel landings history prior to 1994 may be viewed as inequitable for those that qualified for permits in 1994 based on having a vessel construction or conversion, as compared to those that qualified for permits based on 1984 to 1988 landings history, the former having had no opportunity to establish landings history prior to the completion of work on their vessels.

qualifying allocation period for catcher-processors, but using a start date of 1999. For the nonwhiting vessels, the choice of 1997 as the start of an allocation period would decrease the emphasis on conditions prior to the declaration of a groundfish disaster in 2000, as compared to an allocation period that started in 1994. A start date of 1997 and an end date of 2003 would include three years prior to declaration of disaster conditions in the groundfish fishery and four years after that declaration.

1998. This year is used to start an allocation period that would run from 1998 to 2003 or 2004. In considering 1998 as the start for an allocation period, the Council would have to determine whether six or seven years is a period of sufficient length to allow vessels to demonstrate their level of activity and landings mix without needing to include special hardship provisions. Excluding 1994 to 1997 puts more emphasis on more recent participation patterns. A six-year period starting in 1998 would include landings history two years prior to the 2000 disaster declaration and four years from 2000 and after. Using 1998 as a start date for the allocation period covers a greater variety of fishing strategy opportunities than a period that starts in 1999, but not as much as one going back to 1997 or earlier.

1999. While a disaster was not declared until 2000, the first reductions in response to the discovery that some groundfish species were overfished began in 1999. An allocation period starting in 1999 would include the period after the disaster declaration as well as the one-year prelude to those more severe restrictions.

2000. In response to the discovery that a number of groundfish species were overfished, a disaster was declared for the 2000 fishery, and a number of severely constraining management measures were imposed. Using 2000 as the start of an allocation period would base the allocation entirely on fishermen’s opportunities and choices under conditions present after the disaster declaration. Regulations prior to 2000 allowed extensive use of large footropes on trawl gear. In 2000, restrictions on the use of large footropes were used to shift trawl effort away from reef and rocky bottom substrates. Additionally, large closures on the shelf (rockfish conservation area closures) were imposed at that time. This substantially changed fishing opportunities and the mix of species landed. The year 2000 was used to start a four-year allocation period option that was considered (2000-2003). Four years is the period used to qualify vessels for the license limitation program. The use of the shorter qualifying period puts more emphasis on more recent conditions in the fishery but also increases the need to take into account short-term hardships.

2003. In order to prevent speculative effort and the consequent exacerbated management problems, a control date of November 6, 2003 was announced. This announcement put fishery participants on notice that fishing after 2003 would not be counted toward qualifying for IFQ. Since there was little fishing opportunity in the last two months of 2003, all of 2003 is being included in the allocation period.

2004. Using 2004 instead of 2003 as the final year for the qualification period would allow entities with more recent participation and less longevity in the fishery to have one additional qualifying year. It would include in the allocation period one year of fishing after the buyback program implementation, a year in which all remaining vessels had greater fishing opportunity.

It would also violate the Council's 2003 control date and may adversely affect the Council's future ability to credibly use control dates to prevent vessels from racing for participation status.

GUIDANCE FOR MAKING ALLOCATION DECISIONS
RELATED TO CATCH SHARES

This document contains guidance on allocation issues that the Council should take into account in its reconsideration of the quota share allocations for the shorebased whiting fishery and the catch history allocations to catcher vessel permits the mothership whiting fishery. The guidance is drawn from the Magnuson Stevens Act (MSA), related NOAA/NMFS guidance, and the groundfish FMP.

Contents

MSA

MSA § 303(b)(6) 16 U.S.C. § 1853(b)(6)

[Any FMP may] establish a limited access system for the fishery in order to achieve optimum yield if, in developing such a system, the Council and the Secretary take into account—
(A) present participation in the fishery;
(B) historical fishing practices in, and dependence on, the fishery;
(C) the economics of the fishery;
(D) the capability of fishing vessels used in the fishery to engage in other fisheries;
(E) the cultural and social framework relevant to the fishery and any affected fishing communities;
(F) the fair and equitable distribution of access privileges in the fishery; and
(G) any other relevant considerations

The phrase “take into account” means only that the council and NMFS must consider the factors listed in section 303(b)(6) and must balance the factors against each other and against any other relevant considerations. *Sea Watch Int’l v. Mosbacher*, 762 F. Supp. 370, 379 (D.D.C. 1991).

MSA § 303A—LIMITED ACCESS PRIVILEGE PROGRAMS - 16 U.S.C. §1853a

(c)(5) ALLOCATION.—In developing a limited access privilege program to harvest fish a Council or the Secretary shall**—**

(A) **establish procedures to ensure fair and equitable initial allocations, including consideration of—**

(i) current and historical harvests;

(ii) employment in the harvesting and processing sectors;

(iii) investments in, and dependence upon, the fishery; and

(iv) the current and historical participation of fishing communities;

(B) consider the basic cultural and social framework of the fishery, especially through…

(C) include measures to assist, when necessary and appropriate, entry-level…

(D) ensure that limited access privilege holders do not acquire and excessive share…

(E) authorize limited access privileges to harvest fish to be held, acquired, used by, or issued under the system to persons who substantially participate in the fishery, including in specific sector of such fishery, as specified by the Council.

MSA National Standards

An allocation must be consistent with:

National Standard 2: Conservation and management measures shall be based on the best scientific information available.

National Standard 4: Conservation and management measures shall not discriminate between residents of different States. **If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocations shall be (A) fair and equitable to all such fishermen**; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

National Standard 8: Conservation and management measures shall, consistent with the conservation requirements of this Act…take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of paragraph (2), in order to (AP provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

Agency Guidance

National Standard Guidelines

600.325 National Standard 4 – Allocations

****

(c)(2) ***Analysis of allocations.*** Each FMP should contain a description and analysis of the allocations existing in the fishery and of those made in the FMP. The effects of eliminating an existing allocation system should be examined. Allocations schemes considered but rejected by the Council, should be included in the discussion. The analysis should relate the recommended allocations to the FMP's objectives and OY specification, and discuss the factors listed in (c)(3) of this section.

(c)(3) ***Factors in making allocations.*** An allocation of fishing privileges must be fair and equitable, must be reasonably calculated to promote conservation, and must avoid excessive shares. These tests are explained in paragraphs (c)(3)(i) though (c)(3)(iii) of this section.

(i) ***Fairness and equity***.

(A) An allocation of fishing privileges should be rationally connected to the achievement of OY or with the furtherance of legitimate FMP objectives. Inherent in an allocation is the advantaging of one group to the detriment of another. The motive for making a particular allocation should be justified in terms of the objectives of the FMP; otherwise, the disadvantaged user groups would suffer without cause. For example, an FMP objective to preserve the economic status quo cannot be achieved by excluding a group of longtime participants in the fishery. On the other hand, there is a rational connection between an objective of harvesting shrimp at their maximum size and closing a nursery area to trawling.

(B) An allocation may impose a hardship on one group if it is outweighed by the total benefit received by another group or groups. An allocation need not preserve the status quo in the fishery to qualify as "**fair and equitable,**" if a restructuring of fishing privileges would maximize overall benefits. The Council should make an initial estimate of the relative benefits and hardships imposed by the allocation, and compare its consequences with those of alternative allocation schemes, including the status quo. Where relevant, judicial guidance and government policy concerning the rights of treaty Indians and aboriginal Americans must be considered in determining whether an allocation is fair and equitable.

(ii) ***Promotion of conservation.*** Numerous methods of allocating fishing privileges are considered "conservation and management" measures under 303 of the Magnuson-Stevens Act. An allocation scheme may promote conservation by encouraging a rational, more easily managed use of the resource. Or, it may promote conservation (in the sense of wise use) by optimizing the yield in terms of size, value, market mix, price, or economic or social benefit of the product. To the extent that rebuilding plans or other conservation and management measures that reduce the overall harvest in a fishery are necessary, any harvest restrictions or recovery benefits must be allocated fairly and equitably among the commercial, recreational, and charter fishing sectors of the fishery.

(iii) ***Avoidance of excessive shares*****.** An allocation scheme must be designed to deter any person or other entity from acquiring an excessive share of fishing privileges, and to avoid creating conditions fostering inordinate control, by buyers or sellers, that would not otherwise exist.

(iv) ***Other factors.*** In designing an allocation scheme, a Council should consider other factors relevant to the FMP's objectives. Examples are economic and social consequences of the scheme, food production, consumer interest, dependence of the fishery by present participants and coastal communities, efficiency of various types of gear used in the fishery, transferability of effort to and impact on other fisheries, opportunity for new participants to enter the fishery, and enhancement of opportunities for recreational fishing.

§ 600.345 National Standard 4—Communities.

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(b)(2) This standard does not constitute a basis for allocating resources to a specific fishing community nor for providing preferential treatment based on residence in a fishing community.

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(c)(3)To address the sustained participation of fishing communities that will be affected by management measures, the analysis should first identify affected fishing communities and then assess their differing levels of dependence on and engagement in the fishery being regulated. The analysis should also specify how that assessment was made. The best available data on the history, extent, and type of participation of these fishing communities in the fishery should be incorporated into the social and economic information presented in the FMP. The analysis does not have to contain an exhaustive listing of all communities that might fit the definition; a judgment can be made as to which are primarily affected. The analysis should discuss each alternative's likely effect on the sustained participation of these fishing communities in the fishery.

(4) The analysis should assess the likely positive and negative social and economic impacts of the alternative management measures, over both the short and the long term, on fishing communities. Any particular management measure may economically benefit some communities while adversely affecting others. Economic impacts should be considered both for individual communties and for the group of all affected communities identified in the FMP….

(5) A discussion of social and economic impacts should identify those alternatives that would minimize the adverse impacts on those fishing communities within the constraints of conservation and management goals of the FMP, other national standards, and other applicable law.

NOAA Guidance on LAPP Programs

Selected portions relevant to the "reconsideration of the qualifying time periods for the initial allocations of whiting" from *The Design And Use Of Limited Access Privilege Programs*, NOAA Technigcal Memoradum NMFS-F/SPO-86, November 2007

In summary, the allocations must be fair and equitable and they should consider the cultural and social framework of the fishery. However, given the use of term "including consideration of" there is some allowable flexibility beyond the four required considerations in determining exactly how the harvest privileges will be distributed. The discussion here will not attempt to list all of the things that cannot be done other than to say any distribution that showed blatant favoritism or utter disregard to the "fair and equitable" standard in the law would likely not be approved nor would it withstand legal challenge. Similarly there will be no attempt to make a list of all the permissible procedures or formulae that could be used. Rather the discussion will focus on procedures and lessons learned. The goal will be to assist the Councils as they use their ingenuity and inventiveness to develop allocation procedures that support their objectives, taking into account the recent changes in the Act.

The initial allocation task can be broken down into two parts.[7] Note however that the material under (B) has more to do with restrictions on the use of the harvesting privilege than it does with initial allocation, but the two are related. First, it is necessary to select the pool of entities that will be eligible to receive harvest privileges. The basics of this step have already been discussed in the section on "Eligibility." It is possible however, that the pool of potential recipients can be a subset of those who are qualified to own privileges. The Council may approve of certain types of entities being able to acquire privileges in the open market, but may feel that they do not merit an initial allocation. Congress has placed RFAs in this category.

The second step is to determine how the privileges will be distributed among those in the designated pool. Under the reauthorized MSA, there are two ways that this can be accomplished. As has been done in the past, the privileges can be given away according to specified allocation formulae. It is also possible to use auctions to sell the initial privileges as long as the auctions are constrained such that they meet the "fair and equitable" standards specified in the Act. If auctions are to be used, they would be most appropriate in traditional IFQ programs, but Councils may also wish to use them in more general LAP programs as well. The two possible ways of allocating the privileges will be discussed in turn. The revised MSA also allows rent collection with formula-based allocations, and this will be treated in a separate section.

B. Free Formula-Based Allocations

There are literally an infinite number of allocation formulae that are acceptable under the MSA. It is possible, however, to list some of the attributes upon which the formulae can be based. In the IFQ programs that have already been adopted under the MSA, the attributes were related to various aspects of participation in the fishery, primarily catch, capital investment, and number of years fished over a reference period.

In response to suggestions to expand the pool of eligible recipients that lead to some of the most recent revisions in the Act, characteristics of entities have become other attributes to consider. Examples are size, ownership characteristic (owner-operated), and operating location of the firm, various measures of dependence on the fishery including percent of revenue or opportunities to participate in other fisheries, and inter-relations with other fishery related business especially with respect to employment.

The participation attributes, though not without controversy, are relatively easy to handle both conceptually and with respect to data availability. For example, in the surf clam and ocean quahog program, the allocation formula was based on a weighted average of a relative catch index and a relative investment index. Working with characteristic attributes will likely be a different story. Coming up with appropriate measures of the specific characteristics that can be calculated given existing or readily available data, and then using several of them to come up with an actual allocation formula will be more difficult. Nonetheless it is a task that will have to be accomplished by those Councils who choose to broaden the potential range of eligible entities.

The following discussion starts of with a consideration of the relatively easy participation attributes in the context of traditional IFQ fisheries. Using that as a base, the discussion will turn to a preliminary assessment of the consideration of both types of attributes in the context of more general LAP programs.

Traditional IFQ Programs.

If the eligible group is restricted to vessel owners, the allocation formula could be based on equal shares (for all individuals satisfying some minimum requirements), vessel size, catch history, the number of consecutive years of participation in the fishery, or some combination of two or more of these factors. One problem with equal shares is that part-timers will have their relative shares increased, and highliners (those who have historically accounted for a disproportionate share of the landings) will be brought down to the level of the average fisherman. If the eligible group also includes crew members, it might be difficult to use catch histories for logistic reasons (turnover rates of crew are high and there may be no records of who was on which boat when catches were taken). Allocations to crew members could be based on either equal shares or the number of years of participation in the fishery or both.

If both vessel owners and crew members are considered to be eligible to receive an initial allocation, it would probably be necessary to include several of the above categories in the allocation formula. For example, 30 percent of the total quota could be divided equally among all eligible parties, 30 percent could be divided on the basis of the number of years of full-time participation in the fishery, and 40 percent could be split among vessel owners on the basis of vessel size. Strategies of this nature (with the percentages split out differently) should be explored with the industry as alternatives to strategies that rely on catch histories especially where catch documentation is weak or missing. An alternative that avoids the necessity of deriving an allocation formula is to use a lottery system.

Identified options for allocations:

1. Allocate shares equally among eligible recipients.
2. Allocate shares on the basis of vessel size.
3. Allocate shares on the basis of catch histories.
4. Allocate shares on the basis of historical participation.
5. Use a lottery to allocate shares.
6. Allocate shares using combinations of two or more of the above.

General LAP Programs.

There is little new in the above discussion for those individuals who have watched the current IFQ programs being developed. It is all second nature. However, to consider how to approach more complicated cases where LAPs are given to both traditional recipients and to FCs and may be available for purchase by RFAs, it will be useful to go back and recreate the mental process through which the above potential options were developed.

Given the laws and accepted views on who were potential recipients, historically the main concern was to set up an allocation that would change the fishery from the *status quo* to an IFQ fishery with a minimum disruption of the current distribution between the recipients. When that was the goal, the question became what sorts of things could be used to quantitatively compare allocations among the potential recipients? Looking at participation characteristics was a good way to do this. Catch histories are a way to compare the relative success of various participants. Comparing the financial investments shows, albeit imperfectly, relative commitments to a fishery, and at the same time, relative differences in amounts that will have to be earned to support the capital equipment. It is interesting to note that the two measures will provide different rankings. A smaller older boat operated by a high-liner could have a very good catch record but could be way low on the financial investment ladder. Which measure is best? That is a judgment call. At the same time, others may not like either of these measures and would argue for years of participation. Finally, others would suggest that the notion of maintaining the existing distribution is not appropriate and would argue for an equal distribution. The allocation formulae actually used in U.S IFQ programs were usually based on more than one of these measures (see the initial allocation entries in the LAP Program Spotlights in Appendix 1).

Consider now the problem of coming up with an allocation formula or procedure for a more general LAP program. It would certainly be permissible to use the same type of measures that have been used in IFQ programs. However, such measures may miss some of the elements or issues that are being addressed by allowing FCs to receive harvesting privileges. It may be possible to correct for this by only using a subset of the measures or to use different weights to make weighted averages.

If Councils want to do more, it may be useful to go through the same type of exercise as described above. For example, what are the motivations for choosing to use a RFA-type organization in a particular case? Assume that it is the ability to look at the full range of fishery related businesses including processing, supply companies, and downstream marketers. In that case it will be necessary to find some measures that capture the specific issues that are being addressed, and can be quantitatively measured. Some possibilities include total employment, employees per unit of fish, percentage of net revenue that remains in the area, etc. The final step would be to turn these measures into an allocation formula. This is but one example of many options, and simply demonstrates a process that the Councils can use to expand the standard ways of calculating allocation formula if they choose to do so.

It would also be possible to use different types of formulae within the general LAP program. The Council may split the TAC into two parts and allocate one part as IFQs according to more or less traditional methods and allocate the second part to other entities with other methods.

Even with this vast array of choices, it is probably impossible to devise a system that will be perceived as equally fair by all eligible entities. To improve the perceived fairness it would be essential for the Council to repeatedly consult with the members of the selected pool and the broader suite of stakeholders.

FMP Goals, Objectives, and Guidance on Allocations

The guidelines for National Standard 4 state with respect to analysis of allocation

> **"The analysis should relate the recommended allocations to the FMP's objectives and OY specification ...." 600.325(c)(2)**

To that end, the Council FMP goals and objectives and the goals and objectives for Amendment 20 are provided here.

Section 2.1 Goals and Objectives for Managing the Pacific Coast Groundfish Fishery

The Council is committed to developing long-range plans for managing the Washington, Oregon, and California groundfish fisheries that will promote a stable planning environment for the seafood industry, including marine recreation interests, and will maintain the health of the resource and environment. In developing allocation and harvesting systems, the Council will give consideration to maximizing economic benefits to the United States, consistent with resource stewardship responsibilities for the continuing welfare of the living marine resources. Thus, management must be flexible enough to meet changing social and economic needs of the fishery as well as to address fluctuations in the marine resources supporting the fishery. The following goals have been established in order of priority for managing the west coast groundfish fisheries, to be considered in conjunction with the national standards of the Magnuson-Stevens Act.

Management Goals

Goal 1 - Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.

Goal 2 - Economics. Maximize the value of the groundfish resource as a whole.

Goal 3 - Utilization. Within the constraints of overfished species rebuilding requirements, achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Objectives. To accomplish these management goals, a number of objectives will be considered and followed as closely as practicable:

Conservation

Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.

Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group. Achieve a level of harvest capacity in the fishery that is appropriate for a sustainable harvest and low discard rates, and which results in a fishery that is diverse, stable, and profitable. This reduced capacity should lead to more effective management for many other fishery problems.

Objective 3. For species or species groups that are overfished, develop a plan to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem.

Objective 4. Where conservation problems have been identified for non-groundfish species and the best scientific information shows that the groundfish fishery has a direct impact on the ability of that species to maintain its long-term reproductive health, the Council may consider establishing management measures to control the impacts of groundfish fishing on those species. Management measures may be imposed on the groundfish fishery to reduce fishing mortality of a non-groundfish species for documented conservation reasons. The action will be designed to minimize disruption of the groundfish fishery, in so far as consistent with the goal to minimize the bycatch of non-groundfish species, and will not preclude achievement of a quota, harvest guideline, or allocation of groundfish, if any, unless such action is required by other applicable law.

Objective 5. Describe and identify EFH, adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.

Economics

Objective 6. Within the constraints of the conservation goals and objectives of the FMP, attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.

Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable. Encourage development of practicable gear restrictions intended to reduce regulatory and/or economic discards through gear research regulated by EFP.

Utilization

Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing), in accordance with conservation goals, of the Pacific Coast groundfish resources by domestic fisheries.

Objective 10. Recognize the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.

Objective 11. Develop management programs that reduce regulations-induced discard and/or which reduce economic incentives to discard fish. Develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Promote and support monitoring programs to improve estimates of total fishing-related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.

Social Factors.

Objective 12. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

Objective 13. Minimize gear conflicts among resource users.

Objective 14. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment.

Objective 15. Avoid unnecessary adverse impacts on small entities.

Objective 16. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.

Objective 17. Promote the safety of human life at sea.

[Amended; 7, 11, 13, 16-1, 18, 16-4]

FMP Allocational Guidelines

Section 6.2.3 Non-biological Issues—The Socioeconomic Framework

From time to time, non-biological issues may arise that require the Council to recommend management actions to address certain social or economic issues in the fishery. Resource allocation, seasons, or landing limits based on market quality and timing, safety measures, and prevention of gear conflicts make up only a few examples of possible management issues with a social or economic basis. In general, there may be any number of situations where the Council determines that management measures are necessary to achieve the stated social and/or economic objectives of the FMP.

Either on its own initiative or by request, the Council may evaluate current information and issues to determine if social or economic factors warrant imposition of management measures to achieve the Council's established management objectives. Actions that are permitted under this framework include all of the categories of actions authorized under the points of concern framework with the addition of direct resource allocation.

If the Council concludes that a management action is necessary to address a social or economic issue, it will prepare a report containing the rationale in support of its conclusion. The report will include the proposed management measure, a description of other viable alternatives considered, and an analysis that addresses the following criteria: (a) how the action is expected to promote achievement of the goals and objectives of the FMP; (b) likely impacts on other management measures, other fisheries, and bycatch; (c) biological impacts; (d) economic impacts, particularly the cost to the fishing industry; (e) impacts on fishing communities; and (f) how the action is expected to accomplish at least one of the following, or any other measurable benefit to the fishery:

1. Enable a quota, HG, or allocation to be achieved.
2. Avoid exceeding a quota, HG, or allocation.
3. Extend domestic fishing and marketing opportunities as long as practicable during the fishing year, for those sectors for which the Council has established this policy.
4. Maintain stability in the fishery by continuing management measures for species that previously were managed under the points of concern mechanism.
5. Maintain or improve product volume and flow to the consumer.
6. Increase economic yield.
7. Improve product quality.
8. Reduce anticipated bycatch and bycatch mortality.
9. Reduce gear conflicts, or conflicts between competing user groups.
10. Develop fisheries for underutilized species with minimal impacts on existing domestic fisheries.
11. Increase sustainable landings.
12. Reduce fishing capacity.
13. Maintain data collection and means for verification.
14. Maintain or improve the recreational fishery.

The Council, following review of the report, supporting data, public comment, and other relevant information, may recommend management measures to the NMFS Regional Administrator accompanied by relevant background data, information, and public comment. The recommendation will explain the urgency in implementing the measure(s), if any, and reasons therefore.

The NMFS Regional Administrator will review the Council's recommendation, supporting rationale, public comments, and other relevant information, and, if it is approved, will undertake the appropriate method of implementation. Rejection of the recommendation will be explained in writing.

The procedures specified in this chapter do not affect the authority of the Secretary to take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Act if an emergency exists involving any groundfish resource, or to take such other regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act.

If conditions warrant, the Council may designate a management measure developed and recommended to address social and economic issues as a routine management measure, provided that the criteria and procedures in Section 6.2.1 are followed.

Quotas, including allocations, implemented through this framework will be set for one-year periods and may be modified inseason only to reflect technical corrections to an

ABC. (In contrast, quotas may be imposed at any time of year for resource conservation reasons under the points of concern mechanism.)

Section 6.3.1 Allocation Framework

Allocation is the apportionment of an item for a specific purpose or to a particular person or group of persons. Allocation of fishery resources may result from any type of management measure, but is most commonly a numerical quota or HG for a specific gear or fishery sector. Most fishery management measures allocate fishery resources to some degree, because they invariably affect access to the resource by different fishery sectors by different amounts. These allocative impacts, if not the intentional purpose of the management measure, are considered to be indirect or unintentional allocations. Direct allocation occurs when numerical quotas, HGs, or other management measures are established with the specific intent of affecting a particular group's access to the fishery resource.

Fishery resources may be allocated to accomplish a single biological, social or economic objective, or a combination of such objectives. The entire resource, or a portion, may be allocated to a particular group, although the Magnuson-Stevens Act requires that allocation among user groups be fair and equitable, reasonably calculated to promote conservation, and determined in such a way that no group, person, or entity receives an undue excessive share of the resource. The socioeconomic framework described in Section 0 provides criteria for direct allocation. Allocative impacts of all proposed management measures should be analyzed and discussed in the Council's decision-making process.

In addition to the requirements described in Section 0, the Council will consider the following factors when intending to recommend direct allocation of the resource.

1. Present participation in and dependence on the fishery, including alternative fisheries.
2. Historical fishing practices in and historical dependence on the fishery.
3. The economics of the fishery.
4. Any consensus harvest sharing agreement or negotiated settlement between the affected participants in the fishery.
5. Potential biological yield of any species or species complex affected by the allocation.
6. Consistency with the Magnuson-Stevens Act national standards.
7. Consistency with the goals and objectives of the FMP.

The modification of a direct allocation cannot be designated as routine unless the specific criteria for the modification have been established in the regulations.

Amendment 20 Goals and Objectives

Section 1.2.3 Purpose of the Proposed Action

In 2003, the Council established a Trawl Individual Quota Committee (TIQC), which was charged with assisting the Council in identifying the elements of a trawl individual quota program and scoping alternatives and potential impacts of those alternatives in support of the requirements of the MSA and NEPA. At its first meeting in October 2003, the TIQC drafted a set of goals and objectives, which another Council-established committee, the Independent Experts Panel (IEP), subsequently recommended modifying. The Council adopted this list in June 2005, but at their March 2007 meeting, the Council adopted a further revision of the goals and objectives. The participation of the TIQC, the IEP, and other entities in the scoping process is described below in Section 1.6. To pursue the goal thus developed and shown below, the Council considered alternatives that would rationalize the west coast trawl fishery and provide incentives to reduce bycatch, either through an IFQ program for all groundfish LE trawl sectors and/or through cooperatives for the fishery sectors targeting Pacific whiting. Under either alternative, allocations would be made to eligible fishery participants as a privilege to harvest a portion of fish, and not as a property right. Though structurally different, the Council's intention is that both the IFQ and co-op alternatives fulfill the goal of the program.

The following goal objectives outline the purpose of the proposed action:

<u>Goal</u>

> *Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch.*

<u>Objectives</u>

The above goal is supported by the following objectives:

1. Provide a mechanism for total catch accounting.
2. Provide for a viable, profitable, and efficient groundfish fishery.
3. Promote practices that reduce bycatch and discard mortality and minimize ecological impacts.
4. Increase operational flexibility.
5. Minimize adverse effects from an IFQ program on fishing communities and other fisheries to the extent practical.
6. Promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry.
7. Provide quality product for the consumer.
8. Increase safety in the fishery.

Constraints and Guiding Principles

The above goals and objectives should be achieved while the following occurs:

1. Take into account the biological structure of the stocks including, but not limited to, populations and genetics.
2. Take into account the need to ensure that the total OYs and allowable biological catch (ABC) are not exceeded.
3. Minimize negative impactsresulting from localized concentrations of fishing effort.
4. Account for total groundfish mortality.
5. Avoid provisions where the primary intent is a change in marketing power balance between harvesting and processing sectors.
6. Avoid excessive quota concentration.
7. Provide efficient and effective monitoring and enforcement.
8. Design a responsive mechanism for program review, evaluation, and modification.
9. Take into account the management and administrative costs of implementing and oversee the IFQ or co-op program and complementary catch monitoring programs, as well as the limited state and Federal resources available.

SUPPLEMENTAL ANALYSIS

This attachment provides:

- data on permit transfers occurring after the 2003 control date,
- information on active harvest capacity,
- status of permits with no fishing activity after 2003, and
- replacements for figures and a table that did not print properly in the draft Environmental Assessment (EA).

Errata -

- Please note, Table 4-38 on page 126 of the draft EA should have been deleted from the document (it was replaced by Table 4-37).
- In the endnote to Table 4-38, the reference to 13 permits should be a reference to 14 permits.

Permit Transfers

Changes in the ownership of limited entry trawl permits with whiting history (mothership or shoreside) were reviewed for the years 2004-2010. Changes in ownership do not include changes associated with company restructuring (adding or subtracting a partner or co-owner) or family changes (divorce, death, or adding or subtracting a family member).

- Eighteen permits changed hands after 2003 (changed at least once sometime between the start of 2004 and the end of 2010).
- Seven permits changed hands after 2007 (changed at least once sometime between the start of 2008 and the end of 2010).
- Three permits changed hands after 2008 (changed at least once sometime between the start of 2009 and the end of 2010).

Active Harvest Capacity

The following information was produced in response to a Council request for an evaluation of effort levels and capacity utilization. Information on harvest trends is provided in the EA in Figure 3-3 on page 37, and information on season duration is provided in Table 3-1 on page 45. Active harvest capacity can be measured as fleet and vessel maximum harvests per week during a year, as well as numbers of vessel participating. Fleet maximums will be driven by both the vessel harvest rates and the number of vessels participating. In the shoreside fishery, vessel participation was variable, declining to a low in 2004, increasing substantially in 2006 and 2007 before dropping off a bit in subsequent years and substantially in 2011. In the mothership fishery, participation increased rather steadily after 2002, reaching a peak in 2009, then declining in 2010 and 2011. In the shoreside fishery, the maximum vessel harvest was relatively stable (Figure 1) relative to the variation in the mothership sector (Figure 2). In the shoreside fishery, maximum fleet harvests per week increased substantially in 2006 and 2007, generally declining thereafter, particularly in 2011. A limit on participation in the whiting fishery was imposed by emergency action in 2007 and was later made permanent through Amendment 15. Maximum fleet harvest rates per week in the mothership fishery varied within a range of about 10,000 to 12,000 mt per week before dropping substantially in 2011.

Status of Permits with No Fishing Activity After 2003

At the June Council meeting, interest was expressed in those permits receiving an allocation of whiting quota shares (QS) or catch history allocations (CHA) but which had no post-2003 whiting catch history in their respective sectors. Entities may depend on a particular fishery in a number of ways. In addition to direct participation, entities may depend on a fishery to recover investments or provide a backup fishery during downturns in other fisheries. Additionally, some entities may have invested in multiple permits prior to the start of the program in order to accumulate a greater initial quota allocation. These participants may have needed only one permit to operate their vessel until the start of the rationalization program, therefore allowing their other permits to remain dormant.

Of the 21 permits in the shoreside whiting fishery that were inactive after 2003, six remained active in other West Coast or Alaskan fisheries (including some that were active in the mothership fishery) while 15 had no activity in any West Coast or Alaskan fisheries (see Table 3-3 of the EA). Of the 14 permits[1] in the mothership whiting fishery that were inactive after 2003, 12 remained active in other West Coast or Alaskan fisheries (including some that were active in the shoreside fishery) while two had no activity in any West Coast or Alaskan fisheries (Table 3-5 of the EA). The two permits with some mothership sector history but none after 2003 were also among the 15 permits that had some shoreside history but no West Coast or Alaska activity after 2003.

The 15 permits with no post-2003 activity in any West Coast or Alaska fisheries were allocated 4.3 percent of the shoreside QS and 1.5 percent of the mothership sector CHA (Table 2). Six of these permits were owned by entities that owned other permits which remained active. These six permits accounted for 3.0 percent of the shoreside QS and 0.5 percent of the CHA. Thus, 1.3 percent of the shoreside QS and 1.0 percent of the CHA was associated with entities that apparently had no fishing activity after 2003, based on history associated with the trawl groundfish permits owned by these entities (these entities may have owned other fishing vessels or non-trawl limited entry permits).

Other Observations

- Two permits were not associated with vessels for most of the 2003-2010 period. Based on post-2006 status of permits and vessel registrations, 1.0 percent of shoreside QS and 1.5 percent of the mothership sector CHA (i.e., all of the CHA earned by dormant permits) was associated with the permits not registered with vessels.
- Permits associated with communities from Coos Bay south (where the whiting fishery has been minimal in recent years) accounted for 2.3 percent of the shoreside whiting QS.

[1] Table 3-5 of the EA shows 39 permits in the mothership fishery, 14 of which were inactive after 2003, while Table 4-23 of the EA shows 37 permits in the mothership fishery 13 of which were inactive after 2003. The difference between these two tables is that Table 3-5 includes 2 permits which have mothership history but not enough history to qualify for an allocation under any alternative while Table 4-23 excludes these permits.

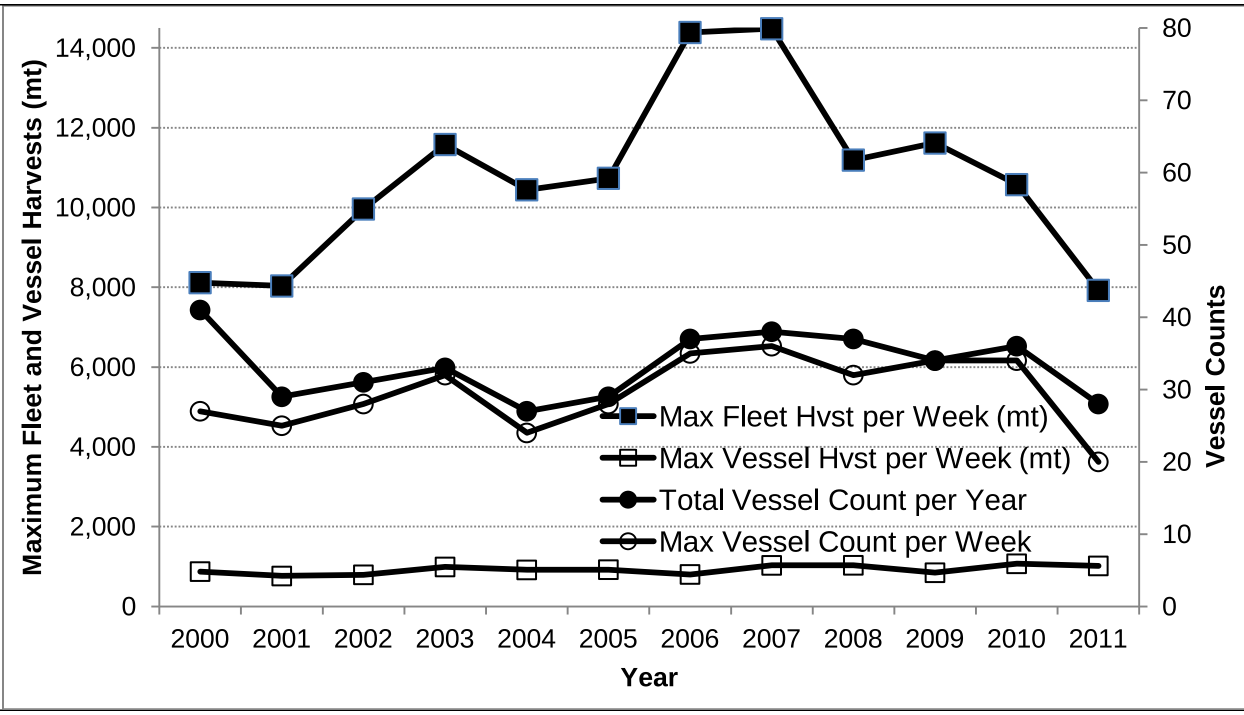


Figure 1. Maximum weekly fleet and vessel harvests and maximum fleet vessel counts and annual vessel counts in the shoreside whiting sector: 2000-2011.

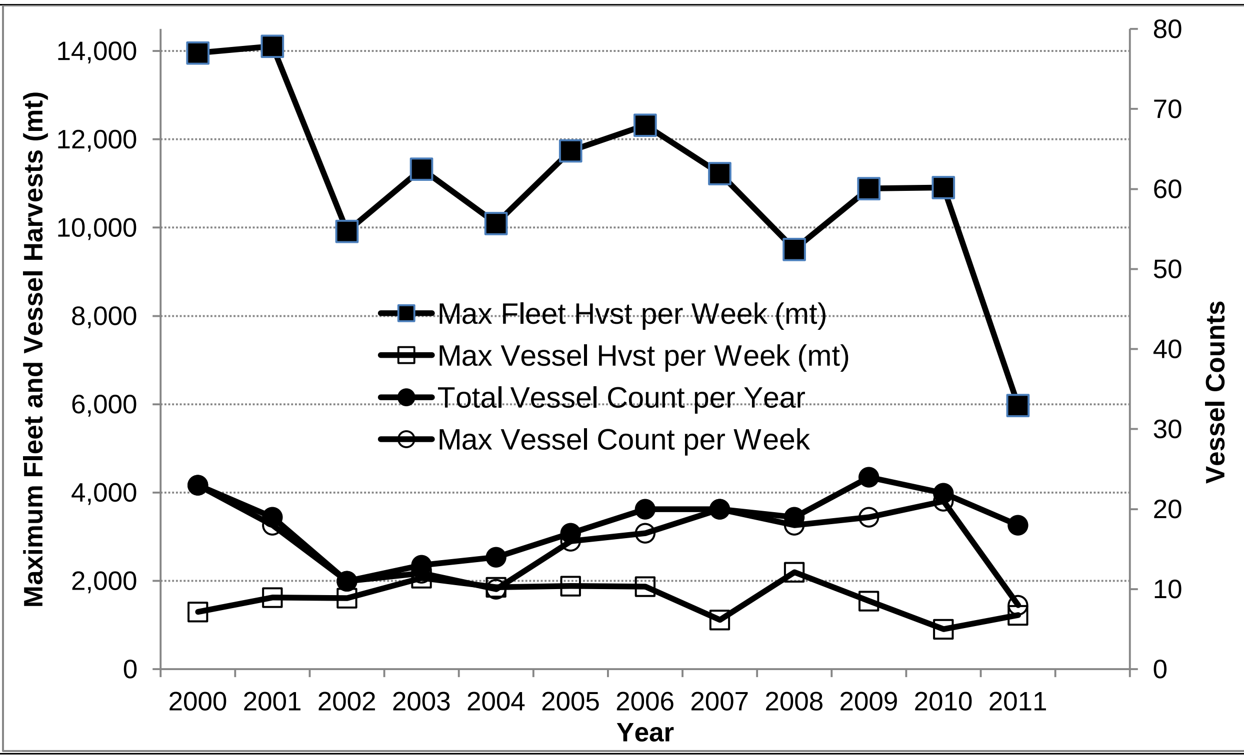


Figure 2. Maximum weekly fleet and vessel harvests and maximum fleet vessel counts and annual vessel counts in the mothership whiting sector: 2000-2011.

Table 2. Allocatio ns to permits with no post-2003 activity showing geographic area (shading indicates change in geographic location of permit owner), vessel affiliation (U=not affiliated with a vessel) and whether permit is owned by an entity owning other permits.

		Allocations			Years			
Dummy Identifier [a/]	Permit Owner Also Owns Other Permits	CHA Allocation	Status Quo Allocation	Cumulative Percent (North-South)	2002-2003	2004-2006	2007-2008	2009-2010
P01			0.0%	0.0%	OR - North	OR - North	OR - North	WA - Coast
P02	Yes	0.5%	1.4%	1.4%	OR - North/U	WA - Pug Snd	WA - Pug Snd/U	WA - Pug Snd/U
P03			0.5%	1.9%	OR - North	OR - North	OR - North	OR - North
P04			0.0%	1.9%	OR - North	OR - North	OR - North	OR - North
P05			0.0%	2.0%	OR - North	OR - North	OR - North	OR - North
P06			0.1%	2.1%	OR - North	OR - North	OR - North	OR - North
P07	Yes		0.4%	2.5%	OR - South	OR - South	OR - South	OR - South
P08	Yes		1.0%	3.4%	OR - South/U	OR - South	OR - South	OR - South
P09	Yes		0.1%	3.5%	OR - South	OR - South	OR - South	OR - South
P10	Yes		0.1%	3.6%	CA - North	CA - North	CA - North	WA - Pug Snd
P11			0.0%	3.6%	CA - North	CA - North	CA - North	CA - North
P12			0.0%	3.7%	CA - North	CA - North	CA - North	CA - North
P13	Yes		0.1%	3.7%	CA - Cntrl	CA - Cntrl	CA - Cntrl	CA - Cntrl
P14			0.0%	3.8%	CA - Cntrl	CA - Cntrl	CA - Cntrl	CA - Cntrl
P15		1.0%	0.5%	4.3%	CA - Cntrl	CA - Cntrl/U	CA - Cntrl/U	CA - Cntrl/U
Total		1.5%	4.3%					
QS to Permits Not Registered to Vessels					1.5%	0.5%	1.0%	1.0%
QS to Owners of Multiple Permits				3.0%				
QS to Permits With Multiple Owners or Permits Not Registered to Vessels					3.0%	3.5%	3.5%	3.5%

a/ Dummy identifiers in this table do not correspond to dummy identifiers in other tables.

Replacement Pages

The following are provided as replacements for pages that did not print properly in the EA in the briefing book EA (Agenda Item H.7.a, Attachment 1).

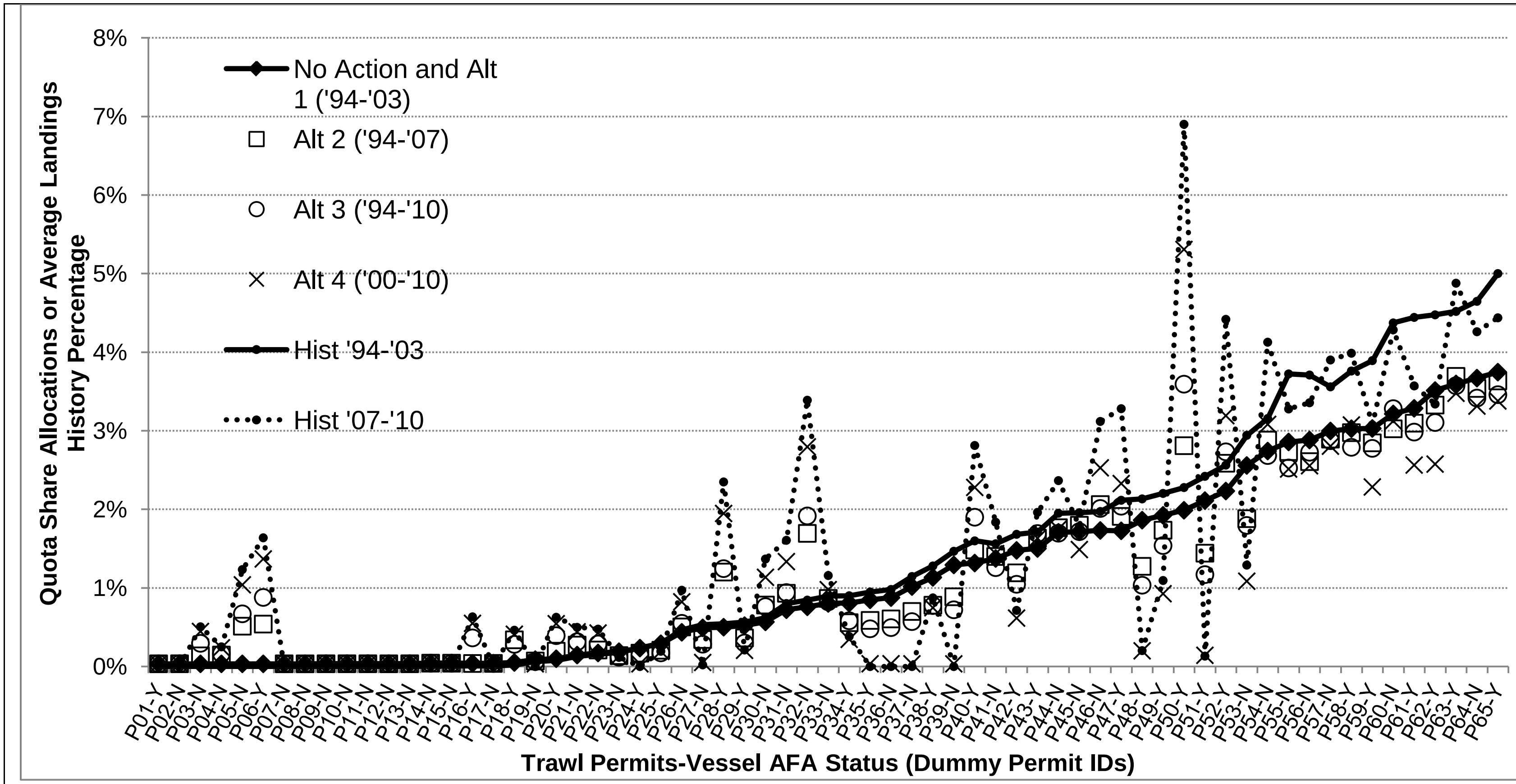


Figure 4-6. Shoreside whiting QS allocations to permits, by alternative, compared to each permit's share of shoreside whiting landings in recent and historic periods (permits ordered from lowest initial allocation to highest initial allocation under status quo (No Action) – permit numbers followed by an "N" were not associated with AFA vessel at any time from 1994 through 2011, those with a "Y" were. [a/]

a/ Excludes 102 permits that received only equal allocations of 0.04 percent each, for which the allocation does not change among the alternatives.

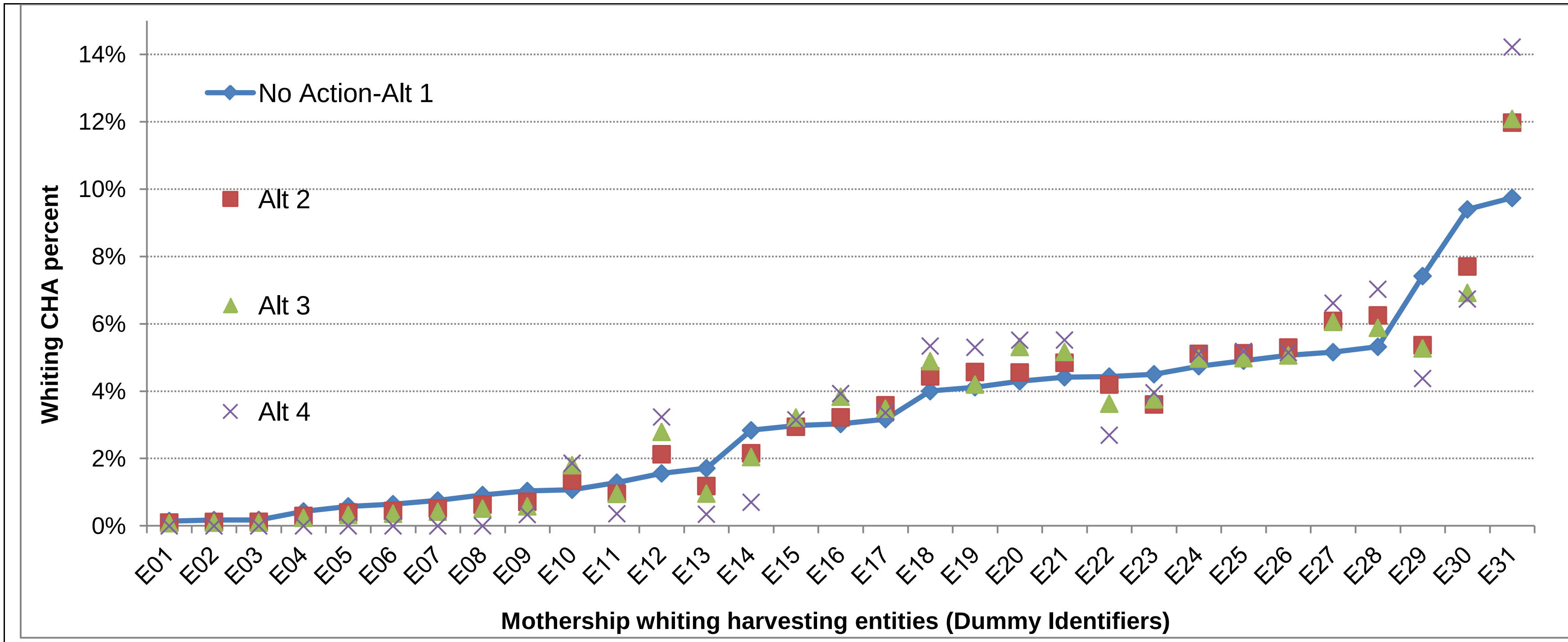


Figure 4-9. Concentration of **mothership** whiting CHA allocations among entities owning permits, by alternative (results ordered from lowest to highest for the No Action Alternative.

Table 4-36. Port dependence on whiting, involvement (port historic share of the whiting deliveries), and estimated geographic distribution of the shoreside whiting QS allocated to processors based on processor delivery patterns in 2007-2010 and 2011 2011 (for processors with more than one landing port for whiting).

							Processor Shares Allocations Associated with Each Port									
							Status Quo		Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dependence			Involvement			Years used to distribute whiting QS among ports (for processors with whiting landings in multiple ports)									
	Avg 94-03	Avg 04-06	Avg 07-10	Avg 94-03	Avg 04-06	Avg 07-10	'07-'10	'11	'07-'10	'11	'07-'10	'11	'07-'10	'11	'07-'10	'11
Westport	3.2%	15.7%	13.3%	12.2%	34.3%	39.6%	3.6%	3.7%	3.4%	3.4%	4.3%	4.3%	4.6%	4.7%	4.9%	5.0%
Ilwaco	2.0%	5.1%	3.3%	3.5%	5.7%	4.7%	0.5%	0.6%	0.5%	0.5%	0.9%	0.9%	0.9%	0.9%	1.0%	1.0%
Astoria	8.8%	7.6%	8.0%	33.5%	17.5%	22.4%	5.5%	6.1%	5.8%	6.4%	4.6%	5.3%	4.8%	5.5%	4.8%	5.5%
Newport	12.8%	13.4%	9.4%	43.6%	33.3%	26.2%	8.5%	8.7%	8.4%	8.6%	8.7%	8.9%	8.2%	8.3%	7.8%	7.9%
Coos Bay	0.6%	2.3%	1.6%	1.5%	3.9%	2.9%	0.5%	0.4%	0.5%	0.4%	0.6%	0.4%	0.6%	0.4%	0.6%	0.4%
Crescent City	2.3%	0.9%	3.4%	4.0%	1.3%	3.1%	0.7%	0.5%	0.8%	0.6%	0.4%	0.1%	0.4%	0.1%	0.5%	0.2%
Eureka	1.1%	4.1%	1.5%	1.7%	4.1%	1.2%	0.5%	0.0%	0.5%	0.1%	0.5%	0.0%	0.5%	0.0%	0.5%	0.0%

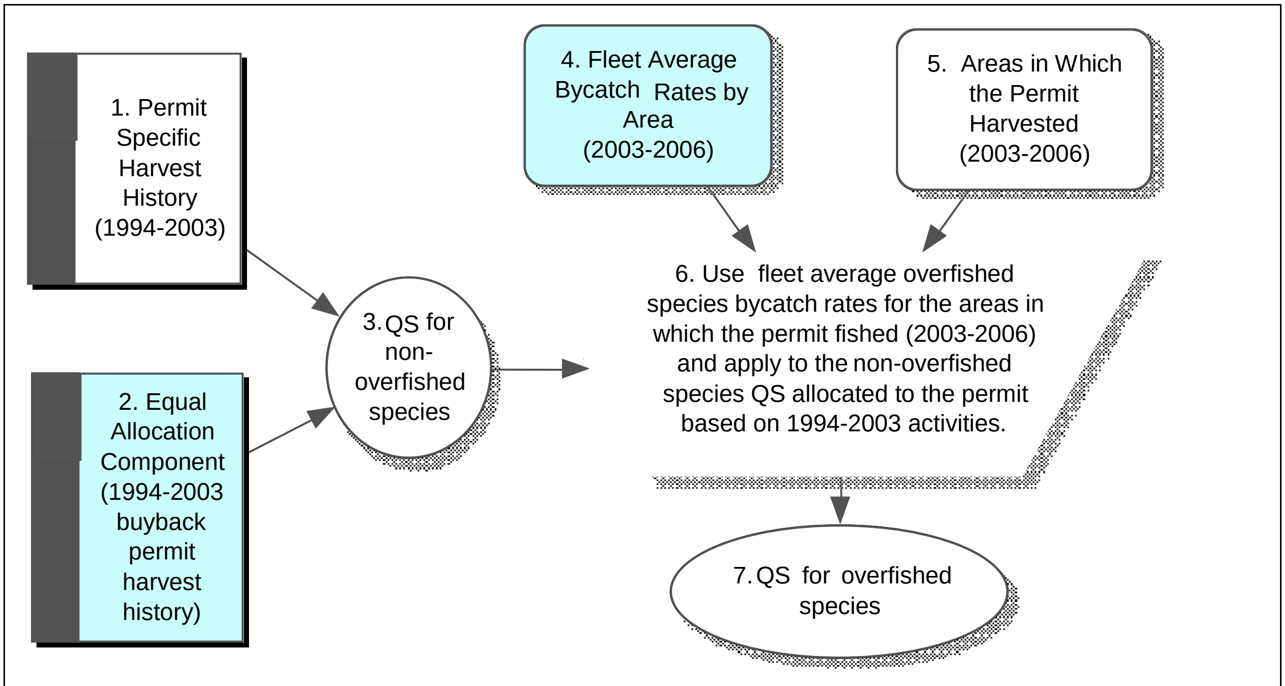


Figure 5-1. Flow chart of steps used to determine the allocation of overfished species (shaded boxes indicate the use of fleetwide data, unshaded boxes indicate permit-specific data and calculations.

Some examples of the importance of the distinction between the way 1994-2003 information was used and the way 2004-2006 information was used (as part of the 2003-2006 data set used for overfished species distributions) are as follows.

- If two permits had identical 1994-2003 history, but after 2003 (2004-2006) one landed 1,000,000 pounds and the other only 1,000 pounds, the two permits could receive identical allocations of overfished species as long as the latitudinal and depth distribution of their 2003-2006 harvests were the same.
- If two permits had 2003-2006 history that was identically distributed geographically, but one permit had 10 times the 1994-2003 history of the other permit, then (with respect to the QS allocated based on permit history) one permit would generally receive 10 times the allocation of overfished species than the other permit.
- Regardless of how much a permit harvested from 2004 through 2006, if it had no 1994-2003 history it would receive no allocation of overfished species except for the equal allocation component of the allocation formula for canary rockfish.

Thus, using 2004-2006 history in this manner did not reward higher levels of 2004-2006 harvest with increased allocations.

The Amendment 20 EIS also discusses the fact that the buyback program implemented in 2003 would have substantial effects on patterns of harvest in the fishery which would not be picked up in allocation formulas that did not take into account harvest levels after 2003.

One of the major factors that will result in differences between the pattern of initial QS allocation and the patterns of fishery harvest in more recent years will be the effects of the buyback program. The buyback program occurred just after the 2003 control date. It

H.7.a, Whiting Catch Share Reallocation

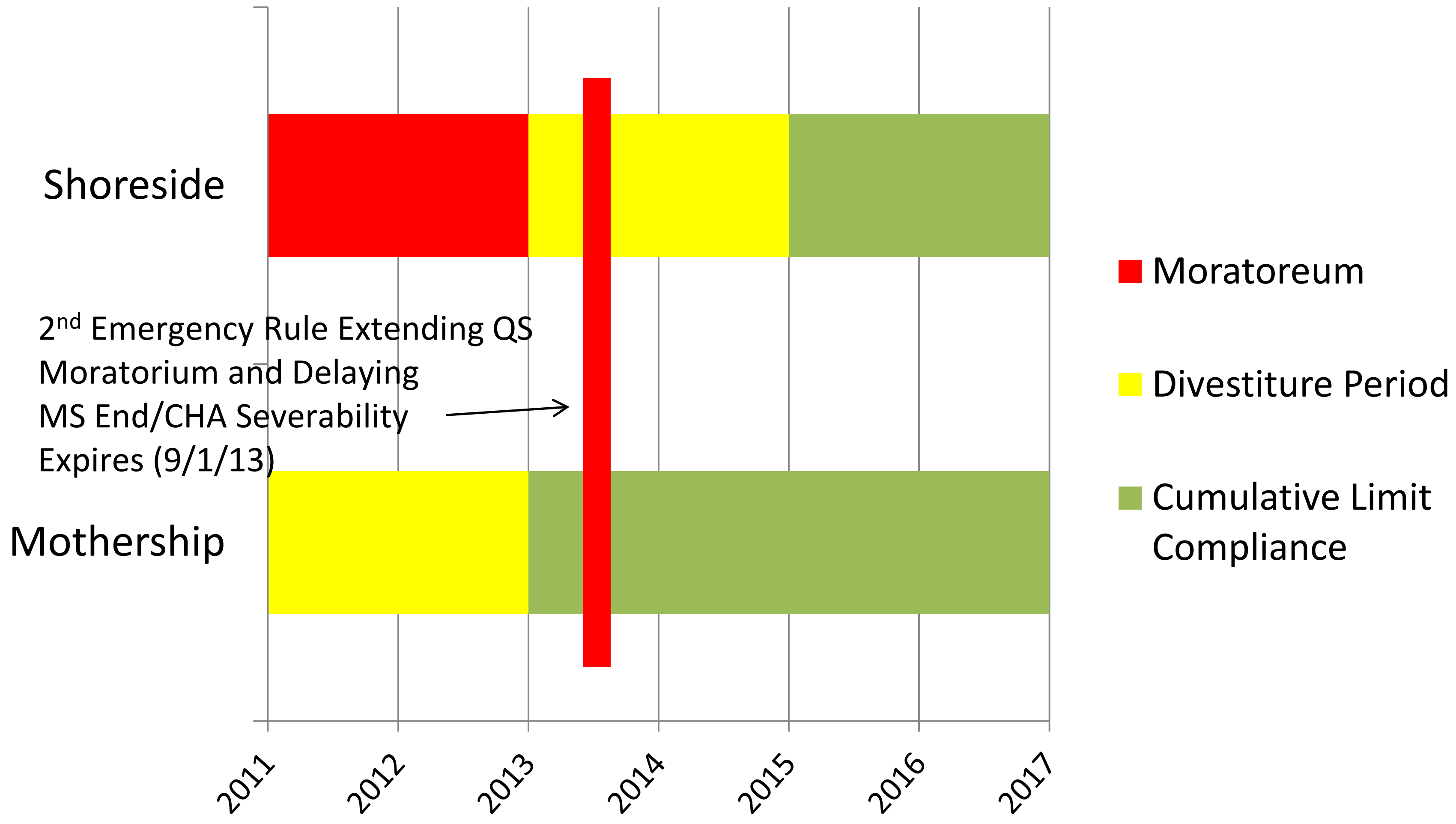
Decisions

New Analysis

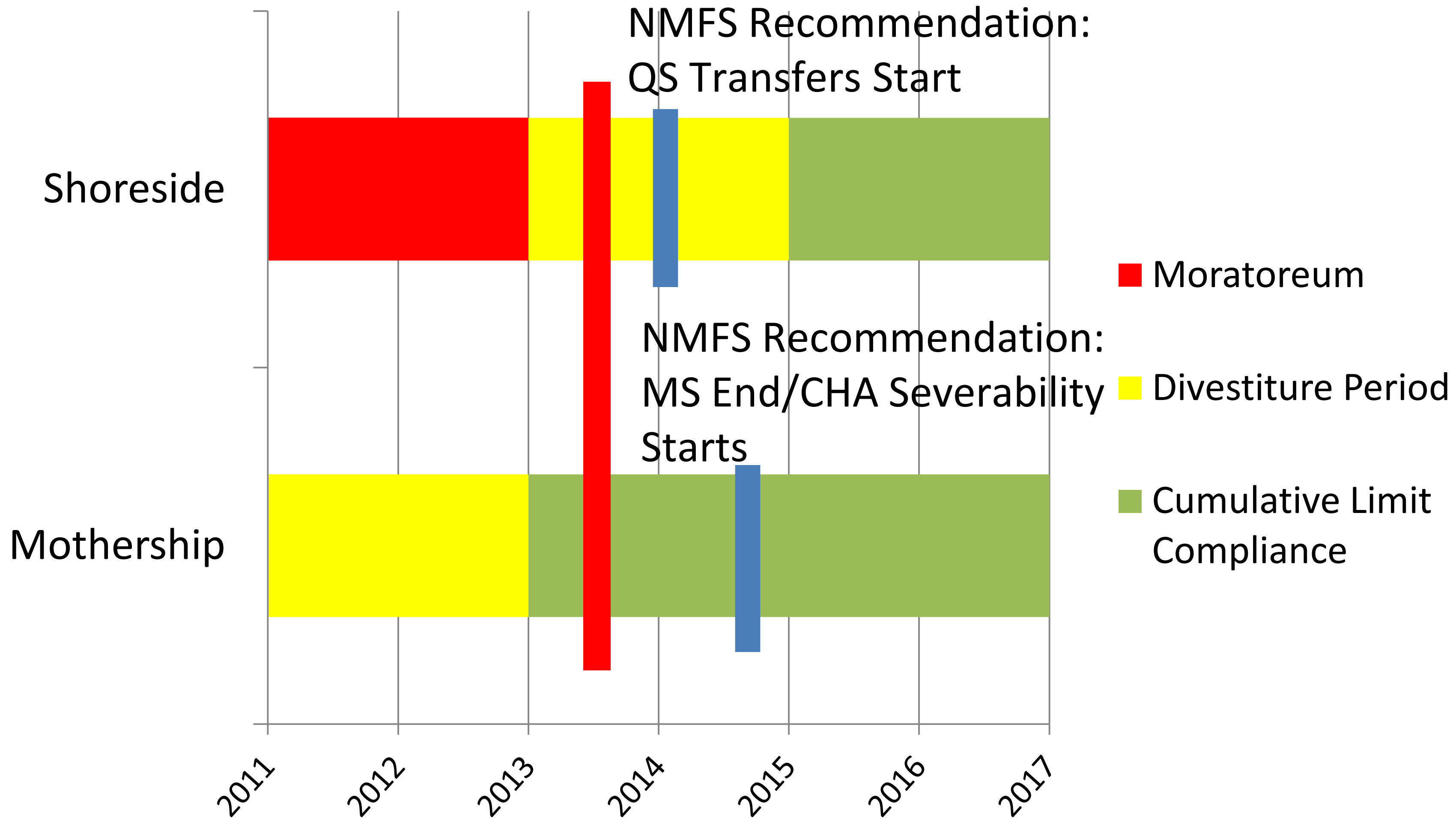
Council Action

1. Identify final preferred alternative for allocation time periods
2. Recommendations on extension of divestiture period and other guidance, as needed
   - Delay of trading – start of divesture
   - Length of time provided for divestiture

Extension of Divestiture Period



Extension of Divestiture Period



How much additional time should be provided for divestiture?

New Analysis

Focus – Looking at the whole

Inactive Permits

- Shoreside
  - 21 shoreside permits inactive from 2004-2010
  - 10.2% of QS (Table 4-8)
  - 4 of the 21 were active in the mothership sector and 2 elsewhere (Table 3-6)
  - 15 permits with no West Coast/AK Activity (Table 3-3)

- Mothership
  - 13 mothership permits inactive from 2004-2010
  - 9.6% of CHA (Table 4-23)
  - 9 were active in the shoreside sector and 2 elsewhere (Table 3-6)
  - 2 Permits with no West Coast/AK Activity (Table 3-5)

- Combined shoreside and mothership sectors – 15 permits with no West Coast or AK Activity (Ag Item H.7.a, Supp Att 3, Table 1)
  - 4.3% of QS and 1.5% CHA

(Note: Chapter 3 shows 39 permits with MS history and 14 permits inactive after 2003 – includes two permits that did not meet 500 mt qualifying threshold one of which was not active after 2003.)

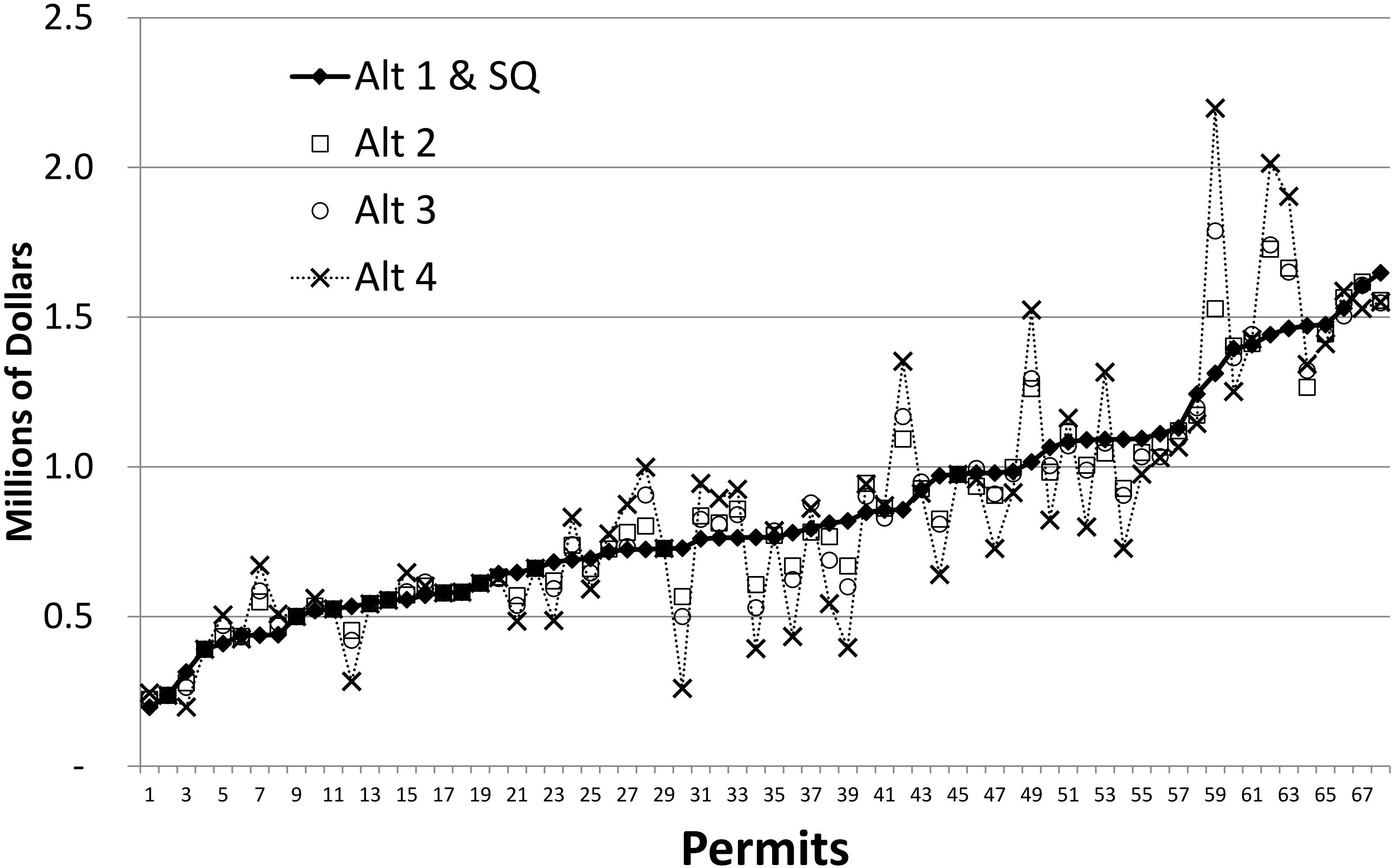
15 Inactive Permits (H.7.a, Sup Att3, Table 1)

- 4.3% of QS and 1.5% CHA
- 6 of the 15 held by owners with other permits that were active
- Those 6 account for
  - 3.0% of the QS and 0.5% of the CHA
- Remaining 9
  - 1.3% of the QS and 1.0% of the CHA
  - Don't know the status of fishing enterprises owning these permits

Changing Levels of Participation (Table 4-37, page 125)

2004-2010 Share of Fleet Revenue Compared to 1994-2003 Share of Fleet Revenue		NonWhiting Groundfish	
		Increase	Decrease
Combined Whiting (SS & MS)	Increase	23	7
	Decrease	14	24

Aggregate Value of All Quota Allocated (Figure 4-26, page 127 – Exvessel Value Equivalent)



Council Action

1. Identify final preferred alternative for allocation time periods
2. Recommendations on extension of divestiture period and other guidance, as needed
   - Delay of trading – start of divesture
   - Length of divestiture

Agenda Item H.7.b
NMFS Report
September 2012

A Draft Rulemaking Schedule for the Reconsideration of Allocation of Whiting for the Shoreside and Mothership Sectors of the Trawl Rationalization Program

ITEM	**DATE**
FPA Selected- September PFMC Meeting	September 13-18, 2012
Reconsideration of Allocation of Whiting (RAW 2) Proposed Rule Scheduled to Publish	November 2012
RAW 2 Public Comment Period	November- December, 2012
RAW 2 Final Rule Scheduled to Publish	March 2013
RAW 2 Final Rule Scheduled Effective Date	April 1, 2013

Agenda Item H.7.b
Supplemental GAP Report
September 2012

GROUNDFISH ADVISORY SUBPANEL REPORT ON RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES

The Groundfish Advisory Subpanel (GAP) received information from Mr. Jim Seger regarding the need to identify a final preferred alternative for mothership and shoreside whiting catch share allocations and other actions related to that matter. The task before the GAP, and ultimately the Council, is to select a final allocation alternative based on the goals and objectives of the program, guidance from the Magnuson-Stevens Act and national standards, and the goals and objectives of the Groundfish Fishery Management Plan. As we mentioned in our June report, it is the GAP's strong belief that the Council did just that in the plan it adopted in November 2008. We took a fresh look at the five allocation alternatives at this meeting, reviewed the voluminous record, and heard extensively from plaintiffs and others in industry, and came to the conclusion that the status quo (no action) alternative is the most fair and equitable option.

To help frame the discussion, the GAP reiterates these comments from our June statement:

> "This is an allocation decision. The Council must consider the relevant factors and make a determination about which alternative best satisfies those factors (National Standard Guidelines, 50 C.F.R. §600.325(c)(3)(i)). Further, as the judge noted in his remand order, the Council is required to consider current harvest, but no particular outcome is mandated (*Pacific Dawn* Order at 6). In fact, there are many other co-equal factors the Council must consider, including historic harvest and community participation, dependence, investments, and employment in harvesting and processing (Magnuson-Stevens Fishery Conservation and Management Act 303a(c)(5)). Finally, because we are looking at these options now, the Council must also consider the disruptive effect of changing the allocation more than a year and a half into the program, because to do otherwise would be to fail to adequately consider current harvest and participation."

In addition, the GAP notes that the program seems to be achieving its desired outcomes. The goal of the trawl rationalization program was to create a capacity rationalization plan that increases net economic benefits, generates individual economic stability, and drives better stewardship of the resource through individual accountability. Data through the first 18 months of the program suggest the program is achieving those goals. (See West Coast Groundfish IFQ Fishery Mid-year Catch Report (January-June 2012): Emerging Trends, Agenda Item H.5.b, NMFS Report, September 2012 suggesting that whiting revenue relative to catch is up slightly compared to last year, while bycatch remains extremely low; See also West Coast Groundfish IFQ Fishery Catch Summary for 2011: First Look, Agenda Item F.6.b Supplemental NMFS Report, March 2012 describing a longer whiting season with nearly full attainment, increased revenue across the fleet and decreased bycatch.)

As a final framing matter, the GAP calls the Council's attention to the recent Ninth Circuit decision in *PCFFA v. Locke*, where, on a related ruling regarding "consideration" of community impacts, the court essentially held that consideration means consideration and does not mandate any particular outcome or action. As the court noted in that case, the plaintiffs reasonably disagreed with the policy choice made by the agency, but that was not enough to make that choice unlawful. Here, plaintiffs disagree with the no action alternative, but on balance, after considering recent participation as well as the other factors required to be considered for fair and equitable allocation decisions, that policy disagreement is inadequate to overturn a program that is otherwise meeting its goals and the goals of the FMP.

The Council is not required to consider current harvest in isolation

When making allocations, there are many factors the Council must consider. As mentioned above, these include current and historical harvest, employment in harvesting and processing, investments in and dependence on the fishery, and the current and historical participation of fishing communities. If the Council's task was solely to consider current harvest, then the plaintiffs would have a strong argument. Indeed, the GAP, like Congress when it passed the reauthorized act, understands that there is benefit in considering current harvest. It reflects the current make-up of the fishery, rewards those who are currently active, and does not reward those who may have left the fishery for other pursuits.

However, the Council's task is much more complicated. The Council is required to balance all of the factors and make a determination about which allocation option is most fair and equitable, while also achieving the goals of the FMP. On balance, the no-action alternative must prevail because it is the most fair and equitable and appropriately considers all, rather than just one, of the required factors.

Consideration of current and historical harvest

What does current mean? Ideally, current harvest would include harvest information up to the point of implementation. But, as Judge Henderson noted, "present cannot therefore prudently be contemporaneous with the promulgation of the final regulations" because the "process of review, publication, public comments, review of public comments, and so forth, had to take a substantial amount of time." (*Pacific Dawn* Order at 8) While alternatives 2, 3, and 4 would seem to give us a snapshot of current harvest, there are significant problems with those options.

Looking at catch beyond 2003 is misleading because there are many participants who could have dramatically increased their participation after the control date (e.g. fishermen with other boats that fish elsewhere), but did not do so. Had they known that speculating might give them access to more fish, they would no doubt have introduced that additional capacity, despite the explicit goals of the program. Therefore, looking at history and basing an allocation on history beyond 2003 unfairly disadvantages those who made decisions that better met the Council's goals and objectives to decapitalize and stabilize the fishery. This effect is exacerbated the further away from the control date the allocation years are set. In this respect, alternatives 3 and 4 are especially suspect.

Even with the caveat that harvest after 2003 is not reflective of how it might have looked had other fishermen not responded appropriately to the Council directive to start decapitalizing the fishery, current harvest must still be balanced with historic harvest. Under the no-action alternative, the Council has appropriately captured historic harvest by basing allocations on history all the way back to the imposition of limited entry permits in 1994. Alternative 4, looking back only to 2000, fails to adequately consider historic participation, and arbitrarily truncates years, solely to benefit the plaintiffs.

As a final point, consideration of current harvest must consider the disruptive effect that would occur if the Council drastically alters the current allocation formula. (See Groundfish Fishery Management Plan Objective 14, requiring that Council management measures accomplish the management objectives with the least disruption of current fishing practices). Looking at the fishery now, it's clear that the no action alternative would cause the least disruption. Investments have been made and are leading to employment for harvesters and processors, and revenue for communities. As an example, 18 permits have changed hands since 2003 at least once. (Supplemental Analysis, Draft Supplemental Attachment 3, September 2012.)

Consideration of employment in harvesting and processing sectors

As the draft Environmental Assessment (EA) shows, there are more winners than losers by sticking with no-action. That fish comes from other fishermen in the program. Put another way, reallocation alternatives disadvantage the many to the benefit of the few. This turns the goals of the Council on their head. Moreover, it seems to fly in the face of National Standard 4 guidance, which states that "an allocation may impose hardship on one group if it is outweighed by the total benefit received by another group or groups." (50 C.F.R. §600.325(c)(3)(i)(B)) We would see exactly the opposite outcome with any of the reallocation alternatives. For example, alternative 3 reduces the allocation of 40 permit holders to advantage 25 (Draft Environmental Assessment, Section 4.3.1.1 and Figure 4) Alternatives 2 and 4 lead to similar outcomes.

More losers than winners results in less employment, as well as geographic impacts. As an example, alternative 2 would dramatically reduce allocations to certain permits, one of which would lose 67 percent of its allocation resulting in an expected loss of 130 employees a day for 4 months. (Public comment of Tom Libby) Alternative 4 would result in a 99 percent reduction of quota share to that same processor. (Id.) This is exacerbated by the double dipping effect where processors, harvesters, and communities lose twice, as both processors and the fishermen who fish for them lose quota. For example, the 20 percent processor allocation was designed to protect shoreside communities and infrastructure dependent on the fishery at the time of program development. If there is a reallocation and more recent years are selected, boats affiliated with processors with stronger recent participation will also receive more history, thereby shifting quota away from the historically dependent plants and communities. Put another way, both harvester catch history and processing history will shift in unison, moving quota away from historically dependent communities. As the goal of the processor allocation decision was to maintain, rather than shift landings and infrastructure, selecting more recent years will upset the delicate balance struck by the Council. (See Groundfish Fishery Management Plan Objective 17, requiring that Council actions minimize adverse impacts on communities to the extent practicable.)

Consideration of investments in and dependence on the fishery

Both plaintiffs and those who support the no action alternative have significant investments in and dependence on the fishery. On balance, however, impacts to losers under reallocation alternatives are more extreme than the benefits to the winners. For example, one processing plant's 2011 landings were 100 percent Pacific whiting and that accounted for 98 percent of their production volume. (Public comment of Tom Libby). Under alternatives 2, 3, and 4, that processor would lose at least two-thirds of its allocation, stranding capital and creating negative repercussions for employment and the community.

The GAP also points out that consideration of investments in the fishery, particularly Ocean Gold's investment in the early 2000s, is what led to the discrepancy between the 2003 harvester date and the 2004 processor date. The Council did its best to accommodate those investments, and protect processors and communities within the larger goal of reducing overcapacity in the fishery. On a related note, while the GAP believes that the control date put harvesters on notice that catch history after 2003 might not count towards allocation, it was not clear the control date applied to processors until 2004.

In the mothership sector, one permit would increase its allocation by almost 50 percent. This increase would come at the expense of many other permit holders in the sector. (Draft EA at 91).

Finally, much has been made of the fact that there are 15 permits with no activity after 2003. Together they account for only 4.3 percent of shoreside QS and 1.5 percent of mothership quota. However, six of those permits that account for the lion's share of that quota (3 percent shoreside and .5 percent mothership), were owned by entities that owned other permits that remained active in the fishery. (See Supplemental Analysis, Draft Supplemental Attachment 3, September 2012) Those permit owners clearly intended to consolidate those inactive permits on active vessels after rationalization, rather than infusing additional capital into the fishery.

Consideration of current and historical participation of fishing communities

One of the primary goals of the Council was to protect fishing communities. The processor allocation component was designed largely to achieve that outcome. In the short term, alternatives 2, 3, and 4 would all shift quota, revenue, and employment from currently active fishing communities to a smaller number of winners. As mentioned above, the potential impacts on processing employment are significant, with attendant ripple effects on communities.

Finally, the GAP believes it is important to note that 23 permits (only 3 are plaintiffs) increased participation after the control date and would therefore benefit economically from the reallocation alternatives. (Draft EA, Table 4-37 at 125). However, they do not support moving away from status quo because they support the decision the Council reached, but more importantly because moving away from status quo will have negative repercussions on communities, processors, harvesters, and other fisheries hoping to rationalize.

Conclusion

Selecting more recent window years prioritizes current participation over historical participation and dependence. This effect is compounded for those fishermen who could have increased capacity and effort (either number of boats or hold size) after the 2003 control date, but, in good faith, did not do so. The effect can be most clearly seen in option 4 which truncates history before 2000, but applies as well to options 2 and 3, which consider history beyond 2003. And, as mentioned above, the interaction between the processor allocation decision and modified window years would serve to shift quota away from historically active fishing communities, contrary to the Council's intent.

Upending the existing plan would create significant instability and jeopardize the benefits already accruing in this fishery. Moreover, there would be harmful impacts to other fisheries across the country hoping to rationalize. These outcomes would be especially unfair when one takes into account the years of open and transparent public process that went into the initial decision, and the fact that many of the plaintiffs testified in favor of the program adopted by the Council. As a final point, the GAP notes that there are relative winners and losers in every allocation system. But as one of the funders of the lawsuit said in support of the Council decision in public testimony in November 2008, "… the long-term benefits are going to outweigh the short-term compromises that we make. And that is truly in the betterment of the industry." Those benefits are already accruing. A shift away from the plan as adopted would jeopardize that.

Related matters

On the associated regulatory issues, the GAP offers the following comments:

Trading Moratorium – The GAP understands the rationale behind the QS trading moratorium, but notes that the inability to permanently transfer quota makes it impossible for fishermen to build a long-term business plan and acquire quota to carry out that plan. Presently, there are many fishermen who have species they do not fish due to the buyback allocations and other factors. Allowing QS transfer will make the program more efficient and allow more healthy target stocks to be harvested.

Divestiture – The GAP believes that the QS trading moratorium and divestiture are closely linked. The GAP believes those needing to divest have had significant time to think about how to do so, and that one year from the end of the trading moratorium is adequate to allow them to complete that process. A longer period would unnecessarily allow those in excess of caps additional use of that excess quota.

PFMC
09/17/12

Agenda Item H.7.b
Supplemental NMFS Report 2
September 2012

RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES, NMFS RECOMMENDATIONS FOR RELATED PROVISIONS IN RAW 2

Background

The Reconsideration of Allocation of Whiting rulemaking (RAW 1) delayed several portions of the Pacific Coast trawl rationalization program regulations in response to the decisions issued by the U.S. District Court for the Northern District of California in the case Pacific Dawn v. Bryson, No. C10–4829 TEH (2012), which required NMFS and the Council to reconsider the initial allocation of Pacific whiting. This action:

(1) Delayed the ability to transfer quota share (QS) and individual bycatch quota (IBQ) between QS accounts in the shorebased IFQ fishery in order to avoid complications that would have occurred if QS permit owners in the shorebased individual fishery quota (IFQ) fishery were allowed to transfer QS percentages prior to completion of the whiting allocation reconsideration;
(2) Delayed the requirement to divest excess quota share amounts for the shorebased IFQ fishery and the at-sea mothership fishery so that QS permit owners will have sufficient time to plan and arrange sales of excess QS, as originally recommended by the Council for this provision of the trawl rationalization program; and
(3) Delayed the ability to change mothership/ catcher vessel (MS/CV) endorsement and catch history assignments from one limited entry trawl permit to another in order to avoid the complications which would have occurred if permit owners were allowed to transfer ownership of catch history assignments before completion of the reconsideration takes place.

In this document NMFS seeks to advise the Council regarding appropriate actions which must take place following the selection and implementation of an FPA. The above items were delayed via emergency action authority for 180 days, NMFS may request an additional 185 day delay. This would result in reinstatement of QS transfer and divestiture, as well as severability on September 1, 2013.

Issue

Council guidance (Agenda Item D.7, June 2012) concurred with NMFS and GAP guidance in recommending that transfer of QS, divestiture periods, and MS/CV severability be delayed during the reconsideration of the allocation of whiting. However, the motions made during the June 2012 Council meeting did not address when these processes should be reinstated.

NMFS proposes:

For the shoreside IFQ sector, QS transfer and divestiture periods be reinstated to begin on January 1, 2014, with divestiture periods being extended to two years from that date (i.e. the deadline to divest would be December 31, 2015). This would allow NMFS adequate time to implement the necessary QS transfer rules and regulations, as well as the programming necessary to allow online transfers of QS.

For the MS sector, NMFS recommends reinstating MS/CV severability on September 1, 2014, and delaying the deadline to divest to August 31, 2016, in order to allow NMFS adequate time to implement regulations and to coincide with the annual permit renewal process.

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATIONS IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES

The Scientific and Statistical Committee (SSC) met with Mr. Jim Seger to discuss the September 2012 version of the Draft Environmental Assessment of Pacific Whiting initial catch shares in the mothership and shoreside Pacific whiting fisheries. The SSC finds the additional information and analyses presented to be a useful addition to those presented in the June version of the report. The SSC has no additional substantive comments beyond those we submitted in June, hence we insert our comments from the June SSC meeting below.

<u>June 2012 SSC Report (June 2012 Agenda Item, D.7.b, Supplemental SSC Report)</u>

The Scientific and Statistical Committee (SSC) met with Mr. Jim Seger to discuss the reconsideration of initial catch shares in the mothership and shoreside Pacific whiting fisheries. Although most of the information presented in the briefing book deals solely with distributional or policy issues, there are several scientific components the SSC wishes to highlight.

The way the fisheries are actually prosecuted (geographic location of fishing and landings, timing of fishing, and participants) will in the long-term tend not to be affected by who receives the initial allocation of catch shares. Over time, the use of the catch shares will likely migrate through leases or sales to the participants who can put them to their most profitable use. This means that the eventual biological, ecological, and economic performance of the fisheries will be relatively independent of the initial allocation of catch shares. It has been the experience of many catch share programs that such transitions occur rather quickly, often within the first few years. As a consequence, the initial allocation of quota shares is not an effective tool to direct fishing or processing effort to particular geographic locations.

Furthermore, it is not evident whether, and to what degree, changes in fishing effort between the ports would affect the Pacific whiting resource. The harvest control rule for Pacific whiting is robust to changes in the distribution of effort, thus there is unlikely to be a conservation issue. However, the overall yield from the resource may be affected, and a bioeconomic model would need to be developed to answer this question.

A control date for quota share allocation can be an effective tool to discourage excessive resource expenditures intended exclusively to secure additional quota shares. This applies equally to catcher vessels, at-sea processors, and shoreside processors.

PFMC
09/15/12

Da Yang Seafood Inc.

Seafood Processing & Trading

Dear Council Members,

Thank you for the opportunity to provide our perspective on the Groundfish rationalization process. We are writing to object to any proposed alterations that include processor shares or processing rights granted through historical landings.

I am writing on behalf of Da Yang Seafood, a small processing plant in Astoria. We started participating in the shore-side hake program in 2005. We are a small hake processor in Astoria. Our products include frozen HGT and whole round whiting and our markets are based upon exports to Africa, China, Europe and Russia. As a small processor, we must be creative in our marketing and production techniques to ensure our niche market for hake overseas. It has given us an opportunity to continue our investment and our operation in Astoria and help promote the local economy.

The addition of the whiting production has extended our plant season from 3 months to 4 months out of a year, including our sardine production. Several whiting vessels deliver to our plant and we employ over a hundred workers in our processing plant. In early 2007, we continued investing in our plant and upgrading our production capacity to meet the needs of our global customers.

Fisherman benefit when new processors enter the market participating against the bigger players and competition between processors to buy fish from fishermen is an essential component to the success of our fishery – at all levels. Any exclusive grant to a processor to buy hake will stifle competition, limit advancements in technology and product forms, and drive down the price to the fisherman - as such an arrangement have done in the Alaska crab fishery after implementation of a “two pie system.” We strongly oppose any plan which includes such an element.

Our position is still against any processor shares granted to the plant. On the other hand, we support 100% fishermen catch shares that will benefit the management of our resources and a free competition between plants for marketing and processing fish.

Thank you for your consideration on these issues.

Sincerely Yours,
Chih Yuan, Wang
President and CEO

Davis Wright Tremaine LLP

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August 20, 2012

Mr. Dan Wolford
Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384

Re: Reconsideration of IFQ Allocation for Pacific Whiting; September 13-18, 2012 Council Meeting; Boise, Idaho

Dear Mr. Wolford:

Our firm presents the following comments on the various options for reallocation of Pacific whiting ordered by Judge Thelton Henderson in *Pacific Dawn LLC, et al. v. Bryson*, No. C10-4829 TEH (2012). The following entities support these comments: Pacific Dawn LLC; CHELLISSA LLC; Ocean Gold Seafoods, Inc.; Jessie's Ilwaco Fish Company; and James and Sandra Schones. We ask that these comments be provided to Council Members prior to the September Meeting in Boise and be made part of the administrative record of the reconsideration of the Pacific whiting Individual Fishing Quotas (IFQ) by the Council.

<u>The Issue of Present or Recent Participation</u>

First of all, the analysis by the Council staff has been very helpful in identifying the implications of the various alternatives, and some issues of great concern, with respect to the reallocation question. In particular, Supplement Attachment 5, Agenda Item D.7.a, provided at the June 2012 meeting highlighted the concern that was driving Plaintiffs' participation in the lawsuit. Because the Council did not undertake a full documentary analysis of the previous, now discredited, allocation of Pacific whiting, only now are the fundamental flaws becoming more obvious. Most significantly, the data put forward by the staff has shown that the original Council allocation (the No-Action Alternative now before the Council), which was based on a "political compromise", allocated significant portions of the Pacific whiting IFQ to permits which had **no participation in the fishery at all** for seven or more years prior to the institution of the IFQ Program in 2011. With respect to the shoreside sector, the data indicates that, under the No-Action Alternative, (1) 4.6% of the IFQ goes to 12 permits that did not participate in the fishery from 2000-2010; and (2) 10.2% of the IFQ goes to 21 permits that did not participate from 2004-

2010. In the mothership sector, (1) 10.5% of the IFQ goes to 13permits that did not participate from 2000-2010; and (2) 5.2% goes to 10 permits that did not participate from 2004-2010.[1] How could it be said that these permits are committed to or "depend" on the Pacific whiting fishery?

The statute and NOAA's guidelines make clear that "present participation" must be considered and not ignored. The question of "present participation" in the fishery also implicates the other principal considerations under the statute and the guidelines, such as the requirement for a fair and equitable allocation and the dependency factor. *See* Guidance for Making Allocation Decisions Relating to Catch Shares; Agenda Item I.5.a, Supplemental Attachment 3, April 2012. Why should those who chose to leave the Pacific whiting fishery be given any IFQ if they left many years prior to institution of the IFQ program? Why should those who remained committed to the fishery, with substantial history and participation in the fishery up to the year the IFQ Program was approved, be required to purchase or lease IFQ from those who "retired" from the fishery long ago? One can understand why there would be trading of IFQ between and among those who were committed to the fishery at the time the IFQ program started, but why should those who long ago dropped out be given any fishing privileges to trade? Why burden those who maintained the necessary financial and business commitment to the fishery with the legal obligation of paying off these retirees, particularly when at some point the administrative costs of the program (such as observers) will soon be allocated to the current participants? Fishery management measures instituted under catch shares are not retirement programs for the uncommitted. Those who left the fishery long ago clearly no longer have any dependence on the fishery for their livelihood.

As an example of the unfairness in the Status Quo approach, Joe Hamm, who owns and operates the CHELLISSA, has been required to lease 60% of the IFQ he fishes from others who have not made the same commitment he has to the Pacific whiting fishery over the years. He started in 1996 and has fished every year since. Why should he pay speculators who dropped out, and have since made little commitment to the fishery, for his ability to stay in the fishery he has been dependent upon?

This issue was considered by the North Pacific Council when framing one of the first IFQ programs instituted in 1993. 58 Fed. Reg. 58375 (Nov. 9, 1993) (final rule implementing the IFQ limited access system in fixed gear fisheries for Pacific halibut and sablefish in and off Alaska). The issue of present participation was thoroughly discussed as follows:

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[1] We understand that the Council staff is rechecking these statistics to make sure they are entirely correct. For now, the general point remains true: under the IFQ program as previously approved (the Status Quo Option), significant IFQ went to permits (and vessels) that have not participated in the Pacific whiting fishery for more than seven years and to a processing entity that is no longer in business.

> *Present participation in the fishery*. For purposes of the IFQ program, "present participation" is defined by the initial allocation qualifying criteria: ownership or lease of a vessel that made fixed gear landings or halibut or sablefish during 1988, 1989, or 1990. The Council developed these criteria after consideration of earlier years and ways of participating in the fishery other than by vessel ownership. The Council's rationale for the specified qualifying years was that they provided a reasonable time in which to demonstrate dependence on the fishery. Including earlier years would allow more fishermen to qualify that have since exited the fishery and are no longer participating. ...Therefore it is reasonable to define the group of persons who make the capital investment decision to either enter or exit a fishery as "present participation."

58 Fed. Reg. at 59380. We offer this cogent analysis to the Council as an example to be followed.

We believe that, because of the significant allocation of IFQ to permits that long ago dropped out of the Pacific whiting fishery, the No-Action Alternative (and Alternative 1) will not, and cannot, be approved by NOAA and would likely be struck down by a Federal Court as being in violation of the Magnuson-Stevens Act. Just as importantly, the allocation of significant IFQ to non-participants is bad public policy. IFQ should be allocated to those who have shown their commitment to the fishery by both the size of their fishing history and by actually participating in the fishery just prior to the institution of the IFQ program. *Yakutat, Inc. v. Gutierrez,* 407 F.3d 1054, 1069 (9th Cir. 2005) (NOAA must and did consider present participation, along with historical dependence, when it approved a qualification period in 2000 that went up to the year 1998 for an LLP program).

<u>The "Control Date" Question</u>

Some supporters of the No-Action Alternative have argued that it is of greatest importance to honor the sanctity of the "control dates" that were issued with respect to the Pacific groundfish fishery generally, or else their usefulness nationwide will be destroyed. Such arguments fail to recognize the legal meaning of control dates and the fact that most IFQ programs frequently are preceded by a variety of changing control dates that do not necessarily become part of a final license limitation or IFQ program.

First, control dates, including those referred to in this debate, are nothing more than publications in the Federal Register that give notice. Control dates are not regulations approved by NOAA as part of a fishery management plan, although the dates might later because part of a legally enforceable program that cuts off new licenses or qualification periods. Only the latter are reviewed for approval by NOAA and consistency with the Magnuson-Stevens Act and other applicable law. But the single publication of a control date does not create a new regulation.

Second, NOAA's statements and publications with regard to control dates have been consistent: The establishment or revision of control dates does not commit a council or NOAA to any particular management regime. The councils may or may not make use of published control dates as part of qualifying criteria in any management program, and may even change them at will. Thus, those who said they relied on the publication of the control dates and changed their business practices took the business risk that the final dates in the IFQ Program as finally approved would change; therefore they have no complaint. Moreover, by leaving the fishery, these fishermen indicated clearly that they did not depend on the fishery to keep their businesses operating. By the same token, a processing entity that is no longer in business should not be allocated any IFQ.

Third, the length of time between publication of the control dates in this case and the date of final approval of the IFQ program has already been called into question in the ruling by Judge Henderson. Evidence presented at the last Council meeting by Ocean Gold Seafoods, Inc. has indicated how greatly the Pacific whiting fishery changed after 2003/2004, moving away from surimi as the principle final product to headed/gutted and blocks products.

Fourth, Amendment 15 to the Pacific Fishery Groundfish FMP set special limits on those who could participate in the Pacific whiting fishery. Related to these special limited entry rules is the new factual information from the Council staff showing that permits (and vessels) have been leaving the Pacific whiting fishery for years. There is no evidence that there is an over-capacity problem in this fishery. Again, testimony by Ocean Gold alluded to the fact that the fishery is not over-capitalized and may be under-capitalized at present. The control dates at issue here apply to all Pacific groundfish, which has been over-capitalized, not just to Pacific whiting which is conducted as a separate fishery.

General concern about the sanctity of control dates is not a sufficient legal or policy reason to approve the No-Action Alternative or Alternative 1 in lieu of other options that take into account more recent fishing history and participation. As the North Pacific Council stated with respect to its allocation decisions in the halibut and sablefish IFQ program: "The Council considered a person's record of landings in a fishery as the most important indicator of that person's dependence on the fishery." 58 Fed. Reg. at 59380. Again, the Council should not ignore this wise precedent.

Recent Fishing and Processing History

Considering recent fishing and processing history in making the initial IFQ allocation for Pacific whiting is a separate but related issue before the Council. If the Council eliminates those permits that have no recent history of fishing, more IFQ will become available to the other eligible participants in the fishery. As stated in prior Council meetings, the fishing and processing entities identified above believe that the Council should include all fishing and processing history through the year 2010 in framing the reallocation of IFQ that must result from the reconsideration process. As just noted, that history is the most important indicator of a particular fishery or processing entity's dependence on the Pacific whiting fishery. Using 2010 as the end of the history qualification period takes into account the very recent changes in the fishery for both processors and harvesters pointed out by presentations of Christopher Kayser and Steve Hughes at the June 20-26, 2012 Council meeting, especially the dramatic shift from surimi to headed/gutted and block products. Allocations of IFQ must reflect the current conditions in the fishery to assure that the allocations are fair and equitable to those committed to the future prosecution of the fishery under today's business conditions, not past conditions.

In this regard, we believe that Alternative 2, which would end the fishing and processing history in the year 2007, is based on a false premise. The Council may not go back in time to that year, given that (1) the Court has ordered reconsideration as of 2012; (2) NOAA must determine consistency with the Magnuson-Stevens Act as of the date the agency gets the new proposed allocation (2012 or 2013); and (3) the best available scientific information, available this year, includes all fishing and processing history through the end of the open access system in 2010.

Recommended Option

At the last meeting, Council put off selecting a preferred alternative and further changes were made to some of the Alternatives. We understand that the staff work on the Alternatives is still on-going. Therefore, we cannot recommend any Alternative at this time. We know for sure, however, that the Status Quo Alternative and Alternative 1 (Through 03) are unquestionably unacceptable and likely to be found unlawful under the Magnuson-Stevens Act.

Very truly yours,

DAVIS WRIGHT TREMAINE LLP

James P. Walsh

JPW/ig

SEADAWN FISHERIES, INC.
P. O. Box 352
Newport, Oregon 97365

August 21, 2012

Mr. Dan Wolford, Chairman
Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: September Council Meeting, Agenda Item H.7 - Reconsideration of the Initial Catch Share Allocations in the Mothership and Shoreside Whiting Fishery

Dear Chairman Wolford and Council Members:

I am a long term and continuous participant in the Whiting fishery and it is my continued belief that the Council's original decision in this matter is sound, it is fair and equitable to the participants and therefore the Council should stay with the status quo option.

The use of control dates have been approved by the Courts in the past in upholding quota share programs where the Council did not allow credit for catch history after the control date because the alternative would be to encourage speculation, including over investment and overfishing which the control date was intended to restrain. Further, it is not fair and equitable to those that play by the rules to reward those who pour money and time into a fishery that is already overcapitalized after a control date has been set.

The plaintiffs contend there was no evidence of speculation in the Whiting fishery after the control date. However, that contention is false and contrary thereto there is evidence that one of the plaintiffs (Pacific Dawn, LLC and the vessel Pacific Challenger) did in fact engage in speculation, did in fact significantly increase their participation in the Whiting fishery after the control date and did so by using the benefits of the American Fisheries Act (AFA) that rationalized the pollock fishery. These activities were clearly in violation of the policies of this Council when it established the control date and in violation of the policy of the American Fisheries Act which included provisions to discourage the utilization of the benefits of that act to cause adverse impacts on fisheries in other areas.

I am attaching "Directed Pollock Fisheries Results" as published by the AFA Mothership Fleet Cooperative for the years 2002 through 2011 as evidence of the speculation (10 pages attached). From the attachment it is shown that prior to the control date in 2002 and 2003 the Pacific Challenger harvested all of its pollock quotas. Starting in 2004 the Pacific Challenger began catching significantly less of its pollock. In 2005 it caught less than 1/2 of its pollock, in 2006 and 2007 it caught approximately 1/3 of its pollock, in 2008 and 2009 it caught less than 1/3 of its pollock, in 2010 it harvested approximately 60% and then in 2011 after the West Coast Quota Share program was implemented it caught over 100% of its pollock.

These official records demonstrate what appears to be a dramatic effort by one Plaintiff to play the system by giving up their right to harvest pollock (presumably by leasing) during the whiting season so as to significantly increase catch history in the whiting fishery in anticipation of litigation that might reward that behavior in contravention of the policy of this Council in setting control dates, specifically to discourage such behavior.

I do not believe the Pacific Dawn, LLC/Pacific Challenger anticipated quota for whiting if the dates are extended to 2010 has been specifically identified, however, it is our information and belief that it would be rewarded for its speculation by one of the highest whiting IQ shares (I'm sure this information could be verified on questioning if the Plaintiff or their representatives testify). If they had not significantly increased their history they would not now be complaining. The Pacific Dawn, LLC/Pacific Challenger contend that they are somehow now dependent on the whiting fishery even though it is apparent that to engage in the whiting fishery to the level that they did since the control date required that they forego catching most of their pollock. This is not dependency on whiting but rather an effort to double dip and gain wealth unfairly by playing the system and using the benefits of AFA unfairly.

The AFA included provisions requiring the PFMC to adopt regulations to prevent AFA vessels from doing just what the Pacific Challenger appears to have done. The PFMC did not specifically adopt regulations pursuant to AFA to restrict AFA vessels, I believe, because it was felt unnecessary since the PFMC was considering rationalizing the whiting fishery and had in place the control date which it thought would discourage AFA vessels from increasing their participation in the whiting fishery by making it clear that they would not benefit on a long term basis. This is further justification for retaining the control date, i.e., to prevent AFA catcher vessels that did unfairly use the benefits of AFA by leasing pollock and increasing history in the whiting fishery from permanently benefitting by that activity.

It simply is not fair and equitable to allow those who ignore the control dates, use the benefits of another rationalized program to increase participation in the whiting fishery to benefit by those actions all to the detriment of those who played by the rules set by this Council. It should be noted that the vast majority of the Industry did play by the rules and overwhelmingly supports the Council in its previous decisions on this matter.

I respectfully urge the Council to make the appropriate findings of fairness and equity and stand on status quo.

Sincerely,

Fred A. Yeck

Table 2. 2002 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.93%	6,369	9,447	7.31%
Alyeska	2.27%	2,933	3,939	3.05%
Amber Dawn	5.23%	6,757	0	0.00%
American Beauty	6.00%	7,751	8,518	6.59%
California Horizon	3.79%	4,896	5,336	4.13%
Mar-Gun	6.25%	8,074	8,115	6.28%
Margaret Lyn	5.64%	7,286	0	0.00%
Mark I	6.25%	8,074	11,731	9.08%
Misty Dawn	3.57%	4,612	6,217	4.81%
Morning Star	3.60%	4,651	0	0.00%
Nordic Fury	6.18%	7,984	7,397	5.72%
Ocean Leader	6.00%	7,751	9,315	7.21%
Oceanic	7.04%	9,095	9,097	7.04%
Pacific Challenger	4.45%	5,749	5,781	4.47%
Pacific Fury	5.89%	7,609	8,134	6.30%
Popado II	2.95%	3,811	5,163	4.00%
Traveler	4.27%	5,516	5,475	4.24%
Vanguard	5.35%	6,912	8,152	6.31%
Vesteraalen	6.20%	8,010	11,832	9.16%
Western Dawn	4.15%	5,361	5,493	4.25%
TOTAL	100.0%	129,204	129,141	99.95%
TOTAL UNHARVESTED			62	0.05%

Pacific Challenger harvested all
pollock allocated to it in 2002

2003 Directed Pollock Fishery Results

Table 2. 2003 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.93%	6432.49	9,022	6.91%
Alyeska	2.27%	2967.44	2,372	1.82%
Amber Dawn	5.23%	6824.32	0	0.00%
American Beauty	6.00%	7836.54	8,326	6.38%
California Horizon	3.79%	4944.86	5,731	4.39%
Mar-Gun	6.25%	8164.37	8,308	6.36%
Margaret Lyn	5.64%	7370.27	0	0.00%
Mark I	6.25%	8164.37	11,807	9.04%
Misty Dawn	3.57%	4661.44	7,286	5.58%
Morning Star	3.60%	4703.23	0	0.00%
Nordic Fury	6.18%	8067.72	4,294	3.29%
Ocean Leader	6.00%	7836.54	9,563	7.32%
Oceanic	7.04%	9192.26	9,102	6.97%
Pacific Challenger	4.45%	5806.88	6,413	4.91%
Pacific Fury	5.89%	7691.56	10,722	8.21%
Popado II	2.95%	3856.88	5,895	4.51%
Traveler	4.27%	5579.62	5,526	4.23%
Vanguard	5.35%	6987.58	8,991	6.88%
Vesteraalen	6.20%	8099.06	11,767	9.01%
Western Dawn	4.15%	5420.27	5,440	4.17%
TOTAL	100.0%	130,608	130,566	99.97%
TOTAL UNHARVESTED			42	0.03%

Pacific Challenger harvested all Pollock allocated to it in 2003

Table 2. 2004 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.925%	6398.4	7,849.8	6.04%
Alyeska	2.272%	2951.7	3,285.0	2.53%
Amber Dawn	5.225%	6788.2	0.0	0.00%
American Beauty	6.000%	7795.0	9,988.4	7.69%
California Horizon	3.786%	4918.7	5,914.4	4.55%
Mar-Gun	6.251%	8121.1	9,018.1	6.94%
Margaret Lyn	5.643%	7331.2	1,998.8	1.54%
Mark I	6.251%	8121.1	10,858.7	8.36%
Misty Dawn	3.569%	4636.7	5,812.6	4.47%
Morning Star	3.601%	4678.3	0.0	0.00%
Nordic Fury	6.177%	8025.0	5,685.7	4.38%
Ocean Leader	6.000%	7795.0	9,777.7	7.53%
Oceanic	7.038%	9143.6	9,431.8	7.26%
Pacific Challenger	4.446%	5776.1	4,318.6	3.32%
Pacific Fury	5.889%	7650.8	9,946.6	7.66%
Popado II	2.953%	3836.4	5,286.6	4.07%
Traveler	4.272%	5550.1	5,610.1	4.32%
Vanguard	5.350%	6950.6	8,101.4	6.24%
Vesteraalen	6.201%	8056.2	10,624.6	8.18%
Western Dawn	4.150%	5391.6	5,713.2	4.40%
TOTAL	100.0%	129,916	129,221.8	99.47%
TOTAL UNHARVESTED			694.2	0.53%

Pacific Challenger did not harvest 1458 tons of Pollock it was allocated in 2004

2005 Directed Pollock Fishery Results

Table 2. 2005 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.925%	6439.78	6,678	5.11%
Alyeska	2.272%	2970.80	4,162	3.18%
American Beauty	6.000%	7845.42	9,073	6.94%
California Horizon	3.786%	4950.46	6,539	5.00%
Mar-Gun	6.251%	8173.62	8,157	6.24%
Margaret Lyn	5.643%	7378.62	8,221	6.29%
Mark I	6.251%	8173.62	4,676	3.58%
Misty Dawn	3.569%	4666.72	7,271	5.56%
Morning Star	3.601%	4708.56	0	0.00%
Nordic Fury	6.177%	8076.86	6,879	5.26%
Ocean Leader	6.000%	7845.42	9,314	7.12%
Oceanic	7.038%	9202.68	9,289	7.10%
Pacific Challenger	9.671%	12645.51	5,671	4.34%
Pacific Fury	5.889%	7700.28	8,799	6.73%
Popado II	2.953%	3861.25	0	0.00%
Traveler	4.272%	5585.94	8,187	6.26%
Vanguard	5.350%	6995.50	6,984	5.34%
Vesteraalen	6.201%	8108.24	13,217	10.11%
Western Dawn	4.150%	5426.42	7,548	5.77%
TOTAL	100.0%	130,757	130,665	99.93%
TOTAL UNHARVESTED			92	0.07%

Pacific Challenger did not harvest 6974 tons of Pollock it was allocated in 2005

2006 Directed Pollock Fishery Results

Table 2. 2006 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.925%	6504.2	7,744.0	5.86%
Alyeska	2.272%	3000.5	676.7	0.51%
American Beauty	6.000%	7923.9	6,766.7	5.12%
California Horizon	3.786%	5000.0	3,052.8	2.31%
Margaret Lyn	5.643%	8255.4	12,179.9	9.22%
Mar-Gun	6.251%	7452.4	11,953.8	9.05%
Mark I	6.251%	8255.4	5,388.8	4.08%
Misty Dawn	3.569%	4713.4	7,558.1	5.72%
Morning Star	3.601%	4755.7	0.0	0.00%
Nordic Fury	6.177%	8157.7	4,571.4	3.46%
Ocean Leader	6.000%	7923.9	13,364.9	10.12%
Oceanic	7.038%	9294.7	11,361.7	8.60%
Pacific Challenger	9.671%	12772.0	3,892.4	2.95%
Pacific Fury	5.889%	7777.3	8,772.3	6.64%
Popado II	2.953%	3899.9	0.0	0.00%
Traveler	4.272%	5641.8	6,970.3	5.28%
Vanguard	5.350%	7065.5	7,336.6	5.56%
Vesteraalen	6.201%	8189.4	11,872.4	8.99%
Western Dawn	4.150%	5480.7	7,940.8	6.01%
TOTAL	100.0%	132,064	131,404	99.50%
TOTAL UNHARVESTED			660	0.50%

Pacific Challenger did not harvest 8880 tons of Pollock it was allocated in 2006

2007 Directed Pollock Fishery Results

Table 2. 2007 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.925%	6015.7	6,968	5.70%
Alyeska	2.272%	2775.2	737	0.60%
American Beauty	6.000%	7328.8	6,748	5.52%
California Horizon	3.786%	4624.5	6,013	4.92%
Margaret Lyn	5.643%	6892.8	3,966	3.25%
Mar-Gun	6.251%	7635.4	8,521	6.98%
Mark I	6.251%	7635.4	8,276	6.78%
Misty Dawn	3.569%	4359.4	9,122	7.47%
Morning Star	3.601%	4398.5	0	0.00%
Nordic Fury	6.177%	7545.0	4,495	3.68%
Ocean Leader	6.000%	7328.8	10,926	8.95%
Oceanic	7.038%	8596.7	10,617	8.69%
Pacific Challenger	9.671%	11812.8	3,107	2.54%
Pacific Fury	5.889%	7193.2	10,393	8.51%
Popado II	2.953%	3607.0	0	0.00%
Traveler	4.272%	5218.1	7,693	6.30%
Vanguard	5.350%	6534.9	7,097	5.81%
Vesteraalen	6.201%	7574.3	9,017	7.38%
Western Dawn	4.150%	5069.1	7,817	6.40%
TOTAL	100.0%	122,146	121,512	99.48%
TOTAL UNHARVESTED			634	0.52%

Pacific Challenger did not harvest 8705 tons of Pollock it was allocated in 2007

2008 Directed Pollock Fishery Results

Table 2. 2008 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.925%	4,277.36	3,454.78	3.98%
Alyeska	2.272%	1,973.23	817.96	0.94%
American Beauty	6.000%	5,211.00	6,312.84	7.27%
California Horizon	3.786%	3,288.14	2,545.73	2.93%
Margaret Lyn	5.643%	4,900.95	5,807.30	6.69%
Mar-Gun	6.251%	5,428.99	6,209.71	7.15%
Mark 1	6.251%	5,428.99	1,804.79	2.08%
Misty Dawn	3.569%	3,099.68	7,449.29	8.58%
Morning Star	3.601%	3,127.47	0.00	0.00%
Nordic Fury	6.177%	5,364.72	2,043.28	2.35%
Ocean Leader	6.000%	5,211.00	8,726.78	10.05%
Oceanic	7.038%	6,112.50	7,100.85	8.18%
Pacific Challenger	9.671%	8,399.26	1,738.20	2.00%
Pacific Fury	5.889%	5,114.60	8,664.25	9.98%
Papado II	2.953%	2,564.68	0.00	0.00%
Traveler	4.272%	3,710.23	4,894.23	5.64%
Vanguard	5.350%	4,646.48	5,938.32	6.84%
Vesteraalen	6.201%	5,385.57	7,250.01	8.35%
Western Dawn	4.150%	3,604.28	4,605.93	5.30%
Total Harvest	100.00%	86,850.00	85,364.26	98.29%
Unharvested			1,486	1.71%

Pacific Challenger did not harvest 6661 tons of Pollock it was allocated in 2008

Table 2. 2009 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.93%	3,467.99	4,686.55	6.66%
Alyeska	2.27%	1,599.85	1,597.92	2.27%
American Beauty	6.00%	4,224.96	2,484.84	3.53%
California Horizon	3.79%	2,665.95	3,322.52	4.72%
Margaret Lyn	5.64%	3,973.57	4,686.41	6.66%
Mar-Gun	6.25%	4,401.70	1,596.77	2.27%
Mark 1	6.25%	4,401.70	6,266.64	8.90%
Misty Dawn	3.57%	2,513.15	4,556.35	6.47%
Morning Star	3.60%	2,535.68	0.00	0.00%
Nordic Fury	6.18%	4,349.60	6,217.98	8.83%
Ocean Leader	6.00%	4,224.96	6,593.95	9.36%
Oceanic	7.04%	4,955.88	6,879.07	9.77%
Pacific Challenger	9.67%	6,809.93	1,630.83	2.32%
Pacific Fury	5.89%	4,146.80	6,231.41	8.85%
Papado II	2.95%	2,079.38	0.00	0.00%
Traveler	4.27%	3,008.17	2,876.19	4.08%
Vanguard	5.35%	3,767.26	3,872.29	5.50%
Vesteraalen	6.20%	4,366.50	2,296.88	3.26%
Western Dawn	4.15%	2,922.26	4,511.43	6.41%
Total Harvest	100.00%	70,415	70,308	99.85%
Unharvested			107	0.15%

Pacific Challenger Did not harvest 5179 tons of Pollock it was allocated in 2009

Table 2. 2010 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.93%	3,482.34	3,113.58	4.40%
Alyeska	2.27%	1,606.14	0.00	0.00%
American Beauty	6.00%	4,241.58	1,736.45	2.46%
California Horizon	3.79%	2,676.44	3,939.52	5.57%
Margaret Lyn	5.64%	3,989.21	0.00	0.00%
Mar-Gun	6.25%	4,419.02	0.00	0.00%
Mark 1	6.25%	4,419.02	6,951.69	9.83%
Misty Dawn	3.57%	2,523.03	3,542.57	5.01%
Morning Star	3.60%	2,545.65	0.00	0.00%
Nordic Fury	6.18%	4,366.71	4,132.37	5.85%
Ocean Leader	6.00%	4,241.58	8,223.90	11.63%
Oceanic	7.04%	4,975.37	7,166.09	10.14%
Pacific Challenger	9.67%	6,836.72	4,017.03	5.68%
Pacific Fury	5.89%	4,163.11	6,995.07	9.89%
Papado II	2.95%	2,087.56	0.00	0.00%
Traveler	4.27%	3,020.00	6,493.95	9.19%
Vanguard	5.35%	3,782.08	5,804.98	8.21%
Vesteraalen	6.20%	4,383.67	4,389.99	6.21%
Western Dawn	4.15%	2,933.76	4,069.34	5.76%
Total Harvest	100.00%	70,693.00	70,576.52	99.84%
Unharvested			116.48	0.16%

Pacific Challenger did not harvest 2819 tons of Pollock it was allocated in 2010

2011 Directed Pollock Fishery Results

Table 2. 2011 Mothership Fleet Co-op Pollock Allocations and Harvest - MT

Catcher	Co-op %	Co-op MT	Actual MT	Actual %
Aleutian Challenger	4.93%	5,450.12	4,644.80	4.20%
Alyeska	2.27%	2,509.49	0.00	0.00%
American Beauty	6.00%	6,633.00	4,792.67	4.34%
California Horizon	3.79%	4,189.85	6,843.22	6.19%
Margaret Lyn	5.64%	6,235.02	0.00	0.00%
Mar-Gun	6.25%	6,909.38	0.00	0.00%
Mark 1	6.25%	6,909.38	11,120.51	10.06%
Misty Dawn	3.57%	3,946.64	6,700.39	6.06%
Morning Star	3.60%	3,979.80	0.00	0.00%
Nordic Fury	6.18%	6,831.99	8,004.39	7.24%
Ocean Leader	6.00%	6,633.00	9,669.88	8.75%
Oceanic	7.04%	7,782.72	9,041.21	8.18%
Pacific Challenger	9.67%	10,690.19	11,774.77	10.65%
Pacific Fury	5.89%	6,511.40	7,447.47	6.74%
Papado II	2.95%	3,261.23	0.00	0.00%
Traveler	4.27%	4,720.49	8,422.46	7.62%
Vanguard	5.35%	5,914.43	6,298.64	5.70%
Vesteraalen	6.20%	6,854.10	9,590.44	8.68%
Western Dawn	4.15%	4,587.83	5,505.21	4.98%
Total Harvest	100.00%	110,550	109,856.06	99.37%
Unharvested			693.94	0.63%

Pacific Challenger harvested all of its Pollock in 2011.

Agenda Item H.7.c
Supplemental Public Comment MTC PowerPoint
September 2012

Midwater Trawlers Cooperative

Why Status Quo was fair and equitable in 2008

Why Status Quo is the most fair and equitable option now

Amendment 20 Purpose and Need

Despite a program completed in 2003 to reduce fishing capacity through the buy back of groundfish LE permits and associated vessels, management of the west coast LE Groundfish trawl fishery is still marked by biological, social, and economic concerns, similar to those cited in the U.S. Commission on Ocean Policy's 2004 report (2004). Many participants and observers view the trawl fishery as economically unsustainable under the current management regime.

Purpose Of Trawl IQ Program

"Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch"

What the judge ordered

"Reconsideration" of initial allocation of whiting quota shares

Judge Henderson did not mandate that a particular change be made

MSA – Allocations “must consider”

1. Current and Historical Participation
2. Employment in the Harvesting and Processing Sector
3. Investments in and Dependence on the Fishery
4. Current and Historical Participation of fishing communities

1. Current & Historical Harvests

- Harvester allocation to current permits – this recognizes recency <u>and</u> investment – 18 permits traded hands after 2003

- Status quo alternative <u>is</u> the current fishery and clearly recognizes current participants

- Moving the window period forward ignores historical participation

Recent Participation

23 permits had increased whiting landings after 2003 – only 3 are suing for an increased initial allocation

Permit	Initial Allocation Shoreside	Rank	Initial Allocation Mothership	Rank
Pacific Dawn	1.991%	18 out of 55	3.00%	16 out of 36
Chellissa	1.734%	20 out of 55	0.00%	N/A
James Schones	1.504%	24 out of 55	0.00%	N/A

Recent Participation

- No one is prevented from harvesting or processing whiting due to the initial allocation

- Da Yang Seafoods received no initial allocation and still processed a large amount of fish in 2011 and 2012

Latent Permits are Insignificant

15 permits with no post 2003 activity were allocated 4.3% of the shoreside quota share and 1.5% of the mothership sector allocation

6 of these permits were owned by entities who owned other active permits. These six permits accounted for 3% of the shoreside quota share and 0.5% of the mothership sector allocation, leaving 2.4% of the shoreside quota share and 1% of the mothership sector quota share that apparently had no fishing activity after 2003

Page 2 of the Supplemental Analysis – Attachment 3

2. Employment in the harvesting and processing sector

- Status quo option considers employment in the processing sector by allocation of quota share to processors
- Status quo option considers employment in the harvesting sector by allocation of quota to harvesters
- Under any action alternatives resource shifts from one community to another possibly affecting employment in that community

3. Investments in and Dependence on the Fishery

- Allocating to current permits considers and recognizes current participation <u>and</u> investment in the fishery
- Status quo fishery took into account more recent investment by including 2004 for the processor allocation
- Considering only recent participation in the fishery discounts long-term investments and dependence

West Coast Seafood Processors Dependent on Diversification

CRAB

GROUNDFISH (NON WHITING)

SHRIMP

SALMON

SARDINES

ALBACORE

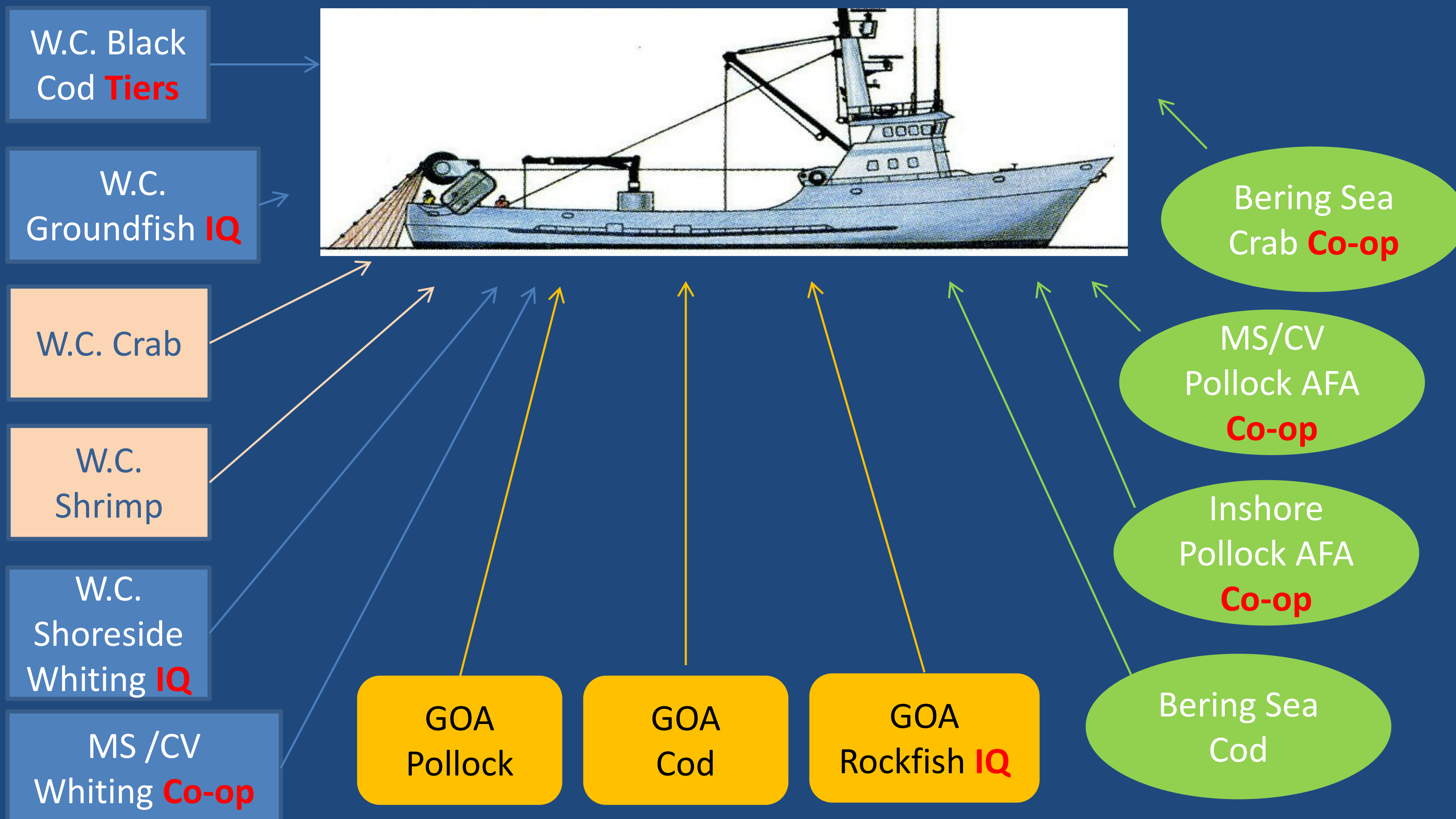
TRIBAL WHITING

CANADIAN FISH

SHORESIDE WHITING

FISH MEAL

Dependent on Diversification



4. Current and Historical Participation of Fishing Communities

Processors were allocated whiting in order to recognize and protect communities

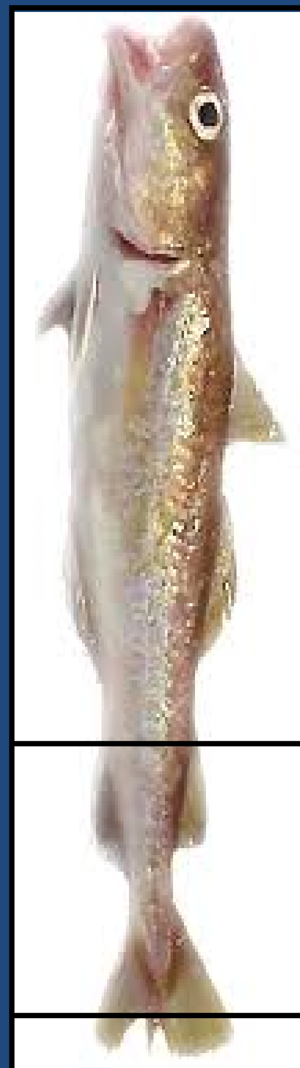
	Company	Port Community	Initial Allocation
1	Trident Seafood	Newport, OR	4.666%
2	Ocean Gold Seafood	Westport, WA	3.865%
3	Pacific Coast Seafood	Warrenton, OR	3.793%
4	Pacific Shrimp	Newport, OR	2.853%
5	Point Adams Packing	Warrenton, OR	1.993%
6	Jessie's Ilwaco Fish	Ilwaco, WA	0.651%
7	Pacific Seafoods	Eureka, CA	0.558%

Moving off status quo transfers fish from OR & CA to Washington

	Company	Port Community	Initial Allocation
1	Trident Seafood	Newport, OR	4.666%
2	**Ocean Gold Seafood**	**Westport, WA**	3.865%
3	Pacific Coast Seafood	Warrenton, OR	3.793%
4	Pacific Shrimp	Newport, OR	2.853%
5	Point Adams Packing	Warrenton, OR	1.993%
6	**Jessie's Ilwaco Fish**	**Ilwaco, WA**	0.651%
7	Pacific Seafoods	Eureka, CA	0.558%

Includes:

- Catcher Processors
- Mothership CV’s
- Shoreside CV’s
- Shoreside Processors
- Tribes



69%

28%

3%

Pacific Whiting Distribution 2012 By State – Based on % of U.S. OY

Disruption to Existing Program

- Existing deals and arrangements based on Council decisions (permit purchases, etc.) could be rendered valueless (those 18 permits which traded hands after 2003)
- Fish moving out of communities in Oregon and California and migrating north to Washington
- Double-dip loss

Other Impacts of moving from status quo

- Control dates become meaningless here and elsewhere
- Making a change supported by a small minority alienates the majority of the industry
- Participants that don't like policy calls made by the Council continue to believe litigation is the answer

PCFFA Decision

“consider” means just that

“substantial participants” are not guaranteed an allocation

The overall Groundfish ITQ program considered a reasonable range of alternatives and met NEPA requirements

Status Quo is the current 2012 Fishery

Status Quo is the only fair and equitable choice

Agenda Item H.7.c
Supplemental Public Comment PowerPoint
September 2012

Ocean Gold Seafood's Public Comments Before Pacific Fishery Management Council On Reconsideration of IFQ Allocation for Pacific Whiting

September 13-19, 2012

Status Quo's Heavy Burden

- Council Must "Consider" the Record Before it.
  - The council must "consider the relevant factors [under the MSA] and articulat[e] a rational connection between the facts found and the choices made."
- Exclusion of 8-9 Years Can't Be Justified
  - An allocation that excludes three of the most recent years from catch history "pushes the limits of reasonableness" while one that, like the initial whiting allocation, excludes 6 to 7 years, "arguably fall[s] beyond those limits."

What are the relevant facts to consider?

- From 2003 to the Present:
  - In 2004, the fishery no longer overfished. DEIS at 34.
  - "Export market growth increases significantly after 2003, especially exports to Germany, the Russian Federation, and Ukraine." DEIS at 40.
  - "After taking into account the world recession in 2008-2011, ex-vessel prices have been increasing since 2003, even as total harvests also increased." DEIS at 39.
  - Beginning in 1997, Ocean Gold makes significant investments in H&G plant and helps develop diversified international markets.
  - Ocean Gold now employs close to 700 annually and derives 60% of its revenues each year from whiting.
  - Between 2004-2011, Westport has become more dependent on whiting revenues than any other port on the West Coast. DEIS at 121.

Factors Under MSA and FMP

- Most recent history years takes into account:
  - "Present participation in the fishery" MSA §303(b)(6)(A).
  - "Current harvests and participation," MSA §303(c)(5)(A)(i)&(iv).
  - Ensure allocations to "persons who substantially participate in the fishery," MSA §303(c)(5)(E).
  - "Employment in the . . . processing sectors." MSA §303(c)(5)(A)(ii).
  - "Investments in, and dependence upon the fishery." MSA §303(c)(5)(A)(iii).
    - "The more recent the years of harvest included in the allocation formula, the more likely it is that allocations will reflect current dependence on the fishery." DEIS, at 140.
- Advances economic goals and objectives of FMP to "maximize the value" of the fish (Goal 2), and "achieve the greatest possible net economic benefit to the nation from managed fisheries" (Objective 6).

Why exclude recent history?

- Inclusion of the most recent years will not undermine sanctity of the control date.
  - Groundfish control date has changed three times:
    - November 13, 1991: "a vessel entering the fisheries [after the control date] may be assigned a lesser priority for issuance and shares of individual quotas (IQs) in a potential IQ-based limited access system for Pacific coast commercial groundfish fisheries." 57 FR 4394 (February 5, 1992)
    - September 16, 1999: "if catch history is used as basis for [future] participation, it is likely that AFA-qualified vessel participation in the fishery after the control date will receive little or no credit." 64 FR 66158, 66159.
    - November 6, 2003.

Control Dates Change

- Atlantic Mackerel: August 13, 1992, changed to September 12, 1997, and changed again to July 5, 2002 due to concern that "nearly five years have passed since the 1997 control date was published." 67 FR 44792, 44792.
- New England small-mesh multispecies fishery: September 9, 1996 changed to March 25, 2003 because "conditions have changed sufficiently in this fishery to make the September 1996 control date an unreliable indicator of current participation." 68 FR 14388, 14388.
- South Atlantic Spanish Mackerel: July 2, 1993 changed to June 15, 2004. 70 FR 64459.
- Panaeid Shrimp: September 8, 2000 changed to December 10, 2003. 69 FR 10189.
- Snapper-grouper fishery: October 14, 2005 changed to September 17, 2010 "due to concern that the previous control date established for the snapper-grouper fishery was almost five years old." 76 FR 532576 FR 5325.
- Hawaiian offshore pelagic handline fishery: July 2, 1992 changed to February 15, 2001 out of a concern that the earlier control date was outdated. 66 FR 27623, 27624.

September 13, 2012

Dr. Donald O. McIsaac
Executive Director Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Dear Dr. McIsaac,

The purpose of this letter is to show that setting the end of the allocation period in any year after 2003 rewards wanton waste in the Pacific whiting fishery and induces wanton waste in other, as yet, unrationalized fisheries. This letter is largely based on Kudjundzic et al.,[1] and the analysis in that paper in turn was based largely on an application to the whiting fishery of the work of Yoram Barzel. As Barzel noted,[2] in the 19th century, the U.S. government distributed land so as to induce socially productive behavior and to reduce socially destructive behavior by claimants. The issue facing the Council is also one involving the distribution of rights in order to maximize socially productive behavior and minimize socially destructive behavior. We find proposals to extend the qualifying time to be, in effect, proposals to punish productive behavior and reward socially destructive behavior.

Fishery rationalization generates large net gains to society and also increases net tax revenues. If market shares were auctioned, then the buyers of those market shares would gain the free use of existing specialized capital. In all U.S. major rationalized fisheries (and in almost all fisheries elsewhere), owners of specialized capital have been awarded market shares on the basis of fish history, often terminating well before implementation of the market shares. If market shares are awarded on the basis of fishing after a control date has been set, the gains from rationalization will be lost as a race-for-quota adds to the losses generated by the race-to-fish.

Market shares have led to a reduction in the cost of exploiting fisheries by reducing capital costs. Anthony Scott and H.S. Gordon predicted this in the 1950s. These projections have been realized in practice, but these gains have been exceeded by large increases in the value of the output of rationalized fisheries—a positive outcome which had few predicted. Market share fishing turns efforts from maximizing the volume of fish caught and processed per day to efforts to increase the value of output per unit of fish caught.

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[1] Kujundzic, Ana, Christopher C. Riley, Joseph T. Plesha and Levis A. Kochin, *Analysis of the Use of Processing and Harvesting History in the Allocation of Pacific Whiting Quota (revised)*, Paper presented to the Pacific Fisheries Management Council, 2012.

[2] Yoram Barzel, *Economics of Property Rights*, 2nd ed., (Cambridge University Press, 1997), 121-122.

Market share fishing protects the resource. Large gains have come from the shift in fishing regulations from maximizing current fishing output under industry pressure when no one owns the fish, to maximizing the present value of fish by conservation under pressure from catch share owners. Costello et al.[3] examined the records of hundreds of fisheries worldwide and found that the firmer the property rights the likelier the fishery is to be preserved.

As mentioned earlier, if market shares were auctioned then the buyers of those market shares would gain the free use of existing specialized capital. Market share fishing cuts the demand for those specialized assets and lowers or even eliminates their value. These losses are likely to be larger for processors than for fishers because unlike the fishing vessels, shore-based processing plants do not have propellers and cannot be moved to other fisheries except at great cost. Allocating quota to those holding specialized physical capital reduces the industry's resistance to market share programs and so facilitates access to the social benefits of this form of fishery management.

Soon after the Pacific Fishery Management Council (PFMC) was created by the 1977 Magnuson-Stevens Act, the PFMC set an overall Total Allowable Catch (TAC) for whiting. The TAC was set at a level which until 1983 allowed American catchers and processors to operate without limit, and foreign fishers to catch any TAC leftover. The foreign share of the catch declined from ninety-nine percent in 1977 to zero percent in 1983. American entrants into the whiting fishery before 1983 were helping in the achievement of a goal which was one of the stated aims of the Magnuson-Stevens Act.

After 1983 there was additional entry by American fishers and American processors into the whiting fishery and the season length shrank. The race-to-fish shortened the season and lowered the value of the fish. In other words, those who increased their catching and processing capacity (after the domestic had displaced the foreign industry) subtracted from the value of the product of the fishery by reducing the length of the season. The PFMC took action in 1994 by license limitation, awarding transferable licenses to those who had participated in the fishery in the past. The PFMC took further action to limit the number of available licenses by making some licenses expire and leading the buyback and retirement of many licenses. Those who added capital to the fishery by adding catching or processing capacity after 1994 were countering the efforts of public policy to reduce dissipation by limiting the amount of resources used to catch and process whiting.

These PFMC actions signaled that further rationalization was on the way. Given that market shares had been distributed in other fisheries on the basis of fish history, an intensified race-for-quota was added to the race-to-fish. In 1998 the PFMC announced that catch history after 1997 would not be considered in the distribution of catch shares. The initial control date was 1997. The PFMC stated the purpose of its control date:

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[3] Costello, Christopher, *et al.*, *Can Catch Shares Prevent Fisheries Collapse?,* Science 321, 1678 (2008).

> In order to discourage from intensifying fishing efforts for the purpose of amassing catch history … the Council announced in April, 1998 that any program proposed would not include consideration of catch landed after that date.

Intensified fishing or processing can take the form of added capital or of shifting efforts from producing fish product to producing fish history through wanton waste, for example, by catching and processing undersized fish which do not yield any appreciable value. The U.S. Congress put into place a moratorium on new catch share programs in the U.S.. The moratorium expired in 2003; during that year the PFMC set 2003 as a new control date. In 2004, the PFMC clarified that the control date would also apply to allocations of market shares to processors. The process of rationalization took seven years to be implemented in part because the Council took the innovative action of handing twenty percent of catch shares in whiting to processors. Market shares were based on historical catch between 1994-2003 for catchers and 1998-2004 for processors.

Moving the end of the qualifying period from 1997 to either 2003 or 2004 (as was done) was a mistake in our view. It rewarded those who subtracted from the total value of output, while punishing those who reduced their rate of utilization. If the initial control date had been left intact (and participants had predicted that it would be left intact), these losses could have been avoided. If participants in the whiting fishery had ignored the warnings given in the control date announcement, allocating quota based upon a qualifying period that ends, coincidentally, with the end date in the control date announcement, would have sent a signal to other, as yet unrationalized fisheries, that it would be a mistake to interpret an announcement of a control date as a starting gun for the last lap of derby fishing and processing for quota. It would be best, in our view and given the option, if that mistake were now corrected and the control date were moved back to 1997.

Moving the end of fish history in whiting back to 1997 would not eliminate the wanton waste generated by the race-for-quota after 1997. But, to use a fitting though extreme analogy, that argument would eliminate any punishment for a murderer if we were sure that he would never murder again. No punishment of the felon can resurrect his victim. But such reasoning is rightly rejected by the law. Both equity and deterrence are served by punishing even sincerely repentant felons. Punishing murderers does not save those who have already been murdered but it does save some of those who would otherwise be murdered in the future.

Those who entered additional capital after 1997 were under a clear warning that rationalization was coming. Their efforts were socially counterproductive. If their vessels or plants have become more efficient, as they have testified to repeatedly before the Council, their operations will retain much of their value as their owners lease or purchase quota (which must be worth more to them, under the definition of efficiency, than to less efficient quota recipients). If the qualifying period for whiting is moved forward from 2003 and 2004 then the harm done by the move to 2003 and 2004 will be repeated. Moving the qualifying period forward in time is irrational as it generates wanton waste. If regulators cannot avoid selecting a qualifying period at a time subsequent to an announced control date, either because of political pressure or judicial mandate, then new legislation is needed.

Sincerely yours,

Yoram Barzel
Professor of Economics
University of Washington

Levis A. Kochin
Associate Professor of Economics
University of Washington

ATTACHMENT I

YORAM BARZEL

AUGUST 2012

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EDUCATION

1957-1961	University of Chicago Ph.D. in Economics, 1961
1950-1956	Hebrew University M.A. in Economics, 1956 B.A. in Economics, 1953

POSITIONS

1961-Present	Department of Economics, University of Washington Assistant Professor, 1961 Associate Professor, 1966 Professor, 1970
1999-2003	Western Economics Association International (WEAI) Vice President, 1999 President Elect, 2000 President, 2001
1985-1989, 1996	External Examiner, Hong Kong University
1958-1959 (Summer)	Research Assistant, Transportation Center, Northwestern University
1953-1957	Economist, Energy Department, Israel
1956	Instructor, Hebrew University

VISITING POSITIONS

1996 (Winter)	Visiting Professor, Hong Kong University
1995 (Fall)	Visiting Fellow, New College, Oxford University
1994 (Winter)	Visiting Professor, Hong Kong University
1992 (Winter)	Visiting Professor, Hong Kong University
1988 (Spring)	Visiting Professor, Tel Aviv University, Israel

1985 (Spring)	Visiting Professor, Bar Ilan University, Israel
1984 (Fall)	Visiting Professor, Washington University, St. Louis, MO
1981-1982	Visiting Scholar, Hoover Institution, Stanford University
1974-1975	Visiting Scholar, Hoover Institution, Stanford University
1970-1971	Visiting Fellow, University College, London
1963-1964	Visiting Research Fellow, Falk Foundation, Jerusalem

HONORS AND GRANTS

2008	Grant from Microsoft
1998	Summer grant from Earhart Foundation
1986	Summer grant from Earhart Foundation
1978-1980	HEW grant to study medical insurance
1973-74	U.S. Department of Labor contract to study Oil Import Quota
1971	Summer grant from Earhart Foundation
1970-71	Ford Faculty Fellowship
1965-69	Three one-year grants from NSF
1960-61	Ford Foundation Fellow
1958-60	Public Finance Workshop Fellow
1957-58	University Fellow, University of Chicago
1954-55	University Fellow, Hebrew University

PUBLICATIONS

Journal Articles:

"The Evolution of Criminal Law and Police during the Pre-Modern Era" (with D.A. Allen) *Journal of Law, Economics and Organization*, Fall 2011.

"Prevention Is Better than Cure: The Role of IPO Syndicates in Precluding Information Acquisition" (with Michel A. Habib and D. Bruce Johnsen), *Journal of Business*. November 2006.

"Organizational Forms and Measurement Costs," *Journal of Institutional and Theoretical Economics*, September 2005.

"Moral Hazard, Monitoring Cost, and the Choice of Contracts," *Nanjing Business Review* (in Chinese), June 2005.

"Transaction Cost and Contract Choice," *Nanjing Business Review* (in Chinese), June 2004.

"Standards and the Form of Agreement," *Economic Inquiry*, January 2004.

"Taxation and Voting Rights in Medieval England and France" (with Edgar Kiser), *Rationality and Society,* November 2002.

"Dispute and Its Resolution: Delineating the Economic Role of the Common Law," *American Law and Economics Review,* Fall 2000.

[Reprinted in The Evolution of Efficient Common Law, Paul Rubin, editor, April 2007, Edward Elgar.]

[Reprinted in Foundations of Law and Economics, Robert D. Cooter and Francesco Parisi, editors, Fall 2009, Edward Elgar.]

"The Role of Contract in Quality Assurance," inaugural issue of *Current*, An (Electronic) Journal of the Can. Ag. Econ. Soc., May 2000.

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Econometrica
Economic Development & Cultural Change
Economic Inquiry
Bell Journal
Public Choice
Explorations in Economic History
Journal of Legal Studies
Research in Law and Economics
Canadian Journal of Economics
Journal of Economic Literature
Journal of Business
Journal of Economic Behavior and Organization
Journal of Public Economics
Journal of Contemporary Policy Issues
Journal of Human Resources
Journal of Law, Economics, and Organization
National Science Foundation
Economica
Journal of International Trade and Economic Development
Managerial and Precision Economics
Encyclopedia of Law and Economics
Journal of Development Economics
AREUEA Journal
Journal of Economic Education
Rationality and Society
American Political Science Review
JITE Journal of Institutional Economics
Journal of Organizational and Institutional Economics (JOIE)

ATTACHMENT II

Curriculum Vitae August 2012

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Teaching and Research Fields:

Biology and Economics
Financial Crisis
Economic History of Israel
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Honors and Fellowships: NDEA Fellowship, 1966-68, University of Chicago.

Professional Record:

Visiting Scholar, Federal Reserve Bank of St. Louis	1986
Visiting Associate Professor, University of Tel Aviv	1982-1983
Associate Professor, University of Washington	1979-Present
Visiting Fellow, Hoover Institution, Stanford University	1978-1979
Assistant Professor, University of Washington	1973-1979
Economist-Special Studies, Federal Reserve Bank of New York	1971-1972
Visiting Lecturer, University of Western Ontario	1969-1971

Published or Accepted:

"The Determinants of the Difference Between Bid and Ask Prices on Canadian Government Bonds" (with J.E. Tanner), *Journal of Business*, Vol. 44, 4 (October 1971), pp. 375-379.

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“The Success of the Fed and the Death of Monetarism” (with N. Kundan Kishor)
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Papers Presented:

“The Term Structure of Nominal Interest Rates and Uncertainty About the Future Price Level,” presented at the Federal Reserve Bank of Philadelphia.

“The Spreading Farm Risks,” presented at Iowa State University.

“Theory of State and Local Finance” (with Daniel K. Benjamin), presented at Toronto, Stanford, Harvard, Pennsylvania, Rochester and Carnegie-Mellon Universities.

“Real (Estate) Booms and Busts on the Frontier? From the Fall of Cow to the Arrest of Keating,” presented at Rutgers, Princeton, Chicago, Lehigh and Northwestern Universities.

“The Changing Political Economy of Fishing: Efficient and Expedient Regulation Under ITQ and Open Access” (with Chris Riley), presented at the Western Economic Association, Vancouver, B.C., July 1994

“Analysis of the Use of Processing and Harvesting History in the Allocation of Pacific Whhting Quota (with Ana Kudjundzic, Chis Riley and Joe Plesha) Presented to the June 2012 Meeting of the Pacific Fisheries Management Council

Papers Refereed:

American Economic Review
Economic Inquiry
Journal of Political Economy
Journal of Money, Credit and Banking
Quarterly Journal of Economics
Journal of Macroeconomics
American Real Estate and Urban Economics Association Journal

Current Research:

Real Options and the Economics of Enrichment
Individual Transferable Quotas in Fisheries

Consultant

Trident Fisheries
Pacific Seafood
Internal Revenue Service

ATTACHMENT III

Analysis of the Use of Processing and Harvesting History in the Allocation of Pacific Whiting Quota

September 13, 2012

By
(Alphabetical by first name)

Ana Kujundzic
Christopher C. Riley
Joseph T. Plesha
Levis A. Kochin

CONTENTS

Abstract

The purpose of this paper is to define the economic context of the decision facing the Pacific Council and the Secretary of Commerce concerning the re-examination of the dates that define the period of history that were used for the allocation of quota in the Pacific whiting fishery. We begin with a contrast between the performance of derby fisheries and rational fisheries; it is shown that the theoretical economic predictions and empirical observations in actual fisheries are in substantial agreement. The evidence shows that the problems associated with derby fishing are real and the solutions promised by catch share programs have been effective in addressing these problems.

We then move to the central problem of the evolution between derby and rational fishery operations. The problem is how to affect a rational allocation that is fair and equitable to both those receiving quota privileges, and the society that is the owner of such privileges, when the first move towards rationalization potentially causes the "race-to-fish" of a derby fishery to accelerate into a much more intensive and fundamentally more dangerous race-to-fish for quota. We demonstrate how such a race destroys wealth in much the same process that causes derby fisheries to consume the economic potential of a fishery. This example also demonstrates the fact that Pacific whiting is particularly vulnerable in both a biological and an economic sense to a race-to-fish for quota. We include a discussion of control dates and the impact they have on the expectations of those making investments in the industry.

We also examine the fundamental rationale for allocations of quota to the owners of fishing vessels and processing plants as opposed to the general public and describe why, in capital intensive fisheries such as Pacific whiting, allocations to such private entities are necessary to compensate them for the reduction in the value of fishery related physical capital that is the inevitable consequence of any program that rationalizes an overcapitalized fishery.

Given the rationale for allocations to private entities, criteria are developed to describe the quality of the investments made by the industry for purposes of determining which of these most warrant inclusion in the quota allocations. The criteria are the benefits to society and the reasonable expectations of those who have made financial commitments to the industry. Using these criteria, we evaluate investments made in the Pacific whiting fishery industry overall from the time of the passage of the MSA to the present.

I. Rational, Derby and License Limitation Fishery Management

Rational, derby and license limitation management systems are distinguished by the method by which the resource is allocated among its users. In rationalized,[1] or catch share management, the available fish are allocated between the users, usually in units of a percentage of the Total Allowable Catch (TAC). In derby fisheries the users compete for a share of a common pool of fish during a fishing season that begins on a certain date and ends when the biologically optimal amount of fish (TAC in the case of Pacific whiting) has been taken. License limitation fisheries are a hybrid between these two systems where the number of vessels participating in the derby is limited by a fixed number of permits in an attempt to prevent the overcapitalization that occurs in derby fisheries. License limitation was once thought to be a complete solution to the entry-driven dissipation of rents. However license limitation does not address the overcapitalization that has already occurred when the program is initiated, nor can it prevent the entry that occurs through "capital stuffing," i.e., increase in fishing vessels' capacity when the total number of vessels is fixed through such techniques as better fishing gear, increasing engine power, better electronics, expanding the width and depth of a vessel, etc.. Groundfish trawl fisheries managed under license limitation have operated essentially as derby fisheries.[2] They are of interest here due to the fact that the Pacific Whiting fishery was managed under a license limitation system from 1994 through 2010.

It is now widely believed that derby fisheries substantially under-perform rationalized fisheries in every relevant criterion by which performance can be measured. These include: conservation of the resource, gross value extracted from the resource, cost of harvesting and processing the resource, managing bycatch, difficulty in controlling effort and safety at sea. Derby fisheries systematically destroy the ability of society to collect net benefit (rent) from the fisheries it owns and manages.

The root cause of these shortcomings is the fact that no one is providing, for the resource itself, the services that are normally provided by an owner. There is no price paid for the fish. This results in the dissipation of rent in derby fisheries.

The theory that overcapitalization and the tendency toward overfishing could be cured through sole ownership of the fishery and privately owned fishing vessels was first proposed by Anthony

[1] We define "rationalization" as "privatizing the privilege to utilize fishery resources." We also used the terms "rationalization" and "catch share" interchangeably in this paper.

[2] Wilen, James, *Limited Entry Licensing: A Retrospective Assessment*, Marine Resource Economics 5(4), 313-324 (1988).

Scott in 1955.[3] The rationale for all current catch share programs draws heavily on the logic of this seminal paper.

Dissipation of Rent: The Problem with Derby and License Limitation Management
There are three economically driven mechanisms involved in the dissipation of rent. These are:

- Overcapitalization
- Intensive operation
- Underinvestment in conservation

1. Overcapitalization.

Overcapitalization in open access fisheries is a process that was first outlined in Gordon 1954[4] and succinctly described by Crutchfield and Pontecorvo in 1969.

The economic analysis follows directly from the traditional exposition of the firm. …[F]or any resource which is not owned and there are no barriers to entry, average cost rather than marginal cost will be equated with price; infra marginal rents will be dissipated by the creation of excess capacity.[5]

A simple example of overcapitalization is as follows: Imagine a fishery that is fished at the maximum sustainable yield, and produces one million dollars worth of fish per year with the services of five boats, at a total cost per boat of one hundred thousand dollars per year per boat. This results in a private and societal profit of five hundred thousand dollars per year. In this case each boat is earning one hundred thousand dollars of revenue above its total cost which includes a return on invested capital. These excess profits (rent) induce entry into the fishery despite the fact that the new capital investments do not add anything to the total catch. Entry continues until all the rent is dissipated. This occurs when the fishery contains ten boats for a total cost that exactly equals the value of the catch. If the price of fish doubled this would attract ten additional boats. The derby fishery squanders whatever societal benefits a fishery is otherwise biologically and technically capable of providing. If the cost of managing the fishery is not totally borne by the industry, the fishery managed by a derby becomes a net cost to society.

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[3] Scott, Anthony, *The Fishery: The Objectives of Sole Ownership*, Journal of Political Economy, 63, 2, 116-124 (April 1955).

[4] Gordon, H.S., *The Economic Theory of a Common-Property Resource: The Fishery*, Journal of Political Economy, 62, 124-142 (April 1954).

[5] Crutchfield, J. A., and Pontecorvo G., *The Pacific Salmon Fisheries: A Study of Irrational Conservation*, 32 (1969).

In order to limit the entry of capital into a fishery, a license limitation program is frequently the first step managers take in attempting to organize the industry in such a way so as to limit the flow of resources, thus creating conditions that allow the fishery to produce some benefit to society. To the extent that the marginal cost of adding capacity by capital stuffing exceeds the marginal cost of doing so through the entry of additional vessels under the license limitation program, less than all of the potential rent is dissipated through investments in capital equipment. This will be reflected through a positive permit price, an increase in fishing intensity and hence the cost of fishing, or both.

2. Intensive operation.

When the primary method of capital infusion into a fishery (i.e., entry of vessels) is cut-off, and profitable opportunities for capital stuffing have already been exploited, the primary competitive tactic of fishermen becomes the operational aspects of fishing (or processing). When the capital portion of the production function is constrained, the marginal product, or the amount of additional fish that will be caught for an additional dollar of investment in capital is low, which is another way of saying the cost of increasing harvest by one ton per day using additional capital is very high.

This is referred to as the "race-to-fish," which differs from vessel entry and capital stuffing in that it does not involve any capital investment. This lack of capital investment is not in and of itself of much significance; however, it does affect the reliability of any estimate of stranded capital that uses changes in harvest rates as a proxy for capital investment. The race dissipates rent in two ways: (1) It can increase the cost of operation both on a per day and a per ton basis; and, (2) decreases the value and quality of the products produced, as suboptimal schools of fish are targeted and a suboptimal product mix is produced with less than the optimal amount of time dedicated to production. Raw fish itself is used as a substitute for other factors of production, leading to lower finished product recovery (or yield). Safety is also necessarily sacrificed to some extent. Nobel Prize winning economist George Stigler describes it this way: "[t]he least cost combination of inputs is achieved when a dollar's worth of any input adds as much value as any other input."[6]

When capacity enhancement is very expensive using capital and raw fish are free, the result is the substitution of raw fish for capital in the production function and a waste of the resource.

The amount of capacity enhancement, as reflected in daily catch rates that can be traced to purely operational decisions in harvesting and processing (as well as some concept of the magnitude of the societal loss these operational methods introduce) has been provided by Wilen and Richardson, who documented the operational changes and the effect on output of finished products during the first year of rationalization in the Alaska pollock factory trawler fleet. This article documents the changes that occurred between the last year of derby fishing and the first year of operation under the American Fisheries Act.

[6] George Stigler, *The Theory of Price*, 14 (1969).

> New rents were generated by tuning the fishing operations and coordinating harvesting operation with the onboard processing plants. In the initial year of cooperative fishing, daily catch rates were only forty percent of those recorded by the same vessels over the 1995-1998 seasons. Catch per haul was twenty-seven percent lower and the number of hauls per day dropped by forty-five percent. The length of the 1999 A-season was doubled compared with the 1998 season because of these substantial reductions in daily catch.
>
> [In the last year] before cooperative fishing, total product recovery rates averaged 19.5 percent. In the first year of cooperative fishing, total product recovery shot up to 24.6 percent, exceeding the increases anticipated by most knowledgeable factory managers.[7]

Silvia *et al.* conducted a similar study of the Pacific Whiting catcher processor fleet documenting the rapid transition that occurs from a race-to-fish regime to a rationalized fishery.

> The PWCC agreement also resulted in significant improvements in product recovery or yield, producing more food from each pound of fish landed. Product recovery rate or yield is the ratio (expressed as a percentage) of the weight of raw processed product relative to landed product. Prior to the formation of the cooperative, catcher-processors achieved on average a 17.2 percent yield in surimi operations. In 1998, the first full year under the harvest cooperative, catcher-processors were achieving an average yield of 24 percent. Based on 1998 landings, this equated to over ten million more pounds of food from the same number of fish (APA, 2003). While engaged in the "race-for-fish," vessels had prosecuted the fishery at the highest possible speed without taking the time to consider product quality or output quantity. Inferior quality and low product recovery rates were simply necessary trade-offs given the time constraints of a race for-the-resource management system. Rationalizing the fishery allowed the vessels to prosecute the fishery at slower speeds and choose the time and location of fishing that would optimize returns. It allowed fishers to search for schools of larger and higher quality fish that generated higher yields than smaller fish (APA, 2003). It also motivated vessel owners to invest in equipment that would improve product yield and quality rather than simply maximize capacity for rapid throughput.[8]

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[7] Wilen, James, and Richardson, Ed, *Rent Generation in the Alaskan Pollock Conservation Cooperative,* FAO Technical Paper, 504 Case Studies in Fishery Self-Management (2000).

[8] Silvia, G., Munro Muin, H., and Pugmire, C., *Achievements of the Pacific whiting conservation cooperative: rational collaboration in a sea of irrational competition,* FAO technical paper 504, Case Studies in Fishery Self-Management.

The differences here are not trivial. The differences in yield indicate that the race-to-fish induced the industry to waste 1.7 pounds of raw fish per pound of finished product. The ten million pounds of additional product produced by the cooperative would have a value $10,580,000 per year at current Pacific whiting surimi prices.

3. Under-investment in conservation.

The third, and potentially most damaging, mechanism through which a derby fishery destroys wealth is that it provides economic incentives that can, and do, lead to the destruction of the resource upon which the fishery is based. This is consistent with both microeconomic theory and numerous empirical studies.

Derby fisheries provide insufficient incentives for conservation on the part of the industry.[9] In a situation where it is desirable to temporarily reduce the catch in order to facilitate a large increase in the annual harvest at some time in the future, existing fishermen often resist the conservation programs on perfectly rational grounds. While they must bear the entire cost of the reduced landings, they are forced to share the benefits of such a conservation program with the owners of however much additional capital that enters the fishery in order to share in the increased quota made possible by the industry-wide investment in conservation.

Imagine a shrimp fishery that had one hundred boats in an open access equilibrium harvesting ten million pounds of shrimp per year. Suppose the fishery managers proposed a two-year closure after which, when the fishery re-opened, the TAC would double. Even if the fishermen had one hundred percent confidence the TAC would double after the two-year closure, they would likely oppose this proposal because they would know that the additional ten million pounds of shrimp would attract one hundred additional boats. They would pay all the costs of the conservation effort, yet the benefits of that effort would be shared with the new boats, leaving them no better off than they were before they "invested" in the conservation effort. In fact, they would be worse off after accounting for the costs of a two year hiatus in revenue. Two of the authors here used the term "Rational Myopia" to describe and explain the apparent paradox of the fishing industry opposing fishery conservation in a 1994 presentation to the Western Economic Association.[10] The industry's rational hostility toward conservation promoting regulation is translated through a process well documented by Stigler,[11] Buchannan and others. It is referred to as "regulatory capture,"[12] where

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[9] http://www.economist.com/node/21548240, http://www.economist.com/node/21548212, The Economist, Feb 2012. See also, Costello, Christopher, *et al.*, *Can Catch Shares Prevent Fisheries Collapse?,* Science 321, 1678 (2008).

[10] Kochin, Levis A. & Riley, Christopher C., *The Changing Political Economy of Fishing: Efficient and Expedient Regulation Under ITQ and Open Access,* Western Economic Association Annual Meeting (July 1994).

[11] Stigler, George J., *The Theory of Economic Regulation*, The Bell Journal of Economics and Management Science Vol. 2, Issue 2 (1971).

the political process delivers a regulatory policy that is tailored to the economic interests of the regulated. When these interests are the necessarily short-term concerns of an industry regulated under a derby fishery, the results can be catastrophic for the resource.

Once the resource has collapsed, these perverse incentives tend to hold fisheries in an economic, political and biological trap, from which there is seemingly no escape. This process is referred to as "Ludwig's ratchet," which is frequently used to describe the situation in the New England Groundfish fishery.[13]

The Social Benefits of a Rationalized Fishery

The term rationalization, when used with respect to fisheries, is used to mean conversion to some sort of a catch share program. As mentioned earlier, the theoretical case for this was first made by Scott in 1955. Catch share programs mimic the prescription of Scott with the exception that the rational sole owner is replaced by a group of quota holders with a financial interest in the health of the stock. This reverses the negative effects of Stigler's "regulatory capture" in that the quota owners will support increased conservation instead of excessive harvests. The combination of the rational interest of the quota holders and the final decision making power of the government functionally satisfies Scott's condition of "sole ownership."

In a catch share program, the TAC is allocated largely among fishery participants on a percentage basis. This quota share gives its owners the right to harvest a certain share of the TAC, eliminating the problems with derby operations at their source. Quota owners have every incentive to squeeze the maximum amount of value from each ton of round fish, which is behavior consistent with efficiency. Those same firms operating under a derby structure had an incentive to derive the maximum financial benefit out of every hour available during the fishing season, which is the behavior described by the term expediency. Fishery managers now generally understand that rationalization of fishery resources is essential to maximize efficiency.

Derby fisheries also cause more difficultly in addressing bycatch issues for two reasons. It is for practical purposes impossible to devise a rational allocation of individual bycatch quota in the absence of a pre-existing allocation of target species quota. Second, the high premium placed on fishing time by the derby raises the cost of bycatch avoidance and thereby causes higher bycatch than would be the case in a rational fishery where the incentives are such that the fleet maximizes margins per ton of the target species rather than margins per day.

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[12] Dal Bo, Ernesto, *Regulatory Capture: A Review*, Oxford Review of Economic Policy, Vol. 22 Issue 2. http://faculty.haas.berkeley.edu/dalbo/Regulatory_Capture_Published.pdf

[13] Hennessey, T., and Healey, M., *Ludwig's Ratchet and the Collapse of the New England Groundfish Stocks* Coastal Management, 28:187-213.

This is not to say that any program bearing the label "rationalization" or "catch share" automatically provides all the economic efficiency that would be provided by a sole owner of a fishery resource. In some rationalized fisheries, there are additional constraints on quota ownership and transferability with goals other than economic efficiency in mind. These additional constraints weaken property rights and do not come without a cost.[14] Grainger and Costello, for example, have shown that the strength of the property right granted in a catch share program is positively correlated with the biological health of the fishery involved.[15]

II. Catch Share Programs: The Initial Allocation Problem

As Hannesson[16] has lamented, the typical progression of fisheries here and throughout the world is that we tend to wait until a fishery is overcapitalized—through the uncontrolled entry process inherent in a derby fishery—before attempting to impose a catch share system. The fact that we tend to wait until a fishery is overcapitalized complicates the initial allocation process enormously. Because a conversion to catch share management has usually involved allocation of quota to those with investment in the fishery, any perception that a quota allocation is imminent causes firms in the industry to "invest" in an effort to maximize their catch history that will be used for determining their respective allocations. The first impact of a move toward rationalization, therefore, is to make the existing overcapitalization problem worse.

Control dates

A control date announcement is an Advanced Notice of Proposed Rulemaking that must be voted on by a council, approved by NOAA and published in the Federal Register. Control dates are not legally binding.[17]

The control date announcement has two components: (1) Notice that a council is considering developing a catch share program; and, (2) a date, after which fishery participation may not be utilized in the calculation used in the final allocation of quota. With respect to their influence on investment decisions, these two components work at cross purposes with one another. The announcement that the Council is considering a catch share program stimulates the very problem (investment and behavior that increases industry capacity), that rationalization programs are intended to prevent. The specification of the date, which is usually essentially coincident with a

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[14] Environmental Defense Fund, *Catch Share Design Manual*, 2010.

[15] Grainger, Corbett A., and Costello, Christopher, *The Value of Secure Property Rights: Evidence from Global Fisheries,* NBER working paper, 1709 (May 2011).

[16] Rognvaldur Hannesson, *The Privatization of the Ocean,* MIT press, p. 172.

[17] http://www.pcouncil.org/resources/archives/control-dates/

council's action to begin development of a catch share program, is meant to ensure that the industry understands that the time for expansion of capacity for the purpose of capturing fishing rights may have ended, and so discourages further investment in capacity.[18] The control date serves to provide the industry with information useful in the formation of reasonable expectations.

If the industry believed universally that the date cited in the announcement was in fact a perfect predictor of the last day of fishery participation that would be considered for the allocation, investment and operating strategies, for the purpose of maximizing fishing history would cease immediately. If the industry believed that the date itself was completely irrelevant to the final decision on qualifying dates, the race-to-fish for quota would be exacerbated. Under the Magnuson-Stevens Act (MSA) a regional fishery management council is able to select years of history for purposes of allocating quota under a catch share plan that are later to, *or previous to*, the control date. We however are unaware of any instances where the end of the qualifying period was set prior to the date announced in the control date announcement.

Even if there were zero capacity enhancements after a control date was published, there would still be differences in the distribution of harvests in the period from the control date announcement to implementation of a catch share program. Randomness alone will always produce variation in relative catch shares between two distinct time periods. For example, the biomass could move closer to a particular port. This would affect the distribution of the catch history, but would not in any way alter the distribution of invested capital that the proxy of catch history is attempting to measure.

If these differences between the distribution of harvesting and processing participation are treated as a legitimate reason to move the years used for allocation of quota to a time after the control date, an economically destructive feedback loop will be created. Some firms will realize that investing in additional capacity after the control date would cause the years used for determination of quota allocation to move forward. These firms would speculatively invest in capacity enhancement, or increase the intensity of their operations. Other firms will realize that respecting the control date would result in a loss of quota they would otherwise have received, and they would also invest in capacity enhancement, or increase the intensity of their operation in order to protect their initial allocation position. Firms that choose to ignore the control date could be expected to exert political pressure and take legal action to have the years used to determine initial allocation of quota to include a period after the control date in order to "better reflect the pattern of current harvests." Instead of providing notice to the industry that increases in relative harvest after the publication of a control date may not result in the allocation of quota, a control date would instead become the starting gun on an intensive "race-to-fish" not for fish, but for something far more valuable: quota.

[18] Pacific Dawn, LLC. v. John Bryson, Summary Judgment, Dec 22, 2011; http://www.pcouncil.org/resources/archives/control-dates/

The rationale behind the initial allocation of quota in a catch share program system
A central problem in rationalizing a fishery is the initial allocation of quota, yet very little thought or analysis has been given to the rationale behind the initial allocation of quota when an overcapitalized fishery is rationalized. In industrial, capital intensive fisheries, historically allocations have been given to owners of capital in the fishery; typically vessel owners and, since the American Fisheries Act was enacted in 1998, processing plant owners have also received rights when the fishery is rationalized. In resolving the problem caused by the initial allocation of quota, it is important to understand the rationale behind the allocation of quota to owners of capital in the fisheries.

1. Why not hold an auction?
The MSA allows for an auction of the fishing rights.[19] At first blush an auction seems sensible. Our nation's fishery resources belong to the general public.[20] So why allocate fishing rights to private entities at all when the fish actually belong to the general public? An auction, it turns out, would be financially devastating to an industry participating in a fishery, when that industry is both capital intensive and as grossly overcapitalized as was the Pacific whiting industry. An auction would in fact be an expropriation of the value of investments made in the fishery without compensation.[21]

In order to understand the economics of this, it is useful to imagine a situation where the quota holder has no investment in the capital involved in the fishery. This allows for a clear analysis of the financial consequences of rationalization on the recipients of the quota, and the owners of the non-malleable physical capital dedicated to the fishery. If the rationalization occurs in a fishery operating under a license limitation system in economic equilibrium, with a level of capitalization twice what is optimum for the fishery, a fishing vessel-owning firm would be earning, on average, the market return on investment on its vessel. The same can be said for the owners of processing facilities. Immediately upon the beginning of operations under the catch share program, however, these owners of fishery-related capital will see the return on their investment fall to zero. This cannot be avoided and is, in fact, absolutely necessary in order to de-capitalize an overcapitalized industry. The owners of the physical capital cannot expect to realize any return on their investment until the excess capital stock is depreciated to the point where it is at the optimal level for the

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[19] Riley, Christopher C., and Plesha, Joseph T., *Allocations of Harvesting Quota in the Shore-based Whiting Fishery*, p. 4 (Nov. 2008). http://www.pcouncil.org/bb/2007/1107/D7h_PC.pdf

[20] The United States claims sovereign rights over all fish within the United States exclusive economic zone, 16 U.S.C. §1853a.

[21] Plesha, Joseph T., and Riley, Christopher C., *The Allocation of Individual Transferable Quotas to Investors in the Seafood Industry of the North Pacific*, (Jan. 1992). See also, Matulich, S.C., Mittelhammer, and Reberte, *Toward More Complete Model of Individual Transferrable Fishing Quotas*: *Implications of Incorporating the Processing Sector,* Journal of Environmental Economics and Management, Vol. 31(1) 112-28 (1996).

recently rationalized fishery.[22] Another part of this loss is actually a transfer of wealth from owners of vessels and processing facilities to quota holders.[23]

The mechanism at work here is that, by definition, the overcapitalized fishery has much more capital and hence daily harvesting and processing capacity than is necessary to prosecute the fishery when it is rationalized. A quota holder would not need to own a boat or a processing plant in order to participate in a fishery. If a quota holder decides to participate in the fishery, it could simply hold a reverse auction[24] among fishing vessel owners. The vessel owners would bid the price of "fishing services"[25] down to the point where the "winning" boat just covered its variable costs. The quota holders would then proceed to secure processing services with the same result. The "winning" bid for processing services would cover only the variable costs of production. The quota owners would temporarily own not only the fish in the fishery but also usufructuary rights to all the non-malleable physical capital used to harvest and process those fish. This situation, where the quota holders enjoy free-of-charge use of physical capital, continues until the capital stock wears out to the point where only the appropriate amount remains (i.e., when a fishery is no longer overcapitalized). One model produced that was loosely based on the Pacific whiting fishery estimated that the direct impact of such an allocation would result in the loss of over ninety percent in the value of non-malleable capital assets in both the harvesting and processing sectors.[26]

This explains the fact that owners of the physical capital in a fishery that will be devalued by rationalization are among the fiercest opponents of any attempt to rationalize a fishery where the owners' losses are not expected to be compensated for with an initial allocation of quota. In short, no one with capital investments in vessels or processing plants would support a simple auction of the resource, given that they understand that much of value of their boats or plants would be expropriated without compensation, and sold in the auction.

Fishery managers in the U.S. and elsewhere have solved this problem by allocating the fishing rights to those firms that can be expected to suffer the loss in capital value that results from rationalization.

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[22] Ibid.

[23] Ibid.

[24] In a reverse auction, the sellers compete to obtain business from the buyer and prices will typically decrease as the sellers undercut each other.

[25] "Fishing services" as defined here refers to a fishing transaction wherein the contract is made on a services rendered basis rather than the traditional price per pound basis. In other words, "fishing services" includes locating, capturing, and delivering fish to a specified location.

[26] Riley and Plesha, *supra*, p. 13.

There is no question that the U.S. treasury, in the short run, and neglecting consequential effects, would be better served by an auction than it would be by a direct allocation to private entities. This is not to say that such a decision would be socially optimal. The first reason to choose a direct allocation to those private entities that would otherwise be the losers in the process relies on the same regulatory capture mechanism described by Stigler,[27] which is to say that regulations often reflect the economic interest of the regulated. It is therefore more probable a fishery will be rationalized if the impacted industry is supporting the process instead of opposing it.

A second, and perhaps more compelling reason exists for the fact that in most catch share programs involving capital intensive, large scale fisheries, the quota is not allocated by auction, but is instead granted nearly exclusively to the owners of capital. A public auction would present what is known as a "time inconsistency" problem. The essence of a time inconsistency problem is that what may seem to be an optimal decision based upon a simple calculation of costs and benefits, may not yield the optimum choice because such calculations do not take into account the effect of the decision on future behavior of the economic actors. The existence of such problems has been reflected in decision-making conventions for centuries. The legal principle of *Stare Decisis* is an example.

> All Courts rule ex-post, after most economic decisions are sunk. This might generate a time-inconsistency problem. From an ex-ante perspective, Courts will have the (ex-post) temptation to be excessively lenient. This observation is at the root of the principle of stare decisis.[28]

Finn E. Kydland and Edward E. Prescott published an article in 1977,[29] *Rules Rather Than Discretion: The Inconsistency of Optimal Plans,* which formalized this concept and provided a mathematic description of its effects on optimal decision making. This article was a central part of the work for which they were awarded the 2004 Nobel Prize in Economics. In this article they provide an example of the "time inconsistency" problem from patent law.

> A second example is patent policy. Given that resources have been allocated to inventive activity which resulted in a new product or process, the efficient policy is not to permit patent protection. For this example, few would seriously consider this optimal-control-theory solution as being reasonable. Rather, the question would be posed in terms of the optimal patent life (see, e.g., Nordhaus, 1969), which takes into consideration both the incentive for inventive activity provided by patent protection

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27 Stigler, George J., *The Theory of Economic Regulation*, The Bell Journal of Economics and Management Science, Vol. 2, Issue 2, 3-21 (1971).

28 Felli, Leonardo, Anderlini, Luca and Riboni, Alessandro, *Why Stare Decisis?,* CEPR Discussion papers, 8266. Centre for Economic Policy Research, London, UK (2011).

29 Kydland, Finn E., and Prescott, Edward E., *Rules Rather than Discretion: The Inconsistency of Optimal Plans,* (1977).

> and the loss in consumer surplus that results when someone realizes monopoly rents. In other words, economic theory is used to predict the effects of alternative policy rules, and one with good operating characteristics is selected.

A proposed alteration of existing patent law, which is analogous to distributing the fishing rights of the whiting industry, would be as follows: Congress passes legislation that cancels all existing patents and pending applications, however, the law does not affect in any way future patent applications. Future developers of new technology, however, would remain fearful that Congress would again cancel all new patents at some future date, thereby greatly decreasing the incentive to make investments necessary for future invention.

If the federal government auctioned the resource, the entire net present value of the resource would be transferred to the nation, as would the net present value of the excess non-malleable capital. In an allocation to private entities the U.S. Treasury would still receive tax revenue in perpetuity from the resource, which would be roughly equal to thirty-five percent of the net present value of that resource. Far more importantly, while an auction of fishing rights is legal under the MSA any benefit to the Treasury would be offset as a consequence of the increase political risk attached to, and premium demanded for, any future investments in the United States.

2. Criteria for initial allocations to private entities.

Assuming the allocation will be made primarily to the industry itself, the first question is what entities within the industry should get quota, and why should these entities receive quota? What public service have these entities provided, or what financial losses would these corporations experience as a result of rationalization?

The MSA applies to every federally managed fishery. It provides managers with a wide range of alternatives in the allocation decision. It requires that a council formally consider a large number of parameters across the history of the fishery before making a recommendation as to the rules that define the actual allocation. These include ecological, economic and sociological considerations. In small scale, artisanal, labor-intensive fisheries, sociological concerns — and therefore the personal participation of crew members — may trump those of economic efficiency. In large scale, industrial, capital intensive fisheries such as Alaska pollock, the allocation is received by those with investments in the fishery. In some fisheries the allocation is split between the investors in capital and labor. In all these allocations, however, landing history has been used as the proxy for estimating relative amounts of participation or investment. *"Often, allocation is based on catch history as many in the fishing industry view their history as a <u>quantifiable</u> and <u>verifiable</u> <u>proxy</u> for participation and investment."*[30]

[30] Establishing Criteria for IFQ programs Managing Fisheries, 2005 (emphasis added). http://www.managingfisheries.org/2005/backgrounders/establishing.pdf

The quality of investments

The purpose of initial allocations of quota to the investors of harvesting and processing capital in a fishery is to compensate those investors for the loss of value their investments will suffer when a fishery is rationalized. Otherwise, why allocate quota to the private entities (typically corporations) that own the processing plants or harvesting vessels? The corporate entities that own fishing vessels, for example, have never harvested a pound of fish. We define quality of investment, therefore, to mean a particular investment's relative fitness for qualification in a program that compensates for the expected loss in value that is a necessary by-product of the rationalization process.

We propose here a two dimensional method for rationally evaluating the quality of investments, these being: (1) the contribution made to society by the investor at the time the investment was made; and (2) the consideration due a particular investor as a result of reasonable expectations regarding quota allocations that the investor had at the time a decision to make, or not make, an investment in capacity.

1. Societal impact.

We classify investments into two categories: socially positive and socially negative. We base this evaluation on the conditions which existed at the time the investment was made. Those that were made prior to the point where the industry was capable of harvesting and processing the entire TAC resulted in an increase in final production from the fishery, and consequently had a positive societal impact. The initial private returns on these investments must have been at least high enough to justify the risk as evidenced by the fact that the fishery was fully capitalized relatively rapidly. These capacity investments resulted in the utilization of additional fish and did not simply redistribute the utilization from the already existing industry to the investors in new capacity. Those capacity investments that occurred after the full U.S. utilization have a negative economic impact on society as the landings attributable to the new investment come one hundred percent from the landings attributable to previous investments. The first component of societal loss is the value of resources that were diverted away from productive uses to a use that produces zero or less than zero additional product. Additional loss results from the shortening of the fishing season and the fact that additional negative social value investment in capacity causes an equal amount, in capacity terms, of negative value social investment in the processing sector. Of course this also works in reverse. New investment in processing capacity also causes additional investment in harvesting capacity.

2. Basis for reasonable expectations.

Reasonable expectations are *"Those spoken and unspoken understandings on which the founders of a venture rely when commencing the venture."*[31] We restrict this to the relative level of expectations that the utilization history resulting from a particular investment would, or would not be included in the allocation calculation. The basis we use for these expectations is limited to official actions by

[31] Kaplan v. First Hartford Corp., 484 F. Supp. 2d 131, 147 (D. Me. 2007).

a council or the agency. These range from a *tacit* indication that the management authorities believed that additional capacity would be harmful, such as the imposition of the license limitation, to the *expressed* (a publication of a control date), to the *unequivocal,* in the form of final council action. Using this definition, relevant expectations began in 1994 with the adoption of the license limitation program in the Pacific whiting fishery.

When a firm pursues a strategy of not increasing, or actually decreasing its participation, it has done so with some level of expectation that the decrease in relative participation will not be punished with a loss of fishing rights with a value that exceeds its private financial savings of that strategy. Reasonable expectations are complimentary. When a firm pursues a strategy of increasing its relative participation it has done so with some level of expectation that the increase in relative participation will be rewarded with a grant of fishing rights with a value that exceeds its private financial cost of that strategy. Any regulatory action that encourages the industry to increase capacity after the publication of a control date must also discourage those contemplating acting in furtherance of the goal of the fishery managers by refraining from actions that increase the speed of harvesting and processing.

A council typically takes no actions that would affect expectations regarding limiting entry until after the fishery is fully utilized. Actions that tacitly discourage additional investments consequently take place during the time period when additional investments produce a negative societal contribution. It is therefore possible to construct a rank-ordered grading of investment quality (see next page for detail) as the creation of reasonable expectations (as we define them here) occur after the time when the capital deployed in the fishery has exceeded that which is socially optimal.

3. Investments that are not devalued by rationalization.

As stated earlier, after a council has determined the broad definition of the class of potential grantees and the algorithm to be used to divide the allocation among the class of investors, it must decide the limits that define the history that will be used in the final allocation calculation. This must be done in consideration of the National Standards and other relevant factors in the MSA. Compensation for what would otherwise be a regulatory expropriation provides the rationale for choosing a direct allocation to private investors in the industry over an auction. It would seem necessary to first try to exclude from this quality evaluation those investments that will not be stranded, i.e., significantly devalued as a result of the rationalization process.

We have heard it argued that a shore-based plant may be more dependent upon the receipt of quota because the Pacific whiting fishery has moved closer to it while the Pacific Council was making its final allocation decision and the Secretary was reviewing and approving the Council's recommendation.

A superior location for a shore-based plant would translate into a relatively lower cost of fishing services as a vessel would spend less time and burn less fuel in delivering fish to such a plant. A superior location does not get "stranded" when a fishery is rationalized and an award of quota based upon such a fortuitous development is therefore inappropriate. If the distribution of a stock of fish moves toward a plant, an award of quota to such a plant for suddenly having fish nearby is actually perverse, as the lucky plant would merely be a reward for its good fortune, with the costs paid for by those who had bad luck.

Summarily, we have heard it argued that a processor invested in new technology that made it more efficient and therefore it needs to be rewarded with allocations of quota even if those investments were made well after the fishery was fully utilized and a control date published. The claim of new technology is debatable (given the well-known methods of processing groundfish such as Pacific whiting), but let us assume the claim is true. If a processing plant developed a machine that resulted in twenty percent more revenue from each pound of raw whiting delivered to it (or a vessel invested in a net that increased efficiency in harvesting by twenty percent over other vessels) the investment in new technology would *not* be stranded when the fishery is rationalized because that processor would only have to pay what other processors pay for the rationalized whiting delivered to its plant would still achieve twenty percent more revenue from each pound delivered. The investment in this new technology would receive a return equal to that which it earned in the derby fishery and therefore does not require compensation through the allocation of quota.

Capacity Investment "Grades"

We have graded the capital investments in the fishery in order of their impact on benefits to society and reasonable expectations of those making the investments. Those grades are as follows:

Grade A: Net-beneficial to society. Investments in a vessel or processing plant that result in additional harvest. These investments also produce a variety of un-quantified positive externalities not captured in accounting measures, including non-proprietary technical development and furtherance of a national goal. For example, a vessel will try four different trawl nets before finding the one that is most efficient and then the net supplier will sell the efficient net to other vessels who invested nothing in the costly experimentation that lead to the identification of the more efficient method.

Grade B: Net-harmful to society. Investments made in a vessel or a processing plant that do not result in additional harvest, but only a redistribution of the harvesting or processing that already existed in the fishery, but where there is an absence of any *tacit* or *explicit* discouragement by the management authority to make investments in the fishery.

Grade C: Net-harmful to society. Investments in the fishery made in the presence of *tacit* discouragement (i.e. license limitation program) by the management authorities.

Grade D: Net-harmful to society, made subsequent to *expressed* discouragement (i.e., publication of a control date) from the management authorities.

Grade E: Net-harmful to society. Investments in the fishery made subsequent to *unequivocal* discouragement from the management authorities (i.e., publication of final council action). These investments must be of the type that will likely be stranded due to rationalization.

Fishing and Processing History as a Proxy for Capital Investments

To say the least, it would be extremely difficult to objectively measure the amount of capital value that each entity in a fishery would lose in rationalization. Therefore, fishery managers have settled on using "fishing and processing history" as a proxy for the stranded capital losses expected by current participants in the derby fishery.[32] This proxy should work well so long as the term "history" is properly defined and taken seriously by all participants. If the industry were to believe that "history" might at least in part occur in the future, after the announced control date, the current derby participants would have the incentive to race-to-fish for quota. This behavior would dissipate much of the societal gain that can be expected from fishery rationalization. The race-to-fish for quota is not necessarily a race involving capital stuffing and new processing plants. The participants in this race have the incentive to create fishing history in the least expensive manner, which includes the use of intensive fishing and processing.

Stale control dates

One concept that has received some credence in this debate is that if, after the setting of a control date, an "unreasonable" amount of time elapses before final action, this will allegedly cause damage to some firms. A remedy that has been suggested is that a "stale" control date must be abandoned to avoid causing some unspecified form of damage. We have been unable to find the logic behind the concept of staleness. How is net social utility negatively affected by the aging of a control date? We assert that the aging of a control date does not and cannot cause economic damage. We discuss the simple and most extreme case where a control date is published and, for whatever reason, a council never reaches final action.

Control dates are not legally binding, but they do impact reasonable expectations of the industry that has invested in the fishery, or is considering investing in the future. For at least the past twenty years, industry has always been aware that there was some possibility that it was operating in a time period that could possibly be part of "history" that would one day be converted into allocations of quota. The sort of conditions that prompt a council to take such action would have been obvious to the industry years before, and it is certain that this would have had some simulative effect on capital investment and operating behavior. It is, therefore, safe to say that on the day a control date is published, a fishery is more overcapitalized than it would have been if the

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32 Stranded capital is physical capital that has been substantially reduced in value due to a new regulation, policy or statue.

concept of catch share management had never been invented, simply because essentially all control dates are announced during a low-grade, race-to-fish for quota.

On the day a control date is announced, additional investment in socially harmful capital investments for the purpose of capacity enhancement is at least partially suppressed. Socially harmful and human-life endangering operational "investments" for the purpose of capturing a greater share of the eventual allocation are also suppressed. Overcapitalization and risky operational behavior are the problems we are trying to address with a catch share program. Society begins collecting partial returns in the form of reductions in potential overcapitalization as soon as the control date announcement is made.

If the industry is certain that the allocation will not be made on the basis of any landings after the control date, the suppressive effect of the control date is immediate and complete. The race-to-fish for quota ends. As long as the industry continues to believe with one hundred percent certainty that no allocation will ever be made using history after the control date, the fishery would de-capitalize through depreciation (wearing out) of the physical capital. Capacity would decline by attrition, as major maintenance projects on capital that will soon be surplus are curtailed. Disinvestment will continue until total capitalization is equal to what it would have been in an ordinary race-to-fish derby. As long as the control date is perfectly durable, the time it is expected to take for final action, or the length of time it actually takes (even if this is literally forever), does not reduce this suppressive effect one iota.

The existence of the concept that the rationalization process may take so long that the old control date *must* be abandoned (i.e., a council cannot consider qualifying years for quota to end on a date at or before the published control date) increases the expected probability that actions and investments with an effect of increasing the relative share of landings by a firm will be rewarded with an increase in the amount of quota allocated. Any credence given to the concept of perishable control dates is harmful to society, in that it encourages and causes more anti-social behavior (and discourages and causes less pro-social behavior) than would otherwise be the case on the part of the industry, and so exacerbates the very problem that catch share management is designed to suppress.

We believe that, given the time needed to complete the Fishery Management Plan procedure as required in the MSA, realization of the full benefits of rationalization and the existence of perishable control dates are mutually exclusive. Any attempt to rationalize a fishery that eventually fails, where a control date existed that was believed to be perishable, will certainly leave the fishery even more overcapitalized than it would otherwise have been if the managers had simply allowed a continuation of a derby fishery.

III. Fishery Development in the United States EEZ and Ranking of Investments in the Pacific Whiting Fishery

In order to illustrate the economic evolution inherent in the fishery development process and the regulatory responses to that evolution, we have divided this process into five phases. In Phase I, we present the initial exploitation as it occurred in Pacific whiting specifically, as the initial exploitation of whiting occurred in a way for which there is no precedent or general case. In Phases II-V, we first discuss the general fishery development case, which is followed by comment on the specific case of the Pacific whiting fishery.

Phase I: Initial Exploitation and Development (1976-1992)

The development of domestic utilization of the Pacific whiting fishery began with passage of the MSA (then called Fishery Conservation and Management Act) in 1976. This law asserted the United State's right to manage the fisheries within 200 miles of shore. At the time of this law's passage, the Pacific whiting fishery was exploited by factory trawlers from the Soviet Union and Japan. A stated goal of the MSA was to encourage the domestic fishing and processing industry to develop the skills and invest the capital necessary to convert these fisheries from foreign into domestic operations. This goal soon developed the moniker "Americanization." The MSA established preference for U.S. fishermen, meaning that the amount of the TAC that was available for foreign fishing fleets was the remainder of the TAC, after that which the U.S. fleet was able to harvest was subtracted. Congress, with passage of the MSA, had made the Americanization of the fisheries a national goal.

In 1976 the U.S. seafood industry had neither the equipment nor the expertise to exploit these newly available resources. The Pacific whiting industry, and most of the other trawl-caught groundfish industries that were opened up by the MSA, grew by taking over the harvesting, then the processing and then the marketing of the target species. The first step was a joint venture fishery with the U.S.S.R. that began in 1978. In this operation, U.S catcher boats caught the fish and then transferred them (while they were still in the cod-end) to the Soviet ships for processing and freezing.

The financial returns were sufficient to attract vessels into the fishery quickly. Within four years, the U.S. fishing fleet catch grew from 856 MT in 1978 to 72,100 MT in 1983, the first year when one hundred percent of the harvest was caught by U.S. vessels.[33]

The development of processing capability proceeded at a much slower pace than the harvesting sector. Some of the difficulty was due to the fact that the conversion of existing processing assets was much more complicated than the conversion of crab boats and bottom-trawlers to mid-water trawlers.

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[33] Nelson, R.E., Marine Fisheries Review, Vol. 47(2) 39-41 (1985).

In 1978, Congress, after "reaching an understanding that mere assertion of jurisdiction was not enough to 'Americanize' the fishery,"[34] passed the Processor Preference Amendment that gave preferential claim on the TAC to operations where both the harvesting and the processing were accomplished by U.S.-controlled firms.

In I980, Congress passed the American Fisheries Promotion Act, which provided for research and development of new products and processes, a vessel loan guarantee program and established Fishery Trade Officers within the State Department.

In 1988, Congress passed the Anti-Reflagging Act, which prohibited the reflagging of existing foreign process ships and tightened ownership and manning restriction for ships operating in U.S. fisheries. The following quote from the Federal Register documents the contribution of this statute to the overall goal of "Americanization."

> Eleven years later another step was taken to further Americanize U.S. fisheries. The Commercial Fishing Industry Vessel Anti-Reflagging Act of 1987 required U.S. citizens to own and control more than fifty percent of any U.S.-flag fishing vessel. As the last of the foreign-flag fishing vessels in U.S. fisheries were being replaced by U.S.-flag vessels in 1986, federal law did not require U.S. fishing vessels to carry U.S. crew members.[35]

Investments made during Phase I would all qualify as grade "A" under our criteria. The following evidence justifies this assertion:

- New entry resulted in additional fish utilized so that the private return to investors was not simply a transfer of income from the pre-existing industry where the return on investment is automatically and completely offset by a reduction in the returns to the pre-existing fleet. The rapid pace of development is consistent only with a high return on investment, substantially above market rates of return. The fact that entry continued at a rapid pace after 1992 is further indication that return on investments were above the market rate of return, a condition which defines an investment with a net national benefit.
- Firms investing in the whiting industry were furthering a national goal.[36] This was clearly expressed in five separate pieces of legislation. Furtherance of a national goal is a societal benefit.

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[34] Greenberg, Eldon, Presentation at the Eighth Marine Law Symposium Roger Williams University School of Law Bristol, Rhode Island (Nov. 4, 2010).

[35] https://www.federalregister.gov/articles/2000/07/27/00-18941/citizenship-standards-for-vessel-ownership-and-financing-American-fisheries-act

[36] *Handbook of Marine Fisheries Conservation and Management*, R. Quinton Grafton ed., Governance of Fisheries in the United States, Chapter 29, Daniel S. Holland, Oxford University Press (2010).

- The firms that first entered into and developed this industry, as is the case in nearly all manufacturing, developed the necessary non-propriety technology and human capital. This resulted in a positive externality.

Phase II: **Rent Dissipation through Entry of Additional Capacity (1993-1994)**
So long as *above* market *average* returns still exist at the time when the fishery is fully developed, entry will continue despite the fact that the *marginal* rate of social return will be negative when the fishery is limited by a TAC rather than a lack of capacity.[37] Entry will continue until average returns fall to the market rate, or until the fishery is otherwise limited through some sort of effective limited entry program. It should be noted that "return on investment" includes, in addition to the receipts for raw fish or fishery products, the perceived value of fishing history in any future limited entry or catch share program. The negative marginal rate of social return on capacity investments when the fishery is fully developed means that such investments impose a net cost on society because the capital so used produces nothing whilst it could have produced goods and services with value equal to the market rate of return if deployed elsewhere in the economy. However, this is not the only source of the societal loss. Another component of loss is the fact that increased capacity shortens the season, which in and of itself increases costs and reduces the total value of finished products.

Entry of catcher vessels into the Pacific whiting fishery ended in 1994 with the imposition of the license limitation program, though entry continued through capital stuffing. There was no limited entry in processing capacity. This is important because when a new processor enters the fishery, it tends to increase the demand for raw fish and thus pushes the ex-vessel prices up, thereby fueling the demand for additional harvesting capacity, which in turn causes further capital stuffing and more intense fishing activity.

We consider investments made in this period to be grade "B" in that they did not result in an increased harvest or utilization of Pacific whiting, but where there is an absence of any *tacit* discouragement by the management authority to make investments in the fishery.

Phase III: From License Limitation to Catch Share Management: Before Final Control Date (1994-2003)
As mentioned earlier, new license limitation programs are now generally seen as an interim step between open access and a catch share fishery management program. The fact that imposition of a license limitation program is now seen as a signal that a fishery will be converted to a catch share system provides an additional incentive for new, and at the margin, socially harmful increases in

[37] The negative marginal rate of social return is primarily due to the fact that private returns of a new entrant completely and exactly cancel out returns earned by the fleet that existed prior to the entry of a new vessel, or a capacity added to an existing vessel. This is significantly exacerbated by shortened fishing seasons and an increase in cost in both harvesting and processing sectors, along with a reduction in finished product value.

capacity. There can be no dispute that a low intensity race-to-fish for quota was occurring at least as far back in time as the 1994 start of the license limitation program.

Capital stuffing in pursuit of increased daily capacity under a license limitation program has a negative societal value whether the motivation for such investment is maximization of current income or the capture of future fishing rights. Socially harmful investments in fishing power can be augmented with operational investments such as fishing for immature lower-priced fish if the Catch Per Unit Effort (CPUE) on the immature, lower, or even zero-priced fish is high enough so that the perceived value of the history earned offsets the lower price of fish.

Although it is not legally binding, a control date draws a bright line in time beyond which the industry can have no reasonable expectation that increases in their relative harvest or processing history will be reflected in increases in their share of quota under any future allocation. The first control date announced by the Pacific Council was 1998. This was published during that year in the Federal Register. The verbatim announcement follows:

> The Pacific Fishery Management Council (Council) is considering whether there is a need to impose additional management measures to further limit harvest capacity or to allocate between or within the limited entry commercial and the recreational groundfish fisheries in the U.S. exclusive economic zone off the States of Washington, Oregon, and California. If the Council determines that additional management measures are needed, the Council will recommend a rulemaking to implement those measures. Possible measures include allocating harvest of particular groundfish species (rockfish and lingcod) between limited entry gear groups and between commercial and recreational fisheries and further limiting access to certain species within the Pacific Coast groundfish complex. The Council may proceed with some or all of these measures. In order to discourage fishers from intensifying their fishing efforts for the purpose of amassing catch history for any allocation or additional limited access program developed by the Council, the Council announced on April 9, 1998, that any program proposed would not include consideration of catch landed after that date. At present, the Council is planning to consider catch history through the 1997 fishing season. Persons interested in the Pacific Coast groundfish fishery should contact the Council to stay up to date on the management of the fishery.[38]

Though the 1998 control date was obviously superseded by the 2003 date, this action by the Pacific Council remains relevant because it served to provide notification to the industry that it wanted to discourage additional capacity enhancing investments or behavior. By implication, it also served to encourage those contemplating a decision to cease investing in additional capacity. It should also

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[38] http://www.pcouncil.org/resources/archives/control-dates/

be noted that any capacity investments made between 1998 and 2003 were made despite the expressed discouragement of the Council.

The Pacific whiting fishery operated under a license limitation program from 1994 through the fall of 2003, when the Council developed a control date of November 6, 2003. In the years immediately preceding the announcement of the control date, a significant investment in a new shore-based processing facility was made. This investment was socially harmful in that it provided a significant increase in capacity at a significant cost, at a time when the marginal societal value of capacity was negative. It has been argued that, due to its superior location, this new factory made a marginal contribution to the public good. If this were true, this part of the capital investment would not be stranded due to the catch share system because the entire benefit of the location would be reflected in a lower cost of the fishing services needed to supply the plant. Thus, it would be inappropriate to compensate the owners of this plant for their investment, even if, in the unlikely case that some sort of investment was what caused the fish to move. This is another demonstration of the weakness of catch history as a proxy for stranded capital loss.

We would consider investments during this period to be grade "C" using our grading scale, as they were made after at least a tacit discouragement by the Council.

Phase IV: From License Limitation to a Catch Share Management After the (most recent) Control Date (2003-2008)

This phase begins with the announcement of the control date and ends with the final Council action. The setting of a control date that is taken seriously by the industry causes the benefits of rationalization to begin immediately. In a perfect world, it ends the race-to-fish for quota.

The behavior of the industry during this phase will be entirely determined by expectations regarding two things: the probability and timing of the conversion to the catch share program and the conditional probability that, given a conversion to a catch share program indeed occurs, the control date will be the same date used to determine harvesting and processing history.

The Pacific Council took final action on the catch share program in November of 2008. The quota was allocated based on vessels' and processors' relative history within the time period set by the Council. This is shown in Table 1 below.

Initial Allocation Group	History Years for Initial Allocation
Shoreside Harvesters	1994 through 2003
Shoreside Whiting Processors	1998 through 2004
Mothership Catcher Vessels	1994 through 2003

Table 1.

There were a few notable investments in capacity in the Pacific whiting fishery where the quantity of fish processed by some processors steadily increased after the announcement of the control date. Further, there was one Pacific whiting processor who first began its operations after publication of the control date. We would consider investments after the publication of the control date to be grade "D" under our grading system as they were made after being explicitly discouraged.

Phase V: Implementation and Operation (2008-??)

The following is a discussion of what's currently ongoing. We outline what would be predicted to occur, from past experience and economic theory and comment on this transition process as has actually occurred to date in Pacific whiting.

The implementation phase begins immediately after the final Council action and continues until the time when both the fishery is operating under the catch share system and all disputes regarding the initial quota allocation are settled. In the years between the final Council action and the beginning of catch share operations, the fishery continues to operate under the license limitation program. During this period, the industry accelerates its evolution from throughput maximizers to value-per-ton maximizers. Decapitalization should accelerate as the industry approaches the date of actual implementation.

When the catch share plan becomes operational, the ex-vessel price of fish will reflect both the costs of harvesting the fish and a quota value. The return on assets that are intended simply to maximize capacity will normally be close to zero. Excess capacity-related assets begin either leaving the fishery for other employment, are retired or are used up and not replaced while socially beneficial value enhancements (e.g. increased product quality, increased recovery rate, etc.) increase. This was clearly the case in Alaska pollock fishery, which is a close relative of pollock. It is harvested with very similar gear, processed on similar or identical equipment, and processed into the same sorts of products (surimi, mince, fillet block, H&G) as pollock.

We would expect the fishery to slow down; recovery of finished product increases while discards decrease. The harvesting of small immature fish should drop immediately as harvesting small fish carries a strong financial penalty in the form of wasted quota.

Another benefit expected from the catch share program is that fishing intensity decreases, reducing costs and substantially reducing the physical hazards associated with commercial fishing.

The final rule that implemented the catch share program for Pacific whiting was published in the Federal register on October 1, 2010.

The catch share management of the Pacific whiting fishery started in January 2011. The catch share program is delivering the benefits that were promised. This is evidenced in specific comments from the industry prior to the discussion of this issue at the April Pacific Council meeting. The season has been extended, discards and fish processed directly into fishmeal have fallen, and new investments are now being directed toward extracting more value from a ton of fish rather than utilizing a ton of fish as quickly as possible.

Investments made by the industry to increase harvesting or processing capacity after the date of final Council action to rationalize the Pacific whiting fishery would earn a grade "E" under our grading system.

IV. Current Status of Pacific Whiting Allocation

On October 25, 2010, a complaint was filed in U.S. District Court for the Northern District of California on behalf of plaintiffs including the Pacific Dawn LLC. The complaint alleged, among other things, that the Pacific whiting allocation was illegal under the MSA on grounds of equity. They contended that the Secretary of Commerce failed in its obligation to consider current harvests as required by the MSA and that quota shares should have been allocated to firms who entered, or increased their landings after the control date.[39]

The court issued a judgment partially in favor of the plaintiffs on December 22, 2011. The primary basis of this judgment was that harvests after 2003 were considered for some purposes, but not in the decision of how quota should be allocated, and use of a 2004 date as the last year processors' participation earned allocations of quota was a result of a political compromise rather than the considerations required under the MSA.[40] On February 21, 2012, the court ordered that the regulations regarding the Pacific whiting be remanded to the Council for reconsideration.

At its April 2012 meeting in Seattle, the Pacific Council chose a suite of five alternatives of fishing history for the shore-based processors for analysis in preparation for the process of choosing a preliminary preferred alternative at the June Council meeting.

The MSA requires, among other things, that allocations of Pacific whiting be fair and equitable and that the Council consider current and historical harvests as well as investments in and dependence upon the Pacific whiting fishery when making those allocations.[41] Regardless of any published control date, therefore, the Council must carefully consider current (as well as historical) harvest.

Taken in the context of the purpose of rationalizing the Pacific whiting fishery and the reason that the private entities that own capital in harvesting and processing capacity receive allocations (as

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[39] Pacific Dawn v. Locke, Plaintiffs' Motion for Summary Judgment, p. 12 (Nov. 14, 2011).

[40] Pacific Dawn V. Locke, Order, p.10 and 11 (Dec. 22, 2011).

[41] 18 U.S.C. §1853a.

opposed to the general public), consideration of current and historical harvest and investments indicate that the Council's initial choice of qualifying years was fair and equitable.

We have the following observations regarding the issue currently before the Council:

1. Prior to 1993, investments made in harvesting and processing capacity resulted in additional harvest and production of food from the fishery. These investments also produced a variety of un-quantified positive externalities not captured in accounting measures, including non-proprietary technical development and furtherance of a national goal of Americanizing the utilization of domestic fishery resources.

2. From 1994 through 2003 investments in the fishery were made despite at least tacit discouragement from the management authority. These investments resulted in negative societal consequences consistent with a derby fishery.

3. After 2003 any investments in the fishery resulted in no additional harvest and were made with formal public notice that such activities may not result in the awarding of quota. These investments not only resulted in negative societal consequences of a derby fishery, they could have been made in a race-to-fish, not for fish but for future allocations of quota, exacerbating these negative impacts. Because increases in relative production could either be a result of "intense operation," or of other participants reducing their own "intensity" from a race-to-fish for quota level, in response to the publication of the control date, relative landings are not a plausible proxy for capital investment after the publication of the control date.

Recommendations

It is important when considering current and historical harvests, and investments in and dependence upon the fishery, to recognize the quality of the investments in terms of societal goals. The purpose of rationalizing a fishery is to allow more efficient utilization of the resource through de-capitalization of an overcapitalized industry. In determining a fair and equitable allocation, considerations of an investor's reasonable expectations are also relevant. Given that investments made after 2003 to increase capacity had a net-negative impact on society and were made during a race-to-fish for quota, thereby exacerbating the overcapitalization problem, and were undertaken with clear public notice that they may not result in the allocation of quota, it seems rational that the Council would, after consideration of these recent investments' impacts, choose dates for catch history that end at 2003. In addition, given that catch history is a proxy for capital investments in the fishery, participation after 2003 may not be a good proxy for actual investment in the fishery as vessel and processing plant owners had a strong incentive to increase their production through intensive operation rather than additional capital investment. It is irrational for a management program to subsidize the behavior it is attempting to suppress, while punishing the behavior it is trying to encourage. Such irrationality certainly exceeds the limits imposed by the prohibition against arbitrary and capricious decision making, which requires "a rational connection between the facts found and the choice made."[42]

Moreover, it would be unfair, in both the common and legal definitions of that word to, in a program designed to de-capitalize the fishery, to reward with quota those who added additional capital during the period when it was commonly understood that the Council was developing its catch share program. Such a choice would also be inequitable in the legal sense "existing or valid in equity or as a matter of equity as distinguished from law."[43]

We believe that after consideration of current and historical harvests, and investments and dependence upon the fishery, the Pacific Council's choice of years to determine history, as originally developed in 2008, were fair and equitable, and with the additional consideration given in the reexamination process would be neither arbitrary nor capricious. We believe that we have shown here that a decision to extend the time period during which relative utilization levels are used in the allocation of quota beyond the dates in the 2008 Council action would be both unfair and inequitable and arbitrary and capricious.

As inappropriate as it would be to reward with allocations of quota those who had exacerbated an existing overcapitalization problem while the Pacific Council was deliberating as to how best rationalize that fishery, it is likely that only a fraction of the total damage to the national interest that would result by such a decision would in fact be felt in the Pacific whiting industry. Many of our nation's fisheries are currently operating below their potential. The science of fishery management has demonstrated a method of managing fisheries that provides for both a healthy stock and a healthy industry. Any reward deliberately or inadvertently granted by the Council or agency for expansion of capacity in Pacific whiting after the publication of the control date will guarantee that more such socially detrimental investments will occur than would otherwise be the case in any future attempt to rationalize an overcapitalized fishery managed under the MSA.

[42] NRDC v. US EPA, 966 F2d. 1292 (9th Cir. 1992).

[43] http://dictionary.findlaw.com/definition/equitable.html

Agenda Item H.7.c
Supplemental Public Comment 4
September 2012

September 3, 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Re: Agenda H7: Reconsideration of the IFQ Allocation for Pacific Whiting Before the Pacific Fishery Management Council

I represent Ocean Gold Seafoods, Inc. and present this statement to the Council to supplement Ocean Gold's prior written and oral statements presented before the Council during the June 20-26, 2012 meeting concerning the reconsideration of the IFQ allocation for Pacific Whiting.

Introduction

Ocean Gold appreciates the hard work and effort it took to reach the initial allocation the first time around. As a participant in that process, Ocean Gold fully understands that the compromises which were reached among the diverse interests were difficult. At that time, it seemed like the right outcome. That's why Ocean Gold's decision to oppose the initial allocation has not been an easy one. However, after realizing what implementation of that initial allocation looks like and the consequence it would have for Ocean Gold, its more than 700 employees, and the future of the fishery, the need for reconsideration of the initial allocation became apparent.

This process has been contentious and it should come as no surprise. There is much at stake. But there is one thing everyone should be able to agree on. The need for finality. Finality does not mean reaching a resolution on which most people can agree. Finality means reaching a decision consistent with the dictates of the MSA, approved by the Secretary of Commerce, and capable of surviving judicial review. There are two options under Council consideration that do not meet those basic threshold requirements: status quo and option 1. The purpose of this public comment is to explain why.

A. Excluding 8-9 years of recent processing history in strict adherence to the control date lacks a rational basis in fact and law.

The principal justification raised during the June council meeting for status quo or option 1 was the sanctity of the 2003 control date. Judge Henderson's decision reversing the initial allocation already raised serious concerns about that justification. Judge Henderson's decision explained that under certain circumstances control dates can be used to exclude more recent years from allocation considerations. However, adherence to a control date must be balanced against the MSA's requirement to consider current harvests and participation in the fishery.

Judge Henderson provided guidance as to what the boundaries of that balance are. A control date that excludes three of the most recent years from catch history "pushes the limits of reasonableness" while one that, like the initial whiting allocation, excludes 6 to 7 years, "arguably fall[s] beyond those limits." *Pacific Dawn, LLC et. al. v. John Bryoson,* Case No. 3:10cv04829 (Dec. 22, 2011) at p. 9. Judge Henderson warned that "it may be that a 2003 cutoff date is 'so far' from 'current' harvest when the regulation was promulgated in 2010 as to be arbitrary or capricious." *Id.*

If Judge Henderson's decision was not an outright rejection of the status quo, it set forth a heavy burden to justify continued adherence to the control date. That burden cannot be met here. During the June council meeting, there were two justifications given. First, there was a concern that disregarding the control date would undermine the credibility of future control dates and adversely impact future fisheries. Second, some complained that fairness and equity would be compromised if harvesters who speculatively fished following the control date would be rewarded while those who respected the control date would be punished. Neither of those rationales is applicable to processor allocations or justifies excluding recent processing history years from an initial allocation.

i. Changing the control date will not undermine the credibility of control dates in the future.

The fallacy of control date sanctity is that control dates must remain immutable once set or risk becoming meaningless in the future. The Pacific coast groundfish fishery is a perfect example of why this is not true. There have been three separate control dates in the Pacific coast groundfish fishery, the first established more than 20 years ago on November 13, 1991. 57 FR 4394 (February 5, 1992). That control date warned that "a vessel or individual entering the fisheries [after the control date] may be assigned a lesser priority for issuance and shares of individual quotas (IQs) in a potential IQ-based limited access system for Pacific coast commercial groundfish fisheries." The groundfish control date was then changed to September 16, 1999 and intended to apply specifically to AFA qualified vessels which were put on notice that "if catch history is used as basis for [future] participation, it is likely that AFA-qualified vessel participation in the fishery after the control date will receive little or no credit." 64 FR 66158, 66159. It then changed again to November 6, 2003.

Changing the 1991 and 1999 control dates did not undermine the credibility of the 2003 control date. The testimony during the June council meeting from vessel owners and fishermen was consistent in establishing that fact: after the 2003 control date was established, harvesters could have but did not increase effort on the speculative hope of obtaining more catch history. Instead, the change of 1991 and 1999 control dates was simply a recognition that the significant changes in the fishery that had occurred since the control dates were established rendered it obsolete. The same is true with respect to the 2003 control date. Now, in the intervening nine years after the control date was established, the significant changes in the fishery discussed in Ocean Gold's previous public comments provide more than a sufficient basis for not adhering to the 2003 control date.

Nor will the change in the control date here have any impact on control dates in other fisheries. That control dates change is a well known and established fact. The following are just a few examples of control date changes in other fisheries:

- Atlantic Mackeral control date changed three times over a decade. It was first established on August 13, 1992, changed to September 12, 1997, and changed again to July 5, 2002 due to concern that "nearly five years have passed since the 1997 control date was published." 67 FR 44792, 44792.

- The control date for the New England small-mesh multispecies fishery changed from September 9, 1996 to March 25, 2003 because during the intervening 9 years "conditions have changed sufficiently in this fishery to make the September 1996 control date an unreliable indicator of current participation." 68 FR 14388, 14388.

- South Atlantic Spanish Mackeral control date changed twice over a decade. It was first established July 2, 1993 and changed again on June 15, 2004. 70 FR 64459.

- Panaeid Shrimp control date changed from September 8, 2000 to December 10, 2003. 69 FR 10189.

- The snapper-grouper fishery in the South Atlantic established "a new control date of September 17, 2010 . . . due to concern that the previous control date established for the snapper-grouper fishery of October 14, 2005 (70 FR 60058; October 14, 2005), was almost five years old." 76 FR 532576 FR 5325.

- The control date for the Hawaiian offshore pelagic handline fishery was changed from July 2, 1992 to February 15, 2001 out of a concern that the earlier control date was outdated. 66 FR 27623, 27624.

As with the six fisheries identified above, a change in the 2003 control date will not undermine the credibility of control dates in general. Instead, it merely recognizes that like so many other fisheries conditions have changed sufficiently to make the control date an unreliable indicator of current participation. Indeed, to ignore the changes discussed in Ocean Gold's previous comments and maintain a blind adherence to a control date that has already changed three times would lack a rational basis in fact and run this Council's decision squarely into the arbitrary and capricious arena Judge Henderson's decision warned against. *Pacific Dawn*, at p. 9 ("it may be that a 2003 cutoff date is 'so far' from 'current' harvest when the regulation was promulgated in 2010 as to be arbitrary or capricious.").

Control dates will continue to play an important role in fisheries management even if the 2003 control date is not strictly applied here. That has been established in cases upholding control dates that have been used to exclude history years within three years of promulgation of the initial allocation of IFQs. *See e.g., Alliance Against IFQs v. Brown*, 84 F.3d 343, 348 (9th Cir. 1996) (upholding control date used to exclude three years from catch history for initial allocation but noting that it "pushed the limits of reasonableness"). However, when they push, or in this case, exceed the limits of reasonableness their usefulness has been exhausted and they should not be applied.

ii. There is no record evidence of speculative processing or fishing.

The 2003 control date was intended to "discourage increased *fishing* effort . . . based on economic speculation while the Pacific Council develops and considers a trawl IQ program." 69 FR 1563. By its own terms, the 2003 control date was not directed to concerns about processing at all. As the NFMS presentation at the last council meeting observed, while there is a direct concern about harvester speculation, with respect to processors, that concern is, at best, a "theoretical indirect concern." Using the control date to exclude recent processing history years due to a post-hoc "theoretical concern" that the control date was never intended to address would be wrong.

However, even assuming that the control date was intended to apply to processing history (we have grave doubts it was), there is absolutely no record evidence that any speculative processing occurred after 2003. To the contrary, there was testimony at the last council meeting that processors were provided an extra year of history due to a concern of *undercapitalization* in the processing sector, not overcapitalization. This was supported by the testimony of several fishermen who testified that there were years in which they could not fish because they lacked markets. And as Judge Henderson observed, applying the control date to exclude several new, post-2003 processing entrants from any allocation may have lacked a rational basis when "[t]here does not appear to be any evidence . . . that the new entrants engaged in speculation when they entered the market after the announced 2003 control date." *Pacific Dawn* at p. 11. Moreover, the fact that several of these processors continued to process even after initial allocation of quota had been decided provides strong evidence that their interest in the whiting fishery is not based on speculation but instead on the economics of the fishery.

There is also no record evidence that there was any speculative harvesting after 2003. To the contrary, the data NMFS presented for the June council meeting established that only four new permits entered the fishery after 2003 and of those four, only two fished for more than two years. The concerns of post-2003 speculation rests on little more than speculation. And even assuming that there were harvesters speculatively fishing after the 2003 control date, the fairness and equity concerns would apply equally to those harvesters that continued to speculatively fish after the 1991 and 1999 control dates. Indeed, if there is any evidence at all that speculation occurred, it is the 2002 declaration that the fishery was overfished. Accordingly, awarding quota for harvesting years prior to 2003 risks rewarding harvesters who ignored the 1991 and 1999 control dates, increased their fishing effort on the speculation of more quota and thereby contributed to overfishing. That would be contrary to the number 1 goal of the FMP: to "[p]revent overfishing and rebuild overfished stocks." Thus, including years in which the fishery was declared overfished but excluding the years when it was declared to be recovered would be precisely the type of arbitrary decision-making that would not survive judicial review.

B. <u>The Council must give due consideration to the significant investments Ocean Gold has made and the resulting dependence on the fishery.</u>

The MSA requires the Council to consider employment in the processing sector and investments in and dependence upon the fishery as part of its initial allocation decision. 16

U.S.C. §1863(a)(C)(5)(A)(ii)-(iii). The record before the Council establishes that there have been no more significant investments in this fishery than those that Ocean Gold has made in its processing facility, cold storage, and fish meal plant over the last ten years. Those investments have enabled Ocean Gold to employ more than 700 people annually and become the second largest employer in Grays Harbor County. And because those investments are rooted in Westport where approximately 60% of Ocean Gold's annual revenue relies on whiting, Ocean Gold is entirely dependent on the whiting fishery.

As the evidence presented at the June council meeting demonstrates, it was the increasing demand from international world markets which fueled Ocean Gold's investments and growth. While there has been some debate concerning Ocean Gold's role in helping develop those markets, whether or not Ocean Gold is in part responsible for the benefits achieved from them is ultimately irrelevant to the Council's consideration. What is relevant is that Ocean Gold invested significant capital into new product forms to meet the demand of those markets which now represent the future of the fishery. It is precisely this type of investment that the MSA directs the Council to consider in making its initial allocation determination.

Some have suggested that the new capital investments that have been made in recent years represent "bad" capital and are the result of overcapitalization in a derby fishery. Those claims are substantiated by nothing more than economic theory. The factual record before the Council presents a much different picture. Fishermen repeatedly testified during the last council meeting about the difficulties they had in finding markets for their fish that forced some to drop out of the fishery altogether in certain years. Moreover, the new international whiting markets that have developed over the last ten years in places like Eastern Europe were not buying surimi. To meet the international demand, capital investments in equipment to process new product forms like H&G was required. To dismiss those investments by excluding the last 8 or 9 years from the allocation formula would be to ignore two critical factors the MSA requires this Council to consider. That would be a mistake.

C. <u>The initial allocation must be made to true stakeholders and active participants in the fishery.</u>

The MSA sets forth several conditions for limited access systems which repeatedly underscore the importance of ensuring that present participants and true stakeholders are the beneficiaries of any such system. The MSA provides that FMPs may establish a limited access system like an ITQ but only if they take into account "present participation in the fishery" (§303(b)(6), they consider "current" harvests and participation (§303A(C)(5(A)(i) & (iv), and they ensure that "persons who substantially participate in the fishery" qualify for allocations. The best evidence that the status quo did not meet these standards is the fact that allocations were made to permits that have not fished whiting for a decade and to 39 permits that did not in fact fish the quota in 2011. According to NMFS's analysis, those 39 permits amounted to 20.4% of all quota which more than likely was leased to harvesters committed to staying in the fishery. That result fails to meet the standards of the MSA.

The reason why it is so important to allocate to true stakeholders is obvious from experiences in other fisheries that failed to do so. For instance, a 2009 report on the Canadian halibut fishery noted that 79% of the quota was leased to fishermen and that, on average 70% of the ex-vessel value was lease cost. E. Pinkerton, D.N. Edwards, *The Elephant in the Room: The Hidden Costs of Leasing Individual Transferable Quotas*, 33 Marine Policy 707, 710 (February 3, 2009). These increased lease costs resulted in captain and crew share of overall catch value dropping from 10-20% before ITQs to between 1-5% today. *Id.* While some leasing is bound to occur in an ITQ, the Council should endeavor to the greatest extent possible to mitigate the negative effects from leasing by minimizing allocations of quota to those who do not intend to fish it. The status quo and option 1 fail to meet that goal.

Conclusion

The duty of this Council in reaching an allocation decision is to consider the "relevant factors and articulate a rational connection between the facts found and the choices made." *Midwater Trawlers Coop. v. Dep't of Commerce*, 282 F.3d 710, 716 (9th Cir. 2002). In doing so, the Council should reject status quo and option 1 and, for the reasons previously discussed, select the option that provides the greatest weight to recent years.

Sincerely,

Christopher J. Kayser
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CJK\lss

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Sincerely,

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September 12, 2012

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Re: Remedy Alternatives Pacific Dawn, LLC v. Bryson

Dear Chairman Wolford:

Plaintiffs in the above matter have now had an opportunity to review the September 2012 update to the Draft Environmental Assessment entitled RECONSIDERATION OF INITIAL CATCH SHARE ALLOCATION IN THE MOTHERSHIP AND SHORESIDE PACIFIC WHITING FISHERIES. This document, in part, provides descriptions of the proposed actions before this council, the purpose and needs of the proposed actions, a broad range of alternatives and extensive analysis on the impacts of the alternatives on whiting participants and communities.

At the heart of the remedy alternatives, is the very clear need to update the history years beyond 2003 for harvesters and beyond 2004 for processors, and equally important, to provide whiting quota shares to harvesters and processors that have a recent history of dependence on the fishery. While the preliminary alternatives considered at the April council meeting include updates of the history years through 2010, the extensive information on recent participation by catcher vessels in the shoreside and mothership fisheries now provided in the EA must be addressed in the final preferred alternative.

Specifically, the EA analysis shows that many permits NOT active in the whiting fishery during the past seven years (2004-2010) were initially allocated whiting quota share. In the shoreside sector, the EA page 82, Table 4-8 documents that 21 catcher vessel permits with no participation in the shoreside whiting fishery during 2004-2010 received 10.2% of the shoreside sector quota share that was initially allocated. In the mothership sector, page 96, Table 4-23 documents that 13 catcher vessel permits with no participation in the mothership sector whiting fishery during 2004-2010 received 9.6% of the mothership quota share that was initially allocated. The nearly 20% of shoreside and mothership quota share being initially allocated to whiting permit holders having no activity in or dependence on the whiting fishery for the 2004-2010 requires remedy.

In light of the above, coupled with the MSA requirements for limited access privileges, plaintiff's catcher vessel owners provide below their final preferred alternative with two options for the Pacific Fishery Management Council's consideration. We believe that our recommended final preferred alternatives meets the remedy requirements of updating the history years and the requirement of recent participation and dependence on the fishery as conditions for receiving whiting quota share allocation.

FINAL PREFERED ALTERNATIVE: History years updated to include recent years for the allocation period beyond 2003 for harvesters per Option 1 (1994-2010) and Option 2 (2000-2010) below. Harvesters eligible to receive shoreside whiting IFQ must have participated in the directed whiting fishery during 2004-2010 with minimum deliveries to shoreside processors totaling 500 mt during that seven year period. Harvesters eligible to receive mothership whiting QS must have participated in the directed whiting fishery during 2004-2010 with minimum deliveries to mothership processors totaling 500 mt during that seven year period. Update the bycatch/overfished species to match the 2010 allocation period end date. Update the IFQ and QS allocation formula to reflect only qualified harvester landings in the denominator so that total allocations to permit holders equal 100% of the sector TAC.

Option 1. History years 1994-2010 drop 2

Option 2. History years 2000-2010 drop 1

Thank you Mr. Chairman for receiving plaintiff catcher vessel owner's suggested final preferred remedy alternative and the rationale that we believe is important to sustained whiting management.

Sincerely,

NATURAL RESOURCES CONSULTANTS, INC.

Steve Hughes

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President

MTC

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Agenda Item H.7.c
Supplemental Public Comment 6
September 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

September 17, 2012

RE: Agenda Item H.7. Reconsideration of Initial Catch Shares for the Shoreside and Mothership sectors of the Pacific Whiting Fishery.

Dear Mr. Wolford & Council members:

On behalf of many participants in the Shoreside and Mothership sectors of the Pacific Whiting fishery who will be impacted by this decision and who believe the Council acted properly in its original selection of catch history years, we have been asked to respond to specific issues raised by the plaintiffs in their written comments to the Council under this agenda item. The plaintiff's comments can be found in the public comment section of the most recent version of the Draft EA.

Issues raised by plaintiffs in their letters to the Council are in bold and extracted from their comment letters. Our response follows excerpts.

Issues identified by the plaintiff's in their February letter to the Council:

1) The Issue of Present or Recent Participation.

- "We see no rational basis for excluding any of the more recent fishing history years, except to favor those who have less fishing history. Why not simply let the fishing and processing years history in the fishery be the primary determining factor with respect to distribution of IFQ? Nothing could be more neutral and/or objective in allocating the benefits of IFQs ......"

- RESPONSE:

The Magnuson-Stevens Act ("MSA") does not require allocations to be "neutral and/or objective," as plaintiffs assert. Instead, under 16 U.S.C. § 1853a(c)(5)(a), the Council must "establish procedures to ensure fair and equitable initial allocations," including consideration of a number of different factors such as "current and historical harvests," "investments in" the fishery, and the "current and historical participation of fishing communities" among others. Similarly, National Standard 4 of the MSA, 16 U.S.C. § 1851(a)(4), requires that allocation of fishing privileges be "fair and equitable" to fishermen. The National Standard Guidelines implementing National Standard 4 expressly recognize that "[i]nherent in an allocation is the advantaging of one group to the detriment of another" and state that the "motive for making a particular allocation should be justified in terms of the objectives of the FMP." 50 C.F.R. § 600.325(c)(3)(i). Thus, there is simply no merit in the plaintiffs' contention that

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the whiting allocations must be "neutral and/or objective." Instead, the whiting allocations can advantage some participants to the detriment of others as long as doing so furthers an objective of the management plan. The Council has broad discretion to select an allocation scheme it believes will maximize overall benefits to the fishery. See id.

The Purpose and Need of the A15, A 20 &21 actions was to stop overcapitalization of the trawl fisheries, gain the efficiency and conservation benefits of a catch share program and simplify management. The Pacific whiting fishery has been overcapitalized since the 1980s despite repeated attempts by the Council to mitigate overcapacity. See Overcapitalization of the Pacific Whiting Fishery, attached hereto as Exhibit A. Use of a Control Date as identified in the federal register and in subsequent actions by the Council in development of A15, 20 &21 was of critical importance to putting the brakes on further capitalization of a fishery which was already overcapitalized. Failing to set a credible control date would only have encouraged additional capitalization as fishermen raced against one another for catch history during development of a catch share program. Such an outcome would have been directly at odds with a fundamental objective of the management plan and the amendments under development to reduce overcapacity. See, e.g., Alliance Against IFQs v. Brown, 84 F.3d 343, 436 (9th Cir. 1996) ("[I]f participation in the fishery while the rule was under consideration had been considered, then people would have fished and invested in boats in order to obtain quota shares, even though that would have exacerbated overcapacity and made no economic sense independently of the regulatory benefit.").

Moreover, allocation based on most recent years is not the "more neutral and/or objective" method of allocation as alleged by the plaintiffs in any event. By allocating catch shares based on most recent years – after the control date – participants that increased participation when it was actively discouraged by the Council would be rewarded while those who heeded the Council's message and either declined to increase capacity or elected to voluntarily reduce their own capacity would be punished. For this reason, SQ and Alternative 1 are the most fair and equitable alternatives and best accomplish the Purpose and Need of these actions consistent with section 1853a(c)(5)(a) and National Standard 4. Conversely, Alternative 2, 3 and 4 would be unfair to those responded to the Council message and would be less responsive to the goals and objectives of the program. Such objectives were clearly articulated in the Purpose and Need Statement of A 15 referenced on page 35 &36 of the Draft Environmental Assessment:
"Action is needed to restrict new vessels from entering into the fully capitalized whiting fishery. This race constrains the available time for vessels to search for whiting, which cause fishers to neglect safety and bycatch concerns to which they would otherwise be more attentive. This accelerated race for fish would likely increase the incidental catch of non-whiting species, increase management costs, and decrease the economic returns to historical participants and communities. This action is about prohibiting additional capacity from entering the Pacific whiting fishery … New entry into the whiting fishery is occurring despite the fishery being greatly overcapitalized, having limited entry groundfish program in place, being heavily regulated in order to protect overfished species, and undergoing planning efforts to rationalize the fishery through ITQs, and/or co-ops."

2) Consideration of Recent History:

- "Our view is that the failure to include the most recent fishing and processing years in the Pacific whiting IFQ allocation was something the agency should have addressed and resolved during the agency review in 2010. It was an obvious legal issue to spot, given the total failure to include any

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information in the record on the question and to simply defer to the Council's much outdated "control date" notices."

• RESPONSE:
The MSA does not require that allocations be based upon "the most recent fishing and processing years" as the plaintiffs contend. Instead, under 16 U.S.C. § 1853a(c)(5)(a), the Council must "consider" various factors when allocating fishing privileges, including "current and historical harvests," "employment in the harvesting and processing sectors," investments in, and dependence upon, the fishery," and "the current and historical participation of fishing communities." In Pacific Coast Federation of Fishermen's Associations v. Blank, ---F.3d---, 2012 WL 3892940, at *7 (9th Cir. Sept. 10, 2012), the Ninth Circuit rejected a similar argument by another set of plaintiffs that the reference to "fishing communities" in § 1853a(c) mandated that fishing communities receive initial allocations. The court held that "§ 1853a requires NMFS to take fishing communities into account in fashioning a limited access program...it does not require NMFS to guarantee communities any particular role in that program." Id. Similarly here, the reference to "current harvests" in § 1853a(c)(5)(a) requires only that current harvests be considered, or "taken into account," when allocating fishing privileges; that section does not mandate that allocations be based upon current harvests. Section 1853a(c)(5) provides the Council with broad discretion to make allocation decisions it believes are in the best interest of the fishery and consistent with the FMP objectives. The Council could rationally conclude that the benefits of adhering to its control date notices in 2003 and 2004 outweigh the benefits of reallocating whiting quota based upon catch history from the most recent years.

3) Revisions to Pacific Whiting Regulations.

• "We believe that, because of the remand, the agency must view 'recent history' from the perspective of the current date, 2012, not 2010. The agency has in its possession all the history of fishing in the Pacific whiting fishery through 2010, the last year prior to initiation of the IFQ program in January 2011. Thus recent history in the statute means all history through 2010.... NMFS will be much better off as a matter of law and policy by including all the history years and thereby let historical statistics be the basis of allocation, not arbitrary exclusions of years."

RESPONSE:
The Plaintiffs are wrong in stating that "the agency must view 'recent history' from the perspective of the current date, 2012, not 2010." As Judge Henderson recognized, in quoting a Ninth Circuit opinion, "'[p]resent' [participation in the fishery] cannot therefore prudently be contemporaneous with the promulgation of the final regulations" because the "process of review, publication, public comments, review of public comments, and so forth, had to take a substantial amount of time." Pacific Dawn LLC v. Bryson, No. 3:10-cv-4829 (N.D. Cal. Dec. 22, 2011), Dkt. # 49, Order Granting in Part and Denying in Part Plaintiffs' and Defendants' Motions for Summary Judgment, at 8 (quoting Alliance Against IFQs v. Brown, 84 F.3d 343, 347-48 (9th Cir. 1996)).

The Plaintiffs assert that the Council should "let historical statistics be the basis of allocation, not arbitrary exclusions of years." There are three problems with this assertion. First, the Council did not arbitrarily exclude any years; instead, the Council deliberately chose to adhere to the control dates and not to base allocations on fishing history from more recent years, even though it took account of such recent history (see footnote 1 above). Second, use of "historical statistics" through 2010 is not required

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for "the basis of allocations;" instead, the MSA only requires that current harvests be considered in making allocations that are fair and equitable. Third, plaintiffs do not explain how the "historical statistics" they claim should be used further the capacity reduction or other objectives of A20 and the FMP; such "historical statistics" are merely a data set which produces a better result for the plaintiffs.

Issues raised by plaiff's in their August letter to the Council:
4. The Issue of Present or Recent Participation.

- "Most significantly, the data put forward by the staff has shown that the original Council allocation, which was based on a 'political compromise,' allocated significant portions of the whiting IFQ to permits that had no participation in the fishery at all for seven or more years prior to the institution of the IFQ program in 2011.... The statute and NOAA's Guidelines make clear that 'present participation' must be considered and not ignored. The question of 'present participation' in the fishery also implicates the other principle considerations under the statute and the guidelines, such as the requirement for a fair and equitable allocation and the dependency factor.... Why should those who chose to leave the Pacific whiting fishery be given any IFQ if they left many years prior to institution of the IFQ program. Why should those who remained committed to the fishery, with substantial history and participation in the fishery up to the year the IFQ Program was approved, be required to purchase or lease IFQ from those who "retired" from the fishery long ago?"

RESPONSE: The Plaintiffs wrongly focus on a single statutory factor that the Council must consider – recent participation – to the exclusion of all other statutory factors that the Council must also consider under 16 U.S.C. §§ 1853a(c)(5)(a) when making allocations. This is not surprising because the plaintiffs would benefit by receiving additional IFQ shares if the Council focused exclusively on "recent participation" as the touchstone of allocation decisions. As explained above, however, the Council has broad discretion to make allocations decisions that it believes will maximize overall benefits to the fishery, and the Council must consider all statutory factors and tie its allocation decisions to the objectives of the FMP. Here, a fundamental objective of the FMP and the amendments at issue was to reduce overcapitalization in the whiting fishery. Allocating IFQ shares based upon "recent participation" after the control date would frustrate, not further, the objective of reducing overcapacity because it would reward those who injected additional fishing capacity into the fishery right when the Council was taking steps to mitigate overcapacity.

The Plaintiffs' assertion that "significant portions of the whiting IFQ" were allocated "to permits that had no participation in the fishery at all for seven or more years prior to the institution of the IFQ program" is wrong. [Insert discussion as to why, citing the charts Jincks referenced.]

Yet even if it is true, as plaintiffs assert, that the existing allocation scheme rewards a small number of participants who "retired" from the fishery, such an outcome is precisely the objective of a rationalization scheme under which fishing privileges can be consolidated on a fewer number of vessels that are active in the fishery. Where the problem is "too many boats chasing too few fish," part of the solution entails reducing the number of active vessels. Here, to the extent that the publication of a control date in anticipation of implementing an IFQ program commenced the process of capacity reduction even before the final program took effect, the Council simply achieved the benefits of its program sooner than it would have if participants were forced to maintain capacity until the program took effect for fear of losing IFQ allocation. Those who made decisions to reduce capacity while the IFQ program was being developed should not be punished for helping sooner achieve the Council's

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objectives. On the other hand, those like the plaintiffs who speculatively increased their fishing capacity while the IFQ program was being developed need not be rewarded for making the Council's task of capacity reduction more difficult.

In addition, early on in the process of developing the details of A20, the Council decided that allocations would be made to permits rather than vessels. In doing this, the current permit holders would be awarded the allocation rather the owners of the vessels at the time the history was accumulated. This devalued the overcapitalized vessels and allowed permits to gain value. Many permits were bought and sold based on this decision often with the purpose of consolidating permit allocations onto a single vessel. This enhanced decapitalization of the fishery and allowed past participants to be compensated for retirement from an overcapitalized fishery and without the assistance of a federal Buyback Program.

Therefore, even if status quo rewards some participants who are no longer actively fishing, the Council can rationally conclude that such an outcome is warranted under the objectives of the FMP and the amendments at issue to reduce capacity, and in the interest of adhering to the control date upon which many participants relied in furtherance of the Council's objectives. As long as the Council "considers" recent participation – which it indisputably has done in this reconsideration process – the Council could determine that any benefits of making allocations based upon the most recent fishing history are outweighed by the fairness and equity of rewarding those who adhered to the control date and declined to inject additional capacity into the fishery as did the plaintiffs. In other words, it is rational to allocate a portion of shares to those who had made prior investments in the fishery but who also, acting on the published control date, elected to reduce their fishing capacity consistent with a goal of the FMP by not actively engaging the fishery. After implementation of the program, non-active participants who receive allocation can lease it to active vessels instead of fishing it themselves. This promotes the goal of rationalization and capacity reduction, and recognizes past investments made in the fishery without contributing to overcapitalization. Such an allocation decision is precisely the type of policy choice that the MSA commits to the discretion of the Council.

5) Recent Participation

- "As an example of the unfairness in the SQ approach, Joe Hamm, who owns and operates the CHELLISSA, has been required to lease 60% of the IFQ he fishes from others who have not made the same commitment he has to the Pacific whiting fishery over the years. He started in 1996 and has fished every year since. Why should he pay speculators who dropped out, and have since made little commitment to the fishery, for his ability to stay in the fishery he has been dependent upon?"

RESPONSE:
Mr. Ham is owner of the permit "Chelissa" which was awarded 1.734% according to public documents. This allocation is ranked 20th highest of the 55 permits to receive an allocation in the SS sector under SQ. Like Mr. Hamm, many of us are now leasing whiting quota. It is not a hardship. It is an opportunity. Consolidation and greater efficiency was a goal of the program. Conversely, Mr. Ham may be leasing quota in other fisheries that enable him to participate to a greater degree in the whiting fishery. Mr. Hamm might not be happy with his 1.734%, but that merely demonstrates his disagreement with the policy choice made by the Council in allocating whiting shares because he would like a larger slice of the pie. As the Ninth Circuit recently confirmed, the mere fact that a plaintiff like Mr. Hamm may "reasonably disagree with the balance NMFS struck between competing objectives"

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does not "show that NMFS exceeded its statutory authority under the MSA." PCFFA v. Blank, 2012 WL 3892940, at *1.

6). The SQ Alternative is not a viable alternative.

- "We believe that because of the significant allocation of IFQ to permits that long ago dropped out of the fishery, the No- Action Alternative (and Alternative 1) will not, and cannot, be approved by NOAA and would likely be struck down by a Federal Court as being in violation of the MSA."

RESPONSE:
The plaintiffs have provided no evidence or analysis to support their conclusory assertion that selection of the SQ alternative or Alternative 1 would likely be struck down by a Federal Court as being in violation of MSA.

First of all, the agency, including NOAA GC, has gone on record saying that all of the alternatives developed by the Council including SQ and Alternative 1 are viable options, provided there is a rational basis in the record regarding how the chosen alternative satisfies all the requirements of MSA and other applicable law, including consideration of recent participation and other factors.

Secondly, while the judge noted the length of time between the control date and implementation date, it was the difference between the control dates – 2003 for harvester allocations and 2004 for processor allocations – that caused him to rule that A. 20 was arbitrary and capricious for failure to explain that difference. "Most problematic is the defendants explanation of why the qualifying period for processors was extended to 2004. Defendants did not rely on the 2003 control date for processors ' because keeping the date at 2003 was viewed to disadvantage a processor that was present as a participant during the window period but had increased its share of the processing substantially since close of the period (2003). Thus, the extension was made to benefit a single processor, which begs the question of why that particular processor should benefit – notwithstanding an earlier control date – when others should not. That appears to be a quintessential case of arbitrariness ... While defendants correctly argue that they have broad discretion to make decisions, and that no participular outcome is required by MSA, they have failed to present a reasonable explanation for relying on the 2003 control date for some purposes but not others. Consequently, the Court finds that the defendants failure to consider fishing history beyond 2003 for harvesters and 2004 for processors was arbitrary and capricious."

Yet there were and are legitimate reasons for the difference in the control dates for harvesters and processors. First, as a procedural matter, the initial control date notices published in the Federal Register in 2003 were not clear that they applied to processors as well as harvesters. Thus, extending the control period to 2004 for processors was rational because, unlike for the harvesting sector, it was not clear that the processing sector was on notice of the potential for a rationalization program that would affect that sector until 2004.

Second, as a substantive matter, a fundamental objective in making allocations to shoreside processors was to protect fishing communities from adverse impacts that were expected to result from the rationalization program. Making direct allocations of harvesting privileges to shoreside processors was unprecedented in U.S. fisheries management. The Council deliberated at length about this issue, and elected to allocate 20% of harvesting privileges for whiting to processors to ensure that such

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privileges remained located within particular communities along the coast that were dependent upon the whiting fishery as a way to encourage continued landings in those communities. One particular processor, Ocean Gold, made substantial investments in shoreside processing facilities in Westport prior to 2003 but which did not come online to develop processing history prior to the 2003 control date. The concern was that, by not recognizing this investment with sufficient IFQ allocation, the investments made by Ocean Gold could become stranded if fishermen elected to land catches elsewhere. So the Council decided to extend the control date to 2004 for processors as a way to recognize this substantial investment in shoreside infrastructure, thereby helping to ensure that such investment was not stranded due the consolidation effects of the program. The extension of the control date to 2004 therefore furthered the Council's objective in protecting communities that were dependent on the whiting fishery.

Finally, with respect to the 2004 date for shoreside processors, I think there is a legal distinction that needs to be recognized here. The legal distinction is that, unlike for harvester allocations, the Magnuson Stevens Act requires that Council take into account current harvests when making IFQ allocations. There is no requirement in the Magnuson Act to consider current processing history. And, of course, shoreside processors aren't harvesters, and have no harvesting history. They only have processing history.

With respect to overfished species allocations, the Council elected to use data through 2006 for several reasons. First, unlike for target species, data on catches of overfished species prior to 2003 were unreliable. Second, allocations of overfished species had a distinct regulatory purpose, which was to distribute the quota for those potential "choke stocks" in a manner that did reflect current fishing patterns so as to maximize harvests of target stocks given the current distribution of the fleet. This was done by establishing a bycatch rate in eight spatial areas and allocating sufficient overfished species quota to cover each participant's catches of target stocks in those areas. Because the underlying purpose of overfished species allocations differed from that for target species allocations, matching allocation periods were not required and would not have achieved the results the Council intended.

7.) The Control Date Question

- "First, control dates, including those referred to in this debate, are nothing more than publications in the Federal Register that give notice. Control dates are not regulations approved by NOAA as part of a fishery management plan..."

RESPONSE: Noo one is asserting that control dates are federal regulations. Federal register notices of control dates are important messages sent to participants. In this case, the clear message sent to participants in 2003 was, "We are taking action because this fishery is severely overcapitalized. Do not increase your participation in this fishery with any expectation that you will be rewarded with an increased allocation based on that increased activity." The message was reinforced during action taken on A 15 and during development of A 20 alternatives and selection of the final alternative. In complying with its statutory mandate under 16 U.S.C. § 1853a(c)(5) to ensure that allocations are "fair and equitable," the Council can rationally determine that allocating fishing privileges to those who heeded the control date by not increasing fishing capacity while the Council developed its rationalization program, and not basing allocations on increased capitalization the Council sought to prevent, is fair and equitable. Why should participants who heeded that warning and made business

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decisions on that warning be punished? Why should those who took the risk of ignoring the message sent by the Council be rewarded?

8) The Control Date Question
"Second, ...Those who said they relied on the publication of the control dates and changed their business practices took the risk that the final dates in the IFQ program as finally approved would change; therefore they have no complaint."

RESPONSE: See answer above.

9) Control Date Question
Third, the length of time between publication of the control dates in this case and the date of final approval of the IFQ program has already been called into question in the ruling by Judge Henderson. Evidence presented ...by Ocean Gold has indicated how greatly the Pacific whiting fishery has changed after 2003/04, moving away from surimi as the principle final product to H&G and block products."

RESPONSE:
The fishing business changes dramatically on a regular basis. The OY varies. Markets vary. Prices vary. New products are developed on a regular basis. The Draft EA indicates that development of the HGT product was not new and that it was more influenced by global hake and pollock supplies. But even if all the claims made by Ocean Gold are valid, why should the Council consider reallocating quota everytime a new product is developed, the ex-vessel price changes or fish aggregations prefer swimming in different areas? That seems destabilizing and contrary to the goals of A 20 and the FMP.

10) (Overcapitalization) "There is no evidence that there is an overcapitalization capacity problem in this fishery. Again, testimony by Ocean Gold alluded to the fact that the fishery is not overcapitalized and may be under-capitalized at present."

RESPONSE:
There is ample evidence that there was an overcapitalization problem in the whiting fishery. See Overcapitalization in the Pacific Whiting Fishery, attached hereto as Exhbit A. The Council attempted to mitigate overcapacity in the whiting fishery for many years, and overcapitalization is the one of the primary reasons A20 was initiated. To the extent the fishery is not overcapitalized "at present," as plaintiffs contend, such a condition would only demonstrate that one of the fundamental objectives of A20 has been achieved. Indeed, allocating additional whiting quota to those who increased fishing capacity after 2003, as plaintiffs demand, could reduce the effectiveness of A20 in mitigating overcapacity. The plaintiffs are essentially using the effectiveness of the program to argue for a change in the program that could reduce its effectiveness.

11.) Recent Fishing and Processing History

- "The fishing and processing entities identified above (plaintiffs & OG) believe that the Council should include all fishing and processing history through the year 2010 in framing the reallocation of IFQ that must result from the reconsideration process. Using 2010 takes into account very recent changes in the fishery for both processors and harvesters ... Allocations of IFQ must reflect the current conditions in the fishery to assure that the allocations are fair and equitable to those committed to the

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future prosecution of the fishery under today's business conditions, not past conditions. In this regard, we believe that Alternative 2, which would end fishing and processing history in the year 2007, is based on a false premise. The Council could not go back in time to that year, given that 1) the Court has ordered reconsideration as of 2012; 2) NOAA must determine consistency with the MSA as of the date the agency gets the new proposed allocation (2012 or 2013); and 3) the best available scientific information, available this year, includes all fishing and processing history through the end of the open access system in 2010."

RESPONSE:
The plaintiffs continue to misconstrue the MSA requirement to consider recent participation. The word "consider" means to take into account and weigh carefully the pros and cons of a situation before making a decision on a due course of action. In weighing those actions, the Council must also consider other issues such as historic participation, social and economic impacts, consistency with the purpose and need of the proposed action and the FMP. While it is true that the Court ordered a reconsideration of catch history years, it did not order a particular outcome. There is no legal requirement to give added weight to the plaintiffs' preferred alternatives, as Judge Henderson recognized in his Remedy Order: "Put simply, Plaintiffs are not entitled to have Defendants adopt their requested methodology, nor is it the Court's role to dictate to defendants how the regulations should be revised."

The plaintiffs also wrongly argue that "allocations of IFQ must reflect the current conditions in the fishery to assure that allocations as are fair and equitable to those committed to the future prosecution of the fishery…". There is no requirement in the MSA that allocations "reflect current conditions in the fishery" or must be made only to those who are "committed to the future prosecution of the fishery." In fact, the Ninth Circuit recently rejected a similar argument that IFQ shares must only be allocated to "substantial participants" in the fishery:

The plaintiffs' final argument is one of policy: allowing persons who do not substantially participate in the fishery to acquire and hold quota shares leads to "liberal transferability," which in turn can result in "extreme or excessive fleet consolidation, regional shifts in fishing commerce, loss of fishing-related employment[,]" and other effects. However, as discussed above, NMFS was aware of these effects but decided to partially prioritize economic efficiency and fleet consolidation over the protection of existing fishery participants, a choice that required fewer restrictions on who could acquire and hold quota shares. The MSA did not preclude NMFS from making that choice.

PCFFA v. Blank, 2012 WL 3892940, at *12. The plaintiffs here are making a similar policy argument; i.e., that there are advantages in making allocations to those who may be more committed to the future prosecution of the fishery. But whatever the merits of that policy argument, there is no legal mandate for the Council to take that course. The Council could alternatively conclude, for example, that any benefits of the plaintiffs' preferred allocation scheme (under which they receive more quota) are outweighed by other factors that the Council is also required to consider. For example, the Council could conclude that adhering to the control dates and not providing increased allocations to those who increased their fishing or processing capacity as the Council developed A20 is more fair and equitable, provides greater overall benefit to the fishery, and is more consistent with the FMP objective of mitigating overcapacity.

In weighing the pros and cons of the various alternatives, it is important to also consider the disruption caused to the current fishery by abandonment of Status Quo. The A 20&21 rationalization program has

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been in place for two years. It is a stable program and has accomplished the goals envisioned during the long and careful development of the program. A reallocation of catch history years will be very disruptive. Co-op and bycatch agreements that were often two years in the making will have to be revised. Harvesting and processing capacity between catcher vessels and processors will be mismatched by the reallocation of quota forcing realignment with markets to occur. Employment on vessels and in plants will also have to be realigned causing some to lose jobs as allocations shift. This potential disruption to current conditions is another social and economic factor the Council will have to consider in weighing the pros and cons of the catch history alternatives.

12.) Viability of Status Quo Alternative

- "We know for sure that the SQ Alternative and Alternative 1 (through 03) are unquestionably unacceptable and likely to be found unlawful under the MSA."

RESPONSE:
It is not surprising that status quo is "unquestionably unacceptable" to the handful of plaintiffs who filed a lawsuit challenging this program with the sole purpose of getting more fish for themselves. What is relevant is the broad discretion the MSA vests in the Council to make difficult allocation decisions which will inevitably disadvantage some and advantage others. Making these decisions requires balancing a number of competing factors and drawing a line that maximizes overall benefits to the fishery. The mere fact that the plaintiffs find the outcome "unacceptable" does not mean that the outcome is "likely to be found unlawful under the MSA," as the Ninth Circuit recently confirmed. See PCFFA v. Blank, 2012 WL 3892940, at *1 (mere disagreement with "the balance NMFS struck between competing objectives" does not "show that NMFS exceeded its statutory authority under the MSA."). The Plaintiffs' arguments boil down to the assertion that the Council should have placed more emphasis on one statutory factor than it did. But as Judge Henderson recognized, the MSA entrusts to the Council, not the Plaintiffs here, the task of balancing the various factors that must be considered when making allocation decisions. At the end of the day, the Council must take the action it believes is in the best interest of the fishery overall. This is a classic line drawing exercise that is committed to the Council's discretion and entitled to deference.

In closing, we urge the Council to carefully consider all the alternatives. We believe careful consideration of the Council's objectives to decapitalize and stabilize the fishery best supports reaffirmation of the Status Quo alternative.
Sincerely,

David Jincks
EXHIBIT A: OVERCAPITALIZATION IN THE PACIFIC WHITING FISHERY

David Jincks, President
P.O Box 2352 * Newport, OR 97365 * (541) 265-9317 * Fax 265.4557 * bluefox@q.com

OVERCAPITALIZATION OF THE PACIFIC WHITING FISHERY

The whiting fishery has been overcapitalized since the 1980s.[1] The Pacific Fishery Management Council ("Council") recognized this as early as 2000, when the Council's Scientific and Statistical Committee estimated that the capitalization rate for the limited entry trawl sector of the Pacific groundfish fishery was between 27% to 41%, depending on the amount of overlap between the non-whiting and whiting trawlers.[2] Based on this estimate, both the SSC report and the Groundfish Strategic Plan recommended that the Council take immediate action to reduce capacity (e.g., a buyout) in the short term (because IFQs were then prohibited and in order to prepare the fishery for an IFQ program) and develop an IFQ program in the long term.[3]

Overcapacity was a longstanding problem that the Council had tried but failed to address with other measures. The Council first implemented Amendment 6 in 1994, which limited entry to the groundfish trawl fishery by requiring endorsements relative to the length of their vessels (thereby creating a "limited entry (LE) trawl fishery"). Catcher-processors and other large vessels desiring to participate in the fishery had to purchase multiple permits and combine them in order to acquire a large enough length endorsement to operate their relatively large vessels in the fishery.[4] Although this amendment ultimately resulted in the effective removal of 114 trawl permits from the fishery by 2003,[5] the Council's Scientific and Statistical Committee ("SSC") concluded by 2000 that "[t]he 1994 limited entry program was not sufficiently restrictive to address the overcapitalization that existed at the time of the program's inception."[6] Worse yet, the SSC found that "the gap between harvest capacity and groundfish [Optimum Yields ("OY")] widened as stocks continue[d] their downward decline, new scientific

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[1] PFMC (Pacific Fishery Management Council) and NMFS (National Marine Fisheries Service). 2010. Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery; Final Environmental Impact Statement Including Regulatory Impact Review and Initial Regulatory Flexibility Analysis, at 15 (AR100435) (hereinafter "A20 FEIS") ("The Council has been developing programs to reduce capacity in the groundfish fisheries since the mid-1980s . . . . "); Government Accountability Office, "Individual Fishing Quotas: Methods for Community Protection and New Entry Require Periodic Evaluation" (Feb. 2004) (GAO-04-277) at 38 (AR040074-7) ("In the 1990s, the [Pacific whiting] fishery was overcapitalized and fishing companies were engaged in a race for fish.").

[2] Pacific Fishery Management Council, Economic Subcommittee Scientific and Statistical Committee (SSC), "Report on Overcapitalization in the West Coast Groundfish Fishery" at 37-38 (2000) (hereinafter "SSC Report"). The SSC considered the minimum number of trawlers needed to fully utilize the non-whiting groundfish OYs, the whiting shoreside allocation and the whiting mothership allocation in 2000, and also (to prevent double counting) the extent to which these boats participate in more than one of these groundfish activities. The SSC did not have data to evaluate catcher boat participation in the whiting mothership fishery at the time.

[3] SSC Report, at 108; Pacific Fishery Management Council, "Groundfish Fishery Strategic Plan" (Oct. 2000), at 7 (hereinafter "Groundfish Strategic Plan").

[4] Amendment 6 of the Groundfish Fishery Management Plan is discussed in the A20 FEIS at 82.

[5] A20 FEIS, at 83, 119 ("During the 1980s, approximately 500 trawl vessels landed groundfish in any given year. With the introduction of LE, the number of vessels declined and remained between 300 and 400 vessels per year for several years.").

[6] SSC Report, at 45.

information [became] available clarifying the extent and gravity of this decline, and OYs [were] reduced to unprecedented low levels."[7]

In accordance with the Groundfish Strategic Plan, the Council's next effort was a buyback program in 2003.[8] As a result of the program, NOAA permanently retired 91 trawl vessels and their Pacific Groundfish limited entry trawl permits, which reduced the number of permits by 35% and the capacity (in terms of endorsed permit length) by 34%.[9] Even so, NOAA estimated that 24 to 32 "latent" permits remained at large as "a significant amount of capacity . . . that can be mobilized at any sign of improved fishing opportunities."[10]

Even with all these reductions, overcapacity remained an issue in the 2004 Pacific whiting fishery. NOAA calculated that "estimated capacity [in the Pacific whiting fishery] exceeded estimated catch in 2004 by 64 thousand t[ons] or 30 percent," and therefore concluded that "there was excess capacity and overcapacity for Pacific whiting."[11] The June 2004 scoping notice for Amendment 20 therefore concluded that despite the 2003 buyback program, "management of the west coast LE groundfish trawl fishery is still marked by biological, social, and economic concerns . . . . [and] is currently viewed as economically unsustainable."[12]

On top of the existing overcapacity, new vessels entered the whiting trawl fishery (i.e., vessels without catch history for Pacific whiting) in 2006, even though it was already "greatly overcapitalized," had a limited entry program in place, was heavily regulated in order to protect overfished species, and facing a future rationalization program.[13] Indeed, one commenter estimated that more than "4 million pounds of excess vessel capacity" entered the Pacific whiting fishery during this time.[14] In response, Amendment 15 implemented a vessel license limitation program in 2008, which required vessels to demonstrate a history of whiting harvest in order to participate as "an interim

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[7] SSC Report, at 45.

[8] A20 FEIS, at 84.

[9] National Marine Fisheries Service (NMFS), Northwest Region, "The Aftereffects of the Pacific Groundfish Limited Entry Trawl Buyback Program: A Preliminary Analysis" (Mar. 2005) at 1 (AR040189). In 2003, for example, 241 trawl vessels recorded landings of groundfish, while in 2004, only 155 trawl vessels recorded landings of groundfish. The number has remained relatively stable since 2004. A20 FEIS at 119.

[10] *Id.* at 2, 5.

[11] National Oceanic Atmosphere Administration (NOAA), "National Assessment of Excess Harvesting Capacity in Federally Managed Commercial Fisheries" at 263 (2008).

[12] Pacific Fishery Management Council, "Information for Public Scoping of Dedicated Access Privileges for the Pacific Coast Limited Entry Trawl Groundfish Fishery" at 1-3 (June 2004) (AR040615); *see also* A20 FEIS, at 3-4.

[13] National Oceanic Atmosphere Administration (NOAA), Environmental Assessment for a Limited Entry Program for the Non-Tribal Sectors of the Pacific Whiting Fishery, at 89 (Apr. 2008) (AR080209) (hereinafter "A15 EA") ("In 2004, 217,000 tons of Pacific whiting worth $22 million ex-vessel ($0.046/lb) were harvested and processed through the activities of 26 shorebased catcher vessels, 10 mothership-catcher vessels, 4 motherships, 9 shorebased processors and 6 catcher-processors. In sharp contrast, during 2006, 265,000 tons of whiting worth $36 million ($0.62 per lb) involved 37 catcher-vessels, 20 motherships catcher vessels, 14 shoreside processors, 6 motherships, and 9 catcher processors.").

[14] Letter from Midwater Trawlers Cooperative to NOAA Fisheries (Oct. 22, 2006) (AR060974).

measure until the implementation of [an IFQ] program."[15] The Environmental Assessment documented that the Pacific whiting fishing continued to function as a derby fishery in 2007.[16]

NOAA and NMFS continued to describe the Pacific whiting fishery as overcapitalized when finalizing the trawl rationalization program in 2008-2010. The Federal Register notice for regulations implementing Amendments 20 and 21 identified the Pacific whiting fishery as a "derby fishery"[17] because it "close[d] due to imposed limits rather than availability of fish or market conditions."[18] The EIS for Amendment 20 anticipated that if no action is taken, the outcome will be "[c]ontinued overcapitalization as a result of derby conditions in shoreside whiting industry."[19] Similarly, comments throughout the development of Amendment 20 reflected that participants believed that the Pacific whiting fishery had characteristics of a "derby fishery."[20]

The shoreside processing sector of the whiting fishery has also been overcapitalized. The harvesting and processing sectors of the groundfish fishery expanded together: in a derby fishery, processors invest in excess capacity to compete with other processors for deliveries by being able to handle peak volumes, and go idle when the derby fishery ends.[21] Testimony from a variety of whiting processors confirmed the existence of overcapacity in the shoreside whiting processor sector. For instance, a Pacific Seafood representative testified at an October 2008 hearing that rationalization would hurt processors because "[t]here is excess freezing capacity [that was] developed in order to service the whiting and sardine fisheries."[22] At another meeting, another processing sector representative testified that "[p]rocessors have incredible capacity from the derby [whiting] fishery."[23] NOAA also recognized this relationship in the Amendment 20 EIS, which concluded that "with the move from a whiting derby fishery to an IFQ program the amount of processing capital needed in the whiting fishery would decline by 30 to 50 percent . . . [because] the move to an IFQ program will slow the pace of the fishery resulting in substantial unneeded processor capital."

The whiting fishery comprises most of the groundfish landed in the Pacific groundfish fishery.[24] Like the whiting fishery, the nonwhiting fishery is also

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[15] A15 EA, at 1-2.
[16] *Id.* at 89.
[17] "Derby fisheries result when overcapacity, combined with restrictive catch limits, serves to concentrate fishing into a very short season." A20 FEIS, at 83.
[18] 75 Fed. Reg. 60868, 60883 (Oct. 1, 2010)
[19] A20 EIS at 440.
[20] *See, e.g.*, Letter from Midwater Trawlers Cooperative to NOAA Fisheries (Oct. 22, 2006) (AR060974).
[21] A20 FEIS, at 57-58; 162 ("Shore-based whiting processors currently must handle large volumes of fish in a relatively short time because the whiting fishery tends to function like a derby, with harvesters competing to catch the available quota.").
[22] AR080747, at 4 (Written Statement of Mike Okoniewski) (Oct. 29, 2009 Hearing in Astoria, OR).
[23] AR080748, at 2 (Synopsis of Processing Sector Comments) (Oct. 27, 2008 Hearing in Newport, OR).
[24] A20 FEIS, at 107 ("The trawl sectors account for 98 percent of all groundfish landings from 1995 to 2008. This is mainly accounted for by the high volume landings of Pacific whiting, a comparatively low value species, which accounted for 84 percent of groundfish landing during this period.")

overcapitalized, but unlike the whiting fishery, it does not operate as a derby fishery.[25] The EIS for Amendment 20 clearly distinguishes between the whiting and nonwhiting fisheries.[26] The persistent overcapacity in the whiting sector of the fishery was clearly a fundamental driver of the rationalization program.[27]

[25] A20 FEIS at 273-74 ("In general, since Olympic conditions do not exist, capital in this fishery should be expected to be more in line with available harvest (compared to the whiting sector, which may have more capital than necessary); however, because of regulations, and due to the reduction in harvest volumes over the past decade, it is generally accepted that the harvesting sector remains overcapitalized. Indeed, research by Lian et al. (2008) indicates the nonwhiting trawl fleet may be overcapitalized by more than 50 percent.")

[26] *See, e.g.*, A20 FEIS at 53 ("For the nonwhiting fishery, an economically healthy fishery would also be expected to result in some improvement in safety. For the whiting fishery, an end to the derby would create substantial safety improvements."); *id.* at 412 ("It is expected that the elimination of derby-style race for whiting, along with a net increase in nonwhiting harvests, will allow vessel operators to have a greater ability to respond to market forces in terms of targeting species.").

[27] *See, e.g.*, A20 EIS, at 419-420.

Mr. Chariman, Council members – my name is Robert Smith. I have been a fisherman since ???. I participate in many different fisheries including shoreside whiting, (list all the others). As a fisherman who has participated in the rationalization process from the beginning I'm here to express my strong support for the status quo option.

You are all well aware of this – but I think it is worth repeating – this is a successful program which was implemented close to two years ago. By all measures the current program is a success. The report to congress from NMFS highlighting the achievements of our program in the first year backs my claim.

In fact, the opponents to the status quo option have also done well during these first two years under the program. They just figured out that they could do better if the system was changed. This really irritates me. Mr. Steve Williams made a comment about control dates at the June Council meeting that really ~~resonated with~~ struck me. He said "it relies upon the fact that after you have argued it through and come down with that date that reasonable people should not expect to get a benefit after that date, whatever the benefit may be for that fishery. And for me, not only is that a kind of standard tenet that we use and should use but for me, it is also a personal, honorable way to approach it."

The bottom line is that the majority of participants chose to respect the control date. If people made additional investments or fished differently after the control date they may have done so for business reasons – but that's fishing. But to turn around and then ask that the control date be vacated because they made those business decisions is simply wrong and immoral. As Bud Walsh said in his testimony – the fishery doesn't remain static just because you put a control date in place. And this is true. But expecting some windfall based on efforts made following the control date is unreasonable and unjust. Especially when your effort included injecting additional capacity into an already overcapitalized fishery. What really burns me is that ~~some~~ one of the plaintiffs in the lawsuit were actually leasing out on average 60% of their Alaskan B Season Pollock in order to come down here and create history after 2003 – this is clearly evidenced in Fred Yeck's written testimony included in your briefing book. under public comment

There were no big winners and no big losers. This is another statement we heard a lot both during the trawl rationalization process and at the June Council meeting during Council discussion. No one fisherman was made whole. No one processor was made whole. I was not made whole. All but three boats in 2011 landed more whiting then their initial allocations. If you move off status quo you will create a few huge winners and many, many losers.

Another thing I don't understand is that some of the Plaintiffs who want to change the control date agreed to the original compromise in San Diego in 2008 ~~What really burns me is that proponents of making a change agreed to the compromise.~~ One of them testified in June that "promises were broken" and that was their reason for ignoring the control date and increasing their capacity in the fishery after 2003. The statement was left hanging and unsubstantiated. I've thought about this phrase. A more important promise and one that can be substantiated is the promise of a stronger, healthier, more economically vibrant and sustainable whiting and Groundfish fishery. These are the goals and objectives of not only the FMP, but the Groundfish strategic plan and the trawl IQ program. They were all born out of the Magnuson Act. The promise to the participants from fisheries managers was that if you participate in the process, if you agree to and abide by the control rule, if you help to develop a program that works and benefits the nation and the fish and meets all of our goals and objectives we will support the program and ensure it is implemented. We ALL did that. Changing the entire program now not only breaks that promise to stakeholders And it undermines all future fisheries management decisions in this Council.

That decision that was made in November 2008 was fair and equitable to stakeholders. It is still fair and equitable today and I strongly urge you to continue to support the successful program that you created and implemented.

Todd Whaley
Brookings, OR
(541) 251-1906

Chair Wolford & Council members,

My name is Todd Whaley – I'm a 2nd generation fisherman and have been fishing my whole life. I've been involved in the Groundfish fishery since 1983 and the whiting fishery since 1994 – participating in both the shoreside and mothership fisheries. I'm here today to support the status quo option and strongly encourage the council not to make a change to our successful program.

I hold one of the permits that would likely benefit from a reallocation in the mothership sector – but I still support no change to the current program. The current program is working.

- In the years after the control date and closer to implementation of the IFQ system there was a lot of bycatch issues. If you wanted to take the high road and stand down when there were bycatch issues you would now be punished by a change in the dates

- A few years ago NMFS gave the industry a heads up that the season would close within a few days. Two of the plaintiffs went fishing and it appeared that they threw caution to the wind because they made trips in higher risk areas, obtained higher amounts of bycatch and fit in as many trips as possible before the season was closed. In the end – the fleet went way over on the bycatch – and these are the people you want to reward? How is that fair and equitable to the rest of the fleet?

- This program was designed in such a way as to not create big winners or big losers . Any change from status quo results in a few HUGE winners and many losers – this is not fair and equitable.

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place Suite 101
Portland, OR 97220-1384

RE: Agenda Item H.7.c Reconsideration of Initial Catch Share Allocations

September 13, 2012

Dear Chairman Wolford and Council Members,

I want to take this opportunity to express my strong support for the status quo option under this agenda item.

I live in Newport, Oregon and I own two vessels that participate in the whiting and non-whiting Groundfish fishery, including both shoreside and mothership whiting, and we have been fishing Groundfish for 27 years. I have been a vocal supporter of rationalizing the Groundfish fishery with a catch share system, and I support the program as implemented.

As a long-time participant in the Groundfish fishery I attended most of the ITQ meetings throughout the years in the development of our catch share program. While there were many species and diverse business interests involved in the development process, a series of compromises led us to a conclusion that resulted in a system that has virtually eliminated bycatch, and has promoted higher fish prices and more stable employment onboard the vessels and at the local processing plants. The compromises reflected the give and take of the participants and their aim to create a system that benefitted the fishery as a whole, with no big winners and no big losers. I had to give up some financial gain in order to make a compromise- we all did – and we were willing to in order to make the program work. We accomplished our goal of not creating big winners and losers and to choose an alternative other than status quo would eliminate all of these gains.

Nearly all the fish boat and permit owners chose to play by the Council rules by accepting the control date. They made business decisions trusting that the Council process would move forward based on the control date. To let a tiny fraction of fishermen benefit from a breach of this control date would not be fair and equitable. Any past or future catch share or limited access program here or around the nation would be in severe jeopardy if the control date is not held.

In response to a statement made that the MTC vessels were "gaming the system" by building history during the development stages of catch shares, I can only speak for myself as the f/v SEEKER, an AFA vessel, and say that we did not lease out our Pollock or change any of our fishing strategies during the development of this catch share program and chose, instead, to play by the rules. It would be interesting to ask some of the proponents of changing the initial allocation if they leased out any of their catch shares in other fisheries in order to increase their participation in the whiting fishery after the control date.

Status quo was fair and equitable in November 2008 and it is even more fair and equitable now. Please don't punish those of us who participated throughout the process and played by the rules. Please stand up and strongly support the successful program that you created by voting status quo today.

Thank you for your consideration.

Jim Seavers
Newport, OR

Mike Retherford
F/V Excalibur
Toledo, Or

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: Agenda Item H.7.c. Reconsideration of Initial Catch Share Allocations

September 10, 2012

My name is Mike Retherford and I own and operate the f/v Excalibur, a trawl vessel which participates in the shoreside whiting fisherey ,as well as the traditional Groundfish fishery. In addition to Groundfish, I participate in the Oregon shrimp and crab fisheries. The Excalibur has been very versatile over the years, from doing at-sea whiting to being a survey boat in the annual NOAA trawl survey for sixteen years. In addition to the Excalibur I partnered with my sons in the purchase of the Winona J, a crabber and trawler, and having a successful business and strong catch share program is important for me as my sons and their families to continue in our family tradition.

I'm writing to you today to express my strong support for retaining the status quo for the ITQ whiting shoreside and at-sea fisheries. I believe for many reasons that this is the most fair and equitable option to all stakeholders, including myself. I participated throughout the ITQ development process and I played by the rules. I supported and adhered to the control date, recognizing that additional landings effort on my part after the control date would not be considered in the initial allocation formula. Permit transfers were allowed up through 2010 and I did purchase a permit, for the Winona J, with traditional Groundfish and at-sea whiting history that qualified for quota shares during initial allocation. My wife and I invested $450,000 for this permit and if the Council decides to rescind their original decision now, it certainly will have a negative effect on my investment and our fisheries business plan. Other folks made their own business decisions – like leasing out Pollock in Alaska so they could spend time building history in the west coast whiting fishery after the control date. The difference is that I made my investment based on what the Council told me was fair and what the program would be. They made their decisions in spite of what the Council told them was fair and what the program would be. This reconsideration is a slap in the face to all of us who played by the rules.

We now have a successful ITQ program in place. By all accounts the status quo fishery is meeting and or exceeding the intended goals and objectives of the trawl catch share program. And if I understand correctly, entities that received little or no initial allocation of whiting still processed and harvested a large amount of fish in 2011.

Upending a successful program that will have been in place for two years in order to pacify a small minority of disgruntled participants will cause undue hardship and disruption to the majority of stakeholders involved in this fishery. It also threatens the integrity of the program itself- a program in which every stakeholder had the opportunity to participate in the development of. In fact, many of the plaintiffs themselves agreed to the status quo and testified to that option in November of 2008.

The Council spent a lot of time figuring out the best way to create a system with no big winners and no big losers. The Council spent time ensuring that new entrants could still come into the fishery. In the case of my boys, who have been fishing with me since childhood, we bought the additional permit in order to gain the quota share so they could enter the fishery on their own. And this option, frankly, is still open to anyone who believes they need more quota share – they can lease, buy, or otherwise trade in order to get into the fishery, just as we did for the Winona J. That's how the program was designed – tinkering with it now only disrupts the cart and puts everyone except a small few at a disadvantage.

The status quo option was fair and equitable in November 2008 and is still fair and equitable now. Please don't punish those of us who supported development and implementation of this successful program. Don't punish those of us who worked WITHIN the confines that the Council established to maximize our business strategy.

Lastly, while I would lose on one permit, I stand to gain financially on the other permit if you were to make a change to alternatives 2, 3, or 4. However, I still believe making a change is the wrong thing to do. The Council and the agency made a deal with the industry and we bought in. We've worked hand in hand with the managers over the years to make this a successful fishery. We're finally getting to a place where we can work together with our processors, with the managers, with our markets and really maximize our business plans while being personally accountable for our behavior and for conservation. Any change from status quo will cause significant disruption, breed distrust between industry and managers, and threaten to break the good will and bonds that have been created under our successful system.

Please vote to retain status quo for our at-sea and shoreside whiting fisheries.

Thank you for your consideration.

Sincerely,

Mike Retherford
Captain & Owner, F/V Excalibur

Mike Storey
Astoria, OR
(503) 791-0935

Dear Chairman Wolford & Council members:

My name is Mike Storey I have fished off the Washington, Oregon, California coast for five decades. Three of those decades participating in the whiting fishery. I have witnessed this council process since its inception. During that time I have seen the different factions, harvesters, processors, environmental groups and communities go from being unable to be in the same room with one another to a collaborative effort to solve the most difficult problems none more complex than the allocation process.

Watching the council from its infancy to the present has been an interesting and sometimes very frustrating journey. None more so, than the issues that we are faced with today. Particularly when the plaintiffs and rest of industry set down at that collaborative table and agreed to what is in place now – both in oral and written testimony.

Judge Henderson in his remand brought to focus some areas of concern although I feel those areas will be covered and, if you will, put to rest. With all due respect to Judge Henderson and his expertise there is no way possible he could fully understand the amount of work and effort put before this council in developing an IFQ program for a multi-species fishery. We are one of the permits that would gain substantially under a reallocation but having said that, it is our (myself and the owners) belief that preserving the allocation and council process is more important than financial gain. And lets face it – we have a program that works.

One additional thing- the plaintiffs defend vacating the control date but are ready to put in place a different restrictive date that creates even bigger winners and bigger losers -

ARCTIC STORM MANAGEMENT GROUP, LLC
2727 Alaskan Way, Pier 69
Seattle, Washington 98121 U.S.A.

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

Agenda Item H.7

RE: **Item H.7. Reconsideration of Initial Catch Shares for SS &MS sectors of the whiting fishery.**

Support of Status Quo

Dear Chairman Wolford,

My name is Donna Parker. I was a member of the TIQ Committee and attended all the GAC and Council meetings relevant to the development of Amendment 20. I am testifying in support of the Status Quo alternative on behalf of the Arctic Storm Management Group.

Arctic Storm is a long time participant in the whiting fishery. We operate two motherships and two catcher vessels that have permits in both the Mothership and Shoreside whiting fisheries. We believe the Council acted properly when it took final action on Amendment 20 in 2008.

Amendment 20 was one of several actions taken by the Council to reduce overcapitalization of the Pacific Coast trawl fisheries. The Control Date of 2003 was identified by the Council to discourage increased capitalization of the fishery and encourage a stable transition to a rationalized fishery. Based on the Control Date and subsequent actions taken by the Council, our company made a business decision to retire one of our vessels in anticipation of consolidating its quota onto our other catcher vessel. In other words, we took seriously the Council's message to decapitalize the fishery. In order for that vessel to continue to participate in the fishery, we would have had to infuse significant capital into rebuilding the vessel. Injecting more capital into an already overcapitalized fishery seemed counter to the purpose and need of actions to decapitalize the fishery as articulated by the Council in establishing the Control Date, and in considering Amendments 15, 20 and 21. If the Council changes the catch history years retrospectively to a set of more recent years, the Neahkahnie permit will be severely devalued and the company penalized for our actions which we thought were in conformance with Council intent.

The SQ alternative is most Fair and Equitable.

> *Status Quo: The catch history years of 1994-2003 for vessels in the shoreside, mothership and catcher processor whiting sectors and for the non-whiting trawl sector. The catch history years awarded to shoreside processors of 1998-2004.*

- **The SQ alternative conforms with the Control Date of 2003 and so does not do harm to those who acted in good faith in choosing not to increase catch history after 2003.** The Control Date was chosen so that participants would not aggravate the race for fish in an overcapitalized fishery by increasing participation in a race for catch history. The Council warned participants, throughout development of A. 15 and A 20, not to expect that catch history after 2003 would accumulate toward catch shares. Participants made business decisions based on these admonitions. Those that acted in good faith in choosing not to increase participation in an overcapitalized fishery after 2003 would be harmed by Alternatives 2,3 & 4 that, instead, use catch history years beyond 2003.

- **The SQ Alternative is most fair and equitable to fishermen unable to find markets in an increasing overcapitalized fishery.** Fishermen unable to find markets during those later years after 2003 will also be harmed by Alternative 2, 3 and 4.

- **The SQ Alternative is most fair and equitable because it awards quota in a balanced manner that avoids allocations that create big winners and big losers.** Taken as a whole, the tables and figures in the Draft EIS show permit allocations based on Alternatives 2, 3 & 4 will create increased disparity in allocations. Specifically, under Alternative 2,3 & 4, more permit holder will suffer quota reductions to fund increased allocations for the fewer permits.

- **Impacts to Shoreside Sector (SS) Permits of Alt 2, 3 &4 that do not seem fair and equitable:** See page 80 in the Draft EIS for Alternative Impacts to SS permits: Table 4-6 & 4-7 and page 77 for narrative that shows more permit holders will have their quota reduced to fund increases in quota to a few others. Specifically: Alt 2 would require that 38 permits suffer quota reductions to fund increased allocations to 27 permits. Alt 3 would require that 40 permit holders suffer reductions to fund increases to 25 permits. Alt 4 would require that 37 permit holders suffer reductions to increase allocations to 28 permits.

- **Impacts to Mothership (MS) Sector Permits of Alt 2, 3 &4 that do not seem fair and equitable. See** page 92 in the Draft EIS for Alternative Impacts to MS permits. Alt 2 would require that 23 permits suffer quota reductions to fund increased allocation to 14 permits. Alt 3 would require that 21 permits suffer reduced allocations to fund increased allocations to 16 permit holders. Alt 4 would require 21 permit holders to suffer reduction to fund increases to 16 permit holders.

- **Impacts to Shoreside Processors of Alt 2,3 &4 that do not seem fair and equitable.** The disruption caused to the industry by reallocating the permit allocations described above hardly seems worth the additional quota awarded to Ocean Gold under any scenario. See pages 107-110 also Fig 4-13 and 4-14. See the last sentence on page 109. "The maximum change for any one processor (from SQ to Alt 4) would be an increase of 1.3% of the quota share."

- **The Impacts to Mothership Processors of Alt 2,3 &4 that do not seem fair and equitable.** See page 116. Based on the annual linkage between catcher vessels and a MS, one MS (Company 2) would lose from 3.3% to 8.8% of the MS quota, or almost a third of the fish it is scheduled to process in 2012.

- **The SQ alternative is most fair and equitable because it does not discriminate among participants in the trawl fisheries by using different catch history years.** If Alternative 2, 3, or 4 is implemented MS and SS whiting participants will receive allocations based on more recent years than participants in the CP and non-whiting participants. Rationalization of the Pacific Coast trawl fisheries was designed as a single program. The Council was purposeful in keeping this a single action knowing that it would take much longer to implement, be more complex yet more balanced. Choosing separate catch history years for the MS and SS whiting participants than the years chosen for the CP sector and non –whiting participants is discriminatory and upsets the balance this action sought to establish. In choosing SQ, all vessel permits are treated equally.

- **The SQ Alternative is the most fair and equitable treatment of non-AFA participants in the whiting fishery.** Congress passed the American Fisheries Act which rationalized the Bering Sea pollock fishery when it was implemented in 1999 and 2000. It allowed pollock participants to lease quota or modify their fishing plans and increase participation in other fisheries, including whiting. For this reason Congress required the Pacific Council to take action that would protect non-AFA participants from increased participation by AFA vessels in the whiting fishery. The PFMC took protective action when it passed A 15 which closed entry to new participants in the whiting sectors in 2006. This action was described as an *interim* measure until A. 20 was passed. During public testimony and in deliberations on A 15, the Council warned the public not to expect catch history to accrue after the 2003 Control Date under A 20 knowing that every year after 2003 would give additional advantage to AFA vessels and further overcapitalize the fishery. Unlike AFA vessels, non-AFA vessels did not have an opportunity to lease quota or modify participation in other fisheries, giving AFA participants who chose to ignore the Control Date, unfair advantage. While there is nothing illegal about increased participation of AFA vessels after 2003, the expectation that those vessels should be rewarded for it, is counter to the messages of intent sent by the Council over many years.

- **The SQ alternative is most fair and equitable to those hoping to rationalize other fisheries on the Pacific Coast and elsewhere in the Country**. Use of a Control Date is a critical management tool in allowing the fisheries under consideration for catch share programs to operate in a manner that does not destabilize the fishery or threaten to undermine conservation efforts such as bycatch reduction or rebuilding overfished species. The North Pacific Council is scheduled to take the first step towards rationalization of the Gulf of Alaska groundfish trawl fisheries in October. They are watching whether the integrity of the Control Date stands here. Without a Control Date established there will undoubtedly be an accelerated race for "catch history" in that region which may destabilize that fishery and threaten the incomes of those current fishery participants who may be displaced by the increased activity of those seeking catch share history. However, if a Control Date is established and later set aside, it is unfair to the participants who heeded it.

- **SQ was supported as the most fair and equitable when final action taken in November 2008.** These catch history years were selected in a transparent, public process that received strong support from the vast majority of participants, including some of the plaintiffs and Ocean Gold. (See attachments) The plaintiffs and Ocean Gold had every opportunity to express concern over the catch history years in the alternatives and chose not too. Instead, they chose to challenge the decision in Court. If alternatives other than SQ are chosen, it supports litigation as a successful strategy outside the Council process. That does not seem fair and equitable to the hundreds of fishermen, processors, conservationists and staff who labored for years over development of this program in a transparent forum.

- **The SQ Alternative was responsive to communities when it exceeded the Control Date in awarding shorebased processor quota.** In awarding a catch history year that extended beyond 2003 to shorebased whiting processors, the Council sought to provide increased stability to the communities where the processors were located. The communities could not engage in a race for fish and so were not the target of a Control Date. The 20% allocation to processors was intended to provide an added incentive for CV permits to land whiting in those communities and to protect processor investment in those communities. The additional year was added when participants were asked to meet and come to agreement on a set of years. Far from being a private deal for the benefit for of a single participant, these very public negotiations were initiated to build consensus around a fair and equitable solution that also mitigated potential impacts to communities. This effort was successful in winning broad public support in testimony and so was approved by the Council. (See attachment) However, Judge Henderson found that departure from the Control Date to accommodate the needs of a single processor was "arbitrary and capricious." This benefit to a single processor was described by the judge as "a quintessential case of arbitrariness" and a "political solution." Those of us at the Council meeting during deliberations know that this decision was not arbitrary. It was instead, an effort to bring consensus to an important decision. Based on his comments, the judge seemed to think that awarding quota to processors and quota to harvesters was similar in intent and impact. When properly viewed in the context of impact to communities where processors are located both the intent and impact are quite different and different treatment in this context may be the most fair and equitable approach.

Ocean Gold argues that changes in markets, products, prices and fish location require an increased allocation to its plant.

- **Ocean Gold claims to have developed a new product which it calls HGT**, or head, gut and tail removal. It claims to have increased markets, prices and recovery rates with this product and argues that it should be rewarded for this with an increased allocation. However, pages 41 and 42 of the Draft EIS indicate that changes in prices seem to be more impacted by changing global supplies of whiting and pollock rather than HGT. "*In comparing trends and accounting for the recent state of the world economy, there appears to be some correlation between ex-vessel prices for hake and trends in world landings.*" Further, HGT was a hake product produced in South America before it was produced in Wesport. **But even if all the claims made by Ocean Gold are valid, why should the Council consider reallocating quota every time a new product is developed, the ex-vessel price changes or fish stocks favor a different region? That seems destabilizing and contrary to the goals of A. 20 and the FMP.**

In closing, we urge the Council to reaffirm its choice in catch history years chosen when it took final action in 2008 to approve Amendment 20. That action has successfully rationalized the whiting and non-whiting fisheries and brought stability and prosperity to a once wildly overcapitalized fishery.

Sincerely,

Donna Parker

Donna Parker
Director of Government Affairs

Attachments include:
Citations from the DEIS in support of SQ Alternative
Testimony from Ocean Gold representative in support of SQ during A 20 action
Written Comments from represeentive of Pacific Dawn in support of SQ during A 20 action

Attachment

Reconsideration of Catch Share Allocations for Shoreside and Mothership Sectors of Whiting Fishery

Draft EIS September 2012

Useful tables, graphs and text in evaluating alternatives

Overcapitalization:

Pgs. 35 & 36. Purpose and Need Statement of A. 15.

Pg. 37. Fig. 3-3. Whiting trends. Quota taken annually.

Pg 43. Fig. 3-13 & 3-10 trends in participation correspond with quota flux until rationalization.

HGT impact on prices.

Pgs. 41 & 42. Price changes seem to be more impacted by changing global supplies of whiting and pollock rather than local HGT production.

Processor trends.

Pg 52. Shoreside processors seem to enter and leave the whiting fishery on a regular basis.

Permit trends.

Pg 48-50. Fig 3-16 & 3-17. Permit activity for SS and MS permits. Seem to be impacted by levels of OY, CD but mostly overcapitalization. Fewest participants in 2002-04 when quota down. Most of the permits have not been active on a regular basis both *before* and *after* CD. 33 Buyback permits retired and compensated, mostly in SS sector, yet 47 remain in that sector. Too many. Similar in MS sector. For instance, there are 34 MS permits and 6 MS. Rarely are more than 16 permits actively fishing in a year or more than 4 MS. A MS fleet usually does not exceed 3 or 4 vessels without becoming "overboated." (3 CV X 6 MS= 18 or 4 CV X 4 MS = 16. In other words no markets for other vessels. Additional markets not needed because a MS needs at least a full trip or two to make participation worthwhile. A 20 allows the remaining permits to be retired or consolidated so that capitalization matches fishery. Why shouldn't these permit owners be compensated for retiring vessels and permits as were those that participated in Buyback program? See page 144: "Current participation of harvesters is taken into account by allocation to current owners of *permits* based on the assumption that current permit owners are current participants. .... While some current permit owners may not take part in the fishery, from a perspective of economic rationality the expectation is that, on average, those owning permits will have sought them in order to earn a return on their investments."

Lots of graphs in this section. Taken as a whole they show following impacts caused by change in allocation from SQ to more recent catch history years: big winners and big losers, more losers than winners, retirement of vessels occurs as expected, no matter what years chosen about half the fleet is always inactive because it is so overcapitalized.

See page 80 for Alternative Impacts to SS permits: Table 4-6 & 4-7 and pg 77 for narrative that shows more permit holder in SS sector hurt than helped by Alternatives 2 - 4. Specifically, Alt 2: 27 permits increase allocation, 38 permits decrease allocation. Alt. 3: 25 permits increase, 40 permits decrease. Alt 4: 28 permits increase, 37 permits decrease.

See page 92 for Alternative Impacts to MS permits. Alt. 2: 14 permits increase, 23 permits decrease. Alt. 3: 16 permits increase, 21 permits decrease. Alt 4: 16 permits increase, 21 permits decrease.

Community trends in whiting landings.

Pg. 46. SQ allocation years 1998-2004 show landings in WPT at 11% of shoreside quota. In 1999-2005, landings in WSP were 19%. In 2006-2010, landings in WSP were 29%. In 2011, following implementation of A 20, landings in WPT were 21%.

Dependency seems to be awash.

SS: pg 86-88. MS: pg. 99. Average allocations to MS permits decline with increasing emphasis in recent years while opposite effect occurs with SS permits.

Processor Impacts.

Shoreside: Ocean Gold seems to be E14. See pages 107-110 also Fig 4-13 and 4-14. See last sentence on page 109. "The maximum change for any one processor (from SQ to Alt 4) would be an increase of 1.3% of the quota share. "

Mothership based on annual processor linkage relationship with its fleet: See page 116. One processor (Company 2 -AS) would lose from 3.3 to 8.8% of MS quota, or almost a third of its 2012 aggregate fleet allocation under Alt 4.

Community Impacts.

See pg 117. Fig 4-18. Difference to communities from SQ to Alt 4 is about 2% of SS quota for WPT and 2% of quota to Ilwaco.

See pg 119, fig 4-22 for historic distribution of whiting landings among ports. In 2011 deliveries to WPT are higher than average '94-'10. Deliveries in 2011 to WPT = 22% of quota even though SQ allocation to OG is 14%. The annual variations in where fish are harvested along the coast probably have most impact on when fish are landed. Price is also a factor. Harvesting shares processors can use to attract deliveries enhances rather than drives those delivery locations.

Pg. 120. Fig 4-23. Allocation to Westport. SQ= 3.7%. Alt 1 = 3.5%. Alt. 2 = 4.3. Alt.3= 4.7. Alt 4 = 4.9. Not much of an increase to OG but big disruption for most permits.

Use of 2004 And Year Allocation Period For Processors

Transcript covering the Council rationale for moving the processor qualifying and allocation window and year from 2003 to 2004.

November 2008 Minutes

F.3.h Public Comment (11/05/08; 3:28 p.m.)

Mr. David Jincks, Midwater Trawlers Cooperative, Newport, OR
Mr. Richard Carroll, Ocean Gold Seafoods, Westport, WA
Mr. Dennis Rydman, Ocean Gold Seafoods, Westport, WA
Mr. Joe Plesha, Trident Seafoods, Newport, OR

(The above individuals testified as a group.)

Transcript of Council questions directed to this group of testifiers regarding the 2004 date and their response (11-06-08pm2.mp3):

Rod Moore (1:43:05) – very briefly either Joe or Rich, there's a difference in the harvesting history years and the processing history years could you explain, I understand from Dave how we got the harvesting history years, could you explain how we got the processing years please.

Richard Carroll - That was really a function of the spirit of compromise, the processing years on which we based our processing history is essentially a year range that we had agreed to at the start of this process five years ago. And, we feel it's an equitable distribution along the coast that recognizes the recent history that we've experienced in Westport.

Rod Moore - I could just follow up very quickly Mr. vice chair. So Rich, these years have appeared previously before the Council in various documents because they're not in the decision document right now?

Richard Carroll - I'm not sure that they've appeared before the Council before but they are a function of an earlier agreement.

Joe Plesha - I think it's important that we recognize that part of the goal of changing the years is to make sure that people who had recent investments, and one company in particular who made substantial investments, doesn't have the value of those investments stranded. And that's a real threat that people have because of the enormous capital that has been put into this fishery. And if they are not included that is a possibility. So I think that was important that the years be modified so that there is less stranded capital possibilities for the processing sector as a whole.

...

Phil Anderson (1:56:45) – I'll be quick but what I have to say is important. First, and that is thanks very much to all of you and everybody that worked on bringing this proposal forward I know you guys worked real hard on it and I know there were probably a lot of hard discussions and while Dave mentioned that you have worked together and talked a lot in the past, maybe not so much lately. On the years on the processor piece, and I understand that it was a compromise, I guess that you called it, and in at least in partial recognition of capital investments that have been made in recent years but is it fair to say that it doesn't capture the - by going to 04 the picture would've looked a lot different had you gone to 06 or 07, this indeed was a compromise to recognize, in part, recent capital investment is that a fair statement.

Rich Carroll - Yes I'd say that's a fair statement and one of the things I've tried to stress in my testimony is that everybody has had to give something here. This is genuinely a compromise but I think it that all of this here at the table recognize that the long-term benefits are going to outweigh the short-term compromises that we make. And that this is truly in the betterment of the industry.

Attachments

September 24, 2008

Mr. Phil Anderson
Washington Dept. of Fish & Wildlife
600 Capitol Way North
Olympia, WA 98501

RE: Whiting co-op mothership/catcher vessel management

Dear Phil:

The suite of preferred alternatives that you presented to the PFMC on the whiting co-op proposal for the mothership/catcher vessel (MS/CV) sector overall captures industry intent and is well developed. Given further reflection, there is, however, one component of the program that has been, and continues to be, of concern and we believe deserving of an additional alternative.

You may recall that the original proposal developed by UCB and presented to PFMC by Steve Hughes and Brent Paine, reported industry agreement on the package with the stipulation that individuals could offer additional alternatives to PFMC for consideration. The following deals with the aligning of catcher boats with motherships in 2009 and the movement of CV's between motherships in general. The below-signed would like to add an alternative that would provide more flexibility to catcher boats and to avoid CV's going through open access to change MS markets. Specifically, the added alternative that we request be added would provide that in the first year of co-op formation, catcher boats are free to deliver to any processor or processors which they choose, and that this procedure would be followed each year, which eliminates the one year open access requirement for CV's to change MS markets between years.

We thank you for your consideration of this additional alternative and we understand that it would be appropriate to discuss its inclusion in the co-op proposal during the October 8 and 9, 2008 Allocation Committee Meeting.

Sincerely,

[signature] (F/V Pacific Challenger)
[signature] (F/V Aleutian Challenger)
[signature] M/V Golden Alaska
[signature] F/V Ocean Leader + F/V American Beauty
[signature] FV Muir Milach
[signature] F/V Perseverance

Tom Libby
California Shellfish Co., Inc.
Hallmark Fisheries/Point Adams Packing Company

Agenda Item H.7: Reconsideration of Initial Catch Share Allocations in the Mothership and Shoreside Pacific Whiting Fisheries

Further discounting, thru reallocation, the history of processors, who, likeTrident Seafoods, Point Adams Packing Company and Pacific Seafoods pioneered shore based volume processing of pacific whiting in the early 90s, and who invested millions in plant, equipment, community infrastructure and labor, is contrary to MSA goals and objectives of:

- current and historical harvests,
- employment in the harvesting and processing sectors,
- investments in, and dependence upon, the fishery; and,
- the current and historical participation of fishing communities.

High volume shoreside whiting began in the early 90's Had the entire processor history been considered, PAPCO would have been allocated approx. 7% at the outset. PAPCO agreed to drop the years from 1992 to 1997 in exchange for those processors with more recent history accepting an end date of 2004 and giving up any recency after 2004. Our allocation dropped from approx 7% to 2%, a transfer of 71.4% of our history to more heavily weight, towards recency, the, history from 1998 to 2004. . Others with early history also gave up the years from their initial entry date thru 1997. The net result of this was a transfer of history from the whiting fishery dependent communities of Newport, Warrenton and Hammond, OR to Westport, WA. In our case the 71.4% reduction in our history contributed to a final allocation of 3.8% for Ocean Gold. Nearly twice the final PAPCO allocation of 2%.

Status Quo is my preferred option, with Alt.1 being the fallback.

Following are the effect of options 2, 3 and 4 for Point Adams Packing Company:
Each of the following alternatives results in the loss of 130 employees per day for as many as 5 months.

Alt. 2: A 67% reduction in PAPCO's Quota Share from 2% to 0.661%.

Alt. 3: A 77% reduction in PAPCO's Quota Share from 2% to 0.47%.

Alt. 4. A 99% reduction in PAPCO's Quota Share from 2% to 0.008%

The only fair and equitable alternatives are status quo and Alt. 1.

In calendar year 2011, Pacific Whiting represented 100% of landings at Point Adams Packing Company's dock and 98% of total production.

PAPCO is 100% dependent on whiting to keep the plant operating.

Excerpt
Page 7 H.7.c
June 2012
Ocean Gold
Public Comments

C. ....."Ocean Gold, in particular, has spent nearly $40 million in the last decade to upgrade its facilities and increase its production capacity. During the period from 2004-2010, it made major capital investments including .... unloading facility at the dock, a wastewater treatment system...., an expanded processing facility, a fish meal plant, and a cold storage facility with a capacity to freeze and store 50 million pounds of seafood. .....When Ocean Gold first began its whiting operations, it had 50 employees and only one vessel delivering to it. Over the last 5 years, it has employed as many as 700 annually, ..., and has on average 12 vessels making deliveries to it."

The following table is taken from information found in the Draft EA, Agenda Item H.7.a, Attachment 1, September 2012, page 46 documenting community shares of the whiting harvest:

	Westport.	*Newport.*	*Astoria.*	*Crescent City*
1994-1998.	*5%.*	*50%.*	*35%.*	*5%*
1999-2005.	*19%.*	*41%.*	*29%.*	*2%*
2006-2010.	*29%.*	*30%.*	*25%.*	*3%*

From 1998 to 2005, Westport's total landings share increased 380% from 5% in 1998 to 19% in 2005.
From 2006 to 2010, Westport's total landings share increased 53% from 19% in 1999 to 29% in 2010.

The above details clearly illustrate Ocean Gold's substantial growth over the post control date years, and the obvious expansion of both harvesting and processing capacity during those years. From 2005-2011 Ocean Gold continued to invest heavily in both capital assets ($40,000,000) and human resources (50 employees in 1997 to 700 + in each of the years 2005-2011). The transfer of rents from those assets (capital and human) plus whiting ex-vessel value to Westport came at the expense of other harvesters, processors and their whiting fisheries dependent communities, and is contrary to the intent of the Quota Share Program. Further reducing fairness and equity In the program.

In considering Alternatives 2, 3, and 4 reallocating Processor QS is unfair and inequitable.
Options 2, 3, and 4 do not meet the standards of MSA. (303A Limited Access Privilege Program)

They do not meet:

1. The fair and equitable requirement:
   Rampant capital expansion after the control date at the expense of other processors.

2. Employment in the harvesting and processing sectors;
   Transferor loses employment value from both sectors
   Transferee gains employment in both

3. Investments in, and dependence upon, the fishery;

4. Stranded capital in dependent communities, loss of employment, deterioration of Community infrastructure
5. The current and historical participation of fishing communities;
   Newport, Astoria, Warrenton and Hammond 1992-2011.
   Westport 1997-2011.

Status quo and Alternative 1 meet MSA requirements including consideration of recency and are the least disruptive, most defensible when all criteria are considered.

The shoreside processing sector of the whiting fishery has also been overcapitalized. The harvesting and processing sectors of the groundfish fishery expanded together: in a derby fishery, processors invest in excess capacity to compete with other processors for deliveries by being able to handle peak volumes, and go idle when the derby fishery ends. (See attached paper "**OVERCAPITALIZATION OF THE PACIFIC WHITING FISHERY**")

Following is a perfect example of latent capacity in the shoreside whiting processing sector:

Point Adams Packing Company capacities, 1992-2011

In the early 90's PAPCO's largest volume year exceeded 12,700 MT

	Whiting Purchased	Purchased In MT	Whiting Landed
1998	4,303,662	1,952	87,627
1999	0	0	83,388
2000	27,883,445	12,648	85,653
2001	6,135,521	2,783	73,326
2002	8,165,162	3,704	45,276
2003	11,659,238	5,289	51,061
2004	0	0	89,251
2005	0	0	74,000
2006	0	0	97,000
2007	7,976,000	3,618	67,000
2008	7,233,600	3,281	68,000
2009	6,439,500	2,921	49,000
2010	4,390,522	1,992	
2011	23,500,000	10,660	

NOAA recognized this relationship in the Amendment 20 EIS, which concluded that "with the move from a whiting derby fishery to an IFQ program the amount of processing capital needed in the whiting fishery would decline by 30 to 50 percent . . . [because] the move to an IFQ program will slow the pace of the fishery resulting in substantial unneeded processor capital."

The whiting fishery comprises most of the groundfish landed in the Pacific groundfish fishery. Like the whiting fishery, the non-whiting fishery is also overcapitalized, but unlike the whiting fishery, it does not operate as a derby fishery. The EIS for Amendment 20 clearly distinguishes between the whiting and non-whiting fisheries. The persistent overcapacity in the whiting sector of the fishery was clearly a fundamental driver of the rationalization program.

OVERCAPITALIZATION OF THE PACIFIC WHITING FISHERY

The whiting fishery has been overcapitalized since the 1980s.[1] The Pacific Fishery Management Council ("Council") recognized this as early as 2000, when the Council's Scientific and Statistical Committee estimated that the capitalization rate for the limited entry trawl sector of the Pacific groundfish fishery was between 27% to 41%, depending on the amount of overlap between the non-whiting and whiting trawlers.[2] Based on this estimate, both the SSC report and the Groundfish Strategic Plan recommended that the Council take immediate action to reduce capacity (e.g., a buyout) in the short term (because IFQs were then prohibited and in order to prepare the fishery for an IFQ program) and develop an IFQ program in the long term.[3]

Overcapacity was a longstanding problem that the Council had tried but failed to address with other measures. The Council first implemented Amendment 6 in 1994, which limited entry to the groundfish trawl fishery by requiring endorsements relative to the length of their vessels (thereby creating a "limited entry (LE) trawl fishery"). Catcher-processors and other large vessels desiring to participate in the fishery had to purchase multiple permits and combine them in order to acquire a large enough length endorsement to operate their relatively large vessels in the fishery.[4] Although this amendment ultimately resulted in the effective removal of 114 trawl permits from the fishery by 2003,[5] the Council's Scientific and Statistical Committee ("SSC") concluded by

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[1] PFMC (Pacific Fishery Management Council) and NMFS (National Marine Fisheries Service). 2010. Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery; Final Environmental Impact Statement Including Regulatory Impact Review and Initial Regulatory Flexibility Analysis, at 15 (AR100435) (hereinafter "A20 FEIS") ("The Council has been developing programs to reduce capacity in the groundfish fisheries since the mid-1980s . . . . "); Government Accountability Office, "Individual Fishing Quotas: Methods for Community Protection and New Entry Require Periodic Evaluation" (Feb. 2004) (GAO-04-277) at 38 (AR040074-7) ("In the 1990s, the [Pacific whiting] fishery was overcapitalized and fishing companies were engaged in a race for fish.").

[2] Pacific Fishery Management Council, Economic Subcommittee Scientific and Statistical Committee (SSC), "Report on Overcapitalization in the West Coast Groundfish Fishery" at 37-38 (2000) (hereinafter "SSC Report"). The SSC considered the minimum number of trawlers needed to fully utilize the non-whiting groundfish OYs, the whiting shoreside allocation and the whiting mothership allocation in 2000, and also (to prevent double counting) the extent to which these boats participate in more than one of these groundfish activities. The SSC did not have data to evaluate catcher boat participation in the whiting mothership fishery at the time.

[3] SSC Report, at 108; Pacific Fishery Management Council, "Groundfish Fishery Strategic Plan" (Oct. 2000), at 7 (hereinafter "Groundfish Strategic Plan").

[4] Amendment 6 of the Groundfish Fishery Management Plan is discussed in the A20 FEIS at 82.

[5] A20 FEIS, at 83, 119 ("During the 1980s, approximately 500 trawl vessels landed groundfish in any given year. With the introduction of LE, the number of vessels declined and remained between 300 and 400 vessels per year for several years.").

2000 that "[t]he 1994 limited entry program was not sufficiently restrictive to address the overcapitalization that existed at the time of the program's inception."[6] Worse yet, the SSC found that "the gap between harvest capacity and groundfish [Optimum Yields ("OY")] widened as stocks continue[d] their downward decline, new scientific information [became] available clarifying the extent and gravity of this decline, and OYs [were] reduced to unprecedented low levels."[7]

In accordance with the Groundfish Strategic Plan, the Council's next effort was a buyback program in 2003.[8] As a result of the program, NOAA permanently retired 91 trawl vessels and their Pacific Groundfish limited entry trawl permits, which reduced the number of permits by 35% and the capacity (in terms of endorsed permit length) by 34%.[9] Even so, NOAA estimated that 24 to 32 "latent" permits remained at large as "a significant amount of capacity . . . that can be mobilized at any sign of improved fishing opportunities."[10]

Even with all these reductions, overcapacity remained an issue in the 2004 Pacific whiting fishery. NOAA calculated that "estimated capacity [in the Pacific whiting fishery] exceeded estimated catch in 2004 by 64 thousand t[ons] or 30 percent," and therefore concluded that "there was excess capacity and overcapacity for Pacific whiting."[11] The June 2004 scoping notice for Amendment 20 therefore concluded that despite the 2003 buyback program, "management of the west coast LE groundfish trawl fishery is still marked by biological, social, and economic concerns . . . . [and] is currently viewed as economically unsustainable."[12]

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[6] SSC Report, at 45.
[7] SSC Report, at 45.
[8] A20 FEIS, at 84.
[9] National Marine Fisheries Service (NMFS), Northwest Region, "The Aftereffects of the Pacific Groundfish Limited Entry Trawl Buyback Program: A Preliminary Analysis" (Mar. 2005) at 1 (AR040189). In 2003, for example, 241 trawl vessels recorded landings of groundfish, while in 2004, only 155 trawl vessels recorded landings of groundfish. The number has remained relatively stable since 2004. A20 FEIS at 119.
[10] *Id.* at 2, 5.
[11] National Oceanic Atmosphere Administration (NOAA), "National Assessment of Excess Harvesting Capacity in Federally Managed Commercial Fisheries" at 263 (2008).
[12] Pacific Fishery Management Council, "Information for Public Scoping of Dedicated Access Privileges for the Pacific Coast Limited Entry Trawl Groundfish Fishery" at 1-3 (June 2004) (AR040615); *see also* A20 FEIS, at 3-4.

On top of the existing overcapacity, new vessels entered the whiting trawl fishery (i.e., vessels without catch history for Pacific whiting) in 2006, even though it was already "greatly overcapitalized," had a limited entry program in place, was heavily regulated in order to protect overfished species, and facing a future rationalization program.[13] Indeed, one commenter estimated that more than "4 million pounds of excess vessel capacity" entered the Pacific whiting fishery during this time.[14] In response, Amendment 15 implemented a vessel license limitation program in 2008, which required vessels to demonstrate a history of whiting harvest in order to participate as "an interim measure until the implementation of [an IFQ] program."[15] The Environmental Assessment documented that the Pacific whiting fishing continued to function as a derby fishery in 2007.[16]

NOAA and NMFS continued to describe the Pacific whiting fishery as overcapitalized when finalizing the trawl rationalization program in 2008-2010. The Federal Register notice for regulations implementing Amendments 20 and 21 identified the Pacific whiting fishery as a "derby fishery"[17] because it "close[d] due to imposed limits rather than availability of fish or market conditions."[18] The EIS for Amendment 20 anticipated that if no action is taken, the outcome will be "[c]ontinued overcapitalization as a result of derby conditions in shoreside whiting industry."[19] Similarly, comments throughout the development of Amendment 20 reflected that participants believed that the Pacific whiting fishery had characteristics of a "derby fishery."[20]

The shoreside processing sector of the whiting fishery has also been overcapitalized. The harvesting and processing sectors of the groundfish fishery expanded together: in a derby fishery, processors invest in excess capacity to compete with other processors for deliveries by being able to handle peak volumes, and go idle

[13] National Oceanic Atmosphere Administration (NOAA), Environmental Assessment for a Limited Entry Program for the Non-Tribal Sectors of the Pacific Whiting Fishery, at 89 (Apr. 2008) (AR080209) (hereinafter "A15 EA") ("In 2004, 217,000 tons of Pacific whiting worth $22 million ex-vessel ($0.046/lb) were harvested and processed through the activities of 26 shorebased catcher vessels, 10 mothership-catcher vessels, 4 motherships, 9 shorebased processors and 6 catcher-processors. In sharp contrast, during 2006, 265,000 tons of whiting worth $36 million ($0.62 per lb) involved 37 catcher-vessels, 20 motherships catcher vessels, 14 shoreside processors, 6 motherships, and 9 catcher processors.").

[14] Letter from Midwater Trawlers Cooperative to NOAA Fisheries (Oct. 22, 2006) (AR060974).

[15] A15 EA, at 1-2.

[16] *Id.* at 89.

[17] "Derby fisheries result when overcapacity, combined with restrictive catch limits, serves to concentrate fishing into a very short season." A20 FEIS, at 83.

[18] 75 Fed. Reg. 60868, 60883 (Oct. 1, 2010)

[19] A20 EIS at 440.

[20] *See, e.g.*, Letter from Midwater Trawlers Cooperative to NOAA Fisheries (Oct. 22, 2006) (AR060974).

when the derby fishery ends.[21] Testimony from a variety of whiting processors confirmed the existence of overcapacity in the shoreside whiting processor sector. For instance, a Pacific Seafood representative testified at an October 2008 hearing that rationalization would hurt processors because "[t]here is excess freezing capacity [that was] developed in order to service the whiting and sardine fisheries."[22] At another meeting, another processing sector representative testified that "[p]rocessors have incredible capacity from the derby [whiting] fishery."[23] NOAA also recognized this relationship in the Amendment 20 EIS, which concluded that "with the move from a whiting derby fishery to an IFQ program the amount of processing capital needed in the whiting fishery would decline by 30 to 50 percent . . . [because] the move to an IFQ program will slow the pace of the fishery resulting in substantial unneeded processor capital."

The whiting fishery comprises most of the groundfish landed in the Pacific groundfish fishery.[24] Like the whiting fishery, the nonwhiting fishery is also overcapitalized, but unlike the whiting fishery, it does not operate as a derby fishery.[25] The EIS for Amendment 20 clearly distinguishes between the whiting and nonwhiting fisheries.[26] The persistent overcapacity in the whiting sector of the fishery was clearly a fundamental driver of the rationalization program.[27]

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[21] A20 FEIS, at 57-58; 162 ("Shore-based whiting processors currently must handle large volumes of fish in a relatively short time because the whiting fishery tends to function like a derby, with harvesters competing to catch the available quota.").

[22] AR080747, at 4 (Written Statement of Mike Okoniewski) (Oct. 29, 2009 Hearing in Astoria, OR).

[23] AR080748, at 2 (Synopsis of Processing Sector Comments) (Oct. 27, 2008 Hearing in Newport, OR).

[24] A20 FEIS, at 107 ("The trawl sectors account for 98 percent of all groundfish landings from 1995 to 2008. This is mainly accounted for by the high volume landings of Pacific whiting, a comparatively low value species, which accounted for 84 percent of groundfish landing during this period.")

[25] A20 FEIS at 273-74 ("In general, since Olympic conditions do not exist, capital in this fishery should be expected to be more in line with available harvest (compared to the whiting sector, which may have more capital than necessary); however, because of regulations, and due to the reduction in harvest volumes over the past decade, it is generally accepted that the harvesting sector remains overcapitalized. Indeed, research by Lian et al. (2008) indicates the nonwhiting trawl fleet may be overcapitalized by more than 50 percent.")

[26] *See, e.g.*, A20 FEIS at 53 ("For the nonwhiting fishery, an economically healthy fishery would also be expected to result in some improvement in safety. For the whiting fishery, an end to the derby would create substantial safety improvements."); *id.* at 412 ("It is expected that the elimination of derby-style race for whiting, along with a net increase in nonwhiting harvests, will allow vessel operators to have a greater ability to respond to market forces in terms of targeting species.").

[27] *See, e.g.*, A20 EIS, at 419-420.

CALIFORNIA FISHERIES FUND

August 31, 2012

Mr. Dan Wolford
Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Re: Agenda Item H.7

Dear Chairman Wolford:

I am writing on behalf of the California Fisheries Fund (www.californiafisheriesfund.org) ("CFF"), a nonprofit revolving loan fund that invests in the Pacific fishing industry. Our mission is to help fishermen, fishing businesses, ports and communities succeed in fisheries that achieve environmental conservation, improved profitability and stability for waterfront communities.

As you know, we have become quite involved in advocating for fishermen and their businesses at PFMC meetings. Today we are writing to express concern that fishermen in the trawl catch share program are not able to operate their businesses to their utmost potential due to delays in transferability of permit transfers. We have heard from a number of fishermen who had planned to purchase additional quota shares, and who were poised to engage in these transactions at the start of 2013. Today, those fishermen are still awaiting the Council's decision on when those quota share transfers will be allowed. In the meantime, they have put some business decisions on hold, and their businesses may not be operating at their full potential.

We have made loans to participants in the groundfish trawl IFQ fishery for vessel purchase and upgrades and gear upgrades/modifications. We are willing to lend to fishermen who wish to round out their quota portfolio with more quota shares, but we must also wait until the moratorium is lifted in order to help our potential borrowers. Please take into consideration the effect this moratorium on quota transfers will have if it continues unresolved. No matter what the decision regarding reallocation of whiting quota, fishermen should be allowed to transact and transfer permits and quota shares with each other at the earliest possible date, in order to allow them to improve their businesses and quota portfolios. Once the allocation issues have been resolved, we ask the council to act as quickly as possible to allow transfers.

We appreciate the opportunity to comment. If you have any questions, please do not hesitate to contact me at (415) 293-6120 or phiggins@californiafisheriesfund.org.

Sincerely,
Phoebe R. Higgins, Director