NATIONAL MARINE FISHERIES SERVICE REPORT ON GROUNDFISH MANAGEMENT

Situation: The National Marine Fisheries Service (NMFS) will report on its regulatory and scientific activities relevant to groundfish fisheries.

Council Task:

1. Discussion.

Reference Materials:

None.

Agenda Order:

a.	Regulatory Activities	Bill Robinson
b.	Science Center Activities	Elizabeth Clarke
c.	Reports and Comments of Advisory Bodies	
d.	Public Comment	
e.	Council Discussion	

PFMC
03/18/04

Sablefish Permit Stacking Regulations - Amendment 14b (4/04)

Through Amendment 14 to the groundfish FMP, a basic permit stacking program for the limited entry fixed gear sablefish fishery participants was implemented in August 2001 (regulatory amendment 14a). Initially, only the basic provisions of the permit stacking program were implemented to get the program started and allow time to get clarification on some of the more complex provisions. NMFS intends to propose 2 additional regulatory amendments, Amendments 14b&c, that would implement the remaining provisions of the permit stacking program. The provisions left to be implemented and the amendments they will be associated with are listed in the table below. The second regulatory amendment, 14b, will implement the ownership interest, certification for mid-season transfers and base permit provisions. The remaining provisions, to be implemented through the third regulatory amendment, 14c, require further analysis to determine the need for the provision or, for the fee program, the appropriate fees to charge. A schedule for these additional regulatory amendments is provided at the bottom of this sheet.

Provision	Regulatory Amendment
1) **Ownership interest**: Permit owners would be required to document their ownership interests in their permits to ensure that no person holds or has ownership interest in more than three permits	14b
2) **Certification for mid-season transfers**: Permit transferors would be required to certify sablefish landings during mid-season transfers	14b
3) **Base Permit**: A definition of the term "base permit"	14b
4) **Owner-on-board**: An owner-on-board requirement for permit owners who did not own sablefish-endorsed permits as of November 1, 2000	14c
5) **Add spouse to permit**: An opportunity for individual permit owners who owned a sablefish-endorsed permit as of November 1, 2000 to add their spouse as co-owner on the permit	14c
6) **At-sea processing**: Vessels that do not meet minimum frozen sablefish historic landing requirements would not be allowed to process sablefish at sea	14c
7) **Fee Program**: required under section 304(d)(2) of the Magnuson-Stevens Act to cover IFQ program costs	14c

Further possible requirements of the permit stacking program that could be implemented through regulatory amendment 14c include:

1. % ownership interest which triggers owner-on-board requirement for individuals in partnerships or corporations who did not own a permit as an individual before November 1, 2000. (additional NEPA analysis required)
2. cap on number of permits that can be leased (GAP to revisit)

SCHEDULE:
Move forward through proposed and final rule on those items in table above selected for the second regulatory amendment, 14b, then consider implementation of further permit stacking requirements mentioned in table above.

<u>Timeline</u>

April 2004	Provide briefing at April Council meeting during NMFS Report
April-Sept 2004	Draft proposed rule and PRA package for second regulatory amendment, 14b
September 2004	Bring proposed rule for 14b to Council in September and discuss 14c plans
Fall 2004	New ownership interest forms would go out to fleet with permit renewal package

PACIFIC FISHERY MANAGEMENT COUNCIL
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March 26, 2004

Mr. Robert Lohn
Regional Administrator
National Marine Fisheries Service
Northwest Region
7600 Sand Point Way NE, Bin C15700
Seattle, WA 98115-0070

Re: Council Recommendations for Pacific Whiting Fishery Management in 2004

Dear ~~Mr. Lohn~~ Bob:

The Pacific Fishery Management Council (Council) met March 7-12, 2004 in Tacoma, Washington to consider, among other matters, a new stock assessment and harvest specifications for Pacific whiting for 2004 West Coast groundfish fisheries. One of the highlights of the week-long Council meeting related to this new stock assessment — the most recent science about the state of abundance of Pacific whiting indicates the stock has increased to a level above the rebuilding goal. This letter transmits the Council recommendations relative to the significance of this new scientific information on the overfished designation of Pacific whiting, as well as recommendations for the harvest specifications for managing 2004 Pacific whiting fisheries.

The new Pacific whiting assessment, "Stock Assessment of Pacific Hake (Whiting) in U.S. and Canadian Waters in 2003," was recommended by a Stock Assessment Review (STAR) Panel and the Council's Scientific and Statistical Committee as the best available science for managing Pacific whiting in U.S. and Canadian waters. Both review bodies recommended two models from the assessment as equally probable. The distinction between the two models is the value of the catchability coefficient (q) from the National Marine Fisheries Service (NMFS) 2003 hydroacoustic survey for Pacific whiting. The two assessment models (q=0.6 and q=1.0) indicate the presence of a strong 1999 year class, with an estimated spawning stock biomass in 2003 is either 47% or 49% of the stock's initial, unfished biomass (termed $B_{47\%}$ and $B_{49\%}$, respectively) depending on whether the true value of q is 1.0 or 0.6. Both of these estimates of spawning stock biomass are above the threshold associated with the level necessary to sustain maximum fishery yields ($B_{40\%}$).

In 2002, the best scientific information at the time indicated abundance in 2001 was less than the $B_{25\%}$ threshold that determines the overfished status designation under the Pacific Coast Groundfish Fishery Management Plan. Consequently, NMFS declared Pacific whiting overfished, and the Council began planning for development of a rebuilding plan as required by the Magnuson-Stevens Fishery Conservation and Management Act. In adopting the new stock assessment that Pacific whiting are greater than the $B_{40\%}$ level during 2004, the Council recommends NMFS implement the procedural necessities to de-list Pacific whiting as an overfished species. While only valuable in hindsight, the new stock assessment and STAR Panel reports note that the best scientific information available now indicates the Pacific whiting stock was not under the $B_{25\%}$ level in 2001.

Additionally, the Council had scheduled the Pacific whiting rebuilding plan, known as Groundfish Fishery Management Plan Amendment 16-4, for adoption in a two-meeting process at the April 2004 and June 2004 Council meetings. Approval of a formal rebuilding plan was also the subject of a U.S. District Court order, to be completed by November 30, 2004. Based on the presumption that Pacific whiting will be de-listed as an overfished species, the Council has deleted Amendment 16-4 from future work planning.

Lastly, the Council also decided 2004 Pacific whiting harvest specifications using the newly-adopted assessment. The Council considered the scientific advice of equally probable abundance estimates and made the policy decision to select the q=1.0 assessment model as the basis for determining the acceptable biological catch (ABC) level of 514,441 mt for the entire stock. The basis of this choice included the historical use of the q=1.0 assumption in prior years' management of this fishery, the negative implication to future year stock abundance if harvest quotas were set using the q=0.6 model in 2004, and the lack of compelling information to choose the less conservative option. Under the terms of the recently negotiated Pacific whiting treaty with Canada, which is still pending Senate ratification and federal rulemaking, the U.S. share of the ABC would be 73.88%, or 380,068 mt. However, the Council recommends U.S. fisheries be managed to an optimum yield (OY) of 250,000 mt. The Council did not want to consider higher Pacific whiting harvests that might risk exceeding the 2004 widow rockfish OY (an overfished species), as well as being cognizant of the effect of higher catches in 2004 on the status of abundance in future years. The Council also considered complications of adopting a level higher than 250,000 mt, which was the upper bound of the range analyzed in the Final Environmental Impact Statement of proposed ABCs and OY specifications for the 2004 Pacific Coast groundfish fishery. Adopting a higher Pacific whiting harvest in 2004 would have likely delayed the normal April 1 start of the Pacific whiting fishery, while further necessary analysis was done under the terms of the National Environmental Policy Act.

Should you have any questions on these matters, please don't hesitate to contact me.

Sincerely,

D. O. McIsaac, Ph.D.
Executive Director

c: Dr. Bill Hogarth
Dr. Rebecca Lent
Mr. Jack Dunnigan
Ms. Eileen Cooney
Mr. David Balton

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Exhibit C.2
Situation Summary
April 2004

GROUNDFISH ALLOCATION RECOMMENDATIONS FOR 2005-06 MANAGEMENT

Situation: The Council's Ad Hoc Allocation Committee (Committee) met on March 24 and 25, 2004 to deliberate allocation issues relevant to 2005-2006 groundfish management. The Council task under this agendum is to review the Committee's report and provide guidance to the Groundfish Management Team (GMT) and Groundfish Advisory Subpanel (GAP) as they develop 2005-2006 management alternatives to recommend under agenda items C.10, C.14, and C.15.

Council Action:

1. Consider the information in the supplemental Ad Hoc Allocation Committee report and provide guidance to the GMT and GAP.

References:

1. Exhibit C.2.b, Supplemental Ad Hoc Allocation Committee Report.

Agenda Order:

a. Agendum Overview — John DeVore
b. Ad Hoc Allocation Committee Report
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. Council Guidance

PFMC
03/22/04

DRAFT SUMMARY MINUTES
Ad Hoc Allocation Committee

Pacific Fishery Management Council
Sheraton Portland Airport Hotel
8235 NE Airport Way
Portland, OR 97220
(503) 249-7642
March 24-25, 2004

WEDNESDAY, MARCH 24, 2004 - 8 A.M.

A. Call to Order

1. Roll Call, Introductions, Announcements, Approve Agenda, etc.

Members Present:
Mr. Donald Hansen, Chairman, Pacific Fishery Management Council
Ms. Marija Vojkovich, California Department of Fish and Game
Dr. Patty Burke, Oregon Department of Fish and Wildlife
Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Bill Robinson, National Marine Fisheries Service, Northwest Region
Ms. Eileen Cooney, National Oceanic and Atmospheric Administration, General Counsel

Others Present:
Ms. Susan Ashcraft, California Department of Fish and Game
Mr. Merrick Burden, National Marine Fisheries Service, Northwest Region, GMT
Mr. Rod Moore, West Coast Seafood Processors Association, GAP
Ms. Cyreis Schmitt, Oregon Department of Fish and Wildlife, GMT
Mr. Peter Huhtala, Pacific Marine Conservation Council
Mr. Don Bodenmiller, Oregon Department of Fish and Wildlife
Ms. Dorothy Lowman, Consultant, Environmental Defense
Mr. Brian Culver, Washington Department of Fish and Wildlife, GMT
Ms. Michele Robinson, Washington Department of Fish and Wildlife, GMT
Mr. Steve Bodnar, Coos Bay Trawlers Association
Mr. Jim Glock, National Marine Fisheries Service, Northwest Region
Mr. Mark Cedergreen, Pacific Fishery Management Council
Mr. Steve Joner, Makah Indian Tribe
Mr. Darby Dickerson, Fisherman, Port Angeles, Washington
Mr. Rob Jones, Northwest Indian Fisheries Commission, GMT
Dr. Donald McIsaac, Executive Director, Pacific Fishery Management Council
Mr. Dan Waldeck, Pacific Fishery Management Council Staff
Mr. Jim Seger, Pacific Fishery Management Council Staff
Mr. Mike Burner, Pacific Fishery Management Council Staff
Mr. John DeVore, Pacific Fishery Management Council Staff

2. Opening Remarks

Dr. McIsaac welcomed the Ad Hoc Allocation Committee (Committee) members and attendees. He highlighted the importance of the Committee's business and offered experience in 2003 as evidence. He identified the good work that came from the Committee's meeting in June of 2003 and suggested a second meeting between June and September would have been beneficial to the process of adopting final management measures for 2004. Dr. McIsaac also spoke to the added importance of the Committee's work this year as the Pacific Fishery Management Council (Council) is beginning its first biennial harvest specifications and management measures cycle.

3. *Agenda Overview*

Mr. Anderson requested clarification on agenda items concerning management concepts. Although the focus of these discussions will be 2005-2006 management, the Committee is going to have to cope with the long-term structure of allocation as we consider concepts such as individual quotas.

B. Preliminary Range of Harvest Levels for 2005-2006

Mr. DeVore reviewed the tables from the April briefing book materials under agendum C.8. The table reflects the approved range of harvest alternatives adopted by the Council in November 2003. The Committee discussed the following new aspects of the harvest specifications:

- Lingcod harvest levels are listed as coastwide optimum yield (OY) and, based on the latest assessment, the harvest levels are also listed as separate OYs north and south of 43° N latitude (boundary between the Columbia and Eureka International North Pacific Fishery Commission (INPFC) areas, roughly Cape Blanco, Oregon). A rebuilding plan for lingcod was approved under Amendment 16-2 including a harvest control rule and other rebuilding parameters that were based on an earlier assessment. Ms. Cooney reviewed the provisions under Amendment 16-1 that allows the Council to revise the harvest control rule for lingcod in response to the new assessment.

- Cabezon harvest levels are listed differently for California. The recent assessment only covered populations in California, and cabezon was removed from the "other fish" category in this area. Cabezon is still included in the "other fish" category north of California. A range of harvest specification for cabezon was based on the use of varying harvest rates ($F_{50\%}$ and $F_{45\%}$), as well as varying precautionary reductions (60-20 and 40-10 rules).

- Bocaccio, cowcod, widow rockfish, and yelloweye rockfish are species with alternative rebuilding plans proposed under Amendment 16-3 for Council consideration at the April Council meeting. Dr. McIsaac stated that under the Amendment 16-3 agendum, the Council will select a preferred rebuilding plan for each of these four species. Harvest policies described under the Council preferred rebuilding plans will become the harvest specifications for the 2005-2006 management cycle.

- Pacific whiting management may be addressed outside the Council process beginning in 2005 if the pending treaty between the U.S. and Canada is implemented. However, as a contingency, the Council will need to suggest a range of harvest alternatives for Pacific whiting in the event the treaty is not implemented in time.

C. Observer Data Implementation Status and Preliminary Model Results

1. *Limited Entry Trawl*

Mr. Merrick Burden provided a handout of preliminary results from the trawl bycatch model under four harvest level alternatives (high, medium, low, and medium without differential trip limits for large and small footrope gears). Greater uncertainty exists in the effort module of the model this year, largely due to changes in the fleet as a result of the buyback program. Preliminary results from 2004 indicate landings of the Dover sole/thornyheads/sablefish (DTS) complex and flatfish are tracking very differently from 2003. Under the low OY alternative, flatfish trip limits were reduced dramatically, due to bycatch rates for overfished species which restricted the fishery. The Medium OY alternative without small footrope limits has similar cumulative limits and impacts as the High OY alternative, due in part to the loss of incentive to fish in deeper water associated with differential trip limits based on footrope gear. Any alternative that does not include provisions for reduced trip limits if small footrope gear is used will assume greater effort on the shelf and greater impacts to shelf species than alternatives without differential limits.

Mr. Burden clarified these results require the modeler to make some assumptions about vessel participation by area, but these results are not intended to infer merit for any allocation scenario. Additionally, the model has incorporated the results of the buyback program, but the market for permits is currently very active, and the past may not be a good indicator of the future. The trawl bycatch model has been updated to include new observer data per Scientific and Statistical Committee (SSC) recommendations, but has not been updated for the differential participation and bycatch rates of vessels in fisheries using selective flatfish gear configurations tested by Oregon and proposed for fleet-wide use in 2005-2006. Another consideration for model update is encounters with bocaccio. When modeling impacts for 2004, bycatch estimates were doubled in response to the assessed strength of the 1999 year class. Estimates for 2005-2006 will need to be discussed for a similar adjustment.

2. Limited Entry Fixed Gear

The Committee reviewed the fixed gear bycatch report presented to the SSC by National Marine Fisheries Service (NMFS) Northwest Fisheries Science Center. Preliminary results from the primary sablefish fishery indicate increased bycatch rates for canary rockfish and yelloweye rockfish. There will be additional impacts associated with the daily-trip-limit (DTL) fishery. Based on these preliminary results, the Committee did not feel the results would be significant enough to exceed OYs or necessitate changes to the non-trawl Rockfish Conservation Area (RCA) boundaries. The Groundfish Management Team (GMT) and the Council will consider final analyses and recommendations for inseason adjustments to fixed gear fisheries, including sablefish tier limits, at the April Council meeting.

Mr. Moore added that there is interest within the fixed gear sector to consider increased opportunity for fixed gear vessels as a result of the trawl buyback program. The GMT and Groundfish Advisory Subpanel (GAP) are scheduled to consider this issue at the April Council meeting.

D. Legal Definitions of State and Federal Harvest Limits

Ms. Cooney stated that the fishery management plan (FMP) defines *harvest guideline* as a harvest target where closure is not required if exceeded and defines *quota* as a harvest target where closure is required. These terms can mean different things under state laws. Ms. Cooney also suggested minimizing the application of harvest guidelines or quotas to avoid unnecessary regulatory complexity. The key to an effective implementation of regional harvest targets is being clear during preseason planning about the intended regulatory response to reaching a harvest target. NMFS is looking for specific recommendations on what the expected regulatory response will be when a sector or state reaches or exceeds a harvest target. The Committee considered the example from salmon management North of Cape Falcon. One critical difference is that inseason adjustments to salmon fisheries are often handled with a conference call, but in groundfish management, inseason adjustments occur at Council meetings with lengthy periods between meetings.

The Committee identified two issues with definitions of harvest targets in regulations, (1) what language is required in federal regulation that allows the states to take action to close or curtail a fishery? and; (2) what language is required in the federal regulations to allow federal action?

In Washington, Oregon, and California, attainment of a harvest guideline does not mean the fishery has to close. There is an expectation in Washington and Oregon that the fishery would move inside 30 fathoms if a harvest guideline is achieved, but this action is still at the discretion of the Washington Commission. One critical difference is that Washington and Oregon can take state action on recreational fishery regulations, regardless of how the targets are listed in the federal regulations. California needs specific language in the federal regulations to take state action through the Director of the Department of Fish and Game.

In California, the state will conform to federal commercial regulations. On recreational fisheries, the California Fish and Game Commission is responsible for adopting the federal regulations for species not managed by the state. When the Council takes inseason action, the state commission is asked to conform to an emergency situation.

If federal regulatory action is expected between Council meetings, NMFS needs specific recommendations on how to manage the fishery. This includes issues such as fishery closure versus non-retention for the species in question, area management changes, definition of the trigger for such action (i.e., coastwide OY attainment, regional harvest guidelines/quotas), and recommendations on how to decide if one area closes on attainment of a harvest guideline if catch in another area is tracking behind expectations.

If the preseason language and federal regulations are not very clear in defining harvest limits by region, California is limited to emergency fishery closure based on coastwide attainment of the OY, not on regional catch attributed to state fisheries.

California law does not use the term quota for inseason management. California State regulations were recently changed to give the Department of Fish and Game greater authority to close fisheries on a broader range of species for the entire coast or by region. California reported the following three possible courses of regulatory action for recreational fisheries when an annual harvest limit adopted in federal regulation is reached:

1. *Closure of recreational fisheries for any federal groundfish, greenlings (of the genus Hexagrammos), California sheephead, and ocean whitefish when a federal annual harvest limit for lingcod, rockfish, cabezon, or a subgroup of rockfish, and/or California scorpionfish has been exceeded or is projected to be exceeded (Section 27.82 of Title 14, California Code of Regulations).*

2. *Closure of recreational fisheries for California sheephead, cabezon or greenlings (of the genus Hexagrammos) when a state-established total allowable catch (TAC) or allocation is reached or is projected to be reached (Section 52.10 of Title 14, California Code of Regulations).*

3. *Emergency action by the California Fish and Game Commission (Section 240 of the Fish and Game Code).*

The Committee recommends that for management of groundfish fisheries in 2005-2006, the Council develop and adopt specific harvest limits designed to track and slow recreational fisheries at the state or regional level. The Council and NMFS will work with the states to ensure that any harvest limits adopted by the Council will be adequately defined in state and federal regulations to allow efficient inseason tracking and management.

E. Regional Management Concepts

The Council identified and approved management boundaries at state borders and regional areas within California when management measures for 2004 were adopted. The GMT was also given some latitude to discuss other boundaries and regional approaches.

Stock assessment authors were specifically asked to provide coastwide OYs for canary rockfish, lingcod, black rockfish, and to some degree yelloweye rockfish. However, there are opportunities to identify biological rationale for regional OYs for some overfished species such as lingcod and canary rockfish. The Committee considered changes to the stock assessment process to stop requiring authors to calculate a coastwide OY if the data provides biological rationale for regional OYs. Paucity of data in stock assessments creates uncertainty, and there is the possibility that regional differences in available data could be driving stock assessment results rather than actual biological indicators.

Regional management was considered for lingcod based on the latest assessment. Lingcod management on a coastwide basis has been done in the past when only the northern portion of the coast was assessed. Ignoring the findings of the new assessment in the south could be a mistake when the authors identified different life history characteristics for areas in the north and south. Harvest in the south, based on a coastwide consideration, could slow rebuilding.

Ms. Robinson stated that the GMT is planning to consider area management north and south of the Oregon/California border. Neither species was assessed with the Oregon/California border as a boundary, the GMT is considering mechanisms for shifting the boundaries based on NMFS trawl survey data. The GMT is not considering regional management for any other species for 2005-2006. Black rockfish will continue to be regionally managed as it was in 2004.

The Committee agreed to consider regional management on a species-by-species basis as allocation scenarios for 2005-2006 are discussed, particularly where biological rationale exists.

F. Black Rockfish Allocation Issues

The Committee recommends continuation of the management approach adopted in 2004:

- Manage as two separate OYs, north and south of the Washington/Oregon border.
- Catch sharing in the south, 42% California:58% Oregon.
- Catch sharing between recreational and commercial fisheries specified in each state's nearshore management plans or policies and adopted in federal regulations.

Federal regulations for 2004 do not adequately specify the harvest limits in California and Oregon. Language refers to "catch attributed" to a given region or fishery instead of specifying regional harvest limits. This prevents California from taking state action on black rockfish before a federally-specified, coastwide OY is reached. This language change needs to be addressed for 2005-2006, and NMFS will look into the possibility of a correction for 2004.

G. Yelloweye Allocation Issues

The Committee recommends using the yelloweye rockfish impacts in the 2004 bycatch scorecard as updated at the April Council meeting as an allocation alternative for 2005-2006. The Committee did not see a need to recommend regional management for yelloweye rockfish at this time.

The 2004 bycatch scorecard as updated in March estimates overall impacts of 16.2 metric tons with a coastwide OY of 22 metric tons. The Committee anticipated only modest increases in fixed gear and California recreational fishery impacts, and perhaps a slight reduction in estimated trawl impacts.

H. Lingcod Allocation Issues

The Committee continued discussions of regional management of lingcod started under agendum E. The GMT reported minimal workload associated with adjusting the regional OYs to reflect a division at the Oregon/California border rather than 43° N latitude using the spatial distribution from the NMFS trawl survey.

The Committee devised the following recommendation as a set of steps to adopt a coastwide commercial OY, as well as regional harvest guidelines for recreational fisheries north and south of the Oregon/California border (42° N latitude). Regional commercial management strategies for lingcod under a coastwide OY could be considered through different trip limits north and south of 40°10' N latitude. The Committee considered regional harvest guidelines for the commercial fishery but decided against this approach due to the transient nature of the fishery.

1. Set a coastwide OY.
2. Calculate harvest guidelines for recreational fisheries north and south of 42° N latitude:
   a. Use assessment to divide the coastwide OY north and south of 42° N latitude.
   b. Apply recreational:commercial splits by area (*Example 70:30 rec.:comm. south and 40:60 north, actual splits to be based on anticipated needs of the sectors*).

3. Specify regional management north and south of 42° N latitude for recreational fisheries according to the harvest guidelines calculated under step 2.
4. Combine the commercial portions calculated under step 2 to establish a coastwide commercial harvest guideline.
5. Consider alternative commercial trip limits north and south of 40°10' N latitude.

I. Canary Rockfish Allocation Issues

The Committee reviewed the approach used for canary rockfish allocation for 2004 fisheries and is recommending a similar approach for 2005-2006. Determination of the canary rockfish OY is dependent on the portion of the impacts taken by recreational and commercial fisheries. Therefore, the Committee recommends using 2004 allocation as a template for developing options for 2005-2006.

The Committee recommended using the most recently updated version of the 2004 bycatch scorecard as approved at the March Council meeting for allocation in 2005-2006. Canary rockfish impacts in 2004 recreational fisheries were projected in March to be 8.1 metric tons in California, 7.0 metric tons in Oregon, and 2.5 metric tons in Washington. However, this scorecard has not been fully updated across all sectors. New estimates from the limited entry sectors in response to new observer data and the buyback program will be incorporated at the April meeting along with updated impacts in California recreational fisheries.

An alternate approach is to consider canary rockfish allocations based on the 2004 bycatch scorecard when it is updated at the April Council meeting. It is not anticipated that changes in estimated impacts from the commercial sectors will be substantial. There is some uncertainty in the California recreational estimates as the GMT has not yet reviewed new data or modeling results for 2004.

California stated an intent to manage California recreational fisheries to meet the expectations from September 2003 when management measures were adopted for 2004. At that time, 2004 canary rockfish impacts in recreational fisheries were projected to be 8.1 metric tons in California, 5.9 metric tons in Oregon, and 1.5 metric tons in Washington. It is estimated that California recreational fisheries took over 18 metric tons of canary rockfish in 2003 with more restrictive regulations than those in place for 2004. California proposes using conservative management measures early in the season as a precautionary measure with the potential of liberalizing inseason if catch estimates track behind expectations. There were concerns expressed about creating a derby fishing mentality when the fishery opens after a significant closure.

The GMT is requesting guidance on the use of regional management and harvest guidelines for recreational fisheries. The Committee recommends two alternatives for regional management of recreational impacts to canary rockfish:

- Create state-specific harvest guidelines using impacts as specified in the scorecard as updated in March. This approach could conflict with an allocation scenario based on a scorecard revised in April.
- Create two regional harvest limits north and south of the Oregon/California border, similar to lingcod.

J. Bocaccio Allocation Issues

The Committee recommended no new bocaccio allocation scenarios than what was decided in 2004. The Committee agreed that constraints from other species, principally canary rockfish, will have a greater influence on bocaccio catch allocation than scenarios recommended by the Committee.

K. Widow Rockfish Allocation Issues

Widow rockfish management would be very different under the different OY alternatives which, in 2005, range from the low alternative of zero metric tons to the high alternative at 505 metric tons. Under the low alternative essentially all shelf fisheries would be severely constrained or closed and the high alternative would not likely be constraining to anything but a widow rockfish directed fishery.

Under the Medium OY alternative (285 metric tons in 2005), the Committee recommends that non-whiting directed fisheries be held harmless. For the whiting fisheries, the Committee recommends consideration of "hotspot analyses" where areas of high widow rockfish bycatch are identified for restrictions or closure.

The GMT requested guidance from the Committee on the use of widow rockfish bycatch caps for 2005-2006. NMFS recommends addressing this issue through the bycatch problematic environmental impact statement (PEIS) process.

L. 2005-2006 Recreational Fishery Management Concepts

1. California

California is in the midst of revising recreational fishery modeling and management in light of recent catch information from 2003. The Council, NMFS, and the state have adopted more restrictive regulations for groundfish north of 40°10' N latitude and for lingcod statewide. Additional regulatory changes are anticipated at the April meeting when new analyses are presented by California Department of Fish and Game for GMT and Council consideration. The California Recreational Fisheries Survey (CRFS) is ongoing, but results from this new program are not anticipated in time for the development of management alternatives for 2005-2006. California recreational fishery alternatives will be dependent on the results of modeling and projections at the April Council meeting. A long-term strategy being considered in California is the implementation of a punchcard system for rockfish.

2. Oregon

Relative to recreational regulations in place for 2004, Oregon proposed the following ideas for consideration in 2005-2006:

- Increase lingcod bag limit to three.
- Allow incidental non-rockfish groundfish retention in the halibut fishery.

Additionally, Oregon requested a discussion about planning for 2005 and 2006 and the flexibility for inseason actions based, in part, on information gathered in 2004 and 2005. NMFS reported that notice and comment rulemaking and inseason adjustments are the tools available for regulatory changes within a regulatory cycle, but depending on the scope of the changes, additional National Environmental Policy Act (NEPA) analyses may be required (i.e., tiered environmental assessment [EA]).

3. Washington

In general, Washington recreational fisheries are expected to be similar in 2005-2006 as they were in 2004 including the following concepts:

- No retention of canary was implemented in 2004 and Washington proposes the same for 2005-2006.
- Lingcod, retain the 2 fish bag limit with a 24" minimum size with mid-March to mid-October season.
- Include the fathom closure if preestablished catch levels have been attained.
- Retain the C-shaped Yelloweye Rockfish Conservation Area closure.
- Public meetings suggest a "no red rockfish retention" provision (not necessarily an agency proposal).
- The use of halibut "hotspots" was also discussed as an inseason concept at public meetings (not yet an agency proposal).

M. 2005-2006 Nearshore Management Concepts

1. California

California proposed the following concepts for nearshore management for 2005-2006:

- Minor nearshore rockfish categories (shallow, deeper, and California scorpionfish) will likely be recombined into new groups as a means of controlling bycatch.
- Winter spawning closures to retention of lingcod.
- Consideration of species exclusions when fisheries close to groundfish, i.e. sharks.
- Depth closures need re-analysis in the absence of the ridgeback prawn fishery.
- Adjust lingcod size limits to match limits adopted for recreational fisheries in 2005-2006.
- Increase limited entry fixed gear trip limits for lingcod as a means of balancing impacts between the fixed gear and open access sectors.
- No specific black rockfish issues, consider less than a 12-month season with new depth restrictions north of 40°10' N latitude.

2. Oregon

Nearshore fisheries are proposed to be managed the same as in the last two years. The plan is to continue in 2005 at the harvest levels adopted for 2004, absent new information that suggests otherwise.

3. Washington

Currently, does not allow commercial fisheries inside of three miles closed with no plan to change that for 2005-2006. This includes prohibition of live fish fisheries.

<u>THURSDAY, MARCH 25, 2004 - 8 A.M.</u>

Members Present:
Mr. Donald Hansen, Chairman, Pacific Fishery Management Council
Ms. Marija Vojkovich, California Department of Fish and Game
Dr. Patty Burke, Oregon Department of Fish and Wildlife
Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Bill Robinson, National Marine Fisheries Service, Northwest Region
Ms. Eileen Cooney, National Oceanic and Atmospheric Administration, General Counsel
Dr. David Hanson, Pacific States Marine Fisheries Commission

Others Present:
Ms. Susan Ashcraft, California Department of Fish and Game
Mr. Merrick Burden, National Marine Fisheries Service, Northwest Region, GMT
Mr. Rod Moore, West Coast Seafood Processors Association, GAP
Ms. Cyreis Schmitt, Oregon Department of Fish and Wildlife, GMT
Mr. Peter Huhtala, Pacific Marine Conservation Council
Mr. Don Bodenmiller, Oregon Department of Fish and Wildlife
Mr. Brian Culver, Washington Department of Fish and Wildlife, GMT
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Mr. Jim Glock, National Marine Fisheries Service, Northwest Region
Mr. Mark Cedergreen, Pacific Fishery Management Council
Mr. Steve Joner, Makah Indian Tribe
Mr. Darby Dickerson, Fisherman, Port Angeles, Washington
Mr. Rob Jones, Northwest Indian Fisheries Commission, GMT
Dr. Donald McIsaac, Executive Director, Pacific Fishery Management Council
Dr. Ed Waters, Pacific Fishery Management Council Staff
Mr. Dan Waldeck, Pacific Fishery Management Council Staff
Mr. Jim Seger, Pacific Fishery Management Council Staff
Mr. Mike Burner, Pacific Fishery Management Council Staff
Mr. John DeVore, Pacific Fishery Management Council Staff

N. Trawl Individual Quotas (IQs)

Mr. Seger briefed the Committee on the IQ process and the allocation issues involved.

Two major allocation issues for this Committee:

1. Intersector allocation between the limited entry trawl fishery and other groundfish fisheries for IFQ managed species (all groundfish, all species with OYs, or only trawl target species).

2. The possible reallocation of harvest between limited entry trawl vessels and the open access fishery, if the scope of the IFQ program does not include catch by limited entry trawl vessels using open access gear.

Mr. Seger reviewed the time line and project phases.

Tasks identified for the Committee:

- Concurrence or concerns about the role of the allocation committee in IQ program considerations.
- Provide feedback on the types of analyses or data the Committee would like to see when considering the scope of the intersector allocation decisions needed to support the IQ program. Another way to address this question could be to identify the criteria that would be used in determining whether or not allocations would be needed. This would include decisions on what years from the historic catch records are considered.

Mr. Robinson stated that part of the motivation for this program came from examples from the Canadian program. That program is a comprehensive IQ program. Alternatives for the West Coast that only address a portion of the trawl fleet or a portion of the catch or impacts could be problematic.

Mr. Dickerson spoke to the importance of considering years with larger quotas, when the fishery had the flexibility to provide fish for a stable market.

Committee recommendations on allocation:

- Committee considered economic analyses for use in deciding allocation issues. Those analyses will come in the next phase of the process of developing alternatives. Ensure adequate economic expertise in the development of the program.
- Within the trawl fleet the decision on base years for allocation decisions should be the charge of the Trawl Individual Quota Committee (TIQC). Allocation between sectors would be the charge of the Ad Hoc Allocation Committee. The Committee requested dis-aggregated historic catches, by sector, by landed and discard catch, by geographic area, etc.
- Provide a summary of the data quality issues that may compromise informed allocation decisions.
- Display the historic catches relative to state or federal waters. If it cannot be done, develop a mechanism for addressing landings from catches made exclusively in state waters.

Committee recommendations on the process for developing the IQ program:

- Carefully consider the enforcement program associated with the IQ program. This includes decisions on alternative monitoring programs and the identification of a limited number of ports for trawl IQ deliveries.

- Develop a schedule of program reviews or check points as the program is designed where the Council will have the chance to endorse the process or raise concerns about the direction of the program or if the program should proceed. The TIQC will likely meet again in the fall and the Council could be addressed thereafter for these types of considerations.
- Maintain adequate communication between the Council, NMFS, the TIQC, and the states.

Committee recommendations on the IQ program alternatives:

- Consider an alternative that develops IQs only for overfished species. This type of action could be responsive to the bycatch PEIS process.

O. 2005-2006 Shelf Management Concepts

The Committee recommended shelf management discussions be deferred until the April Council meeting.

P. 2005-2006 Slope Management Concepts

The Committee recommended slope management discussions be deferred until the April Council meeting.

Q. 2005-2006 Tribal Management Concepts

Mr. Joner summarized the following concepts for tribal fisheries in 2005-2006:

- Consider increasing the lingcod trip limits, while considering impacts to yelloweye rockfish. Currently, lingcod catches are incidental in halibut and sablefish fisheries. The tribes are considering a directed lingcod fishery with a moderate increase in impacts.
- Allow some retention of yelloweye rockfish for biological sampling, while avoiding yelloweye targeting. There is full rockfish retention in tribal fisheries. Bait studies in longline fisheries are underway as a means of avoiding yelloweye rockfish.
- Petrale limits may increase as interest in petrale markets increases. Fishery is observed, and staff limitations in 2003 limited the duration of the fishery. In 2004, and in the future, limitations due to observer availability are not anticipated.
- Under current rules, widow rockfish cannot exceed 10% of yellowtail rockfish landed on a per trip-basis. The yellowtail fishery is performing at around a 5% widow rockfish bycatch rate. The fishery is expected to continue. The tribes will consider a moderate increase in yellowtail trip limits as OY and widow rockfish bycatch allow.
- Pacific cod trip limits may be reduced if there is a precautionary reduction in OY, but this needs more discussion.
- Procedure of using a few observed vessels as a test fishery for bycatch will continue.
- Tribal interest in pollock is increasing. The tribes will try some test marketing this spring with the whiting fishery beginning in mid-May with delivery to shoreside processors. Typically this fishery does not begin until mid-June when the mothership fishery concludes.

Mr. Joner reviewed the tribal fleet. There are 10 non-whiting and four whiting trawlers. This is and increase from four non-whiting vessels to 10 in the last few years. About half of the trawlers also fish longline gear. Additionally, there are about 25 vessels that only fish longline gear.

Canary bycatch in the yellowtail rockfish fishery is of interest to Washington, as the bycatch in a Washington yellowtail exempted fishing permit (EFP) program was considerably higher than the tribal results. Washington is interested in sharing methods on canary avoidance and results from the tribal fishery.

Mr. Joner reported that with full retention, the amount of canary did not increase when observers were implemented. The success is credited to local knowledge and careful fishing practices. The fleet is very aware of canary rockfish bycatch problems, and the fleet is good at directing effort to areas where canary rockfish bycatch is low. Trawl and longline fisheries operate with full rockfish retention. Observer coverage is not 100%, but observers do confirm full retention when onboard. The whiting mothership is observed, but individual whiting catcher vessels are not. This does not ensure bags are not dumped at sea. Shoreside deliveries will be monitored in accordance with the state programs.

R. 2005-2006 Exempted Fishing Permit Concepts and Research Activities

1. California

The selective flatfish EFP for this year does not start until fall, so it is difficult, at this time, to forecast a need to continue in 2005-2006. Bocaccio and cowcod caps were increased for this EFP at the March meeting, but there are concerns about canary rockfish bycatch, as the vessels are allowed in deeper water. A placeholder will be proposed for 2005-2006, but getting participation in the program has been problematic. The placeholder caps will likely be higher than 2004 with 10 metric tons for bocaccio, 0.5 metric tons for cowcod, 2 metric tons for canary rockfish (increased from 0.5), 2 metric tons for yelloweye rockfish, and 20 metric tons for lingcod. Gear testing under the Letter of Authorization (LOA) process is also under consideration in 2005-2006. There is a request from a fisherman who would like to modify longline gear for use within the non-trawl RCA. NMFS reports there has not been any final action on including gear testing under research permits. Gear testing would have to proceed under an EFP.

2. Oregon

One new EFP will be proposed for 2005 and 2006. Under this EFP, trawl work will further test legal selective flatfish gear in federal waters. An EFP is required because harvest in the selective flatfish research program would not count against that vessel's trip limits. The DTS EFP is expected to conclude in 2004.

Oregon is also intending to conduct research on gear and release strategies in state waters. These activities will not require an EFP or LOA.

3. *Washington*

EFPs proposed for 2005 and potentially 2006 include:

- The longline dogfish EFP would continue from the current program with the same caps as 2004 (0.1 metric tons of canary rockfish, 0.5 metric tons of darkblotched rockfish, 0.5 metric tons of Pacific ocean perch, 0.4 metric tons widow rockfish, and 0.5 metric tons of yelloweye rockfish.
- The midwater pollock EFP is proposed to continue with gear restrictions and full rockfish retention. In 2002, there was significant pollock caught which started the consideration of an EFP. Pollock is not in the FMP. Proposed caps are 0.1 metric tons of canary rockfish, 1.5 metric tons of widow rockfish, and 0.1 metric tons of yelloweye rockfish.
- Continue the arrowtooth flounder EFP as a placeholder, in the event it does not go forward as a regulation. The area and participation criteria would be relaxed to mimic a regulatory process, rather than an EFP opening participation to any limited entry trawl permit holder. There would still be port and/or buyer restrictions. NMFS is recommending a placeholder because some of the regulatory concepts, such as full retention and observer coverage, are currently not in the FMP. NMFS is suggesting a separate regulatory amendment process for this fishery. It is uncertain that this could occur within the 2005-2006 management cycle. Arrowtooth flounder is an important species to the Washington trawl industry, and taking a year off to settle the regulatory issues is not a favorable option.

The Committee has not had a lengthy discussion of the use of EFPs/LOA/SRPs, and there is a need for consistent use of these programs. Concerns were expressed about the use of impacts in EFPs at the expense of the full fleet. The trawl bycatch model is at the vessel level, therefore, it is a bit of a misnomer to call these set asides, as if there is double counting or re-allocations. Vessels that participate in the arrowtooth flounder fishery would not be participating in the overall trawl fishery, so their bycatch would be removed and transferred into the arrowtooth flounder fishery. The Committee recommended Washington proceed with documenting the arrowtooth flounder fishery proposal in the NEPA process before the regulatory process is addressed, as this may facilitate any regulatory amendments. Additionally, the Committee recommends discussions on how set asides and caps get approved for EFPs, SRPs, and LOAs, particularly in the recreational sector, before 2007-2008.

The Committee also recommended the use of placeholders for addressing uncertainties about 2006 EFP activities. Unused caps set aside for EFPs can be released to other fisheries if not utilized.

4. *Federal*

Provisions for the 2004 shoreside whiting EFP need to be addressed. Cameras will not be available for the start of the fishery. The proposal for installation requires vessels to return to port as soon as the cameras are ready. The industry is concerned about lost time on the water. NMFS is trying to find a way to minimize the inconvenience to the fleet. The rule implies that all fishing stops when the cameras are available for installation, but not all of the cameras can be installed at once. NMFS will explore a fair manner in which camera installation can occur with minimal interruption to the fishery.

Preliminary projections of research impacts for 2005-2006 were provided. The GMT has been asked to develop average weight designations for research projections that were submitted in numbers of fish rather than weights. The GMT will finalize these estimates in April.

S. Other

In 2004, the states went from a one fish limit on canary rockfish (and in Oregon a one fish limit on yelloweye rockfish) to zero retention of either species in recreational fisheries. The intent was to eliminate any targeting of these species, but resulting savings have not been assessed by the GMT. It is very difficult to determine what portion of historic catch came from targeted trips. This will be an issue for modeling 2005-2006 fisheries.

ADJOURN

PFMC
04/01/04

GROUNDFISH MANAGEMENT TEAM CHECK-IN ON INSEASON MANAGEMENT ISSUES (IF NECESSARY)

Situation: The Groundfish Management Team (GMT) is scheduled to begin consideration of the status of 2004 groundfish fisheries and inseason adjustments on Sunday, April 4 (see Ancillary A, GMT Agenda). Monday morning, April 5, the GMT will meet with the Groundfish Advisory Subpanel (GAP) to discuss issues and analyses relative to inseason adjustments (see Ancillary B, GAP Agenda). This agenda item was scheduled on an "if necessary" basis, to provide the GMT an opportunity to pose any key policy questions that would substantially facilitate further GMT analysis on inseason adjustments. Council guidance on these matters is intended to focus GMT analyses of proposed inseason adjustments prior to final Council action, scheduled for Tuesday afternoon, April 6 (Agendum C.7).

Council Task:

1. **Consider the report of the GMT as well as comments of other Advisory Bodies and the public and provide guidance, if necessary.**

Reference Materials:

None.

Agenda Order:

a. GMT Report — Michele Robinson
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Guidance

PFMC
03/30/04

GROUNDFISH MANAGEMENT TEAM (GMT) CHECK-IN ON INSEASON MANAGEMENT MEASURES

The GMT received an update on the National Marine Fisheries Service observer data for trawl and limited entry fixed gear fisheries targeting sablefish, and catch projection models for canary rockfish in California recreational fisheries. In addition, the GMT updated the bycatch scorecard from the March Council meeting to reflect the changes in trawl, limited entry fixed gear, open access, and the inseason action taken in March relative to widow rockfish in the whiting fishery and lingcod in the California recreational fishery. In reviewing the updated bycatch scorecard, it appears that the most constraining species for 2004 inseason considerations are canary rockfish and lingcod; therefore, the GMT focused its discussion and is tailoring the check-in guidance to be specific to those species.

With regard to the trawl fishery, modeling projections for 2004 apply the updated observer data combined with a reduction in effort as a result of the trawl buyback program. The GMT has identified alternatives for inseason action for the trawl fishery using the updated model which would provide higher trip limits for DTS and flatfish coastwide, as well as for minor slope rockfish south of 40°10'. Additional trawl opportunities for minor slope rockfish and chilipepper are also currently being analyzed.

Using the updated trawl model, the following alternatives are being considered:

	Alternative	Canary	Lingcod
1	Near “status quo” with higher DTS coastwide and minor slope limits in south; differential limits thru Dec	7.4	83.7
2	Higher DTS limits and slightly higher flatfish limits coastwide and minor slope in south; differential limits thru Dec	7.9	89
3	Higher DTS and higher flatfish limits coastwide and minor slope in south; differential limits in periods 3 & 4	10.8	105
4	Higher DTS and higher flatfish limits coastwide and minor slope in south; differential limits in period 4	11.3	116

The GMT reviewed 2002 and 2003 canary rockfish catch data from the California recreational fisheries, and two different models for projecting 2004 catches based on those data. The catches in 2003 were very high, especially in Wave 4 (July-Aug); it is thought that a portion of the catch in Wave 4 was the result of the fishery having been closed for the previous 8 months, creating a “derby” style fishery. One model creates an adjusted 2003 dataset by using the effort from Wave 5 (Sept-Oct) in 2003 to adjust catches for all waves in 2003 to those expected under a fishery with a similar structure to the 2002 season. This results in a reduced catch in Wave 4 to account for the “derby” response and added projected catches for the closed periods. The second model uses the adjusted 2003 catches and averages those with the 2002 catch data. The application of an averaged 2002 and adjusted 2003 dataset would be to account for annual catch variability in the California recreational fishery, whereas application of the adjusted 2003 catch data alone would serve to be the most precautionary approach should the high effort levels estimated for 2003 be repeated in 2004.

The GMT recommends using the model with the adjusted 2003 catches only to project 2004 catches. This results in a catch estimate for the 2004 California recreational fishery of 17.49 mt. The catches modeled in September 2003 for the 2004 season projected a catch of 8.1 mt.

The GMT has identified alternatives for inseason management to reduce the canary impacts in the California recreational fishery, including the following:

	Alternative	Canary
1	Close > 20 fms in Central CA (including Waves 5 & 6)	17.49
2	Option 1 + Close > 30 fms North of 40°10' May - Dec	14.76
3	Options 1 + 2 + Close Central CA Recreational Groundfish Fisheries in Aug	10.87

Additional alternatives are available to the GMT to reduce the canary impacts further, but will require additional closures for the California recreational groundfish fisheries.

Council Guidance to GMT

Currently, with status quo trawl fisheries and the 8.1 mt estimate for California recreational, the bycatch scorecard indicates 4.1 mt of canary rockfish (Note: 4.6 mt of canary was specified as “buffer” in the 2004 specifications) and 48.1 mt of lingcod are available (Note: 49.8 mt of lingcod was specified as “buffer” in the 2004 specifications and an additional 59 mt recreational “buffer” was specified as part of the March inseason action. This would require an additional savings of 60.7 mt.) The GMT is requesting Council guidance on how best to use those fish to provide fishing opportunity while ensuring that adequate precaution has been taken to protect overfished species. Specific questions for consideration could include:

1. How much lingcod should be reserved as a “buffer” in the scorecard?
2. Should there be a canary rockfish “buffer” in the scorecard and, if so, how much?
3. After the “buffers” have been identified (if any), how to spend the remaining canary rockfish and lingcod?

Table 1. Estimated mortality (mt) of overfished West Coast groundfish species by fishery in 2004 under the *No Action* alternative.

7/10/2013 12:09

Fishery	Bocaccio *a/*	Canary	Cowcod	Dkbl	Lingcod	POP	Widow	Yelloweye
Limited Entry Groundfish								
Trawl- Non-whiting	**28.0**	**7.4**	**0.4**	**71.0**	**83.7**	**83.0**	**2.0**	**0.2**
Fixed Gear	13.4	**0.9**	0.1	**0.8**	**20.0**	**0.3**	**0.5**	**2.5**
Whiting								
At-sea whiting motherships		0.9		1.4	0.3	1.7	**59.7**	0.0
At-sea whiting cat-proc		1.3		7.6	0.4	10.1	**84.6**	0.4
Shoreside whiting		0.4		0.5	0.7	0.4	**29.9**	0.0
Tribal whiting		4.7		0.0	0.5	1.5	**37.1**	0.0
Open Access								
Groundfish directed	10.6	**1.0**	0.1	**0.2**	**70.0**	**0.1**		0.6
CA Halibut	0.1			0.0	2.0	0.0		
CA Gillnet b/	0.5			0.0		0.0	0.0	
CA Sheephead b/				0.0		0.0	0.0	0.0
CPS- wetfish b/	0.3							
CPS- squid c/								
Dungeness crab b/	0.0		0.0	0.0		0.0		
HMS b/		0.0	0.0	0.0				
Pacific Halibut b/	0.0		0.0	0.0		0.0	0.0	0.5
Pink shrimp	0.1	0.5	0.0	0.0	0.5	0.0	0.1	0.1
Ridgeback prawn	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmon troll	0.2	1.6	0.0	0.0	0.3	0.0	0.0	0.2
Sea Cucumber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spot Prawn (trap)								
Tribal								
Midwater Trawl		2.3		0.0	0.1	0.0	40.0	0.0
Bottom Trawl		0.5		0.0	9.0	0.0	0.0	0.0
Troll		0.5		0.0	1.0	0.0		0.0
Fixed gear		0.3		0.0	15.0	0.0	0.0	2.3
Recreational Groundfish								
WA		2.5			**65.0**			3.5
OR		7.0			101.3		2.0	3.3
CA	62.8	8.1	1.8		**287.6**		1.4	1.4
Research: Based on 2 most recent NMFS trawl shelf and slope surveys, the IPHC halibut survey, and LOAs with expanded estimates for south of Pt. Conception.								
	2.0	1.0		1.6	3.0	3.0	1.5	1.1
Non-EFP Total	118.1	40.9	2.4	83.1	660.4	100.1	258.8	16.2
EFPs e/								
CA: NS FF trawl	10.0	0.5	0.5		20.0			0.5
OR: DTS f/		0.1		6.0		18.0		0.1
WA: AT trawl		1.5		3.0	4.5	8.5	5.5	0.5
WA: dogfish LL		0.1		0.5	2.0	0.5	0.5	1.0
WA: pollock g/		0.1					1.5	0.1
EFP Subtotal	10.0	2.3	0.5	9.5	26.5	27.0	7.5	2.2
TOTAL	128.1	43.2	2.9	92.6	686.9	127.1	266.3	18.4
2004 OY	250	47.3	4.8	240	735	444	284	22
Percent of OY	51.2%	91.3%	60.4%	38.6%	93.5%	28.6%	93.8%	83.5%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available data sources.						

a/ South of 40°10' N. lat.

b/ Mortality estimates are not hard numbers; based on the GMT's best professional judgement.

c/ Bycatch amounts by species unavailable, but bocaccio occurred in 0.1% of all port samples and other rockfish in another 0.1% of all port samples (and squid fisheries usually land their whole catch). In 2001, out of 84,000 mt total landings 1 mt was groundfish. This suggests that total bocaccio was caught in trace amounts.

d/ These estimates have not been revised pending GMT review of the estimation methodology.

e/ Values are proposed EFP bycatch caps, not estimates of total mortality. The EFP is terminated inseason if the cap is projected to be attained early.

f/ The darkblotched rockfish and Pacific ocean perch caps are not defined yet for this EFP but are expected to be lower than the placeholders in this scorecard.

g/ Whiting impacts are deducted from the shoreside sector only.

Table 2. Estimated mortality (mt) of overfished West Coast groundfish species by fishery in 2004 as presented by the GMT in March 2004.

Fishery	Bocaccio a/	Canary	Cowcod	Dkbl b/	Lingcod c/	POP	Whiting d/	Widow	Yelloweye
Limited Entry Groundfish									
Trawl- Non-whiting e/	45.0	9.8	0.6	100.7	78.4	68.1		1.5	0.4
Fixed Gear	13.4	0.5	0.1	1.5	12.7	0.2		5.0	0.1
Whiting									
At-sea whiting motherships		0.9		1.4	0.3	1.7	51,720		0.0
At-sea whiting cat-proc		1.3		7.6	0.4	10.1	73,270	211.0	0.4
Shoreside whiting		0.4		0.5	0.7	0.4	90,510		0.0
Tribal whiting		4.7		0.0	0.5	1.5	32,500		0.0
Open Access									
Groundfish directed	10.6	0.3	0.1		62.5				0.6
CA Halibut	0.1			0.0	2.0	0.0			
CA Gillnet f/	0.5			0.0		0.0		0.0	
CA Sheephead f/				0.0		0.0		0.0	0.0
CPS- wetfish f/	0.3								
CPS- squid g/									
Dungeness crab f/	0.0		0.0	0.0		0.0			
HMS f/		0.0	0.0	0.0					
Pacific Halibut f/	0.0		0.0	0.0		0.0		0.0	0.5
Pink shrimp	0.1	0.5	0.0	0.0	0.5	0.0		0.1	0.1
Ridgeback prawn	0.1	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Salmon troll	0.2	1.6	0.0	0.0	0.3	0.0		0.0	0.2
Sea Cucumber	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Spot Prawn (trap)									
Tribal									
Midwater Trawl		2.3		0.0	0.1	0.0		40.0	0.0
Bottom Trawl		0.5		0.0	9.0	0.0		0.0	0.0
Troll		0.5		0.0	1.0	0.0			0.0
Fixed gear		0.3		0.0	15.0	0.0		0.0	2.3
Recreational Groundfish									
WA		2.5			73.0				3.5
OR		7.0			101.3			2.0	3.3
CA (N) h/		0.5			195.0			1.0	0.1
CA (S) h/	62.8	7.6	1.8		151.8			0.4	1.3
Research: Based on 2 most recent NMFS trawl shelf and slope surveys, the IPHC halibut survey, and LOAs with expanded estimates for south of Pt. Conception.									
	2.0	1.0		1.6	3.0	3.0		1.5	1.1
Non-EFP Total	135.1	42.2	2.6	113.3	707.5	85.0		262.5	14.0
EFPs i/									
CA: NS FF trawl	10.0	0.5	0.5		20.0				0.5
OR: DTS j/		0.1		6.0		18.0			0.1
WA: AT trawl		1.5		3.0	4.5	8.5		5.5	0.5
WA: dogfish LL		0.1		0.5	2.0	0.5		0.5	1.0
WA: pollock k/		0.1					1,000	1.5	0.1
EFP Subtotal	10.0	2.3	0.5	9.5	26.5	27.0	1,000	7.5	2.2
TOTAL	145.1	44.5	3.1	122.8	734.0	112.0		270.0	16.2
2004 OY	250	47.3	4.8	240	735	444	250,000	284	22
Percent of OY	58.0%	94.1%	64.6%	51.2%	99.9%	25.2%		95.1%	73.5%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available data sources.							

a/ South of 40°10' N. lat.

b/ Darkblotched harvest limit ("2004 OY" in this table) is the ABC of 240 mt, which is lower than the projected OY of 272 mt under the *Medium OY* alternative.

c/ Lingcod total reflects total catch, not mortality.

d/ Whiting is rebuilt according to the assessment adopted at the March 2004 Council meeting.

e/ Using observer data, all estimates from the Hastie trawl bycatch model.

f/ Mortality estimates are not hard numbers; based on the GMT's best professional judgement.

g/ Bycatch amounts by species unavailable, but bocaccio occurred in 0.1% of all port samples and other rockfish in another 0.1% of all port samples (and squid fisheries usually land their whole catch). In 2001, out of 84,000 mt total landings 1 mt was groundfish. This suggests that total bocaccio was caught in trace amounts.

h/ These estimates have not been revised pending GMT review of the estimation methodology.

i/ Values are proposed EFP bycatch caps, not estimates of total mortality. The EFP is terminated inseason if the cap is projected to be attained early.

j/ The darkblotched rockfish and Pacific ocean perch caps are not defined yet for this EFP but are expected to be lower than the placeholders in this scorecard.

k/ Whiting impacts are deducted from the shoreside sector only.

Exhibit C.4
Situation Summary
April 2004

OBSERVER DATA AND MODEL IMPLEMENTATION

Situation: In February, NMFS Northwest Fisheries Science Center (NWFSC) released the second annual trawl observer data report followed by the first fixed gear observer data report, which summarized the first two years of at-sea observation data for the fixed gear primary sablefish fishery. Dr. Hastie from the NWFSC recently revised the limited entry trawl bycatch model that was adopted for management use in 2003 by updating the model with new observer data, new logbook data, new fish ticket data, and new observer data stratifications (Exhibit C.4.a, Attachment 1). Dr. Hastie also recently developed a new fixed gear primary sablefish bycatch model (Exhibit C.4.a, Attachment 2). Both of these bycatch models were presented to the Scientific and Statistical Committee (SSC) for their review in March. The SSC recommended some slight model revisions (Exhibit C.4.a, Attachment 3). Dr. Hastie will present the trawl and fixed gear bycatch models at this meeting with the SSC-recommended revisions. The Council task is to approve these models for use in 2004 inseason management and 2005-06 management decision-making.

Council Action:

1. **Adopt bycatch models for use in deciding 2004 inseason management actions and 2005-06 management measures.**

References:

1. Exhibit C.4.a, Attachment 1: Modeling bycatch and discard in the limited entry trawl fishery: A review of data and model updates for fishery analysis during 2004.
2. Exhibit C.4.a, Attachment 2: Modeling sablefish discard and bycatch of overfished species in the 2004 limited entry fixed gear sablefish fishery.
3. Exhibit C.4.a, Attachment 3: Scientific and Statistical Committee Report to the Groundfish Management Team on the groundfish observer data and bycatch model for 2004.

Agenda Order:

a. Agendum Overview — John DeVore
b. NMFS Recommendations — Jim Hastie
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Approve Implementation for 2004 Inseason Management Actions and 2005-06 Management Measures

PFMC
03/22/04

MODELING BYCATCH AND DISCARD IN THE LIMITED-ENTRY TRAWL FISHERY:
A review of data and model updates for fishery analysis during 2004

Prepared by
Dr. James Hastie
Northwest Fisheries Science Center
March, 2004

Introduction

NOAA Fisheries' Northwest Fisheries Science Center (NWFSC) began modeling trawl bycatch of species designated for rebuilding in the Fall of 2001. The bycatch model is based on projecting future landings of major target species (excluding Pacific hake) by each permitted vessel, through use of recent landings data and a specified array of trip limits. Projected landings are then translated into estimates of total bycatch mortality, for species under rebuilding, through the application of bycatch ratios. Since its introduction, the bycatch model has undergone numerous changes to keep pace with the changing fishery management environment and the availability of new data. The purpose of this paper is to briefly review the evolution of the model and to highlight changes in modeling procedures or input data that are anticipated for use of the model during 2004. These uses include inseason modeling of the 2004 fishery, as well as analysis of management alternatives for the 2005-06 fisheries.

Background

Prior to April, 2003, bycatch ratios used in the model were derived from three available sources of information: trawl logbooks and two research studies which deployed observers on a subset of voluntarily participating trawl vessels during some years between 1986 and 1996. The trawl fishery was stratified using area (north and south of 40°10' N. Lat.), bimonthly period and target fishery, and bycatch ratios were specified for each stratum. The ratios were expressed in terms of total bycatch pounds per landed pound of the target species in each target fishery.

In April, 2003, those bycatch ratios were replaced by new ones calculated from data collected between September, 2001 and August, 2002 by the Northwest Fisheries Science Center's (NWFSC) West Coast Groundfish Observer Program (WCGOP). Because management was actively considering the use of depth-based closed areas, the bycatch data had to be stratified by depth to facilitate analysis of management options. Due to the limited number of observations during the first year of WCGOP's monitoring and the variances associated with bycatch ratios calculated from extensively stratified data, the previous stratification of the data into target fisheries and bimonthly periods was discontinued, in favor of depth. Subsequent modeling during 2003 utilized bycatch ratios that were expressed in terms of total bycatch pounds per landed pound of all target species combined. In order to partition projected vessel catch into appropriate depth strata, the depth distributions for each modeled target species were summarized from recent trawl logbook data for each vessel, where available. In cases where a vessel was not represented in the logbook data set, representative averages for vessels in the same area and size class were used.

For final analysis (in September, 2003) of management measures for the 2004 fishery, the model was enhanced to provide estimates of total mortality for target species, using annual, species-specific discard rates calculated from the first year of observer data. These rates were used to calculate the total catch that would give rise to the landings projected by the model.

Data Updates and Model Revision for 2004 Analyses

<u>Data Updates</u>

The principal data inputs to the bycatch model are derived from fish tickets, logbooks, and the WCGOP data base. As new data are added to each of these data sets, it is expected that the corresponding model inputs will be updated. As a general rule, data from multiple years are combined in a weighted manner, where more recent data are weighted more heavily. This is particularly important for current modeling of the trawl fishery, since management has changed dramatically in recent years. Although using only the most recent year to project the future might at first seem to be the best approach to addressing the rate of management change, there are important reasons for basing projections on multiple years.

First, fisheries may close prematurely in some years, as the inshore fishery did in 2003. Failure to incorporate multiple years into the projection process would provide no basis for projecting vessel activity during the same period the following year. This is also the case when data sets for the previous year are not fully complete at a time when modeling awaiting updated data must be carried out. Even when components of the fishery are not closed, there may be considerable variation in the target-species trip limits that are in effect for the same bimonthly period during a series of years. Vessel participation in the traditional groundfish fishery can also be affected by opportunities in other west coast fisheries, such as hake, shrimp, and crab. Incorporating data from multiple years provides projections that are more robust to annual fluctuations in vessel participation than would reliance on the most recent single year. The model used throughout 2004 will drawn upon fish ticket and logbook data from the 2000 to 2003 fisheries. In combining data from these years, the data from 2000 receives roughly one-fifth the weight assigned to data from 2003.

The WCGOP has recently completed review and incorporation of data from the second year of trawl observation into its data base. For purposes of comparison, bycatch ratios derived from data collected during the first and second years of the WCGOP observation are reported in Table 1. In each species category, the table contains two rows that pertain to data collected during the first year of observation. The first of these, labeled "1 ('03)", reflects data that were used in the bycatch model from April through November during 2003. Since then, observations associated with fishing that took place under Exempted Fishing Permits have been identified and removed from that data set. In addition, some records from the first year were revised following April, 2003, as a result of further data quality reviews. Results using the revised year-1 data set are listed in the rows labeled "1 ('04)". These are the values that will be combined with data from the second year in developing updated bycatch rates for use during 2004.

The method proposed for combining data from each data year is to weight catch data from the second year by 0.6 and data from the first year by 0.4. Within each model stratum, weighted catch of target and bycatch species is summed, and then bycatch ratios are calculated. Bycatch ratios developed using this approach are listed in the "weighted data" row for each species. The final two rows in each section report the difference–in absolute and percentage terms–between the weighted 2-year ratios and the ratios that were used in the 2003 modeling of 2004 management alternatives. Negative values indicate reductions in the bycatch ratios.

For most species in the northern and southern areas, bycatch ratios are either lower or are little changed from the values employed in 2003 modeling. In both regions, bycatch ratios for lingcod are higher in most depth strata than the values used in 2003. For other species, where the percentage of increase in bycatch ratios appears large, the absolute differences are nearly always measured in hundredths or thousandths of a percent.

Table 2 reports changes in target species discard rates. These data are displayed in the same format as Table 1. There were relatively small increases in the coastwide discard rates for shortspine, petrale, and arrowtooth in depths greater then 150 fathoms. However, substantial downward trends were observed across all depths in the discard rates for sablefish, Dover sole, and minor flatfish species.

The effects that these changes in rates of bycatch and discard have on the projected amounts of bycatch and discard for 2004 are reported in Tables 3 and 4. For this comparison, all other data inputs, as well as the model structure, remain identical to the configuration used in the September, 2003 modeling of the Council's adopted management measures for 2004. Table 3 summarizes the changes in projected bycatch of rebuilding species. For four of the species–canary, yelloweye, cowcod, and widow–the change in bycatch is less than 1.5 mt, and for the first three of these, projected bycatch decreases. Projected bycatch of lingcod and Pacific ocean perch each increase by about 15 mt (or roughly 20%), but totals remain below 100 mt for each. Projected darkblotched bycatch decreases by about 20% (21 mt), while bocaccio bycatch falls by nearly 40% (8.9 mt).

Table 4 summarizes the changes in projected discard of target species, given the same trip limits and amounts of landed catch. Projected discards for sablefish and minor flatfish decrease by roughly 40% (over 575 mt each) with the inclusion of the second year of observer data. Dover sole discard also decreased substantially, by more than 20% and 200 mt. Minor increases in discard, both in the 10-12% range, are estimated for shortspine and arrowtooth.

Following the September, 2003 Council meeting, the trawl fleet approved a plan to buy back permits and vessel fishing endorsements from roughly one-third of the groundfish trawl fleet. The removal of these permitted vessels from the projection model will have a substantial impact on the size of trip limits that can be supported by available amounts of target and bycatch species. In order not to overstate the effect of the buy back, attention will be focused on previously latent or little-used permits that have recently been transferred to new holders. Where appropriate, the prior history of the new permit holder will be substituted for the permit's actually history. In other such cases where an increase in permit landings is anticipated, a catch history that is representative of other similarly sized vessels in the same area used.

Model Revisions

Three minor revisions to the implementation of the bycatch model are proposed for 2004. All of these involve the methods used to calculate and apply bycatch ratios. The first concerns the measurement of target species catch used in calculating and applying bycatch ratios; the second involves the geographic stratification of data that are used to calculate bycatch ratios; and the third involves the seasonal stratification of data that are used to calculate ratios.

The target-species catch metric used in calculating bycatch ratios

When the bycatch model was first developed, it did not contain procedures for calculating total catch amounts of the included target species. The model projected landings of these species and bycatch ratios for rebuilding species were calculated using landed catch of target species as the denominator. As referenced above, the model was modified prior to the September, 2003 Council meeting, so that inclusion of discard rates for target species would allow the modeling of 2004 measures to automatically include calculation of total catches, based on the projected landings of each target species.

Holding other model parameters constant, a reduction in the discard rate of particular species will not affect landed catch, but will reduce the total catch projected by the model. Aside from possible bycatch consequences, this reduction would allow the trip limits for those target species to be increased. But since bycatch ratios used in the model have been expressed in terms of the **landed** catch of target species, the reduction in target species discard would lead inevitably to an increase in projected bycatch of the rebuilding species. Commencing with modeling during 2004, it is proposed that bycatch ratios be calculated with reference to the total catch of target species, and that those ratios be applied to the projected total target species catches in the model. Bycatch ratios reported below (in Tables 6 and 9) are calculated in this manner.

Geographic stratification of data for calculating bycatch ratios

Following the implementation of depth-specific bycatch rates, and a period in which darkblotched bycatch was underestimated for the fishery occurring between 38° and 40°10' N. Lat., bycatch rates for depth strata deeper than 150 fathoms have been calculated using a dividing line of 38° for all species except Pacific ocean perch. Commencing with modeling during 2004, it is proposed that 40°10' N. Lat. be used to delineate northern and southern bycatch rates for all species and depths, with the exception of darkblotched bycatch occurring in waters deeper than 150 fathoms.

Seasonal stratification of data for calculating bycatch ratios

As described above, the combination of limited observer data from the first year of data collection and the need to evaluate bycatch on a depth-specific basis resulted in discontinued use of seasonal bycatch rates in analysis conducted during 2003. With the accrual of a second year of observer data, reinstatement of some degree of seasonality in bycatch rates is proposed.

Tables 5-10 provide an extensive array of information regarding the seasonal distribution of observed trawling, and seasonal variation in bycatch ratios and their precision. Each table is comprised of four pages; with the first two summarizing data from north of 40°10' N. Lat., and the last two summarizing data from south of that line. The first page for each region reports results for four "shallow"-zone depth strata, which include only trawl tows that began in less than 100 fathoms of water. The second page for each region reports results for four "deep"-zone depth strata that include only trawl tows originating in depths greater than 100 fathoms. The four depth strata specified in each depth zone correspond to potential depth-based closure lines that have been defined in regulations for potential use in managing the fishery.

Within each depth strata, results are summarized according to four alternative approaches for stratifying bycatch results over the span of a calendar year. The first of these approaches is the same as used in 2003: all periods of the year are combined. In the second approach, data from bi-monthly periods 1,2, and 6 are combined into a winter season, and data from remaining periods form a summer season. In the third approach, Periods 1 and 6 form the winter season, Periods 3 and 4 represent the summer, and Periods 2 and 5 are combined to form a Spring-Fall transitional period. The final approach maintains each bi-monthly period as a stratum of analysis.

Table 5 summarizes observer sampling of trawl hauls and target-species tonnage for each year of data collection. Due to management restrictions that encouraged northern vessels to fish seaward of the Groundfish Trawl Rockfish Conservation Area (RCA) throughout most of the second year of data collection, the number of hauls and amount of target-species tonnage observed shoreward of the RCA north of 40°10' N. Lat. fell dramatically. Only one-quarter to one-third of the unweighted combined observations within each depth stratum came from the second year. Even with the proposed method of combining data (using a 0.6 weight for the second year), the second year does not contribute even half of the target species poundage. Of particular note is the lack of observations shallower than 75 fathoms in Period 1–fewer than 20 hauls in both years combined. In addition to the regulatory factors encouraging the fleet to fish deeper in the north, the deep-water fishery was largely closed throughout the final three months of 2001. As a result, for tows starting outside of 150 fathoms, the second year of observation contributes between 57% and 61% of all observed tows and tonnage.

Unlike the northern region, the area south of 40°10' N. Lat. had a large increase in the observed tows and tonnage in the nearshore depths (less than 60 fathoms) that remained open to fishing throughout all of the second year of observation. This increase is particularly useful for bycatch modeling, since these shoreward depth strata contained very little data from the first year of observation. The previous paucity of data resulted from the high percentage of first-year observations that were for hauls originating in depths that were later closed during 2003. Many of the first-year hauls observed in shallow depths were also targeting California halibut, and were subsequently removed from the data set. The level of observation in waters deeper than 150 fathoms during the second year is slightly higher, for the entire 12 months. However, the overall increase was driven by the substantially higher second-year level of observation during Periods 5 and 6. As discussed for the northern area, this was a direct result of the October closure of fishing for most deep-water species in 2001.

Table 6 lists the bycatch ratios for each of the rebuilding species, for each of the area-depth-season strata described above. Table 7 reports on the corresponding coefficients of variation (CV) for the ratios listed in Table 6. Both bycatch ratios and their CVs exhibit considerable variability among 2-month periods. This variability is further illustrated by the relationships of seasonal-to-annual bycatch ratios reported in Table 8. Some of this variability may reflect true underlying seasonal differences in the rates of species co-occurrence or availability to trawl gear. But limited sample sizes, combined with infrequent, large bycatch events, are also likely contributing factors to the observed ranges of values. Consequently, a balance must be struck between the desire that the bycatch model reflect the real variability in bycatch relationships throughout the course of a year and the desire to avoid a situation where random chance in the measurement of bycatch leads to the imposition of a trip list regime that contains unnecessary fluctuation from period to period.

It would also appear important that the same level of seasonal stratification be used for analysis of all potential depths restrictions within the general shallow and deep zones of each area. Failure to do so could result in attempts to avoid the implications of a 'high' 2-month bycatch ratio in the 'less than 75 fathom' stratum, for example, by shifting to the 'less than 60 fathom' stratum, where pooling of bycatch data across additional periods might, by itself, be responsible for producing a lower bycatch ratio for use in that period. This means that, within each area and general depth zone, the determination of appropriate seasonal stratification must driven by the potential management depth stratum that represents the "weakest link" to seasonal disaggregation of the data. In light of sample sizes and CVs in the various strata, the proposed approach for seasonal stratification for 2004 bycatch modeling is to use the two 6-month (winter/summer) seasons for all depth strata less than 100 fathoms, and to use the three 4-month (winter/transition/summer) seasons for depth strata greater than 150 fathoms.

Finally, Tables 9 and 10 summarize bycatch and discard rates for all area/depth/season strata using the proposed 40-60% weighting proposed for combining the first and second year of observer data, respectively. Table 9 lists bycatch ratios for each overfished species. Table 10 list discard rates for each target species.

Table 1.--Comparison of annual bycatch ratios [species catch (lb) / **retained** target species catch (lb)] calculated for rebuilding species from data collected during the first and second years of the NMFS West Coast Groundfish Observer Program, by depth category.

	observer data year	Depth zone <=50 fm	<=60 fm	<=75 fm	<=100 fm	>150 fm	>180 fm	>200 fm	>250 fm
North of 40°10'									
# of observed hauls included in analysis	1 ('03) *	548	913	1,343	1,689	1,047	948	840	666
	1 ('04) *	485	821	1,129	1,419	843	772	668	532
	2 ('04)	170	290	515	691	1,234	1,226	1,116	900
Retained target groundfish pounds	1 ('03) *	374,760	630,871	1,200,883	1,684,093	2,605,786	2,367,038	2,100,219	1,535,360
	1 ('04) *	346,979	582,062	892,071	1,168,214	2,078,170	1,951,340	1,690,580	1,275,325
	2 ('04)	147,402	275,332	586,969	854,453	3,026,946	3,008,144	2,764,184	2,208,185
Lingcod	1 ('03) *	2.424%	3.622%	4.479%	5.555%	0.085%	0.061%	0.046%	0.021%
	1 ('04) *	2.299%	3.622%	4.434%	5.388%	0.117%	0.090%	0.071%	0.025%
	2 ('04)	2.251%	5.860%	6.050%	7.650%	0.090%	0.088%	0.060%	0.017%
weighted data: yr 1 (.4) + yr 2 (.6)		2.280%	4.551%	5.237%	6.571%	0.098%	0.088%	0.064%	0.019%
[weighted years 1+2] - 1 ('03)		-0.144%	+0.929%	+0.758%	+1.017%	+0.013%	+0.027%	+0.017%	-0.002%
% change from yr 1('03)		-6.0%	+25.7%	+16.9%	+18.3%	+15.4%	+44.7%	+37.3%	-9.6%
Widow	1 ('03) *	0.002%	0.052%	0.035%	0.057%	0.010%	0.004%	0.003%	0.002%
	1 ('04) *	0.001%	0.148%	0.101%	0.122%	0.011%	0.005%	0.004%	0.002%
	2 ('04)	0.002%	0.001%	0.014%	0.016%	0.026%	0.024%	0.022%	0.008%
weighted data: yr 1 (.4) + yr 2 (.6)		0.001%	0.087%	0.058%	0.067%	0.021%	0.018%	0.017%	0.007%
[weighted years 1+2] - 1 ('03)		-0.001%	+0.035%	+0.022%	+0.009%	+0.012%	+0.014%	+0.014%	+0.005%
% change from yr 1('03)		-37.3%	+67.7%	+63.1%	+16.4%	+120.8%	+328.7%	+431.8%	+306.6%
Canary	1 ('03) *	0.103%	0.258%	0.724%	1.005%	0.011%	0.007%	0.008%	0.008%
	1 ('04) *	0.108%	0.290%	0.751%	1.016%	0.014%	0.009%	0.010%	0.012%
	2 ('04)	0.059%	0.134%	0.546%	0.944%	0.006%	0.006%	0.004%	0.002%
weighted data: yr 1 (.4) + yr 2 (.6)		0.089%	0.225%	0.649%	0.979%	0.009%	0.007%	0.006%	0.005%
[weighted years 1+2] - 1 ('03)		-0.014%	-0.033%	-0.075%	-0.027%	-0.002%	-0.000%	-0.002%	-0.003%
% change from yr 1('03)		-13.7%	-12.7%	-10.4%	-2.7%	-20.7%	-1.7%	-26.8%	-42.7%
Yelloweye	1 ('03) *	0.001%	0.005%	0.027%	0.033%	0.001%	0.000%	0.000%	0.000%
	1 ('04) *	0.001%	0.002%	0.003%	0.015%	0.000%	0.000%	0.000%	0.000%
	2 ('04)	0.006%	0.004%	0.009%	0.008%	0.000%	0.000%	0.000%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.003%	0.003%	0.006%	0.011%	0.000%	0.000%	0.000%	0.000%
[weighted years 1+2] - 1 ('03)		+0.002%	-0.002%	-0.021%	-0.022%	-0.000%	-0.000%	-0.000%	-0.000%
% change from yr 1('03)		+158.7%	-34.3%	-77.9%	-65.9%	-65.7%	-70.1%	-73.4%	-100.0%
POP	1 ('03) *	0.018%	0.027%	0.292%	0.506%	1.046%	0.692%	0.552%	0.341%
	1 ('04) *	0.007%	0.018%	0.085%	0.378%	0.983%	0.479%	0.420%	0.161%
	2 ('04)	0.000%	0.000%	0.004%	0.023%	1.114%	1.110%	0.907%	0.225%
weighted data: yr 1 (.4) + yr 2 (.6)		0.004%	0.010%	0.045%	0.192%	1.072%	0.919%	0.766%	0.207%
[weighted years 1+2] - 1 ('03)		-0.013%	-0.017%	-0.247%	-0.314%	+0.026%	+0.227%	+0.214%	-0.134%
% change from yr 1('03)		-75.7%	-61.6%	-84.7%	-62.0%	+2.5%	+32.9%	+38.8%	-39.2%
Darkblotched	1 ('03) *	0.031%	0.076%	0.230%	0.504%	1.197%	0.924%	0.521%	0.443%
	1 ('04) *	0.033%	0.060%	0.217%	0.464%	0.948%	0.691%	0.517%	0.504%
	2 ('04)	0.008%	0.018%	0.208%	0.395%	0.841%	0.827%	0.660%	0.303%
weighted data: yr 1 (.4) + yr 2 (.6)		0.023%	0.043%	0.213%	0.428%	0.874%	0.786%	0.618%	0.359%
[weighted years 1+2] - 1 ('03)		-0.008%	-0.034%	-0.017%	-0.076%	-0.322%	-0.138%	+0.097%	-0.084%
% change from yr 1('03)		-26.5%	-44.3%	-7.4%	-15.1%	-26.9%	-14.9%	+18.7%	-19.0%

* Since development of the first year data set in 2003, additional review of data records has occurred, and hauls that were part of EFP programs have been removed. Values in the rows labeled "1 ('03)" were used in modeling bycatch between April and November, 2003.

Table 1 (cont.).--Comparison of annual bycatch ratios [species catch (lb) / **retained** target species catch (lb)] calculated for rebuilding species from data collected during the first and second years of the NMFS West Coast Groundfish Observer Progr by depth category.

	observer data year	Depth zone <=50 fm	<=60 fm	<=75 fm	<=100 fm	>150 fm	>180 fm	>200 fm	>250 fm
South of 40°10'									
# of observed hauls included in analysis	1 ('03) *	38	70	107	167	151	134	111	93
	1 ('04) *	31	64	102	161	386	356	323	252
	2 ('04)	108	172	172	173	394	377	350	303
Retained target groundfish pounds	1 ('03) *	9,955	97,792	281,667	331,849	412,960	360,869	331,878	289,802
	1 ('04) *	25,940	77,284	181,467	238,181	1,097,956	1,043,535	972,853	699,152
	2 ('04)	45,541	120,427	120,427	121,349	1,167,110	1,138,513	1,084,174	976,478
Lingcod	1 ('03) *	1.285%	0.788%	0.869%	2.901%	1.299%	1.391%	0.023%	0.011%
	1 ('04) *	0.926%	1.258%	1.452%	4.012%	0.635%	0.553%	0.082%	0.004%
	2 ('04)	1.639%	4.647%	4.647%	4.612%	0.327%	0.139%	0.067%	0.017%
weighted data: yr 1 (.4) + yr 2 (.6)		1.443%	3.632%	3.046%	4.272%	0.446%	0.296%	0.073%	0.013%
[weighted years 1+2] - 1 ('03)		+0.157%	+2.844%	+2.177%	+1.371%	-0.854%	-1.095%	+0.050%	+0.002%
% change from yr 1('03)		+12.2%	+360.9%	+250.6%	+47.2%	-65.7%	-78.7%	+215.0%	+15.0%
Widow	1 ('03) *	0.311%	0.033%	0.012%	0.015%	0.006%	0.001%	0.000%	0.000%
	1 ('04) *	0.000%	0.002%	0.001%	0.006%	0.007%	0.001%	0.000%	0.000%
	2 ('04)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.000%	0.001%	0.000%	0.004%	0.003%	0.000%	0.000%	0.000%
[weighted years 1+2] - 1 ('03)		-0.311%	-0.033%	-0.011%	-0.011%	-0.004%	-0.001%	+0.000%	+0.000%
% change from yr 1('03)		-100.0%	-98.2%	-96.3%	-76.4%	-59.9%	-69.7%		
Canary	1 ('03) *	0.211%	0.037%	0.053%	0.111%	0.000%	0.000%	0.000%	0.000%
	1 ('04) *	0.081%	0.105%	0.106%	0.167%	0.000%	0.000%	0.000%	0.000%
	2 ('04)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.022%	0.032%	0.053%	0.094%	0.000%	0.000%	0.000%	0.000%
[weighted years 1+2] - 1 ('03)		-0.189%	-0.006%	+0.001%	-0.017%	+0.000%	+0.000%	+0.000%	+0.000%
% change from yr 1('03)		-89.4%	-15.0%	+1.2%	-15.3%				
Yelloweye	1 ('03) *	0.311%	0.032%	0.011%	0.010%	0.000%	0.000%	0.000%	0.000%
	1 ('04) *	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	2 ('04)	0.051%	0.025%	0.025%	0.025%	0.000%	0.000%	0.000%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.037%	0.018%	0.013%	0.011%	0.000%	0.000%	0.000%	0.000%
[weighted years 1+2] - 1 ('03)		-0.274%	-0.014%	+0.002%	+0.001%	+0.000%	+0.000%	+0.000%	+0.000%
% change from yr 1('03)		-88.0%	-43.8%	+15.2%	+12.3%				
Bocaccio	1 ('03) *	2.431%	0.810%	0.511%	3.772%	0.311%	0.313%	0.090%	0.103%
	1 ('04) *	0.933%	1.034%	0.769%	3.598%	0.108%	0.105%	0.027%	0.035%
	2 ('04)	0.000%	0.203%	0.203%	0.202%	0.164%	0.041%	0.004%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.257%	0.452%	0.487%	2.127%	0.143%	0.065%	0.012%	0.011%
[weighted years 1+2] - 1 ('03)		-2.174%	-0.358%	-0.024%	-1.645%	-0.168%	-0.248%	-0.077%	-0.091%
% change from yr 1('03)		-89.4%	-44.2%	-4.8%	-43.6%	-54.1%	-79.2%	-86.1%	-89.0%
Cowcod	1 ('03) *	0.000%	0.005%	0.006%	0.090%	0.014%	0.000%	0.000%	0.000%
	1 ('04) *	0.000%	0.007%	0.010%	0.079%	0.006%	0.002%	0.000%	0.000%
	2 ('04)	0.000%	0.020%	0.020%	0.020%	0.000%	0.000%	0.000%	0.000%
weighted data: yr 1 (.4) + yr 2 (.6)		0.000%	0.016%	0.015%	0.053%	0.002%	0.001%	0.000%	0.000%
[weighted years 1+2] - 1 ('03)		+0.000%	+0.011%	+0.009%	-0.037%	-0.011%	+0.000%	-0.000%	+0.000%
% change from yr 1('03)			+249.2%	+150.5%	-41.0%	-83.6%	+47.0%	-87.2%	
Darkblotched	1 ('03) *	0.000%	0.000%	0.000%	0.049%	0.126%	0.098%	0.042%	0.015%
	1 ('04) *	0.000%	0.000%	0.000%	0.037%	0.154%	0.131%	0.126%	0.069%
	2 ('04)	0.000%	0.001%	0.001%	0.001%	0.124%	0.083%	0.087%	0.002%
weighted data: yr 1 (.4) + yr 2 (.6)		0.000%	0.001%	0.001%	0.022%	0.136%	0.101%	0.101%	0.023%
[weighted years 1+2] - 1 ('03)		+0.000%	+0.001%	+0.001%	-0.028%	+0.010%	+0.003%	+0.059%	+0.008%
% change from yr 1('03)					-56.1%	+8.0%	+3.5%	+141.9%	+56.2%

* Since development of the first year data set in 2003, additional review of data records has occurred, and hauls that were part of EFP programs have been removed. Values in the rows labeled "1 ('03)" were used in modeling bycatch between April and November, 2003.

Table 3.--Comparison of rebuilding species bycatch amounts projected in September 2003 for adopted 2004 measures and updated projections using a weighted combination of observer data from the first and second years of trawl fleet observation.

	lingcod	canary	POP	darkblotched	widow	yelloweye	bocaccio	cowcod
Total bycatch (mt), as estimated at the September 2003 PFMC meeting for Council-approved measures for 2004								
N. of 40°10'	48.0	8.5	67.8	67.7	1.0	0.3	0.0	0.0
S. of 40°10'	30.5	1.0	0.4	33.0	0.5	0.1	22.6	0.6
Coastwide	78.4	9.5	68.1	100.7	1.5	0.4	22.6	0.6
Updated bycatch estimates (mt), changing only the bycatch ratios, calculated using a weighted combination of the first two years of observer data[1]								
N. of 40°10'	58.6	7.6	83.3	59.9	2.4	0.1	0.0	0.0
S. of 40°10'	35.1	0.8	0.0	19.9	0.5	0.1	13.7	0.4
Coastwide	93.7	8.4	83.3	79.7	2.9	0.2	13.7	0.4
Difference between								
N. of 40°10'	10.6	-1.0	15.6	-7.8	1.4	-0.2	0.0	0.0
S. of 40°10'	4.6	-0.2	-0.4	-13.2	0.0	0.0	-8.9	-0.3
Coastwide	15.2	-1.1	15.2	-21.0	1.4	-0.2	-8.9	-0.3
% change from 1st yr obs. data	+19.4%	-11.8%	+22.3%	-20.8%	+94.2%	-53.0%	-39.6%	-41.7%

Table 4.--Comparison of target species discard amounts projected in September 2003 for adopted 2004 measures and revised projections using a weighted combination of observer data from the first and second years of trawl fleet observation.

	sablefish	longspine	shortspine	dover	arrowtooth	petrale	otr. flatfish
Target species discard (mt), as estimated at the September 2003 PFMC meeting for Council-approved measures for 2004							
N. of 40o10'	1,217	230	209	653	739	55	1,046
38o-40o10'	201	55	67	178	9	34	495
S. of 38o	113	50	42	132	1	4	73
Coastwide	1,531	335	318	963	749	93	1,614
Updated discard estimates (mt), changing only the discard rates, calculated using a weighted combination of the first two years of observer data[1]							
N. of 40o10'	728	190	234	518	811	45	628
38o-40o10'	130	46	74	139	14	27	280
S. of 38o	88	42	47	102	1	3	46
Coastwide	947	277	355	758	826	74	954
Difference							
N. of 40o10'	-488	-40	25	-135	71	-11	-418
38o-40o10'	-71	-9	8	-40	5	-7	-215
S. of 38o	-25	-8	5	-30	0	-1	-27
Coastwide	-584	-58	38	-205	77	-18	-660
% change from first year observer data	-38.1%	-17.3%	+11.8%	-21.2%	+10.3%	-19.9%	-40.9%

[1] The first year of trawl data collection was from September, 2001 to August, 2002. The second year was from September, 2002 to August, 2003. In combining these years, first year data weighted by 0.4; second year data by 0.6.

Table 5.--Distribution of the number of observed trawl hauls and target species catch (mt) between the first and second years[1] of NMFS observer data collection, by area, depth strata, and various temporal strata.

			Number of observed hauls					Observed target species catch (mt)					
			Observer program collection year				2-year	Observer program collection year				2-year	Weighted[2]
	Depth	Bi-monthly	**First year**		**Second year**		total	**First year**		**Second year**		total	2nd-year
Area	range	periods	Number	% of tot.	Number	% of tot.	Number	mts	% of tot.	mts	% of tot.	mts	% of tot.
North of 40°10'													
	<=50 fm	**All**	**485**	**74%**	**170**	**26%**	**655**	**221**	**73%**	**81**	**27%**	**302**	**35%**
		1,2,6	48	59%	34	41%	82	20	56%	16	44%	37	54%
		3,4,5	437	76%	136	24%	573	201	76%	64	24%	265	33%
		1,6	38	69%	17	31%	55	17	81%	4	19%	21	26%
		2,5	26	21%	99	79%	125	9	17%	46	83%	56	88%
		3,4	421	89%	54	11%	475	195	87%	30	13%	225	19%
		1	1	100%		0%	1	0	100%	0	0%	0	0%
		2	10	37%	17	63%	27	3	22%	12	78%	16	84%
		3	225	85%	39	15%	264	85	82%	19	18%	104	25%
		4	196	93%	15	7%	211	110	91%	11	9%	121	13%
		5	16	16%	82	84%	98	6	15%	34	85%	40	90%
		6	37	69%	17	31%	54	17	81%	4	19%	21	27%
	<=60 fm	**All**	**821**	**74%**	**290**	**26%**	**1,111**	**434**	**74%**	**155**	**26%**	**589**	**35%**
		1,2,6	116	60%	77	40%	193	45	54%	39	46%	84	56%
		3,4,5	705	77%	213	23%	918	389	77%	116	23%	505	31%
		1,6	48	61%	31	39%	79	23	68%	11	32%	33	42%
		2,5	115	37%	192	63%	307	50	32%	108	68%	158	76%
		3,4	658	91%	67	9%	725	362	91%	37	9%	398	13%
		1	1	50%	1	50%	2	0	35%	1	65%	1	74%
		2	68	60%	46	40%	114	22	44%	28	56%	51	65%
		3	340	88%	47	12%	387	153	88%	21	12%	174	17%
		4	318	94%	20	6%	338	209	93%	15	7%	224	10%
		5	47	24%	146	76%	193	28	26%	80	74%	107	81%
		6	47	61%	30	39%	77	22	69%	10	31%	32	40%
	<=75 fm	**All**	**1,129**	**69%**	**515**	**31%**	**1,644**	**686**	**66%**	**356**	**34%**	**1,041**	**44%**
		1,2,6	205	48%	225	52%	430	82	32%	173	68%	255	76%
		3,4,5	924	76%	290	24%	1,214	604	77%	182	23%	786	31%
		1,6	68	48%	73	52%	141	29	36%	52	64%	81	73%
		2,5	214	39%	340	61%	554	109	31%	243	69%	352	77%
		3,4	847	89%	102	11%	949	547	90%	61	10%	608	14%
		1	7	39%	11	61%	18	1	9%	14	91%	15	94%
		2	137	47%	152	53%	289	53	30%	121	70%	174	78%
		3	454	87%	67	13%	521	266	89%	34	11%	300	16%
		4	393	92%	35	8%	428	282	91%	27	9%	309	13%
		5	77	29%	188	71%	265	57	32%	121	68%	178	76%
		6	61	50%	62	50%	123	28	42%	38	58%	66	67%
	<=100 fm	**All**	**1,419**	**67%**	**691**	**33%**	**2,110**	**956**	**64%**	**540**	**36%**	**1,496**	**46%**
		1,2,6	314	47%	354	53%	668	159	34%	310	66%	469	75%
		3,4,5	1,105	77%	337	23%	1,442	797	78%	230	22%	1,027	30%
		1,6	91	48%	99	52%	190	36	31%	80	69%	116	77%
		2,5	375	44%	482	56%	857	270	41%	392	59%	662	69%
		3,4	953	90%	110	10%	1,063	650	90%	68	10%	718	14%
		1	24	46%	28	54%	52	6	19%	28	81%	35	87%
		2	223	47%	255	53%	478	123	35%	230	65%	353	74%
		3	497	87%	75	13%	572	307	88%	41	12%	348	17%
		4	456	93%	35	7%	491	343	93%	27	7%	370	11%
		5	152	40%	227	60%	379	147	48%	162	52%	309	62%
		6	67	49%	71	51%	138	29	36%	51	64%	81	72%

[1] The first year of trawl data collection was from September, 2001 to August, 2002. The second year was from September, 2002 to August, 2003. [2] First year data weighted by 0.4; second year data by 0.6.

Table 5 (cont.).--Distribution of the number of observed trawl hauls and target species catch (mt) between the first and second years[1] of NMFS observer data collection, by area, depth strata, and various temporal strata.

		Number of observed hauls					Observed target species catch (mt)					
		Observer program collection year				2-year total	Observer program collection year				2-year total	Weighted 2nd-year
Area / Depth range	Bi-monthly periods	First year		Second year			First year		Second year			
		Number	% of tot.	Number	% of tot.	Number	mts	% of tot.	mts	% of tot.	mts	% of tot.
North of 40°10'												
>150 fm	**All**	**1,062**	**43%**	**1,423**	**57%**	**2,485**	**1,542**	**43%**	**2,040**	**57%**	**3,581**	**66%**
	1,2,6	716	52%	669	48%	1,385	1,111	52%	1,040	48%	2,151	58%
	3,4,5	346	31%	754	69%	1,100	430	30%	1,000	70%	1,430	78%
	1,6	346	51%	337	49%	683	487	50%	494	50%	981	60%
	2,5	474	48%	507	52%	981	730	50%	737	50%	1,466	60%
	3,4	242	29%	579	71%	821	325	29%	809	71%	1,135	79%
	1	324	62%	200	38%	524	455	62%	280	38%	735	48%
	2	370	53%	332	47%	702	625	53%	546	47%	1,171	57%
	3	98	22%	354	78%	452	128	22%	453	78%	580	84%
	4	144	39%	225	61%	369	198	36%	357	64%	554	73%
	5	104	37%	175	63%	279	105	36%	190	64%	295	73%
	6	22	14%	137	86%	159	32	13%	213	87%	245	91%
>180 fm	**All**	**980**	**41%**	**1,410**	**59%**	**2,390**	**1,437**	**42%**	**2,012**	**58%**	**3,449**	**68%**
	1,2,6	667	50%	656	50%	1,323	1,040	51%	1,013	49%	2,052	59%
	3,4,5	313	29%	754	71%	1,067	398	28%	1,000	72%	1,397	79%
	1,6	320	50%	325	50%	645	460	50%	468	50%	928	60%
	2,5	433	46%	506	54%	939	666	48%	735	52%	1,401	62%
	3,4	227	28%	579	72%	806	311	28%	809	72%	1,121	80%
	1	298	61%	193	39%	491	428	62%	266	38%	694	48%
	2	347	51%	331	49%	678	579	52%	545	48%	1,124	59%
	3	87	20%	354	80%	441	120	21%	453	79%	573	85%
	4	140	38%	225	62%	365	191	35%	357	65%	548	74%
	5	86	33%	175	67%	261	86	31%	190	69%	277	77%
	6	22	14%	132	86%	154	32	14%	201	86%	234	90%
>200 fm	**All**	**869**	**40%**	**1,300**	**60%**	**2,169**	**1,274**	**41%**	**1,865**	**59%**	**3,139**	**69%**
	1,2,6	565	49%	597	51%	1,162	884	48%	949	52%	1,833	62%
	3,4,5	304	30%	703	70%	1,007	390	30%	916	70%	1,306	78%
	1,6	237	47%	271	53%	508	346	46%	407	54%	752	64%
	2,5	411	45%	501	55%	912	620	46%	733	54%	1,353	64%
	3,4	221	30%	528	70%	749	308	30%	725	70%	1,033	78%
	1	237	63%	140	37%	377	346	63%	207	37%	552	47%
	2	328	50%	326	50%	654	538	50%	543	50%	1,081	60%
	3	84	19%	349	81%	433	118	21%	446	79%	564	85%
	4	137	43%	179	57%	316	190	40%	279	60%	469	69%
	5	83	32%	175	68%	258	82	30%	190	70%	272	78%
	6		0%	131	100%	131	0	0%	200	100%	200	100%
>250 fm	**All**	**685**	**39%**	**1,066**	**61%**	**1,751**	**948**	**39%**	**1,509**	**61%**	**2,457**	**70%**
	1,2,6	436	46%	508	54%	944	651	45%	800	55%	1,451	65%
	3,4,5	249	31%	558	69%	807	297	30%	709	70%	1,006	78%
	1,6	174	45%	210	55%	384	247	44%	315	56%	561	66%
	2,5	340	42%	470	58%	810	482	42%	672	58%	1,153	68%
	3,4	171	31%	386	69%	557	219	30%	523	70%	742	78%
	1	174	59%	120	41%	294	247	58%	177	42%	424	52%
	2	262	47%	298	53%	560	404	45%	485	55%	890	64%
	3	66	20%	271	80%	337	92	21%	351	79%	443	85%
	4	105	48%	115	52%	220	128	43%	172	57%	299	67%
	5	78	31%	172	69%	250	78	29%	186	71%	264	78%
	6		0%	90	100%	90	0	0%	138	100%	138	100%

[1] The first year of trawl data collection was from September, 2001 to August, 2002. The second year was from September, 2002 to August, 2003. [2] First year data weighted by 0.4; second year data by 0.6.

Table 5 (cont.).--Distribution of the number of observed trawl hauls and target species catch (mt) between the first and second years[1] of NMFS observer data collection, by area, depth strata, and various temporal strata.

			Number of observed hauls					Observed target species catch (mt)					
			Observer program collection year				2-year	Observer program collection year				2-year	Weighted
	Depth	Bi-monthly	First year		Second year		total	First year		Second year		total	2nd-year
Area	range	periods	Number	% of tot.	Number	% of tot.	Number	mts	% of tot.	mts	% of tot.	mts	% of tot.
South of 40°10'													
	<=50 fm	**All**	**31**	**22%**	**108**	**78%**	**139**	**13**	**32%**	**26**	**68%**	**39**	**76%**
		1,2,6	21	46%	25	54%	46	12	68%	6	32%	17	42%
		3,4,5	10	11%	83	89%	93	1	4%	21	96%	22	97%
		1,6	9	53%	8	47%	17	6	91%	1	9%	7	12%
		2,5	20	51%	19	49%	39	6	52%	6	48%	12	58%
		3,4	2	2%	81	98%	83	0	0%	20	100%	20	100%
		1	7	47%	8	53%	15	1	61%	1	39%	2	49%
		2	12	41%	17	59%	29	5	51%	5	49%	10	59%
		3	2	7%	25	93%	27	0	2%	5	98%	5	99%
		4		0%	56	100%	56	0	0%	16	100%	16	100%
		5	8	80%	2	20%	10	1	59%	1	41%	1	51%
		6	2	100%		0%	2	6	100%	0	0%	6	0%
	<=60 fm	**All**	**64**	**27%**	**172**	**73%**	**236**	**39**	**36%**	**71**	**64%**	**110**	**73%**
		1,2,6	32	46%	38	54%	70	29	59%	21	41%	50	52%
		3,4,5	32	19%	134	81%	166	10	16%	50	84%	60	89%
		1,6	13	62%	8	38%	21	19	97%	1	3%	20	5%
		2,5	48	60%	32	40%	80	20	49%	21	51%	41	61%
		3,4	3	2%	132	98%	135	0	0%	49	100%	50	100%
		1	10	56%	8	44%	18	13	96%	1	4%	14	6%
		2	19	39%	30	61%	49	11	34%	20	66%	31	74%
		3	3	5%	60	95%	63	0	1%	29	99%	29	100%
		4		0%	72	100%	72	0	0%	20	100%	20	100%
		5	29	94%	2	6%	31	9	94%	1	6%	10	9%
		6	3	100%		0%	3	6	100%	0	0%	6	0%
	<=75 fm	**All**	**102**	**37%**	**172**	**63%**	**274**	**90**	**56%**	**71**	**44%**	**161**	**54%**
		1,2,6	59	61%	38	39%	97	72	78%	21	22%	93	30%
		3,4,5	43	24%	134	76%	177	18	26%	50	74%	68	81%
		1,6	33	80%	8	20%	41	53	99%	1	1%	53	2%
		2,5	65	67%	32	33%	97	37	64%	21	36%	57	46%
		3,4	4	3%	132	97%	136	1	2%	49	98%	50	99%
		1	29	78%	8	22%	37	47	99%	1	1%	47	2%
		2	26	46%	30	54%	56	19	49%	20	51%	40	61%
		3	4	6%	60	94%	64	1	3%	29	97%	30	98%
		4		0%	72	100%	72	0	0%	20	100%	20	100%
		5	39	95%	2	5%	41	17	97%	1	3%	18	5%
		6	4	100%		0%	4	6	100%	0	0%	6	0%
	<=100 fm	**All**	**161**	**48%**	**173**	**52%**	**334**	**133**	**65%**	**71**	**35%**	**204**	**45%**
		1,2,6	82	68%	39	32%	121	92	81%	21	19%	114	26%
		3,4,5	79	37%	134	63%	213	41	45%	50	55%	91	65%
		1,6	51	85%	9	15%	60	71	98%	1	2%	72	3%
		2,5	98	75%	32	25%	130	54	72%	21	28%	75	37%
		3,4	12	8%	132	92%	144	8	13%	49	87%	57	91%
		1	35	81%	8	19%	43	56	99%	1	1%	57	2%
		2	31	51%	30	49%	61	21	51%	20	49%	41	59%
		3	12	17%	60	83%	72	8	21%	29	79%	37	85%
		4		0%	72	100%	72	0	0%	20	100%	20	100%
		5	67	97%	2	3%	69	33	98%	1	2%	34	3%
		6	16	94%	1	6%	17	15	96%	1	4%	15	6%

[1] The first year of trawl data collection was from September, 2001 to August, 2002. The second year was from September, 2002 to August, 2003. [2] First year data weighted by 0.4; second year data by 0.6.

Table 5 (cont.).--Distribution of the number of observed trawl hauls and target species catch (mt) between the first and second years[1] of NMFS observer data collection, by area, depth strata, and various temporal strata.

			Number of observed hauls					Observed target species catch (mt)					
			Observer program collection year				2-year	Observer program collection year				2-year	Weighted
	Depth	Bi-monthly	First year		Second year		total	First year		Second year		total	2nd-year
Area	range	periods	Number	% of tot.	Number	% of tot.	Number	mts	% of tot.	mts	% of tot.	mts	% of tot.
South of 40°10'													
	>150 fm	**All**	**167**	**45%**	**205**	**55%**	**372**	**281**	**48%**	**301**	**52%**	**582**	**62%**
		1,2,6	80	45%	98	55%	178	114	47%	127	53%	241	62%
		3,4,5	87	45%	107	55%	194	167	49%	175	51%	342	61%
		1,6	62	43%	81	57%	143	87	45%	105	55%	192	65%
		2,5	33	32%	69	68%	102	50	31%	111	69%	161	77%
		3,4	72	57%	55	43%	127	145	63%	84	37%	229	47%
		1	54	60%	36	40%	90	73	56%	57	44%	131	54%
		2	18	51%	17	49%	35	27	56%	21	44%	49	54%
		3	32	59%	22	41%	54	96	67%	47	33%	143	42%
		4	40	55%	33	45%	73	48	56%	38	44%	86	54%
		5	15	22%	52	78%	67	23	20%	90	80%	113	86%
		6	8	15%	45	85%	53	13	22%	48	78%	61	84%
	>180 fm	**All**	**148**	**43%**	**193**	**57%**	**341**	**263**	**47%**	**291**	**53%**	**554**	**62%**
		1,2,6	69	44%	87	56%	156	103	47%	118	53%	221	63%
		3,4,5	79	43%	106	57%	185	160	48%	174	52%	334	62%
		1,6	53	41%	77	59%	130	78	43%	102	57%	180	66%
		2,5	25	29%	62	71%	87	41	28%	105	72%	147	79%
		3,4	70	56%	54	44%	124	144	63%	84	37%	227	47%
		1	48	57%	36	43%	84	69	54%	57	46%	126	56%
		2	16	62%	10	38%	26	25	63%	15	37%	41	47%
		3	31	60%	21	40%	52	96	68%	46	32%	142	42%
		4	39	54%	33	46%	72	48	56%	38	44%	85	54%
		5	9	15%	52	85%	61	16	15%	90	85%	106	89%
		6	5	11%	41	89%	46	9	17%	45	83%	54	88%
	>200 fm	**All**	**122**	**42%**	**166**	**58%**	**288**	**232**	**47%**	**261**	**53%**	**493**	**63%**
		1,2,6	49	44%	63	56%	112	88	49%	91	51%	179	61%
		3,4,5	73	41%	103	59%	176	144	46%	171	54%	315	64%
		1,6	34	39%	53	61%	87	62	45%	76	55%	138	65%
		2,5	23	28%	59	72%	82	41	29%	102	71%	143	79%
		3,4	65	55%	54	45%	119	128	60%	84	40%	212	50%
		1	34	55%	28	45%	62	62	61%	40	39%	102	49%
		2	15	60%	10	40%	25	25	62%	15	38%	40	47%
		3	27	56%	21	44%	48	81	64%	46	36%	127	46%
		4	38	54%	33	46%	71	47	56%	38	44%	85	54%
		5	8	14%	49	86%	57	16	16%	87	84%	103	89%
		6		0%	25	100%	25	0	0%	36	100%	36	100%
	>250 fm	**All**	**99**	**42%**	**137**	**58%**	**236**	**187**	**44%**	**236**	**56%**	**422**	**65%**
		1,2,6	44	44%	55	56%	99	84	51%	80	49%	164	59%
		3,4,5	55	40%	82	60%	137	103	40%	155	60%	258	69%
		1,6	33	42%	45	58%	78	62	49%	65	51%	127	61%
		2,5	15	23%	51	77%	66	37	28%	93	72%	129	79%
		3,4	51	55%	41	45%	92	88	53%	78	47%	166	57%
		1	33	57%	25	43%	58	62	66%	32	34%	94	43%
		2	11	52%	10	48%	21	22	59%	15	41%	37	51%
		3	17	45%	21	55%	38	50	52%	46	48%	97	58%
		4	34	63%	20	37%	54	38	54%	32	46%	69	56%
		5	4	9%	41	91%	45	15	16%	77	84%	92	89%
		6		0%	20	100%	20	0	0%	33	100%	33	100%

[1] The first year of trawl data collection was from September, 2001 to August, 2002. The second year was from September, 2002 to August, 2003. [2] First year data weighted by 0.4; second year data by 0.6.

Table 6.--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using data collected all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Bycatch ratios: Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	<=50 fm	**All**	**655**	**0.070%**	**1.699%**	**0.001%**	**0.000%**	**0.004%**	**0.019%**	**0.002%**	**0.000%**
		1,2,6	82	0.110%	0.864%	0.003%	0.000%	0.000%	0.021%	0.000%	0.000%
		3,4,5	573	0.064%	1.814%	0.001%	0.000%	0.004%	0.019%	0.002%	0.000%
		1,6	55	0.177%	1.419%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	125	0.063%	1.978%	0.002%	0.000%	0.000%	0.014%	0.008%	0.000%
		3,4	475	0.061%	1.655%	0.001%	0.000%	0.005%	0.022%	0.001%	0.000%
		1	1								
		2	27	0.020%	0.122%	0.007%	0.000%	0.000%	0.049%	0.000%	0.000%
		3	264	0.030%	1.062%	0.000%	0.000%	0.010%	0.035%	0.001%	0.000%
		4	211	0.088%	2.161%	0.001%	0.000%	0.001%	0.011%	0.001%	0.000%
		5	98	0.080%	2.701%	0.000%	0.000%	0.000%	0.000%	0.011%	0.000%
		6	54	0.180%	1.433%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	<=60 fm	**All**	**1,111**	**0.158%**	**2.865%**	**0.067%**	**0.000%**	**0.008%**	**0.031%**	**0.002%**	**0.000%**
		1,2,6	193	0.157%	1.904%	0.011%	0.000%	0.000%	0.020%	0.000%	0.000%
		3,4,5	918	0.158%	3.025%	0.076%	0.000%	0.009%	0.032%	0.002%	0.000%
		1,6	79	0.292%	2.141%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	307	0.102%	4.803%	0.006%	0.000%	0.000%	0.031%	0.003%	0.000%
		3,4	725	0.169%	2.157%	0.096%	0.000%	0.012%	0.033%	0.002%	0.000%
		1	2								
		2	114	0.069%	1.749%	0.018%	0.000%	0.000%	0.033%	0.000%	0.000%
		3	387	0.090%	1.449%	0.219%	0.000%	0.026%	0.058%	0.002%	0.000%
		4	338	0.231%	2.706%	0.001%	0.000%	0.001%	0.014%	0.002%	0.000%
		5	193	0.118%	6.241%	0.001%	0.000%	0.000%	0.030%	0.004%	0.000%
		6	77	0.301%	2.201%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	<=75 fm	**All**	**1,644**	**0.431%**	**3.270%**	**0.043%**	**0.000%**	**0.034%**	**0.138%**	**0.004%**	**0.000%**
		1,2,6	430	0.499%	3.327%	0.016%	0.000%	0.004%	0.096%	0.005%	0.000%
		3,4,5	1,214	0.409%	3.251%	0.051%	0.000%	0.044%	0.151%	0.003%	0.000%
		1,6	141	0.767%	2.838%	0.014%	0.000%	0.012%	0.166%	0.003%	0.000%
		2,5	554	0.427%	4.506%	0.015%	0.000%	0.000%	0.140%	0.005%	0.000%
		3,4	949	0.389%	2.612%	0.063%	0.000%	0.057%	0.133%	0.003%	0.000%
		1	18								
		2	289	0.374%	3.555%	0.017%	0.000%	0.000%	0.064%	0.006%	0.000%
		3	521	0.360%	2.399%	0.127%	0.000%	0.037%	0.212%	0.003%	0.000%
		4	428	0.417%	2.819%	0.000%	0.000%	0.076%	0.056%	0.003%	0.000%
		5	265	0.479%	5.438%	0.013%	0.000%	0.000%	0.214%	0.005%	0.000%
		6	123	0.591%	3.028%	0.017%	0.000%	0.013%	0.171%	0.003%	0.000%
	<=100 fm	**All**	**2,114**	**0.605%**	**3.890%**	**0.516%**	**0.000%**	**0.140%**	**0.267%**	**0.007%**	**0.000%**
		1,2,6	672	0.985%	5.154%	1.532%	0.000%	0.025%	0.274%	0.016%	0.000%
		3,4,5	1,442	0.432%	3.313%	0.051%	0.000%	0.192%	0.263%	0.003%	0.000%
		1,6	194	1.672%	4.037%	6.084%	0.000%	0.066%	0.251%	0.047%	0.000%
		2,5	857	0.612%	4.891%	0.032%	0.000%	0.156%	0.287%	0.005%	0.000%
		3,4	1,063	0.427%	2.944%	0.062%	0.000%	0.137%	0.250%	0.003%	0.000%
		1	52	2.717%	5.696%	0.029%	0.000%	0.170%	0.476%	0.150%	0.000%
		2	478	0.759%	5.521%	0.038%	0.000%	0.011%	0.281%	0.005%	0.000%
		3	572	0.418%	2.444%	0.128%	0.000%	0.033%	0.419%	0.004%	0.000%
		4	491	0.435%	3.415%	0.000%	0.000%	0.235%	0.092%	0.003%	0.000%
		5	379	0.443%	4.171%	0.026%	0.000%	0.322%	0.294%	0.004%	0.000%
		6	142	1.222%	3.324%	8.689%	0.000%	0.021%	0.154%	0.003%	0.000%

Table 6 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using data collected all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratios							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	>150 fm	**All**	**2,077**	**0.007%**	**0.080%**	**0.016%**	**0.000%**	**0.844%**	**0.704%**	**0.000%**	**0.000%**
		1,2,6	1,229	0.008%	0.092%	0.022%	0.000%	0.773%	0.630%	0.000%	0.000%
		3,4,5	848	0.006%	0.058%	0.004%	0.000%	0.971%	0.837%	0.000%	0.000%
		1,6	616	0.007%	0.155%	0.017%	0.000%	1.310%	1.069%	0.000%	0.000%
		2,5	872	0.007%	0.038%	0.022%	0.000%	0.313%	0.411%	0.000%	0.000%
		3,4	589	0.008%	0.067%	0.004%	0.000%	1.198%	0.782%	0.000%	0.000%
		1	481	0.009%	0.133%	0.007%	0.000%	0.994%	0.810%	0.001%	0.000%
		2	613	0.009%	0.039%	0.027%	0.000%	0.317%	0.256%	0.000%	0.000%
		3	378	0.003%	0.047%	0.006%	0.000%	0.851%	0.704%	0.000%	0.000%
		4	211	0.016%	0.097%	0.002%	0.000%	1.700%	0.894%	0.000%	0.000%
		5	259	0.001%	0.032%	0.005%	0.000%	0.299%	0.999%	0.000%	0.000%
		6	135	0.000%	0.227%	0.050%	0.000%	2.335%	1.912%	0.000%	0.000%
	>180 fm	**All**	**1,998**	**0.006%**	**0.071%**	**0.013%**	**0.000%**	**0.691%**	**0.620%**	**0.000%**	**0.000%**
		1,2,6	1,177	0.005%	0.083%	0.019%	0.000%	0.595%	0.591%	0.000%	0.000%
		3,4,5	821	0.006%	0.051%	0.004%	0.000%	0.858%	0.671%	0.000%	0.000%
		1,6	583	0.007%	0.149%	0.012%	0.000%	1.040%	1.021%	0.000%	0.000%
		2,5	835	0.003%	0.021%	0.020%	0.000%	0.178%	0.253%	0.000%	0.000%
		3,4	580	0.008%	0.067%	0.004%	0.000%	1.128%	0.777%	0.000%	0.000%
		1	449	0.009%	0.123%	0.005%	0.000%	0.633%	0.747%	0.000%	0.000%
		2	594	0.004%	0.027%	0.024%	0.000%	0.222%	0.232%	0.000%	0.000%
		3	370	0.003%	0.045%	0.006%	0.000%	0.726%	0.692%	0.000%	0.000%
		4	210	0.016%	0.097%	0.001%	0.000%	1.706%	0.898%	0.000%	0.000%
		5	241	0.000%	0.000%	0.002%	0.000%	0.005%	0.335%	0.000%	0.000%
		6	134	0.000%	0.231%	0.033%	0.000%	2.300%	1.871%	0.000%	0.000%
	>200 fm	**All**	**1,784**	**0.005%**	**0.052%**	**0.012%**	**0.000%**	**0.583%**	**0.489%**	**0.000%**	**0.000%**
		1,2,6	1,020	0.005%	0.065%	0.017%	0.000%	0.516%	0.462%	0.000%	0.000%
		3,4,5	764	0.004%	0.031%	0.004%	0.000%	0.695%	0.535%	0.000%	0.000%
		1,6	446	0.008%	0.120%	0.006%	0.000%	0.974%	0.808%	0.000%	0.000%
		2,5	812	0.003%	0.021%	0.021%	0.000%	0.163%	0.205%	0.000%	0.000%
		3,4	526	0.006%	0.041%	0.005%	0.000%	0.937%	0.678%	0.000%	0.000%
		1	335	0.011%	0.076%	0.005%	0.000%	0.533%	0.377%	0.000%	0.000%
		2	574	0.004%	0.027%	0.025%	0.000%	0.204%	0.225%	0.000%	0.000%
		3	364	0.003%	0.046%	0.006%	0.000%	0.710%	0.643%	0.000%	0.000%
		4	162	0.011%	0.032%	0.002%	0.000%	1.362%	0.744%	0.000%	0.000%
		5	238	0.000%	0.000%	0.002%	0.000%	0.005%	0.124%	0.000%	0.000%
		6	111	0.000%	0.247%	0.008%	0.000%	2.237%	2.040%	0.000%	0.000%
	>250 fm	**All**	**1,432**	**0.005%**	**0.016%**	**0.005%**	**0.000%**	**0.164%**	**0.306%**	**0.000%**	**0.000%**
		1,2,6	823	0.005%	0.019%	0.007%	0.000%	0.168%	0.246%	0.000%	0.000%
		3,4,5	609	0.004%	0.011%	0.001%	0.000%	0.157%	0.408%	0.000%	0.000%
		1,6	328	0.007%	0.037%	0.001%	0.000%	0.280%	0.306%	0.000%	0.000%
		2,5	726	0.003%	0.006%	0.009%	0.000%	0.079%	0.191%	0.000%	0.000%
		3,4	378	0.005%	0.017%	0.000%	0.000%	0.231%	0.544%	0.000%	0.000%
		1	254	0.009%	0.037%	0.001%	0.000%	0.225%	0.328%	0.000%	0.000%
		2	495	0.004%	0.008%	0.011%	0.000%	0.103%	0.211%	0.000%	0.000%
		3	278	0.002%	0.001%	0.000%	0.000%	0.171%	0.411%	0.000%	0.000%
		4	100	0.014%	0.055%	0.000%	0.000%	0.378%	0.870%	0.000%	0.000%
		5	231	0.000%	0.000%	0.002%	0.000%	0.004%	0.126%	0.000%	0.000%
		6	74	0.000%	0.036%	0.000%	0.000%	0.457%	0.236%	0.000%	0.000%

Table 6 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using data collected all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
				Bycatch ratios							
South of 40°10'											
	<=50 fm	**All**	**139**	**0.024%**	**1.142%**	**0.000%**	**0.280%**	**0.000%**	**0.000%**	**0.027%**	**0.000%**
		1,2,6	46	0.055%	1.844%	0.000%	0.632%	0.000%	0.000%	0.000%	0.000%
		3,4,5	93	0.000%	0.583%	0.000%	0.000%	0.000%	0.000%	0.049%	0.000%
		1,6	17	0.000%	1.122%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	39	0.081%	2.274%	0.000%	0.930%	0.000%	0.000%	0.000%	0.000%
		3,4	83	0.000%	0.492%	0.000%	0.000%	0.000%	0.000%	0.052%	0.000%
		1	15	0.000%	1.643%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2	29	0.092%	2.338%	0.000%	1.064%	0.000%	0.000%	0.000%	0.000%
		3	27	0.000%	0.350%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		4	56	0.000%	0.534%	0.000%	0.000%	0.000%	0.000%	0.068%	0.000%
		5	10								
		6	2								
	<=60 fm	**All**	**236**	**0.034%**	**2.712%**	**0.001%**	**0.431%**	**0.000%**	**0.001%**	**0.013%**	**0.012%**
		1,2,6	70	0.060%	1.787%	0.001%	0.895%	0.000%	0.001%	0.000%	0.024%
		3,4,5	166	0.012%	3.493%	0.000%	0.039%	0.000%	0.000%	0.023%	0.002%
		1,6	21	0.104%	0.445%	0.004%	1.056%	0.000%	0.000%	0.000%	0.000%
		2,5	80	0.040%	2.404%	0.000%	0.623%	0.000%	0.002%	0.000%	0.030%
		3,4	135	0.000%	3.860%	0.000%	0.026%	0.000%	0.000%	0.028%	0.002%
		1	18	0.149%	0.239%	0.000%	0.147%	0.000%	0.000%	0.000%	0.000%
		2	49	0.031%	2.639%	0.000%	0.792%	0.000%	0.002%	0.000%	0.040%
		3	63	0.000%	5.302%	0.000%	0.033%	0.000%	0.000%	0.000%	0.003%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	31	0.068%	1.682%	0.000%	0.105%	0.000%	0.000%	0.000%	0.000%
		6	3								
	<=75 fm	**All**	**274**	**0.054%**	**2.318%**	**0.000%**	**0.462%**	**0.000%**	**0.000%**	**0.009%**	**0.012%**
		1,2,6	97	0.033%	1.529%	0.001%	0.618%	0.000%	0.001%	0.000%	0.019%
		3,4,5	177	0.083%	3.399%	0.000%	0.247%	0.000%	0.000%	0.020%	0.002%
		1,6	41	0.040%	0.919%	0.001%	0.583%	0.000%	0.000%	0.000%	0.000%
		2,5	97	0.111%	2.237%	0.000%	0.587%	0.000%	0.001%	0.000%	0.030%
		3,4	136	0.004%	3.904%	0.000%	0.190%	0.000%	0.000%	0.028%	0.003%
		1	37	0.045%	0.915%	0.000%	0.265%	0.000%	0.000%	0.000%	0.000%
		2	56	0.024%	2.354%	0.000%	0.667%	0.000%	0.002%	0.000%	0.044%
		3	64	0.006%	5.346%	0.000%	0.306%	0.000%	0.000%	0.000%	0.005%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	41	0.306%	1.977%	0.000%	0.409%	0.000%	0.000%	0.000%	0.000%
		6	4								
	<=100 fm	**All**	**334**	**0.088%**	**3.362%**	**0.003%**	**1.956%**	**0.000%**	**0.020%**	**0.007%**	**0.047%**
		1,2,6	121	0.064%	3.034%	0.006%	2.110%	0.000%	0.008%	0.000%	0.044%
		3,4,5	213	0.118%	3.772%	0.000%	1.764%	0.000%	0.035%	0.015%	0.051%
		1,6	60	0.030%	2.568%	0.008%	2.808%	0.000%	0.008%	0.000%	0.040%
		2,5	130	0.187%	3.829%	0.001%	1.550%	0.000%	0.026%	0.000%	0.027%
		3,4	144	0.031%	3.752%	0.000%	1.415%	0.000%	0.027%	0.024%	0.081%
		1	43	0.038%	1.010%	0.000%	0.717%	0.000%	0.000%	0.000%	0.000%
		2	61	0.124%	3.848%	0.002%	0.892%	0.000%	0.008%	0.000%	0.050%
		3	72	0.049%	4.844%	0.000%	2.179%	0.000%	0.042%	0.000%	0.125%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	69	0.264%	3.805%	0.001%	2.352%	0.000%	0.048%	0.000%	0.000%
		6	17								

Table 6 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using data collected all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratios							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
South of 40°10'											
	>150 fm	**All**	**780**	**0.000%**	**0.390%**	**0.003%**	**0.112%**	**0.000%**	**0.114%**	**0.000%**	**0.002%**
		1,2,6	334	0.000%	0.853%	0.006%	0.247%	0.000%	0.060%	0.000%	0.005%
		3,4,5	446	0.000%	0.049%	0.000%	0.013%	0.000%	0.153%	0.000%	0.000%
		1,6	210	0.000%	1.260%	0.002%	0.399%	0.000%	0.097%	0.000%	0.008%
		2,5	211	0.000%	0.220%	0.008%	0.039%	0.000%	0.007%	0.000%	0.000%
		3,4	359	0.000%	0.016%	0.000%	0.000%	0.000%	0.189%	0.000%	0.001%
		1	133	0.000%	0.333%	0.001%	0.108%	0.000%	0.039%	0.000%	0.003%
		2	124	0.000%	0.247%	0.012%	0.021%	0.000%	0.006%	0.000%	0.000%
		3	128	0.000%	0.015%	0.000%	0.000%	0.000%	0.026%	0.000%	0.001%
		4	231	0.000%	0.017%	0.000%	0.000%	0.000%	0.321%	0.000%	0.000%
		5	87	0.000%	0.179%	0.000%	0.066%	0.000%	0.008%	0.000%	0.000%
		6	77	0.000%	3.138%	0.004%	0.988%	0.000%	0.214%	0.000%	0.017%
	>180 fm	**All**	**733**	**0.000%**	**0.278%**	**0.000%**	**0.059%**	**0.000%**	**0.088%**	**0.000%**	**0.001%**
		1,2,6	302	0.000%	0.637%	0.001%	0.125%	0.000%	0.016%	0.000%	0.001%
		3,4,5	431	0.000%	0.030%	0.000%	0.013%	0.000%	0.137%	0.000%	0.000%
		1,6	192	0.000%	0.942%	0.001%	0.204%	0.000%	0.022%	0.000%	0.002%
		2,5	191	0.000%	0.138%	0.001%	0.030%	0.000%	0.007%	0.000%	0.000%
		3,4	350	0.000%	0.015%	0.000%	0.000%	0.000%	0.169%	0.000%	0.000%
		1	126	0.000%	0.329%	0.001%	0.111%	0.000%	0.030%	0.000%	0.003%
		2	110	0.000%	0.171%	0.001%	0.004%	0.000%	0.007%	0.000%	0.000%
		3	123	0.000%	0.013%	0.000%	0.000%	0.000%	0.026%	0.000%	0.000%
		4	227	0.000%	0.017%	0.000%	0.000%	0.000%	0.285%	0.000%	0.000%
		5	81	0.000%	0.090%	0.000%	0.068%	0.000%	0.006%	0.000%	0.000%
		6	66	0.000%	2.354%	0.000%	0.419%	0.000%	0.004%	0.000%	0.000%
	>200 fm	**All**	**673**	**0.000%**	**0.062%**	**0.000%**	**0.012%**	**0.000%**	**0.087%**	**0.000%**	**0.000%**
		1,2,6	254	0.000%	0.139%	0.000%	0.031%	0.000%	0.002%	0.000%	0.000%
		3,4,5	419	0.000%	0.012%	0.000%	0.000%	0.000%	0.141%	0.000%	0.000%
		1,6	149	0.000%	0.112%	0.000%	0.051%	0.000%	0.002%	0.000%	0.000%
		2,5	182	0.000%	0.104%	0.000%	0.002%	0.000%	0.004%	0.000%	0.000%
		3,4	342	0.000%	0.014%	0.000%	0.000%	0.000%	0.174%	0.000%	0.000%
		1	104	0.000%	0.141%	0.000%	0.071%	0.000%	0.001%	0.000%	0.000%
		2	105	0.000%	0.175%	0.001%	0.004%	0.000%	0.002%	0.000%	0.000%
		3	117	0.000%	0.009%	0.000%	0.000%	0.000%	0.028%	0.000%	0.000%
		4	225	0.000%	0.017%	0.000%	0.000%	0.000%	0.286%	0.000%	0.000%
		5	77	0.000%	0.004%	0.000%	0.000%	0.000%	0.006%	0.000%	0.000%
		6	45	0.000%	0.036%	0.000%	0.000%	0.000%	0.005%	0.000%	0.000%
	>250 fm	**All**	**555**	**0.000%**	**0.009%**	**0.000%**	**0.012%**	**0.000%**	**0.024%**	**0.000%**	**0.000%**
		1,2,6	220	0.000%	0.011%	0.000%	0.028%	0.000%	0.001%	0.000%	0.000%
		3,4,5	335	0.000%	0.008%	0.000%	0.000%	0.000%	0.041%	0.000%	0.000%
		1,6	134	0.000%	0.017%	0.000%	0.047%	0.000%	0.000%	0.000%	0.000%
		2,5	150	0.000%	0.001%	0.000%	0.000%	0.000%	0.002%	0.000%	0.000%
		3,4	271	0.000%	0.011%	0.000%	0.000%	0.000%	0.052%	0.000%	0.000%
		1	98	0.000%	0.023%	0.000%	0.065%	0.000%	0.000%	0.000%	0.000%
		2	86	0.000%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
		3	97	0.000%	0.010%	0.000%	0.000%	0.000%	0.011%	0.000%	0.000%
		4	174	0.000%	0.011%	0.000%	0.000%	0.000%	0.087%	0.000%	0.000%
		5	64	0.000%	0.000%	0.000%	0.000%	0.000%	0.003%	0.000%	0.000%
		6	36	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

Table 7.--Coefficients of variation for rebuilding species' bycatch ratios calculated using data from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratio coefficients of variation							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Lingcod	Widow	Bocaccio	Pac. Oc. perch	Darkblotched	Yelloweye	Cowcod
North of 40°10'											
	<=50 fm	**All**	**655**	**16**	**11**	**49**		**38**	**35**	**71**	
		1,2,6	82	42	24	100			76		
		3,4,5	573	17	12	46		38	38	71	
		1,6	55	45	25						
		2,5	125	49	36	100			76	100	
		3,4	475	17	11	46		38	38	37	
		1	1								
		2	27	92	70	100			75		
		3	264	33	14	100		42	51	42	
		4	211	19	14	51		47	40	64	
		5	98	54	36					100	
		6	54	45	25						
	<=60 fm	**All**	**1,111**	**20**	**12**	**76**		**63**	**25**	**42**	
		1,2,6	193	23	27	62			53		
		3,4,5	918	23	13	78		63	27	42	
		1,6	79	29	23				100		
		2,5	307	32	24	57			55	100	
		3,4	725	26	8	78		63	27	32	
		1	2								
		2	114	30	46	62			54		
		3	387	29	11	78		65	32	42	
		4	338	33	11	51		40	49	48	
		5	193	40	27	100			79	100	
		6	77	29	23						
	<=75 fm	**All**	**1,644**	**13**	**8**	**67**		**51**	**19**	**23**	
		1,2,6	430	14	15	27		56	34	38	
		3,4,5	1,214	17	10	74		53	22	28	
		1,6	141	19	17	65		59	57	100	
		2,5	554	21	14	33		100	34	36	
		3,4	949	20	10	78		53	24	27	
		1	18								
		2	289	20	20	28		100	31	41	
		3	521	28	18	78		46	29	44	
		4	428	29	10	51		75	38	30	
		5	265	34	20	66			43	61	
		6	123	20	19	65		64	66	100	
	<=100 fm	**All**	**2,110**	**9**	**8**	**43**		**47**	**12**	**47**	
		1,2,6	668	13	15	26		48	18	69	
		3,4,5	1,442	13	8	57		49	15	22	
		1,6	190	24	22	38		69	32	92	
		2,5	857	12	12	23		75	15	25	
		3,4	1,063	16	9	67		61	20	23	
		1	52	23	43	63		87	34	96	
		2	478	13	18	33		47	21	29	
		3	572	22	16	68		44	24	35	
		4	491	24	10	51		69	33	29	
		5	379	23	15	28		78	21	46	
		6	138	41	22	45		50	60	100	

Table 7 (cont.).--Coefficients of variation for rebuilding species' bycatch ratios calculated using data from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratio coefficients of variation							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	>150 fm	**All**	**2,077**	**26**	**13**	**32**		**12**	**10**	**58**	
		1,2,6	1,229	35	15	35		15	13	58	
		3,4,5	848	28	29	61		20	15		
		1,6	616	38	15	39		17	16	72	
		2,5	872	50	33	47		25	18	100	
		3,4	589	29	33	83		21	15		
		1	481	38	19	37		24	15	72	
		2	613	51	38	50		29	16	100	
		3	378	49	58	100		23	18		
		4	211	35	38	81		32	26		
		5	259	93	48	56		43	33		
		6	135		26	55		23	30		
	>180 fm	**All**	**1,998**	**21**	**15**	**38**		**13**	**10**	**71**	
		1,2,6	1,177	30	17	41		14	14	71	
		3,4,5	821	29	33	74		22	15		
		1,6	583	39	17	46		16	17	100	
		2,5	835	45	53	53		28	19	100	
		3,4	580	29	33	86		22	16		
		1	449	39	21	31		22	17	100	
		2	594	45	53	55		28	17	100	
		3	370	49	61	100		23	18		
		4	210	35	38	100		32	26		
		5	241	100		49		80	52		
		6	134		26	65		24	31		
	>200 fm	**All**	**1,784**	**24**	**21**	**43**		**15**	**12**	**100**	
		1,2,6	1,020	32	22	48		15	17	100	
		3,4,5	764	34	49	74		27	17		
		1,6	446	42	24	30		18	23		
		2,5	812	49	55	54		31	16	100	
		3,4	526	34	49	86		27	18		
		1	335	42	38	38		31	21		
		2	574	49	55	55		31	18	100	
		3	364	50	61	100		24	19		
		4	162	45	77	100		49	36		
		5	238	100		49		81	31		
		6	111		29	47		20	34		
	>250 fm	**All**	**1,432**	**31**	**41**	**44**		**23**	**13**		
		1,2,6	823	40	49	46		27	13		
		3,4,5	609	44	73	50		42	23		
		1,6	328	59	63	100		39	21		
		2,5	726	53	60	45		30	15		
		3,4	378	44	73			42	25		
		1	254	59	81	100		50	24		
		2	495	54	60	48		30	17		
		3	278	58	100			44	20		
		4	100	53	77			74	48		
		5	231	100		50		100	31		
		6	74		41			61	38		

Table 7 (cont.).--Coefficients of variation for rebuilding species' bycatch ratios calculated using data from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratio coefficients of variation							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
South of 40°10'											
	<=50 fm	**All**	**139**	**100**	**25**		**100**			**100**	
		1,2,6	46	100	36		100				
		3,4,5	93		26					100	
		1,6	17		70						
		2,5	39	100	36		100				
		3,4	83		29					100	
		1	15		53						
		2	29	100	38		100				
		3	27		53						
		4	56		32					100	
		5	10								
		6	2								
	<=60 fm	**All**	**236**	**64**	**18**	**100**	**50**		**100**	**80**	**58**
		1,2,6	70	76	28	100	54		100		64
		3,4,5	166	98	20		44			80	83
		1,6	21	100	66	100	92				
		2,5	80	72	21		57		100		63
		3,4	135	100	22		50			80	83
		1	18	100	72		87				
		2	49	100	24		59		100		63
		3	63	100	25		58				100
		4	72		45		100			80	100
		5	31	100	31		75				
		6	3								
	<=75 fm	**All**	**274**	**54**	**16**	**100**	**35**		**100**	**80**	**47**
		1,2,6	97	73	24	100	42		100		51
		3,4,5	177	73	19		59			80	66
		1,6	41	95	54	100	62				
		2,5	97	66	18		46		100		51
		3,4	136	94	22		87			80	66
		1	37	95	60		35				
		2	56	100	21		55		100		51
		3	64	94	24		90				75
		4	72		45		100			80	100
		5	41	75	27		74				
		6	4								
	<=100 fm	**All**	**334**	**37**	**18**	**48**	**24**		**40**	**80**	**41**
		1,2,6	121	65	30	51	34		52		39
		3,4,5	213	43	18	59	32		49	80	74
		1,6	60	95	42	57	40		76		58
		2,5	130	45	28	82	27		55		45
		3,4	144	45	20	100	53		72	80	74
		1	43	95	49		66				
		2	61	84	43	100	41		51		45
		3	72	45	22	100	53		72		75
		4	72		45		100			80	100
		5	69	51	35	71	35		65		
		6	17								

Table 7 (cont.).--Coefficients of variation for rebuilding species' bycatch ratios calculated using data from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Bycatch ratio coefficients of variation							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
South of 40°10'											
	>150 fm	**All**	**780**	**100**	**26**	**51**	**33**	**100**	**28**		**68**
		1,2,6	334		28	52	34		57		76
		3,4,5	446	100	34	75	99	100	32		89
		1,6	210		31	71	35		59		76
		2,5	211		41	60	70		36		100
		3,4	359	100	29			100	32		100
		1	133		29	71	42		31		92
		2	124		56	61	63		60		
		3	128	100	45				62		100
		4	231		38			100	34		
		5	87		45	75	99		37		100
		6	77		36	100	42		80		100
	>180 fm	**All**	**733**		**33**	**50**	**34**	**100**	**32**		**92**
		1,2,6	302		35	51	35		29		92
		3,4,5	431		48	100	100	100	35		
		1,6	192		38	71	36		32		92
		2,5	191		65	68	92		39		
		3,4	350		30			100	35		
		1	126		31	71	43		34		92
		2	110		84	71	100		60		
		3	123		51				62		
		4	227		38			100	37		
		5	81		78	100	100		39		
		6	66		49		51		93		
	>200 fm	**All**	**673**		**46**	**100**	**57**	**100**	**34**		**100**
		1,2,6	254		52	100	57		42		100
		3,4,5	419		32			100	35		
		1,6	149		51		60		69		100
		2,5	182		84	100	100		30		
		3,4	342		34			100	35		
		1	104		56		60		78		100
		2	105		85	100	100		40		
		3	117		73				62		
		4	225		38			100	37		
		5	77		64				41		
		6	45		60				93		
	>250 fm	**All**	**555**		**30**		**68**		**41**		
		1,2,6	220		35		68		48		
		3,4,5	335		48				41		
		1,6	134		37		68				
		2,5	150		57				34		
		3,4	271		48				42		
		1	98		37		68				
		2	86		57				48		
		3	97		78				45		
		4	174		61				46		
		5	64						46		
		6	36								

Table 8.--Ratios of period-specific to annual bycatch rates, within each depth strata, using data collected from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
				Period-specific bycatch ratios divided by annual bycatch ratios							
North of 40°10'											
	<=50 fm	**All**	**655**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	82	1.58	0.51	3.37		0.00	1.10	0.00	
		3,4,5	573	0.92	1.07	0.67		1.14	0.99	1.14	
		1,6	55	2.55	0.84	0.00		0.00	0.00	0.00	
		2,5	125	0.91	1.16	2.20		0.00	0.72	3.79	
		3,4	475	0.88	0.97	0.79		1.34	1.16	0.40	
		1	1								
		2	27	0.29	0.07	7.86		0.00	2.57	0.00	
		3	264	0.43	0.63	0.37		2.63	1.83	0.48	
		4	211	1.26	1.27	1.16		0.24	0.59	0.34	
		5	98	1.15	1.59	0.00		0.00	0.00	5.27	
		6	54	2.59	0.84	0.00		0.00	0.00	0.00	
	<=60 fm	**All**	**1,111**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	193	0.99	0.66	0.17		0.00	0.65	0.00	
		3,4,5	918	1.00	1.06	1.14		1.17	1.06	1.17	
		1,6	79	1.85	0.75	0.00		0.00	0.01	0.00	
		2,5	307	0.65	1.68	0.10		0.00	1.01	1.37	
		3,4	725	1.07	0.75	1.44		1.48	1.08	0.94	
		1	2								
		2	114	0.44	0.61	0.27		0.00	1.07	0.00	
		3	387	0.57	0.51	3.29		3.29	1.88	1.02	
		4	338	1.46	0.94	0.01		0.08	0.45	0.87	
		5	193	0.74	2.18	0.01		0.00	0.99	2.02	
		6	77	1.90	0.77	0.00		0.00	0.00	0.00	
	<=75 fm	**All**	**1,644**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	430	1.16	1.02	0.37		0.12	0.70	1.33	
		3,4,5	1,214	0.95	0.99	1.21		1.29	1.10	0.89	
		1,6	141	1.78	0.87	0.32		0.35	1.20	0.78	
		2,5	554	0.99	1.38	0.35		0.01	1.02	1.50	
		3,4	949	0.90	0.80	1.47		1.66	0.96	0.74	
		1	18								
		2	289	0.87	1.09	0.39		0.01	0.46	1.59	
		3	521	0.83	0.73	2.97		1.07	1.54	0.77	
		4	428	0.97	0.86	0.01		2.24	0.41	0.71	
		5	265	1.11	1.66	0.30		0.00	1.56	1.41	
		6	123	1.37	0.93	0.39		0.39	1.25	0.96	
	<=100 fm	**All**	**2,110**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	668	1.63	1.32	0.82		0.18	1.03	2.16	
		3,4,5	1,442	0.71	0.85	1.08		1.38	0.99	0.47	
		1,6	190	2.76	1.04	0.90		0.47	0.94	6.49	
		2,5	857	1.01	1.26	0.68		1.12	1.08	0.64	
		3,4	1,063	0.71	0.76	1.31		0.98	0.94	0.44	
		1	52	4.50	1.46	0.61		1.21	1.78	20.69	
		2	478	1.26	1.42	0.79		0.08	1.05	0.74	
		3	572	0.69	0.63	2.70		0.23	1.57	0.51	
		4	491	0.72	0.88	0.01		1.68	0.35	0.38	
		5	379	0.73	1.07	0.54		2.30	1.10	0.53	
		6	138	2.01	0.85	1.02		0.15	0.58	0.38	

Table 8 (cont.).--Ratios of period-specific to annual bycatch rates, within each depth strata, using data collected from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

				Period-specific bycatch ratios divided by annual bycatch ratios							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	>150 fm	**All**	**2,077**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	1,229	1.08	1.15	1.41		0.92	0.89	1.56	
		3,4,5	848	0.87	0.73	0.28		1.15	1.19	0.00	
		1,6	616	0.90	1.93	1.08		1.55	1.52	2.31	
		2,5	872	1.00	0.47	1.40		0.37	0.58	0.74	
		3,4	589	1.12	0.84	0.27		1.42	1.11	0.00	
		1	481	1.17	1.66	0.45		1.18	1.15	3.02	
		2	613	1.23	0.49	1.68		0.38	0.36	0.93	
		3	378	0.41	0.59	0.37		1.01	1.00	0.00	
		4	211	2.14	1.21	0.12		2.01	1.27	0.00	
		5	259	0.12	0.40	0.32		0.35	1.42	0.00	
		6	135	0.00	2.83	3.13		2.76	2.72	0.00	
	>180 fm	**All**	**1,998**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	1,177	0.93	1.16	1.42		0.86	0.95	1.57	
		3,4,5	821	1.12	0.71	0.27		1.24	1.08	0.00	
		1,6	583	1.19	2.10	0.90		1.51	1.65	1.61	
		2,5	835	0.57	0.30	1.51		0.26	0.41	1.23	
		3,4	580	1.47	0.94	0.31		1.63	1.25	0.00	
		1	449	1.57	1.74	0.38		0.92	1.20	2.13	
		2	594	0.72	0.38	1.85		0.32	0.37	1.54	
		3	370	0.54	0.64	0.44		1.05	1.12	0.00	
		4	210	2.79	1.37	0.11		2.47	1.45	0.00	
		5	241	0.01	0.00	0.16		0.01	0.54	0.00	
		6	134	0.00	3.25	2.52		3.33	3.02	0.00	
	>200 fm	**All**	**1,784**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	**1.00**	
		1,2,6	1,020	1.08	1.25	1.40		0.89	0.94	1.59	
		3,4,5	764	0.87	0.59	0.32		1.19	1.09	0.00	
		1,6	446	1.55	2.31	0.45		1.67	1.65	0.00	
		2,5	812	0.60	0.41	1.67		0.28	0.42	2.13	
		3,4	526	1.17	0.79	0.37		1.61	1.39	0.00	
		1	335	2.09	1.47	0.39		0.91	0.77	0.00	
		2	574	0.75	0.52	2.05		0.35	0.46	2.68	
		3	364	0.61	0.89	0.48		1.22	1.31	0.00	
		4	162	2.22	0.62	0.16		2.34	1.52	0.00	
		5	238	0.01	0.00	0.18		0.01	0.25	0.00	
		6	111	0.00	4.74	0.65		3.84	4.17	0.00	
	>250 fm	**All**	**1,432**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**		
		1,2,6	823	1.12	1.18	1.51		1.03	0.80		
		3,4,5	609	0.79	0.70	0.14		0.96	1.33		
		1,6	328	1.47	2.31	0.15		1.71	1.00		
		2,5	726	0.70	0.39	1.87		0.48	0.62		
		3,4	378	1.17	1.05	0.00		1.41	1.78		
		1	254	1.93	2.33	0.19		1.37	1.07		
		2	495	0.92	0.51	2.31		0.63	0.69		
		3	278	0.34	0.08	0.00		1.04	1.34		
		4	100	3.21	3.42	0.00		2.31	2.84		
		5	231	0.02	0.00	0.44		0.02	0.41		
		6	74	0.00	2.24	0.00		2.79	0.77		

Table 8 (cont.).--Ratios of period-specific to annual bycatch rates, within each depth strata, using data collected from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
				Period-specific bycatch ratios divided by annual bycatch ratios							
South of 40°10'											
	<=50 fm	**All**	**139**	**1.00**	**1.00**		**1.00**			**1.00**	
		1,2,6	46	2.25	1.61		2.25			0.00	
		3,4,5	93	0.00	0.51		0.00			1.80	
		1,6	17	0.00	0.98		0.00			0.00	
		2,5	39	3.32	1.99		3.32			0.00	
		3,4	83	0.00	0.43		0.00			1.93	
		1	15	0.00	1.44		0.00			0.00	
		2	29	3.80	2.05		3.80			0.00	
		3	27	0.00	0.31		0.00			0.00	
		4	56	0.00	0.47		0.00			2.51	
		5	10								
		6	2								
	<=60 fm	**All**	**236**	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	1.00
		1,2,6	70	1.77	0.66	2.18	2.08		2.18	0.00	1.99
		3,4,5	166	0.35	1.29	0.00	0.09		0.00	1.84	0.16
		1,6	21	3.11	0.16	5.62	2.45		0.00	0.00	0.00
		2,5	80	1.19	0.89	0.00	1.45		2.69	0.00	2.46
		3,4	135	0.01	1.42	0.00	0.06		0.00	2.22	0.20
		1	18	4.45	0.09	0.00	0.34		0.00	0.00	0.00
		2	49	0.92	0.97	0.00	1.84		3.57	0.00	3.26
		3	63	0.01	1.96	0.00	0.08		0.00	0.00	0.27
		4	72	0.00	0.65	0.00	0.04		0.00	5.45	0.09
		5	31	2.02	0.62	0.00	0.24		0.00	0.00	0.00
		6	3								
	<=75 fm	**All**	**274**	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	1.00
		1,2,6	97	0.61	0.66	1.73	1.34		1.73	0.00	1.58
		3,4,5	177	1.53	1.47	0.00	0.54		0.00	2.37	0.21
		1,6	41	0.74	0.40	3.01	1.26		0.00	0.00	0.00
		2,5	97	2.05	0.96	0.00	1.27		2.80	0.00	2.56
		3,4	136	0.07	1.68	0.00	0.41		0.00	3.21	0.28
		1	37	0.84	0.39	0.00	0.57		0.00	0.00	0.00
		2	56	0.44	1.02	0.00	1.44		4.06	0.00	3.71
		3	64	0.12	2.31	0.00	0.66		0.00	0.00	0.40
		4	72	0.00	0.76	0.00	0.04		0.00	7.99	0.10
		5	41	5.64	0.85	0.00	0.89		0.00	0.00	0.00
		6	4								
	<=100 fm	**All**	**334**	**1.00**	**1.00**	**1.00**	**1.00**		**1.00**	**1.00**	1.00
		1,2,6	121	0.73	0.90	1.70	1.08		0.40	0.00	0.93
		3,4,5	213	1.34	1.12	0.13	0.90		1.75	2.25	1.08
		1,6	60	0.34	0.76	2.29	1.44		0.40	0.00	0.86
		2,5	130	2.12	1.14	0.45	0.79		1.30	0.00	0.58
		3,4	144	0.36	1.12	0.09	0.72		1.37	3.59	1.73
		1	43	0.43	0.30	0.00	0.37		0.00	0.00	0.00
		2	61	1.41	1.14	0.66	0.46		0.40	0.00	1.06
		3	72	0.55	1.44	0.14	1.11		2.12	0.00	2.66
		4	72	0.00	0.52	0.00	0.01		0.00	10.14	0.02
		5	69	2.99	1.13	0.20	1.20		2.39	0.00	0.00
		6	17	0.00	2.47	10.69	5.36		1.87	0.00	4.02

Table 8 (cont.).--Ratios of period-specific to annual bycatch rates, within each depth strata, using data collected from all groundfish bottom trawl hauls observed between September, 2001 and August, 2003, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
				Period-specific bycatch ratios divided by annual bycatch ratios							
South of 40°10'											
	>150 fm	**All**	**780**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**		1.00
		1,2,6	334	0.00	2.19	2.32	2.20	0.00	0.53		2.08
		3,4,5	446	1.74	0.12	0.03	0.12	1.74	1.35		0.21
		1,6	210	0.00	3.23	0.68	3.55	0.00	0.85		3.48
		2,5	211	0.00	0.56	2.90	0.35	0.00	0.06		0.05
		3,4	359	2.17	0.04	0.00	0.00	2.17	1.66		0.23
		1	133	0.00	0.86	0.33	0.96	0.00	0.34		1.46
		2	124	0.00	0.63	4.74	0.19	0.00	0.05		0.00
		3	128	4.83	0.04	0.00	0.00	0.00	0.23		0.50
		4	231	0.00	0.04	0.00	0.00	3.92	2.82		0.00
		5	87	0.00	0.46	0.16	0.58	0.00	0.07		0.12
		6	77	0.00	8.05	1.39	8.80	0.00	1.88		7.57
	>180 fm	**All**	**733**		**1.00**	**1.00**	**1.00**	**1.00**	**1.00**		1.00
		1,2,6	302		2.29	2.38	2.12	0.00	0.18		2.44
		3,4,5	431		0.11	0.04	0.22	1.69	1.57		0.00
		1,6	192		3.39	1.59	3.47	0.00	0.25		4.05
		2,5	191		0.50	2.19	0.52	0.00	0.08		0.00
		3,4	350		0.06	0.00	0.00	2.10	1.93		0.00
		1	126		1.18	2.28	1.89	0.00	0.34		5.81
		2	110		0.62	3.59	0.07	0.00	0.08		0.00
		3	123		0.05	0.00	0.00	0.00	0.30		0.00
		4	227		0.06	0.00	0.00	3.81	3.25		0.00
		5	81		0.33	0.21	1.15	0.00	0.07		0.00
		6	66		8.46	0.00	7.12	0.00	0.05		0.00
	>200 fm	**All**	**673**		**1.00**	**1.00**	**1.00**	**1.00**	**1.00**		1.00
		1,2,6	254		2.26	2.55	2.55	0.00	0.02		2.55
		3,4,5	419		0.19	0.00	0.00	1.64	1.63		0.00
		1,6	149		1.81	0.00	4.19	0.00	0.02		4.45
		2,5	182		1.70	3.51	0.20	0.00	0.04		0.00
		3,4	342		0.22	0.00	0.00	2.04	2.00		0.00
		1	104		2.29	0.00	5.84	0.00	0.01		6.20
		2	105		2.85	5.99	0.35	0.00	0.03		0.00
		3	117		0.14	0.00	0.00	0.00	0.32		0.00
		4	225		0.28	0.00	0.00	3.60	3.29		0.00
		5	77		0.06	0.00	0.00	0.00	0.07		0.00
		6	45		0.59	0.00	0.00	0.00	0.06		0.00
	>250 fm	**All**	**555**		**1.00**		**1.00**		**1.00**		
		1,2,6	220		1.14		2.38		0.02		
		3,4,5	335		0.90		0.00		1.71		
		1,6	134		1.80		3.97		0.00		
		2,5	150		0.09		0.00		0.08		
		3,4	271		1.15		0.00		2.17		
		1	98		2.47		5.45		0.00		
		2	86		0.15		0.00		0.06		
		3	97		1.09		0.00		0.48		
		4	174		1.21		0.00		3.61		
		5	64		0.00		0.00		0.11		
		6	36		0.00		0.00		0.00		

Table 9.--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

				Bycatch ratios							
Area	Depth range	Bi-monthly periods	# of hauls	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	<=50 fm	**All**	**655**	**0.067%**	**1.718%**	**0.001%**	**0.000%**	**0.003%**	**0.017%**	**0.002%**	**0.000%**
		1,2,6	82	0.094%	0.728%	0.004%	0.000%	0.000%	0.023%	0.000%	0.000%
		3,4,5	573	0.063%	1.867%	0.001%	0.000%	0.004%	0.017%	0.003%	0.000%
		1,6	55	0.162%	1.308%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	125	0.067%	2.068%	0.002%	0.000%	0.000%	0.013%	0.008%	0.000%
		3,4	475	0.058%	1.642%	0.001%	0.000%	0.005%	0.021%	0.001%	0.000%
		1	1	0.000%	0.611%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2	27	0.022%	0.118%	0.008%	0.000%	0.000%	0.047%	0.000%	0.000%
		3	264	0.029%	1.033%	0.000%	0.000%	0.009%	0.032%	0.001%	0.000%
		4	211	0.084%	2.184%	0.001%	0.000%	0.001%	0.011%	0.001%	0.000%
		5	98	0.084%	2.808%	0.000%	0.000%	0.000%	0.000%	0.011%	0.000%
		6	54	0.164%	1.319%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	<=60 fm	**All**	**1,111**	**0.152%**	**3.081%**	**0.059%**	**0.000%**	**0.007%**	**0.029%**	**0.002%**	**0.000%**
		1,2,6	193	0.148%	1.762%	0.010%	0.000%	0.000%	0.019%	0.000%	0.000%
		3,4,5	918	0.153%	3.322%	0.068%	0.000%	0.008%	0.031%	0.003%	0.000%
		1,6	79	0.289%	2.008%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	307	0.107%	5.134%	0.005%	0.000%	0.000%	0.025%	0.003%	0.000%
		3,4	725	0.163%	2.135%	0.092%	0.000%	0.011%	0.033%	0.002%	0.000%
		1	2	0.000%	0.160%	0.000%	0.000%	0.000%	0.010%	0.000%	0.000%
		2	114	0.064%	1.616%	0.015%	0.000%	0.000%	0.030%	0.000%	0.000%
		3	387	0.086%	1.412%	0.206%	0.000%	0.024%	0.055%	0.002%	0.000%
		4	338	0.224%	2.712%	0.001%	0.000%	0.001%	0.017%	0.002%	0.000%
		5	193	0.126%	6.677%	0.001%	0.000%	0.000%	0.023%	0.004%	0.000%
		6	77	0.300%	2.074%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	<=75 fm	**All**	**1,644**	**0.428%**	**3.453%**	**0.038%**	**0.000%**	**0.030%**	**0.140%**	**0.004%**	**0.000%**
		1,2,6	430	0.462%	3.405%	0.014%	0.000%	0.004%	0.102%	0.005%	0.000%
		3,4,5	1,214	0.415%	3.472%	0.047%	0.000%	0.039%	0.155%	0.003%	0.000%
		1,6	141	0.766%	2.744%	0.015%	0.000%	0.013%	0.188%	0.003%	0.000%
		2,5	554	0.413%	4.789%	0.014%	0.000%	0.000%	0.120%	0.006%	0.000%
		3,4	949	0.383%	2.584%	0.060%	0.000%	0.054%	0.147%	0.003%	0.000%
		1	18								
		2	289	0.324%	3.708%	0.013%	0.000%	0.000%	0.062%	0.006%	0.000%
		3	521	0.363%	2.313%	0.120%	0.000%	0.035%	0.230%	0.003%	0.000%
		4	428	0.402%	2.850%	0.000%	0.000%	0.073%	0.066%	0.003%	0.000%
		5	265	0.500%	5.853%	0.014%	0.000%	0.000%	0.178%	0.006%	0.000%
		6	123	0.570%	2.957%	0.019%	0.000%	0.016%	0.200%	0.004%	0.000%
	<=100 fm	**All**	**2,114**	**0.616%**	**4.134%**	**0.042%**	**0.000%**	**0.121%**	**0.269%**	**0.007%**	**0.000%**
		1,2,6	672	0.950%	5.404%	0.031%	0.000%	0.025%	0.281%	0.013%	0.000%
		3,4,5	1,442	0.433%	3.441%	0.048%	0.000%	0.173%	0.263%	0.004%	0.000%
		1,6	194	1.615%	3.888%	0.039%	0.000%	0.072%	0.276%	0.036%	0.000%
		2,5	857	0.607%	5.265%	0.027%	0.000%	0.122%	0.273%	0.005%	0.000%
		3,4	1,063	0.419%	2.896%	0.059%	0.000%	0.131%	0.263%	0.003%	0.000%
		1	52	2.406%	5.659%	0.021%	0.000%	0.175%	0.495%	0.107%	0.000%
		2	478	0.728%	5.908%	0.029%	0.000%	0.010%	0.283%	0.005%	0.000%
		3	572	0.416%	2.351%	0.121%	0.000%	0.031%	0.434%	0.003%	0.000%
		4	491	0.422%	3.420%	0.000%	0.000%	0.226%	0.100%	0.003%	0.000%
		5	379	0.461%	4.491%	0.025%	0.000%	0.256%	0.262%	0.005%	0.000%
		6	142	1.252%	3.073%	0.047%	0.000%	0.024%	0.176%	0.003%	0.000%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 9 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Bycatch ratios: Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
North of 40°10'											
	>150 fm	**All**	**2,077**	**0.007%**	**0.078%**	**0.017%**	**0.000%**	**0.855%**	**0.697%**	**0.000%**	**0.000%**
		1,2,6	1,229	0.007%	0.090%	0.025%	0.000%	0.769%	0.647%	0.000%	0.000%
		3,4,5	848	0.006%	0.059%	0.004%	0.000%	0.990%	0.775%	0.000%	0.000%
		1,6	616	0.007%	0.158%	0.018%	0.000%	1.325%	1.150%	0.000%	0.000%
		2,5	872	0.006%	0.032%	0.025%	0.000%	0.288%	0.343%	0.000%	0.000%
		3,4	589	0.007%	0.070%	0.004%	0.000%	1.224%	0.777%	0.000%	0.000%
		1	481	0.009%	0.131%	0.007%	0.000%	0.903%	0.835%	0.000%	0.000%
		2	613	0.008%	0.033%	0.030%	0.000%	0.304%	0.226%	0.000%	0.000%
		3	378	0.003%	0.049%	0.006%	0.000%	0.853%	0.681%	0.000%	0.000%
		4	211	0.013%	0.098%	0.002%	0.000%	1.734%	0.911%	0.000%	0.000%
		5	259	0.001%	0.025%	0.005%	0.000%	0.230%	0.768%	0.000%	0.000%
		6	135	0.000%	0.231%	0.051%	0.000%	2.452%	1.994%	0.000%	0.000%
	>180 fm	**All**	**1,998**	**0.005%**	**0.071%**	**0.015%**	**0.000%**	**0.737%**	**0.630%**	**0.000%**	**0.000%**
		1,2,6	1,177	0.005%	0.082%	0.022%	0.000%	0.625%	0.614%	0.000%	0.000%
		3,4,5	821	0.006%	0.053%	0.004%	0.000%	0.910%	0.656%	0.000%	0.000%
		1,6	583	0.007%	0.154%	0.013%	0.000%	1.108%	1.110%	0.000%	0.000%
		2,5	835	0.003%	0.018%	0.023%	0.000%	0.181%	0.216%	0.000%	0.000%
		3,4	580	0.008%	0.069%	0.004%	0.000%	1.175%	0.774%	0.000%	0.000%
		1	449	0.010%	0.123%	0.005%	0.000%	0.596%	0.781%	0.000%	0.000%
		2	594	0.004%	0.023%	0.029%	0.000%	0.229%	0.206%	0.000%	0.000%
		3	370	0.003%	0.048%	0.006%	0.000%	0.765%	0.672%	0.000%	0.000%
		4	210	0.013%	0.099%	0.002%	0.000%	1.739%	0.913%	0.000%	0.000%
		5	241	0.000%	0.000%	0.002%	0.000%	0.003%	0.253%	0.000%	0.000%
		6	134	0.000%	0.235%	0.033%	0.000%	2.417%	1.951%	0.000%	0.000%
	>200 fm	**All**	**1,784**	**0.005%**	**0.051%**	**0.014%**	**0.000%**	**0.618%**	**0.499%**	**0.000%**	**0.000%**
		1,2,6	1,020	0.005%	0.064%	0.020%	0.000%	0.538%	0.479%	0.000%	0.000%
		3,4,5	764	0.004%	0.032%	0.004%	0.000%	0.739%	0.529%	0.000%	0.000%
		1,6	446	0.008%	0.125%	0.005%	0.000%	1.032%	0.895%	0.000%	0.000%
		2,5	812	0.003%	0.018%	0.024%	0.000%	0.163%	0.177%	0.000%	0.000%
		3,4	526	0.005%	0.043%	0.005%	0.000%	0.979%	0.671%	0.000%	0.000%
		1	335	0.011%	0.069%	0.004%	0.000%	0.488%	0.377%	0.000%	0.000%
		2	574	0.003%	0.023%	0.030%	0.000%	0.206%	0.200%	0.000%	0.000%
		3	364	0.003%	0.048%	0.006%	0.000%	0.748%	0.620%	0.000%	0.000%
		4	162	0.008%	0.033%	0.002%	0.000%	1.395%	0.761%	0.000%	0.000%
		5	238	0.000%	0.000%	0.002%	0.000%	0.003%	0.094%	0.000%	0.000%
		6	111	0.000%	0.247%	0.008%	0.000%	2.237%	2.040%	0.000%	0.000%
	>250 fm	**All**	**1,432**	**0.004%**	**0.015%**	**0.005%**	**0.000%**	**0.169%**	**0.292%**	**0.000%**	**0.000%**
		1,2,6	823	0.004%	0.018%	0.008%	0.000%	0.170%	0.230%	0.000%	0.000%
		3,4,5	609	0.003%	0.012%	0.001%	0.000%	0.167%	0.387%	0.000%	0.000%
		1,6	328	0.006%	0.034%	0.001%	0.000%	0.283%	0.311%	0.000%	0.000%
		2,5	726	0.003%	0.006%	0.010%	0.000%	0.080%	0.163%	0.000%	0.000%
		3,4	378	0.004%	0.018%	0.000%	0.000%	0.243%	0.521%	0.000%	0.000%
		1	254	0.009%	0.033%	0.001%	0.000%	0.214%	0.340%	0.000%	0.000%
		2	495	0.003%	0.008%	0.013%	0.000%	0.105%	0.184%	0.000%	0.000%
		3	278	0.002%	0.001%	0.000%	0.000%	0.180%	0.362%	0.000%	0.000%
		4	100	0.010%	0.056%	0.000%	0.000%	0.389%	0.894%	0.000%	0.000%
		5	231	0.000%	0.000%	0.002%	0.000%	0.003%	0.095%	0.000%	0.000%
		6	74	0.000%	0.036%	0.000%	0.000%	0.457%	0.236%	0.000%	0.000%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 9 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Bycatch ratios: Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
South of 40°10'											
	<=50 fm	**All**	**139**	**0.018%**	**1.177%**	**0.000%**	**0.209%**	**0.000%**	**0.000%**	**0.030%**	**0.000%**
		1,2,6	46	0.047%	2.117%	0.000%	0.544%	0.000%	0.000%	0.000%	0.000%
		3,4,5	93	0.000%	0.588%	0.000%	0.000%	0.000%	0.000%	0.049%	0.000%
		1,6	17	0.000%	1.147%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2,5	39	0.065%	2.617%	0.000%	0.751%	0.000%	0.000%	0.000%	0.000%
		3,4	83	0.000%	0.492%	0.000%	0.000%	0.000%	0.000%	0.052%	0.000%
		1	15	0.000%	1.658%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		2	29	0.074%	2.674%	0.000%	0.856%	0.000%	0.000%	0.000%	0.000%
		3	27	0.000%	0.352%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		4	56	0.000%	0.534%	0.000%	0.000%	0.000%	0.000%	0.068%	0.000%
		5	10	0.000%	2.209%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
		6	2	0.000%	0.979%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	<=60 fm	**All**	**236**	**0.025%**	**2.924%**	**0.000%**	**0.364%**	**0.000%**	**0.001%**	**0.014%**	**0.013%**
		1,2,6	70	0.049%	1.989%	0.001%	0.824%	0.000%	0.002%	0.000%	0.028%
		3,4,5	166	0.008%	3.596%	0.000%	0.034%	0.000%	0.000%	0.025%	0.002%
		1,6	21	0.103%	0.464%	0.003%	1.040%	0.000%	0.000%	0.000%	0.000%
		2,5	80	0.032%	2.532%	0.000%	0.595%	0.000%	0.002%	0.000%	0.033%
		3,4	135	0.000%	3.852%	0.000%	0.024%	0.000%	0.000%	0.028%	0.002%
		1	18	0.146%	0.271%	0.000%	0.144%	0.000%	0.000%	0.000%	0.000%
		2	49	0.023%	2.729%	0.000%	0.719%	0.000%	0.002%	0.000%	0.042%
		3	63	0.000%	5.293%	0.000%	0.029%	0.000%	0.000%	0.000%	0.003%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	31	0.066%	1.752%	0.000%	0.102%	0.000%	0.000%	0.000%	0.000%
		6	3	0.000%	0.923%	0.012%	3.172%	0.000%	0.000%	0.000%	0.000%
	<=75 fm	**All**	**274**	**0.044%**	**2.546%**	**0.000%**	**0.407%**	**0.000%**	**0.001%**	**0.011%**	**0.012%**
		1,2,6	97	0.030%	1.674%	0.001%	0.605%	0.000%	0.001%	0.000%	0.021%
		3,4,5	177	0.061%	3.518%	0.000%	0.186%	0.000%	0.000%	0.022%	0.002%
		1,6	41	0.040%	0.924%	0.001%	0.579%	0.000%	0.000%	0.000%	0.000%
		2,5	97	0.094%	2.359%	0.000%	0.571%	0.000%	0.002%	0.000%	0.033%
		3,4	136	0.003%	3.882%	0.000%	0.134%	0.000%	0.000%	0.028%	0.003%
		1	37	0.045%	0.920%	0.000%	0.263%	0.000%	0.000%	0.000%	0.000%
		2	56	0.019%	2.485%	0.000%	0.632%	0.000%	0.002%	0.000%	0.044%
		3	64	0.004%	5.323%	0.000%	0.213%	0.000%	0.000%	0.000%	0.004%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	41	0.301%	2.012%	0.000%	0.403%	0.000%	0.000%	0.000%	0.000%
		6	4	0.000%	0.949%	0.011%	3.066%	0.000%	0.000%	0.000%	0.000%
	<=100 fm	**All**	**334**	**0.075%**	**3.390%**	**0.003%**	**1.688%**	**0.000%**	**0.017%**	**0.009%**	**0.042%**
		1,2,6	121	0.059%	3.021%	0.005%	1.968%	0.000%	0.008%	0.000%	0.044%
		3,4,5	213	0.093%	3.787%	0.000%	1.388%	0.000%	0.027%	0.018%	0.040%
		1,6	60	0.030%	2.553%	0.007%	2.784%	0.000%	0.008%	0.000%	0.040%
		2,5	130	0.164%	3.732%	0.001%	1.420%	0.000%	0.023%	0.000%	0.030%
		3,4	144	0.022%	3.778%	0.000%	0.993%	0.000%	0.019%	0.025%	0.057%
		1	43	0.038%	1.014%	0.000%	0.713%	0.000%	0.000%	0.000%	0.000%
		2	61	0.100%	3.681%	0.002%	0.815%	0.000%	0.007%	0.000%	0.049%
		3	72	0.035%	4.966%	0.000%	1.567%	0.000%	0.030%	0.000%	0.090%
		4	72	0.000%	1.756%	0.000%	0.017%	0.000%	0.000%	0.069%	0.001%
		5	69	0.261%	3.807%	0.001%	2.331%	0.000%	0.047%	0.000%	0.000%
		6	17								

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 9 (cont.).--Bycatch ratios [species catch (lb) / target species catch (lb)] for rebuilding species calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Bycatch ratios Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
South of 40°10'											
	>150 fm	**All**	**780**	**0.000%**	**0.367%**	**0.002%**	**0.118%**	**0.000%**	**0.112%**	**0.000%**	**0.002%**
		1,2,6	334	0.000%	0.791%	0.005%	0.253%	0.000%	0.065%	0.000%	0.004%
		3,4,5	446	0.000%	0.049%	0.000%	0.016%	0.000%	0.147%	0.000%	0.000%
		1,6	210	0.000%	1.133%	0.001%	0.392%	0.000%	0.101%	0.000%	0.006%
		2,5	211	0.000%	0.184%	0.006%	0.041%	0.000%	0.007%	0.000%	0.000%
		3,4	359	0.000%	0.019%	0.000%	0.000%	0.000%	0.188%	0.000%	0.000%
		1	133	0.000%	0.351%	0.001%	0.106%	0.000%	0.032%	0.000%	0.003%
		2	124	0.000%	0.212%	0.011%	0.018%	0.000%	0.005%	0.000%	0.000%
		3	128	0.000%	0.015%	0.000%	0.000%	0.000%	0.021%	0.000%	0.001%
		4	231	0.000%	0.022%	0.000%	0.000%	0.000%	0.336%	0.000%	0.000%
		5	87	0.000%	0.150%	0.000%	0.069%	0.000%	0.008%	0.000%	0.000%
		6	77	0.000%	2.538%	0.003%	0.905%	0.000%	0.223%	0.000%	0.012%
	>180 fm	**All**	**733**	**0.000%**	**0.246%**	**0.000%**	**0.054%**	**0.000%**	**0.084%**	**0.000%**	**0.000%**
		1,2,6	302	0.000%	0.547%	0.001%	0.108%	0.000%	0.013%	0.000%	0.001%
		3,4,5	431	0.000%	0.034%	0.000%	0.016%	0.000%	0.135%	0.000%	0.000%
		1,6	192	0.000%	0.777%	0.000%	0.168%	0.000%	0.017%	0.000%	0.002%
		2,5	191	0.000%	0.119%	0.001%	0.035%	0.000%	0.006%	0.000%	0.000%
		3,4	350	0.000%	0.018%	0.000%	0.000%	0.000%	0.172%	0.000%	0.000%
		1	126	0.000%	0.349%	0.001%	0.109%	0.000%	0.024%	0.000%	0.003%
		2	110	0.000%	0.147%	0.001%	0.004%	0.000%	0.006%	0.000%	0.000%
		3	123	0.000%	0.013%	0.000%	0.000%	0.000%	0.022%	0.000%	0.000%
		4	227	0.000%	0.023%	0.000%	0.000%	0.000%	0.305%	0.000%	0.000%
		5	81	0.000%	0.087%	0.000%	0.071%	0.000%	0.007%	0.000%	0.000%
		6	66	0.000%	1.648%	0.000%	0.289%	0.000%	0.004%	0.000%	0.000%
	>200 fm	**All**	**673**	**0.000%**	**0.061%**	**0.000%**	**0.010%**	**0.000%**	**0.084%**	**0.000%**	**0.000%**
		1,2,6	254	0.000%	0.133%	0.000%	0.026%	0.000%	0.002%	0.000%	0.000%
		3,4,5	419	0.000%	0.014%	0.000%	0.000%	0.000%	0.138%	0.000%	0.000%
		1,6	149	0.000%	0.122%	0.000%	0.041%	0.000%	0.002%	0.000%	0.000%
		2,5	182	0.000%	0.081%	0.000%	0.002%	0.000%	0.004%	0.000%	0.000%
		3,4	342	0.000%	0.017%	0.000%	0.000%	0.000%	0.176%	0.000%	0.000%
		1	104	0.000%	0.162%	0.000%	0.060%	0.000%	0.001%	0.000%	0.000%
		2	105	0.000%	0.150%	0.001%	0.004%	0.000%	0.002%	0.000%	0.000%
		3	117	0.000%	0.010%	0.000%	0.000%	0.000%	0.023%	0.000%	0.000%
		4	225	0.000%	0.023%	0.000%	0.000%	0.000%	0.305%	0.000%	0.000%
		5	77	0.000%	0.003%	0.000%	0.000%	0.000%	0.006%	0.000%	0.000%
		6	45	0.000%	0.036%	0.000%	0.000%	0.000%	0.005%	0.000%	0.000%
	>250 fm	**All**	**555**	**0.000%**	**0.011%**	**0.000%**	**0.009%**	**0.000%**	**0.019%**	**0.000%**	**0.000%**
		1,2,6	220	0.000%	0.011%	0.000%	0.022%	0.000%	0.001%	0.000%	0.000%
		3,4,5	335	0.000%	0.010%	0.000%	0.000%	0.000%	0.033%	0.000%	0.000%
		1,6	134	0.000%	0.018%	0.000%	0.036%	0.000%	0.000%	0.000%	0.000%
		2,5	150	0.000%	0.001%	0.000%	0.000%	0.000%	0.002%	0.000%	0.000%
		3,4	271	0.000%	0.013%	0.000%	0.000%	0.000%	0.043%	0.000%	0.000%
		1	98	0.000%	0.026%	0.000%	0.051%	0.000%	0.000%	0.000%	0.000%
		2	86	0.000%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
		3	97	0.000%	0.011%	0.000%	0.000%	0.000%	0.009%	0.000%	0.000%
		4	174	0.000%	0.015%	0.000%	0.000%	0.000%	0.075%	0.000%	0.000%
		5	64	0.000%	0.000%	0.000%	0.000%	0.000%	0.003%	0.000%	0.000%
		6	36	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 10.--Discard rates (species discard/species catch) for seven target species, calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Target species discard rates: Sablefish	Longspine	Shortspine	Dover sole	Petrale sole	Arrowtooth flounder	Other flatfish
North of 40°10'										
	<=50 fm	**All**	**655**	**79%**	**0%**	**0%**	**20%**	**11%**	**86%**	**22%**
		1,2,6	82	98%	0%		87%	9%	61%	21%
		3,4,5	573	79%	0%	0%	18%	11%	88%	22%
		1,6	55	100%			98%	3%	100%	17%
		2,5	125	89%	0%	0%	38%	26%	78%	16%
		3,4	475	78%	0%	0%	18%	9%	87%	26%
		1	1							
		2	27	23%	0%		84%	13%	30%	25%
		3	264	76%	0%		21%	8%	90%	26%
		4	211	80%	0%	0%	15%	10%	83%	25%
		5	98	90%	0%	0%	25%	35%	98%	13%
		6	54	100%			98%	3%	100%	18%
	<=60 fm	**All**	**1,111**	**86%**	**0%**	**4%**	**15%**	**14%**	**78%**	**24%**
		1,2,6	193	32%	0%	0%	33%	7%	66%	22%
		3,4,5	918	87%	0%	5%	14%	15%	79%	25%
		1,6	79	100%			18%	3%	86%	21%
		2,5	307	61%	0%	4%	11%	16%	67%	19%
		3,4	725	92%	0%	4%	19%	13%	85%	27%
		1	2							
		2	114	14%	0%	0%	41%	8%	57%	22%
		3	387	84%	0%	36%	14%	13%	83%	29%
		4	338	95%	0%	0%	27%	14%	87%	27%
		5	193	66%	0%	7%	6%	25%	69%	17%
		6	77	100%			18%	3%	86%	22%
	<=75 fm	**All**	**1,644**	**85%**	**1%**	**13%**	**19%**	**16%**	**66%**	**25%**
		1,2,6	430	75%	0%	0%	36%	15%	53%	24%
		3,4,5	1,214	85%	1%	15%	15%	16%	70%	26%
		1,6	141	75%			14%	5%	83%	20%
		2,5	554	65%	1%	14%	22%	18%	56%	23%
		3,4	949	90%	0%	10%	18%	15%	70%	29%
		1	18							
		2	289	75%	0%	0%	48%	16%	47%	26%
		3	521	82%	0%	8%	14%	15%	67%	28%
		4	428	94%	0%	13%	25%	15%	78%	29%
		5	265	62%	1%	17%	9%	22%	69%	19%
		6	123	75%			13%	5%	71%	20%
	<=100 fm	**All**	**2,110**	**77%**	**1%**	**26%**	**23%**	**15%**	**65%**	**27%**
		1,2,6	668	62%	10%	2%	34%	12%	55%	28%
		3,4,5	1,442	80%	0%	30%	18%	17%	69%	27%
		1,6	190	49%		0%	14%	12%	64%	20%
		2,5	857	58%	1%	26%	28%	15%	58%	28%
		3,4	1,063	88%	0%	30%	17%	15%	72%	29%
		1	52	20%		0%	19%	23%	100%	18%
		2	478	63%	10%	3%	44%	12%	52%	31%
		3	572	82%	0%	13%	13%	15%	69%	29%
		4	491	92%	0%	33%	23%	15%	76%	29%
		5	379	55%	0%	29%	20%	22%	64%	22%
		6	138	56%		0%	13%	9%	42%	21%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 10 (cont.).--Discard rates (species discard/species catch) for seven target species, calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Target species discard rates: Sablefish	Longspine	Shortspine	Dover sole	Petrale sole	Arrowtooth flounder	Other flatfish
North of 40°10'										
	>150 fm	**All**	**2,077**	**32%**	**18%**	**42%**	**9%**	**0%**	**32%**	**30%**
		1,2,6	1,229	39%	19%	36%	8%	0%	33%	32%
		3,4,5	848	24%	18%	48%	11%	1%	28%	27%
		1,6	616	51%	19%	38%	8%	0%	45%	27%
		2,5	872	30%	18%	35%	11%	1%	22%	42%
		3,4	589	21%	18%	52%	7%	6%	30%	21%
		1	481	44%	19%	37%	7%	0%	37%	23%
		2	613	30%	18%	35%	8%	1%	23%	39%
		3	378	18%	16%	48%	9%	37%	36%	30%
		4	211	26%	22%	57%	4%	3%	26%	14%
		5	259	32%	19%	35%	26%	0%	4%	52%
		6	135	69%	20%	39%	12%	0%	75%	49%
	>180 fm	**All**	**1,998**	**31%**	**18%**	**42%**	**9%**	**0%**	**31%**	**30%**
		1,2,6	1,177	38%	19%	36%	8%	0%	32%	33%
		3,4,5	821	24%	18%	47%	11%	4%	30%	27%
		1,6	583	49%	19%	37%	8%	0%	44%	26%
		2,5	835	29%	18%	35%	11%	1%	21%	44%
		3,4	580	21%	18%	52%	7%	6%	30%	21%
		1	449	42%	19%	37%	7%	0%	36%	22%
		2	594	28%	18%	35%	8%	1%	21%	41%
		3	370	18%	16%	48%	9%	36%	35%	29%
		4	210	26%	22%	57%	4%	3%	26%	14%
		5	241	31%	19%	34%	26%	0%	27%	54%
		6	134	68%	19%	38%	12%	0%	75%	49%
	>200 fm	**All**	**1,784**	**30%**	**18%**	**40%**	**9%**	**1%**	**29%**	**33%**
		1,2,6	1,020	35%	19%	35%	7%	1%	26%	36%
		3,4,5	764	23%	18%	45%	11%	5%	35%	30%
		1,6	446	46%	19%	36%	7%	1%	36%	30%
		2,5	812	28%	18%	35%	10%	1%	19%	45%
		3,4	526	20%	17%	49%	8%	8%	35%	23%
		1	335	37%	18%	35%	6%	1%	21%	24%
		2	574	28%	18%	35%	7%	1%	19%	42%
		3	364	18%	15%	48%	9%	36%	35%	30%
		4	162	23%	20%	51%	5%	0%	35%	15%
		5	238	30%	19%	34%	25%	0%	49%	54%
		6	111	67%	19%	38%	11%	0%	78%	52%
	>250 fm	**All**	**1,432**	**27%**	**18%**	**38%**	**10%**	**4%**	**21%**	**41%**
		1,2,6	823	30%	18%	34%	8%	4%	18%	41%
		3,4,5	609	22%	17%	42%	15%	1%	59%	41%
		1,6	328	39%	19%	35%	7%	3%	19%	30%
		2,5	726	26%	18%	34%	12%	7%	17%	52%
		3,4	378	18%	16%	45%	10%	2%	59%	34%
		1	254	34%	18%	33%	6%	3%	16%	23%
		2	495	24%	18%	34%	8%	7%	17%	50%
		3	278	18%	15%	47%	11%	20%	69%	44%
		4	100	19%	19%	42%	8%	0%	18%	23%
		5	231	30%	19%	35%	25%	0%	58%	55%
		6	74	55%	19%	38%	10%	0%	62%	55%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 10 (cont.).--Discard rates (species discard/species catch) for seven target species, calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Target species discard rates: Sablefish	Longspine	Shortspine	Dover sole	Petrale sole	Arrowtooth flounder	Other flatfish
South of 40°10'										
	<=50 fm	**All**	**139**	**89%**	**0%**	**0%**	**46%**	**6%**	**0%**	**19%**
		1,2,6	46	55%			59%	11%		28%
		3,4,5	93	90%	0%	0%	45%	5%	0%	14%
		1,6	17					0%		10%
		2,5	39	55%			59%	17%		37%
		3,4	83	90%	0%	0%	45%	5%	0%	15%
		1	15					8%		37%
		2	29	55%			59%	19%		43%
		3	27	50%			22%	3%		14%
		4	56	100%	0%	0%	100%	6%	0%	15%
		5	10							
		6	2							
	<=60 fm	**All**	**236**	**90%**	**0%**	**0%**	**91%**	**4%**	**5%**	**22%**
		1,2,6	70	88%			98%	2%		20%
		3,4,5	166	90%	0%	0%	88%	5%	5%	23%
		1,6	21	92%			100%	3%		8%
		2,5	80	87%			98%	2%		26%
		3,4	135	90%	0%	0%	86%	5%	5%	24%
		1	18	87%			100%	6%		11%
		2	49	87%			95%	2%		27%
		3	63	83%			85%	6%	0%	30%
		4	72	94%	0%	0%	100%	2%	52%	18%
		5	31	100%			100%	2%		22%
		6	3							
	<=75 fm	**All**	**274**	**75%**	**0%**	**0%**	**92%**	**5%**	**10%**	**17%**
		1,2,6	97	64%			99%	4%		13%
		3,4,5	177	88%	0%	0%	89%	5%	10%	22%
		1,6	41	83%			100%	14%		6%
		2,5	97	56%			98%	2%		20%
		3,4	136	89%	0%	0%	87%	5%	10%	24%
		1	37	82%			100%	17%		7%
		2	56	56%			94%	2%		22%
		3	64	80%			86%	6%	7%	29%
		4	72	94%	0%	0%	100%	2%	52%	18%
		5	41	48%			100%	1%		15%
		6	4							
	<=100 fm	**All**	**334**	**79%**	**0%**	**13%**	**42%**	**5%**	**87%**	**18%**
		1,2,6	121	78%			58%	4%	100%	14%
		3,4,5	213	81%	0%	13%	38%	5%	86%	23%
		1,6	60	86%			100%	7%		9%
		2,5	130	70%		100%	50%	4%	100%	22%
		3,4	144	79%	0%	8%	32%	5%	62%	24%
		1	43	83%			100%	11%		8%
		2	61	58%			16%	2%	100%	22%
		3	72	71%		9%	31%	6%	63%	29%
		4	72	94%	0%	0%	100%	2%	52%	18%
		5	69	87%		100%	100%	5%	100%	22%
		6	17							

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

Table 10 (cont.).--Discard rates (species discard/species catch) for seven target species, calculated using weighted sums[1] of catch and discard poundage from the first and second years of NMFS-observed bottom trawling, by area, depth strata, and various temporal strata.

Area	Depth range	Bi-monthly periods	# of hauls	Sablefish	Longspine	Shortspine	Dover sole	Petrale sole	Arrowtooth flounder	Other flatfish
				Target species discard rates						
South of 40°10'										
	>150 fm	**All**	**780**	**32%**	**12%**	**28%**	**14%**	**1%**	**88%**	**28%**
		1,2,6	334	39%	19%	34%	19%	0%	95%	24%
		3,4,5	446	28%	9%	21%	10%	4%	87%	36%
		1,6	210	44%	19%	33%	22%	0%	94%	22%
		2,5	211	38%	13%	29%	12%	4%	100%	30%
		3,4	359	23%	10%	22%	10%	2%	87%	36%
		1	133	39%	15%	33%	21%	1%	100%	21%
		2	124	32%	19%	35%	14%	3%	100%	27%
		3	128	15%	9%	29%	13%	0%	89%	47%
		4	231	29%	11%	15%	9%	3%	86%	29%
		5	87	46%	7%	19%	9%	4%	100%	36%
		6	77	53%	23%	34%	24%	0%	67%	24%
	>180 fm	**All**	**733**	**31%**	**12%**	**28%**	**13%**	**1%**	**87%**	**29%**
		1,2,6	302	37%	19%	34%	19%	0%	91%	24%
		3,4,5	431	27%	9%	21%	10%	6%	87%	39%
		1,6	192	41%	19%	33%	22%	0%	88%	23%
		2,5	191	36%	13%	29%	11%	6%	100%	34%
		3,4	350	23%	10%	22%	10%	3%	87%	36%
		1	126	37%	15%	33%	21%	1%	100%	21%
		2	110	32%	19%	35%	14%	0%	100%	28%
		3	123	15%	9%	29%	13%	0%	89%	49%
		4	227	29%	11%	16%	9%	3%	86%	29%
		5	81	41%	7%	19%	9%	7%	100%	52%
		6	66	51%	23%	33%	24%	0%	7%	28%
	>200 fm	**All**	**673**	**30%**	**12%**	**28%**	**13%**	**1%**	**87%**	**29%**
		1,2,6	254	36%	19%	34%	18%	0%	91%	23%
		3,4,5	419	27%	9%	21%	10%	1%	87%	40%
		1,6	149	39%	19%	32%	21%	0%	87%	21%
		2,5	182	36%	13%	29%	11%	0%	100%	34%
		3,4	342	23%	10%	22%	10%	3%	87%	37%
		1	104	38%	15%	33%	21%	1%	100%	15%
		2	105	32%	18%	35%	14%	0%	100%	27%
		3	117	15%	9%	29%	13%	0%	89%	50%
		4	225	29%	11%	16%	9%	3%	86%	29%
		5	77	41%	7%	19%	8%	0%	100%	55%
		6	45	41%	23%	31%	21%	0%	7%	36%
	>250 fm	**All**	**555**	**27%**	**12%**	**27%**	**15%**	**1%**	**91%**	**38%**
		1,2,6	220	33%	19%	33%	19%	1%	89%	29%
		3,4,5	335	24%	9%	21%	12%	2%	91%	53%
		1,6	134	38%	19%	32%	22%	1%	88%	25%
		2,5	150	33%	12%	28%	12%	0%	100%	50%
		3,4	271	19%	10%	22%	12%	3%	91%	49%
		1	98	38%	15%	33%	22%	1%	100%	17%
		2	86	27%	18%	34%	15%	0%	100%	42%
		3	97	13%	9%	29%	15%		56%	55%
		4	174	24%	11%	14%	10%	3%	98%	45%
		5	64	40%	7%	18%	9%	0%		74%
		6	36	39%	23%	30%	23%	0%	9%	52%

[1] Catch and discard poundage from the first year was weighted by 0.4 and poundage from the second year was weighted by 0.6.

MODELING SABLEFISH DISCARD AND BYCATCH OF OVERFISHED SPECIES IN THE 2004 LIMITED-ENTRY FIXED-GEAR SABLEFISH FISHERY

Prepared by
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February, 2004

Introduction

NOAA Fisheries' Northwest Fisheries Science Center (NWFSC) began modeling bycatch of overfished species in the groundfish trawl fishery in the Fall of 2001. The evolution of that modeling was marked in 2003 by the introduction of bycatch data from the first year of trawl coverage–beginning in September 2001–by the NWFSC's West Coast Groundfish Observer Program (WCGOP). The WCGOP began pilot coverage of the limited-entry fixed-gear sablefish fishery during the 2001 primary season, between August and October. However, full coverage of this fishery did not begin until 2002. For the trawl fleet, the existence of logbooks and studies that utilized onboard observers allowed parameterization and use of the bycatch model prior to the availability of observer data. However, comparable data sources were not available for the fixed-gear fleet. Now that the WCGOP has processed data collected during the 7-month primary seasons in both 2002 and 2003, in addition to the pilot coverage from 2001, the development of a framework for modeling discard and bycatch in the fixed-gear sablefish fisheries can advance.

Fishery Background

Sablefish is the principal groundfish target species for most limited-entry fixed-gear vessels, which range in length from 33 feet to 95 feet. Limited-entry vessels fish for sablefish primarily north of Monterey, California. Groundfish permits for these vessels can be endorsed for the use of longline and/or pot gears. The fleet typically fishes in depths greater than 80 fathoms, and has recently faced closures of some depths. These closures have been intended to reduce bycatch of overfished species.

While most of the fleet's sablefish catch is retained, some is discarded at sea. Reasons for at-sea discard include unmarketability and attainment of vessel landing limits. Also, since the price paid by processors for sablefish is dependent on fish size, small fish may sometimes be discarded, as fishermen seek to maximize the value of their landed catch allowances. Unlike most rockfish, sablefish do not have swim bladders that explode when the fish are retrieved rapidly from great depth. Consequently, if handled properly, discarded sablefish can experience high rates of survival (Olla, et al., 1998).

Permit tiers
There are approximately 225 permits limited-entry fixed-gear permits, of which 164 are "sablefish-endorsed". Sablefish-endorsed permits provide the permit holder with an annual share of the sablefish allocated to the primary fishery for fixed-gear permits. Sablefish-endorsed permits are assigned to one of three tiers: 1, 2 or 3. Of the 164 sablefish-endorsed permits, 28 are assigned to Tier 1, 42 to Tier 2, and 94 to Tier 3. Each Tier 1 permit receives 1.4% of the fishery allocation, with Tiers 2 and 3 receiving 0.64% and 0.36%, respectively. Each year, these shares are translated into amounts of poundage, or "tier limits", which may be caught during the primary fishery. For the 2003 season, these shares translated into tier limits of 53,000 for Tier 1, 24,000 for Tier 2 and 14,000 for Tier 3.

Holders of permits that are not sablefish-endorsed are not permitted to land amounts of sablefish in excess of daily/weekly trip limit provisions. During 2003, daily landing limits ranged from 300 –350 lbs. depending on the area fished. There was also a weekly option that provided the opportunity to make a single delivery during a week, up to a poundage threshold that ranged between 800 and 1,100 pounds. Landings made under either of these options are also capped by a 2-month limit, which normally falls between 2,100 and 3,600 pounds. Outside of the primary season, or following the attainment of their tier limits, holders of sablefish-endorsed permits may also land sablefish under the provisions of the daily/weekly limit.

Primary Sablefish Season
The primary sablefish fishery currently takes place over a seven-month season from April 1 to October 31. The seven-month season was implemented first in 2002. During 2001, the season was open from August 15, 2001 to October 31, 2001. For several years prior to 2001, tier limits were assigned, but the could only be fished during a roughly 10-day window. Any primary season tonnage left uncaught would then be divided into equal limits that were available to permitted vessels during a two-week "mop-up" fishery. Permit holders can now land their tier limits at anytime during the 7-month season. However, once the primary season opens, all sablefish landed by a sablefish-endorsed permit is counted towards attainment of its tier limit.

Permit stacking
Regulations allow for up to three sablefish-endorsed limited-entry permits to be 'stacked' on a single vessel. Stacking additional sablefish-endorsed permits on a vessel allows the vessel to land sablefish up to the sum of the associated tier limits. However, stacking does not convey additive landing limits for any other species, nor for sablefish when caught under the daily/weekly option. For example, using 2003 tier limits, a vessel with a Tier 1 permit which bought or leased an additional Tier 2 and a Tier 3 permit could land a total of 91,000 lbs. of sablefish during the primary fishery (Tier 1 + Tier 2 + Tier 3 = 53,000 lb + 24,000 lb + 14,000 lb). Prior to 2002, there were no provisions for obtaining additional tier limits through permit stacking in this fishery. Permit stacking was implemented to increase the economic efficiency of the fleet and promote fleet capacity reduction.

Overview of Modeling Issues

The first step in modeling bycatch in the trawl fleet is projecting landed catch for each permit during each 2-month management period throughout the year. Since trip limits may change from one 2-month period to the next, this approach is necessary in order to capture seasonal differences in historic participation, as well as to facilitate analysis of alternative trip limit scenarios. Recent fishticket and logbook data are used to project landings for target species, given trip limits and depth management constraints. These expected target species landings are then translated into projected total mortalities for target and overfished species, using relationships derived from observer data.

The structure of the limited-entry primary fixed-gear fishery for sablefish is fundamentally different. The sablefish tier limit that is provided to each sablefish-endorsed permit can be landed at any time and in any amounts throughout the 7-month season. Where trawl vessels commonly do not achieve full limits for all target species in each 2-month period, there is a reasonable expectation that seven months provides ample opportunity for all tier limits to be landed. Furthermore, the current 7-month length of the primary season has only existed since 2002. The shortness of this time series presents difficulties for determining when tier-limit fishing will occur, and for interpreting changes in fishery seasonality between 2002 and 2003. Shifts between these two years could represent an ordinary amount of inter-annual variability, reflecting the variability of alternative fishing opportunities or fluctuations in real or expected sablefish prices. Alternatively, they could represent a more permanent shift in behavior that reflects fishermen's increased understanding of how to maximize the value of their fishery participation, given this new structure.

To complicate matters further, with the fishery's stacking provisions, there is much greater opportunity for inter-annual movement of permits between vessels than is the case in the trawl fleet. Hence, the timing and location of future sablefish catch is dependent on the leasing arrangements for stacked permits. And, these leasing arrangements may not be fully resolved until after the season formally begins. Since permits may be stacked without regard to which gear is being used, the gear endorsement of a permit is not a sure indicator of the gear that will be used to catch its tier poundage. Thus, a similar degree of uncertainty may also be associated with the share of catch projected for longline and pot gears. Finally, there is no system of comprehensive logbooks for the fixed-gear fleet, as there is for trawl.

In light of these issues, the existing structure of the trawl bycatch model is not particularly well suited for the task of estimating total mortality of sablefish and overfished species in the 2004 tier-limit fishery. Since the stability of seasonal participation and gear share in this fishery is highly uncertain, it is reasonable to evaluate, for 2004 management decisions, whether average discard and bycatch rates across all months and gears might be applied to the anticipated sablefish catch of each permit. In considering this option, attention should be paid to whether some method of combining observer data from the three available years produces distributions of observed poundage for each gear type that are at least roughly proportional to their fleet averages over 2002-03. Similarly, the patterns of observed gear shares across months should approximate those evidenced by the fishery in 2002-03. What the appropriate structure for modeling the 2004 fishery might be is a topic to which the discussion will return following a review of data from the observer program and the fleet as a whole.

Summary of Observer Data

The tables and figures presented in this document were created specifically to address issues relating to bycatch modeling. Additional information regarding bycatch and discard observed in the primary fishery can be found at the NWFSC website in the WCGOP's February 2004 fixed-gear report (located at www.nwfsc.noaa.gov/research/divisions/fram/Observer/FixedGearReportFeb2004.cfm). An overview of the observer coverage levels for the primary fisheries during 2001-2003 is provided in Table 1. The upper portion of the table presents the number of fleet landings in the left panel, and the number of observed landings in the right panel, for the primary fisheries in each calendar year, and for combined years. The monthly distributions of fleet and covered landings within each year (or year combination) are reported on the rows below those showing the number of landings. Because of the sparse amount of data from the month of April, that month has been combined with May in the column labeled '4 & 5'. In the right panel, a third row indicates the percentage of fleet landings that were observed during each period. In the bottom portion of the table, fleet and observed sablefish tonnage is presented, using the same format. Of these two measures, landed tonnage is the more important for the modeling exercise, since discard and bycatch estimates are most likely to be driven by either landed or total catch of sablefish.

Not surprisingly, the monthly distribution of landings for the overall and observed fleets underwent a dramatic shift between 2001 and 2002. This result is expected, given the expanded length of the primary season. From this initial dispersion of fishing throughout the longer season, the distributions of landings and tonnage were more concentrated during June through August during 2003 (Figure 1). The shaded proportions, derived from combining (with equal weighting) the landings and tonnage from 2001 and 2002, are assumed here to represent a reasonable expectation for the distribution of effort during the 2004 fishery.

Three alternatives for combining the available observer data across years are presented in Table 1 for comparison to this benchmark. These alternatives are, 1) use the same years of 2002-03, 2) use all three years of data with equal weighting, 3) use all three years, but weight the older data less heavily. Graphical comparison of these distributions of landings and tonnage are provided in Figures 3 and 4, respectively. The weighted alternative used in this table and elsewhere in this document assigns the following weights to data from each year: 2003: 0.4; 2002: 0.35; 2001: 0.25. Clearly, including the 2001 data with equal weighting shifts the observed distributions much more heavily towards the end of the season than is the case with the 2002-03 fleet average. However, there are at least two reasons for not ignoring these data completely. First, although the timing of the fishery may be different during 2001, the rules by which the fishery operated have remained largely unchanged. Therefore, there is no reason to believe that these data are not representative of bycatch during those months in subsequent years, notwithstanding changes in relative biomasses over time. Second, WCGOP coverage levels during the last two months of the 2003 season decline considerably, relative to the overall fishery that year and the 2-year average. Of course, these are the months where 2001 can improve the level of coverage. Although none of the three methods of combining observer data replicates the fleet tonnage distribution precisely, they do share the same seasonal patterns. The weighted alternative appears to be an improvement over the unweighted 3-year combination, and it has the strength of not ignoring the 2001 data completely.

Table 2 summarizes gear shares of sablefish tonnage within each month, for the combined 2002-03 fleet data, and for the three combinations of observer data described above. The lower panel of Table 2 summarizes the monthly shares of each gear's primary season landed catch, for the same aggregations of fleet and observed fishing activity. As with the comparison of landed catch above, none of the alternatives for combining observer data has a clear edge reproducing the actual fleet distributions.

Tables 3-8 provide an overview of observed bycatch amounts, bycatch ratios (relative to sablefish catch), and coefficients of variation for the bycatch ratios. Each of the tables is organized using the same set of categories to delineate included years, gears, and periods. Tables 3, 5, and 7 include observed data from sets made in waters deeper than 100 fathoms. Tables 4,6, and 8 include data from only those sets made in waters deeper than 150 fathoms. Tables 3 and 4 list average catches of sablefish and eight overfished species per observed set of gear. For both the 2001-03 and 2002-03 combinations of observer data, the average catch of all overfished species except lingcod was less than 1 lb per set, in conjunction with more than 1,300 lb of sablefish. In most of the strata reported in Table 3, pot gear had lower bycatch of overfished species than did longline gear. Table 4 summarizes data for sets occurring deeper than 150 fathoms. Average catch per set of sablefish remained largely unchanged in the deeper zone, but was lower for all shelf rockfish species. Average catch rates of darkblotched rockfish and Pacific ocean perch in the deeper zone were slightly higher in most of the strata reported.

Table 5 reports bycatch ratios for each of the overfished species. These are calculated by dividing the total of each species by the total catch of sablefish occurring in the same strata. Across all three years, the bycatch of each overfished rockfish species was less 0.05% of the sablefish caught. For lingcod, the ratio was 0.3%. When only sets occurring deeper than 150 fathoms are included (Table 6), all non-zero bycatch ratios decrease. **For two of the overfished rockfish species–bocaccio and cowcod–bycatch rates are zero. Caution is urged in the use of these results, since no primary season landings south of Ft. Bragg, California were observed.**

Coefficients of variation (CVs) for the bycatch ratio estimates are presented in Tables 7 and 8. CVs provide a measure of the precision of the estimates. They are calculated by dividing the standard errors of the ratios by the ratio values and then multiplying by 100. Thus, they express the standard errors as a percentage of the ratio values. Consequently, they provide a relative measure of dispersion that can be compared across ratio values that are very different. Lower CVs indicate that ratio estimates are more precise.

At season-long levels of aggregation (the first six rows of both tables), the CVs for most species are respectably low. In the few cases where CVs of 100 appear for depths greater than 100 fathoms (Table 7), they are associated with species that are very infrequently encountered. When only sets from depths greater than 150 fathoms are included (Table 8), these high CVs do not appear, because those trace amounts of bycatch were not observed at those depths. When the data are stratified further, into monthly periods, and by gear and month, the CVs degrade rapidly in most cases. These findings re-enforce the other reasons discussed above for using season-long average bycatch rates in evaluating the 2004 fishery.

One approach to managing bycatch that the Council has employed for both trawl and fixed gears is to close areas, based on depth, where higher bycatch of overfished species is expected. Tables 9-11 stratify bycatch findings for several depth intervals that are relevant to recent Council discussions. Table 9 reflects the data from all three years, weighted as described previously. Table 10 reflects the unweighted summation of data from all three years, and Table 11 is based on summing data from only 2002-03. The first four columns represent mutually exclusive depth zones. The last of these ('> 150 fm') is followed by two others that include all data from depths greater than 125 fathoms and 100 fathoms. These three 'greater than' columns reflect the choice set most commonly included in prior Council discussion of options for fixed-gear sablefish management.

Not surprisingly, bycatch ratios for lingcod, and canary and yelloweye rockfishes are significantly higher inside of 100 fathoms than they are outside of that depth. Even when compared to the adjoining 100-125 fathom interval, the shoreward bycatch rates are three or more times higher. Bycatch ratios for darkblotched and Pacific ocean perch increase only slightly in moving from a 100 fathom threshold to a 150 fathom threshold. These tables also identify the percentages of sablefish caught and landed from each of these depth ranges. Since there are no logbook records for this fleet, these data represent the best available information regarding the depth distribution of tier-limit sablefish fishing over these time periods. Roughly 65 percent of the sablefish were caught outside of 150 fathoms, 76 percent outside of 125 fathoms, and 92% outside of 100 fathoms.

Using the same tabular structure, the unweighted 2001-2003 data are further disaggregated according to gear usage–longline or pot–in Tables 12 and 13, respectively. While bycatch is generally lower when pot gear is used, it is interesting to note that observed pot sets shallower than 150 fathoms had higher associated bycatch of lingcod than did longline sets in those depths. Discard rates for sablefish were generally higher for observed pot vessels, particularly in waters deeper than 125 fathoms. There is also a clear difference in the average depth of fishing between the two gears. The pot fleet caught 89 percent of its sablefish in waters deeper than 150 fathoms, compared to just 52 percent for the longline fleet. Eighty-nine percent of the longline caught sablefish were taken in waters deeper than 100 fathoms.

Estimation of Discard and Bycatch in the 2004 Sablefish Fishery

Several factors support the use of a relatively simple method of estimating sablefish discard and the bycatch of overfished species in the 2004 primary sablefish fishery. Given the newness of the current fishing structure and the inherent flexibilities conveyed by permit stacking and a 7-month cumulative limit period, there is considerable uncertainty regarding the temporal, geographic, and gear distributions of catch that will be realized in 2004. Holding each gear type individually accountable for its performance is not realistic because it is the gear that is used, not the permit's endorsement that will affect performance. Since a permit with either gear endorsement may be stacked on a vessel using either gear, and permits may be transferred to different holders even after the season begins, there is no way to attribute differential discard/bycatch impacts to permits on the basis of gear endorsement prior to the season. In addition to these difficulties in reliably modeling participation, the precision of bycatch estimates, given the currently available data, degrade rapidly as monthly strata are introduced.

For these reasons, the recommended approach for 2004 is to use fleetwide, season-long estimates of discard and bycatch, and applying those to the total catch of sablefish allocated to this fishery. It is also recommended that a weighted combination of observer data from 2001-2003 be used in calculating bycatch results for this purpose. The following weights are proposed for use with data from each year: 2003: 0.4; 2002: 0.35; 2001: 0.25. Given these assumptions, a summary of the implications for sablefish tier limits and projected bycatch of overfished species associated with three alternative depth restrictions are reported in Table 14. The three shaded columns on the left reflect the recommended assumptions. Results using alternative methods for combining observer data are also included for comparison purposes. The projected bycatch amounts listed at the bottom of the table reflect application of the bycatch ratios to the entire limited-entry fixed-gear allocation of sablefish. While the bycatch ratios are derived from observations of only tier-limit fishing for sablefish, there are no other sources of information regarding bycatch in the portion of the fishery conducted under daily/weekly options. Projected bycatch tonnages for just the primary fishery would be 15 percent smaller than are reported at the bottom of Table 14. Finally, given the lack of observations south of the Ft. Bragg area, the bycatch estimates for bocaccio and cowcod reported in the table are not likely to reflect the true impact on these stocks. This is particularly the case for the columns that reflect fishing shallower than 150 fathoms.

Figure 1.--Percentage of fleet tier-limit sablefish tonnage landed, by month, 2002-2003..

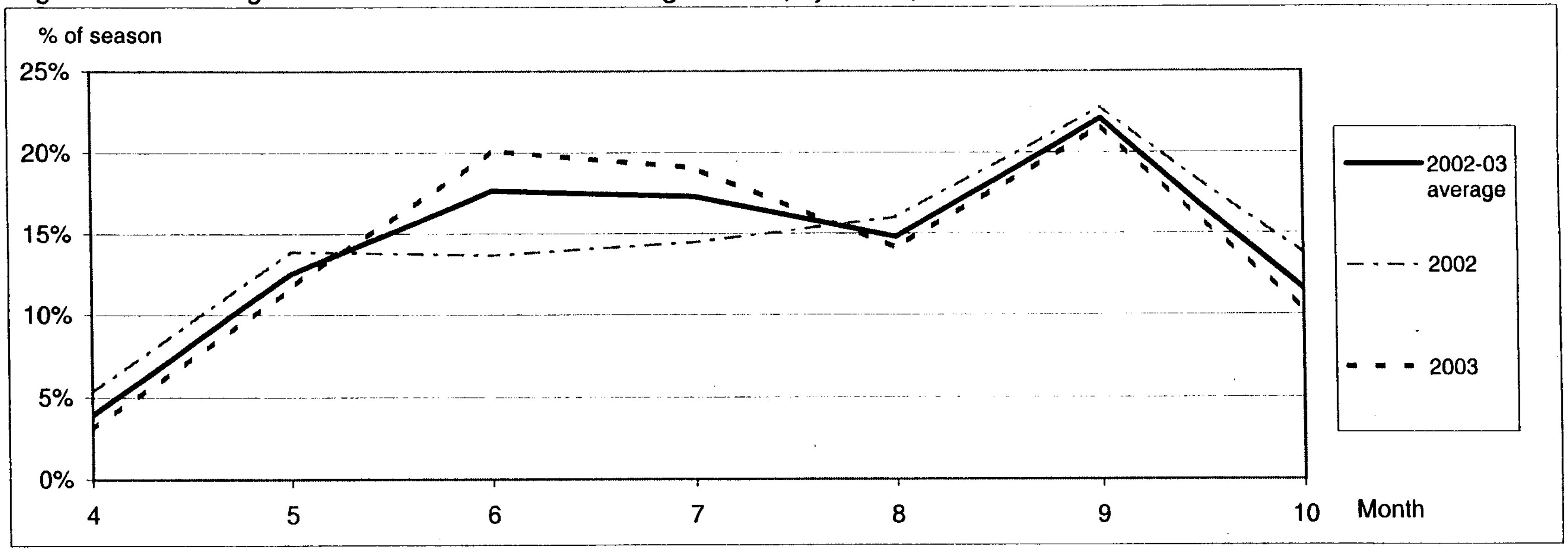

Figure 2.--Share of aggregate 2002-2003 monthly tier-limit sablefish tonnage derived from each year.

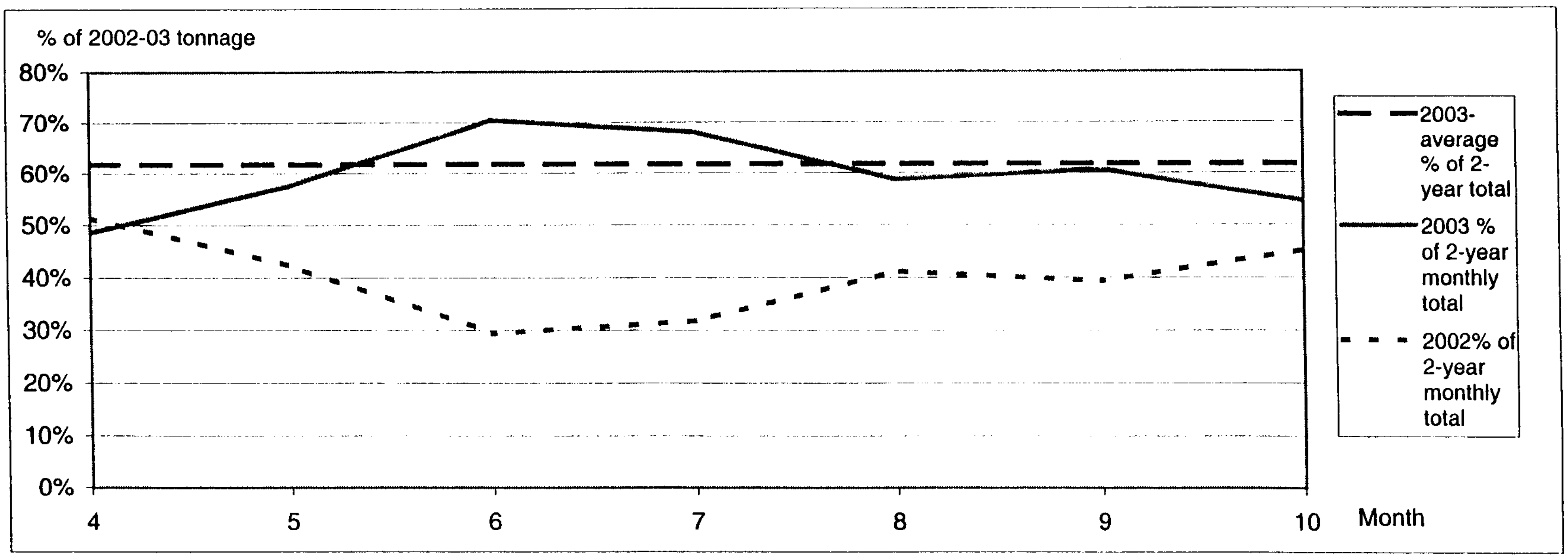

Figure 3.--Percentage of the number of tier-limit landings made, by month, in the overall and observed fleets.

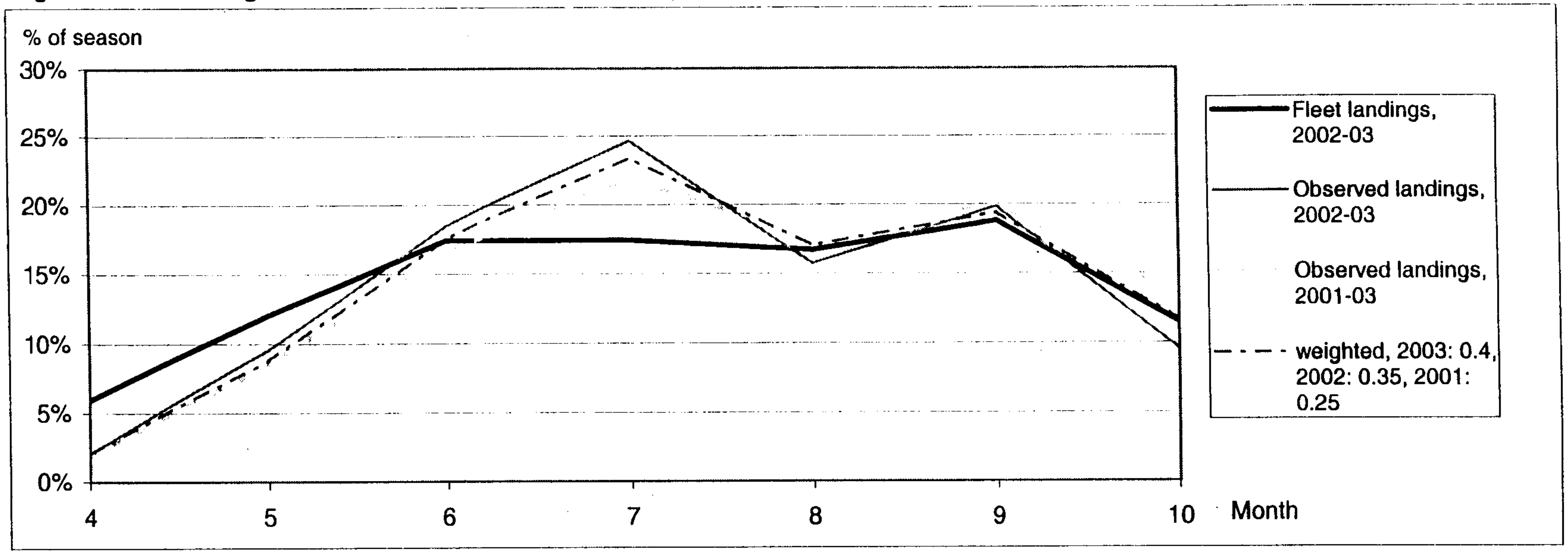

Figure 4.--Percentage of the tier-limit sablefish tonnage landed, by month, in the overall and observed fleets.

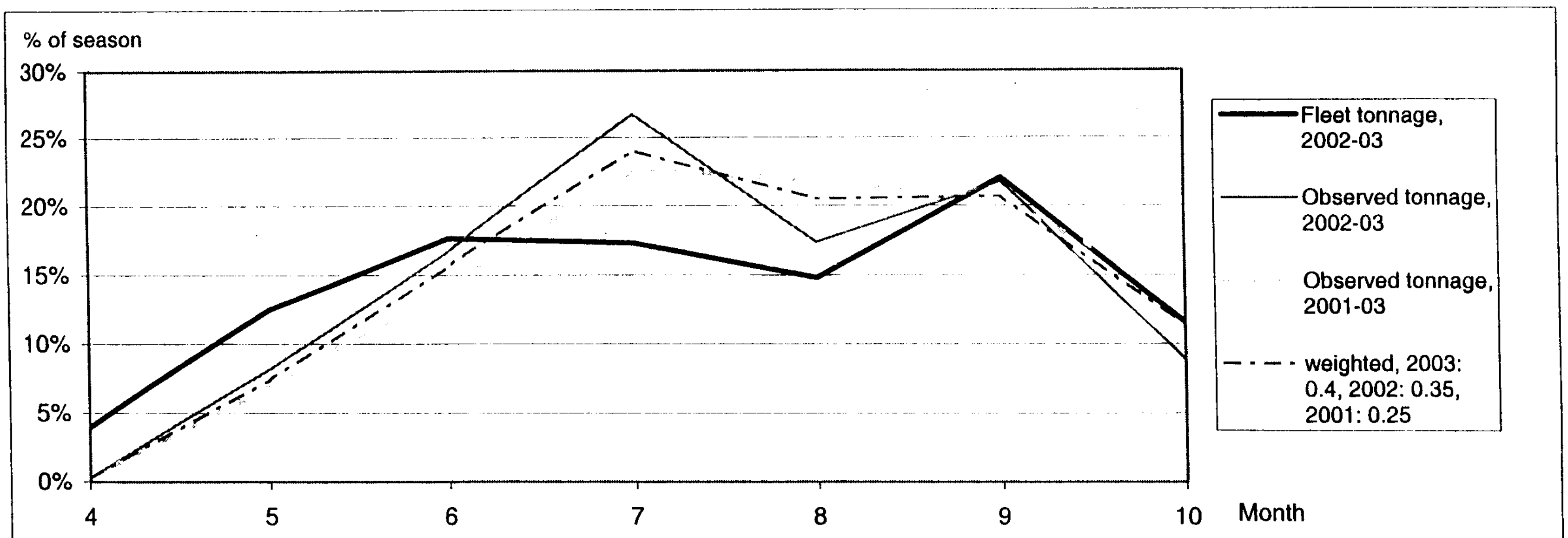

Table 1.--Comparison of primary-season, tier-limit sablefish landings and tonnage by the entire limited-entry fixed-gear fleet and by observed vessels during the 2001 to 2003 fisheries, by year and month.

	Entire sablefish-endorsed fixed-gear fleet							Observed sablefish-endorsed fixed-gear fleet [2]						
	Month of landing							Month of landing						
	4 & 5	6	7	8	9	10	Total	4 & 5	6	7	8	9	10	Total
Number of landings > 1,000 lb														
2001				141	224	136	501				6	4	8	18
% of total				28.1%	44.7%	27.1%					33.3%	22.2%	44.4%	
% of fleet amount covered											4.3%	1.8%	5.9%	4%
2002	93	68	59	62	82	54	418	8	9	12	13	23	14	79
% of total	22.2%	16.3%	14.1%	14.8%	19.6%	12.9%		10.1%	11.4%	15.2%	16.5%	29.1%	17.7%	
% of fleet amount covered								8.6%	13.2%	20.3%	21.0%	28.0%	25.9%	19%
2003	77	97	106	96	96	55	527	9	18	24	10	6		67
% of total	14.6%	18.4%	20.1%	18.2%	18.2%	10.4%		13.4%	26.9%	35.8%	14.9%	9.0%	0.0%	
% of fleet amount covered								11.7%	18.6%	22.6%	10.4%	6.3%	0.0%	13%
2002-03	170	165	165	158	178	109	945	17	27	36	23	29	14	146
% of total	18.0%	17.5%	17.5%	16.7%	18.8%	11.5%		11.6%	18.5%	24.7%	15.8%	19.9%	9.6%	
2001-03	170	165	167	299	402	245	1,448	17	27	36	29	33	22	164
% of total	11.7%	11.4%	11.5%	20.6%	27.8%	16.9%		10.4%	16.5%	22.0%	17.7%	20.1%	13.4%	
weighted 2001-03 [1]								6	10	14	10	11	7	59
								10.9%	17.6%	23.4%	17.0%	19.4%	11.7%	
Landed metric tons from landings > 1.000 lb														
2001				665	688	374	1,727				50	15	41	105
% of total				38.5%	39.8%	21.7%					47.2%	14.2%	38.6%	
% of fleet amount covered											7.5%	2.2%	10.8%	6%
2002	214	152	161	178	254	153	1,112	16	8	62	43	70	53	253
% of total	19.3%	13.7%	14.5%	16.0%	22.8%	13.8%		6.4%	3.3%	24.5%	17.0%	27.9%	21.0%	
% of fleet amount covered								7.5%	5.5%	38.4%	24.1%	27.8%	34.6%	23%
2003	267	364	344	254	391	185	1,805	35	91	97	61	59		343
% of total	14.8%	20.1%	19.1%	14.1%	21.7%	10.2%		10.1%	26.6%	28.4%	17.7%	17.3%	0.0%	
% of fleet amount covered								13.0%	25.1%	28.3%	23.9%	15.2%	0.0%	19%
2002-03	481	516	505	432	645	338	2,917	51	100	159	104	130	53	596
% of total	16.5%	17.7%	17.3%	14.8%	22.1%	11.6%		8.5%	16.7%	26.7%	17.4%	21.8%	8.9%	
2001-03	481	516	506	1,097	1,333	712	4,645	51	100	159	153	145	94	701
% of total	10.4%	11.1%	10.9%	23.6%	28.7%	15.3%		7.2%	14.2%	22.7%	21.9%	20.6%	13.3%	
weighted 2001-03 [1]								19	39	61	52	52	29	252
								7.7%	15.7%	24.0%	20.5%	20.7%	11.4%	

[1] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.25.

[2] Only sets where sablefish was the designated target species are included.

Table 2.--Gear shares of fleet and observed landed tier-limit sablefish tonnage and distributions of each gear's landed catch across months.

	Aggregated monthly totals for 2002 and 2003						Total
	4&5	6	7	8	9	10	
2002-03 fleet landed sablefish tonnage							
Longline	230	233	315	331	472	249	1,829
Pot	252	283	190	101	173	89	1,089
Total	481	516	505	432	645	338	2,918
Percentage of landings by longline gear, within period							
2002-03: Fleet	**48%**	**45%**	**62%**	**77%**	**73%**	**74%**	**63%**
2001-03: Observed	42%	48%	39%	88%	87%	77%	66%
2002-03: Observed	42%	48%	39%	82%	86%	96%	64%
weighted 2001-03: Observed [1]	42%	49%	39%	87%	87%	81%	65%
Distribution of **longline** landings among months							
2002-03: Fleet	**13%**	**13%**	**17%**	**18%**	**26%**	**14%**	**100%**
2001-03: Observed	5%	10%	14%	29%	27%	16%	100%
2002-03: Observed	6%	13%	17%	22%	30%	13%	100%
weighted 2001-03: Observed [1]	5%	12%	15%	27%	28%	14%	100%
Distribution of **pot** landings among months							
2002-03: Fleet	**23%**	**26%**	**17%**	**9%**	**16%**	**8%**	**100%**
2001-03: Observed	12%	22%	41%	8%	8%	9%	100%
2002-03: Observed	14%	24%	45%	9%	8%	1%	100%
weighted 2001-03: Observed [1]	13%	23%	42%	8%	8%	6%	100%

[1] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.25.

Table 3.--Average catches of sablefish and overfished species per observed set of gear in waters deeper than 100 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

				Average catch (pounds) per set								
Years	Gear	Month	# of sets	Sable-fish	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
In depths > 100 fm												
2001-03	All	All	1,174	1,420	0.4	4.2	0.0	0.0	0.2	0.4	0.7	0.0
2002-03	All	All	1,074	1,355	0.4	4.2	0.0	0.0	0.2	0.4	0.8	0.0
2001-03	Longline	All	635	1,672	0.7	5.9	0.0	0.0	0.3	0.6	1.3	0.0
	Pot	All	539	1,123	0.0	2.2	0.0	0.0	0.0	0.1	0.0	0.0
2002-03	Longline	All	555	1,561	0.8	6.7	0.0	0.0	0.3	0.7	1.5	0.0
	Pot	All	519	1,135	0.0	1.5	0.0	0.0	0.0	0.1	0.0	0.0
2001-03	All	4 & 5	84	1,701	0.1	2.8	0.1	0.0	0.0	0.2	0.4	0.0
	All	6	231	1,159	0.2	4.0	0.0	0.0	0.1	0.9	1.0	0.0
	All	7	292	1,199	0.5	3.3	0.0	0.0	0.0	0.2	0.3	0.0
	All	8	195	1,674	0.5	5.7	0.0	0.0	0.0	0.2	1.4	0.0
	All	9	255	1,456	0.5	4.6	0.0	0.0	0.5	0.4	0.7	0.0
	All	10	117	1,782	0.1	4.4	0.0	0.0	0.2	0.2	0.1	0.0
2002-03	All	4 & 5	84	1,701	0.1	2.8	0.1	0.0	0.0	0.2	0.4	0.0
	All	6	231	1,159	0.2	4.0	0.0	0.0	0.1	0.9	1.0	0.0
	All	7	292	1,199	0.5	3.3	0.0	0.0	0.0	0.2	0.3	0.0
	All	8	148	1,371	0.6	7.4	0.0	0.0	0.0	0.3	1.7	0.0
	All	9	234	1,476	0.5	4.7	0.0	0.0	0.6	0.4	0.8	0.0
	All	10	85	1,723	0.1	1.9	0.0	0.0	0.3	0.3	0.1	0.0
2001-03	Longline	4 & 5	41	1,257	0.2	3.5	0.2	0.0	0.0	0.4	0.9	0.0
	Longline	6	92	1,398	0.6	9.1	0.0	0.0	0.2	2.1	2.6	0.0
	Longline	7	106	1,078	1.3	9.1	0.0	0.0	0.1	0.5	1.0	0.0
	Longline	8	148	1,862	0.6	7.6	0.0	0.0	0.0	0.3	1.8	0.0
	Longline	9	161	1,896	0.7	3.3	0.0	0.0	0.8	0.4	1.1	0.0
	Longline	10	87	2,143	0.1	1.8	0.0	0.0	0.3	0.2	0.1	0.0
	Pot	4 & 5	43	2,125	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	6	139	1,001	0.0	0.6	0.0	0.0	0.0	0.1	0.0	0.0
	Pot	7	186	1,268	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	8	47	1,082	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	9	94	701	0.0	6.8	0.0	0.0	0.0	0.4	0.0	0.0
	Pot	10	30	736	0.0	11.8	0.0	0.0	0.0	0.0	0.0	0.0
2002-03	Longline	4 & 5	41	1,257	0.2	3.5	0.2	0.0	0.0	0.4	0.9	0.0
	Longline	6	92	1,398	0.6	9.1	0.0	0.0	0.2	2.1	2.6	0.0
	Longline	7	106	1,078	1.3	9.1	0.0	0.0	0.1	0.5	1.0	0.0
	Longline	8	101	1,506	0.9	10.8	0.0	0.0	0.1	0.4	2.4	0.0
	Longline	9	145	1,937	0.8	3.5	0.0	0.0	0.9	0.4	1.2	0.0
	Longline	10	70	1,984	0.2	2.3	0.0	0.0	0.3	0.3	0.2	0.0
	Pot	4 & 5	43	2,125	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	6	139	1,001	0.0	0.6	0.0	0.0	0.0	0.1	0.0	0.0
	Pot	7	186	1,268	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	8	47	1,082	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	9	89	724	0.0	6.7	0.0	0.0	0.0	0.4	0.0	0.0
	Pot	10	15	506	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4.--Average catches of sablefish and overfished species per observed set of gear in waters deeper than 150 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

				Average catch (pounds) per set								
Years	Gear	Month	# of sets	Sable-fish	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
In depths > 150 fm												
2001-03	All	All	1,174	1,465	0.0	1.6	0.0	0.0	0.2	0.5	0.2	0.0
2002-03	All	All	1,074	1,360	0.0	1.7	0.0	0.0	0.2	0.5	0.2	0.0
2001-03	Longline	All	635	1,941	0.1	2.8	0.0	0.0	0.4	1.1	0.5	0.0
	Pot	All	539	1,157	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0
2002-03	Longline	All	555	1,766	0.1	3.5	0.0	0.0	0.6	1.3	0.7	0.0
	Pot	All	519	1,156	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0
2001-03	All	4 & 5	84	1,693	0.0	1.5	0.0	0.0	0.0	0.2	0.0	0.0
	All	6	231	1,124	0.0	1.6	0.0	0.0	0.0	1.2	0.4	0.0
	All	7	292	1,282	0.0	1.4	0.0	0.0	0.0	0.2	0.2	0.0
	All	8	195	1,832	0.1	0.3	0.0	0.0	0.0	0.1	0.1	0.0
	All	9	255	1,498	0.0	3.0	0.0	0.0	0.7	0.5	0.2	0.0
	All	10	117	1,989	0.0	0.7	0.0	0.0	0.1	0.3	0.0	0.0
2002-03	All	4 & 5	84	1,693	0.0	1.5	0.0	0.0	0.0	0.2	0.0	0.0
	All	6	231	1,124	0.0	1.6	0.0	0.0	0.0	1.2	0.4	0.0
	All	7	292	1,282	0.0	1.4	0.0	0.0	0.0	0.2	0.2	0.0
	All	8	148	1,319	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.0
	All	9	234	1,483	0.0	3.3	0.0	0.0	0.8	0.6	0.2	0.0
	All	10	85	1,722	0.0	1.0	0.0	0.0	0.2	0.5	0.0	0.0
2001-03	Longline	4 & 5	41	1,130	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0
	Longline	6	92	1,707	0.3	7.9	0.0	0.0	0.2	6.3	2.5	0.0
	Longline	7	106	1,327	0.0	7.8	0.0	0.0	0.0	1.3	1.3	0.0
	Longline	8	148	2,375	0.2	0.5	0.0	0.0	0.0	0.2	0.2	0.0
	Longline	9	161	1,996	0.0	2.6	0.0	0.0	1.2	0.5	0.3	0.0
	Longline	10	87	2,308	0.0	0.9	0.0	0.0	0.1	0.4	0.0	0.0
	Pot	4 & 5	43	2,056	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	6	139	1,000	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
	Pot	7	186	1,272	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	8	47	1,082	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	9	94	758	0.0	3.6	0.0	0.0	0.0	0.5	0.0	0.0
	Pot	10	30	690	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2002-03	Longline	4 & 5	41	1,130	0.0	0.5	0.0	0.0	0.0	0.5	0.0	0.0
	Longline	6	92	1,707	0.3	7.9	0.0	0.0	0.2	6.3	2.5	0.0
	Longline	7	106	1,327	0.0	7.8	0.0	0.0	0.0	1.3	1.3	0.0
	Longline	8	101	1,764	0.6	0.0	0.0	0.0	0.0	0.3	0.5	0.0
	Longline	9	145	2,047	0.0	3.0	0.0	0.0	1.4	0.6	0.3	0.0
	Longline	10	70	2,077	0.0	1.3	0.0	0.0	0.2	0.6	0.0	0.0
	Pot	4 & 5	43	2,056	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	6	139	1,000	0.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0
	Pot	7	186	1,272	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	8	47	1,082	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Pot	9	89	758	0.0	3.6	0.0	0.0	0.0	0.5	0.0	0.0
	Pot	10	15	561	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.--Bycatch ratios (species lb/sablefish lb) for overfished species from observed sets in waters deeper than 100 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

Years	Gear	Month	# of sets	Sablefish mts	Bycatch ratios: Canary	Lingcod	Widow	Bocaccio	Pac. Oc. perch	Darkblotched	Yelloweye	Cowcod
In depths > 100 fm												
2001-03	All	All	1,174	756	0.026%	0.296%	0.001%	0.000%	0.011%	0.026%	0.050%	0.000%
2002-03	All	All	1,074	660	0.029%	0.307%	0.001%	0.000%	0.013%	0.030%	0.056%	0.000%
2001-03	Longline	All	635	482	0.040%	0.354%	0.001%	0.000%	0.018%	0.037%	0.078%	0.000%
	Pot	All	539	275	0.000%	0.194%	0.000%	0.000%	0.000%	0.008%	0.000%	0.000%
2002-03	Longline	All	555	393	0.049%	0.427%	0.001%	0.000%	0.022%	0.044%	0.094%	0.000%
	Pot	All	519	267	0.000%	0.132%	0.000%	0.000%	0.000%	0.008%	0.000%	0.000%
2001-03	All	4 & 5	84	65	0.005%	0.166%	0.007%	0.000%	0.000%	0.012%	0.026%	0.000%
	All	6	231	121	0.021%	0.344%	0.000%	0.000%	0.009%	0.076%	0.090%	0.000%
	All	7	292	159	0.041%	0.275%	0.000%	0.000%	0.002%	0.017%	0.029%	0.000%
	All	8	195	148	0.027%	0.343%	0.000%	0.000%	0.002%	0.014%	0.081%	0.000%
	All	9	255	168	0.032%	0.317%	0.000%	0.000%	0.035%	0.025%	0.048%	0.000%
	All	10	117	95	0.006%	0.245%	0.000%	0.000%	0.012%	0.011%	0.006%	0.000%
2002-03	All	4 & 5	84	65	0.005%	0.166%	0.007%	0.000%	0.000%	0.012%	0.026%	0.000%
	All	6	231	121	0.021%	0.344%	0.000%	0.000%	0.009%	0.076%	0.090%	0.000%
	All	7	292	159	0.041%	0.275%	0.000%	0.000%	0.002%	0.017%	0.029%	0.000%
	All	8	148	92	0.044%	0.537%	0.000%	0.000%	0.003%	0.019%	0.121%	0.000%
	All	9	234	157	0.034%	0.319%	0.000%	0.000%	0.038%	0.026%	0.052%	0.000%
	All	10	85	66	0.008%	0.108%	0.000%	0.000%	0.017%	0.015%	0.008%	0.000%
2001-03	Longline	4 & 5	41	23	0.014%	0.276%	0.020%	0.000%	0.000%	0.031%	0.069%	0.000%
	Longline	6	92	58	0.044%	0.652%	0.000%	0.000%	0.017%	0.149%	0.187%	0.000%
	Longline	7	106	52	0.125%	0.843%	0.000%	0.000%	0.005%	0.050%	0.088%	0.000%
	Longline	8	148	125	0.032%	0.407%	0.000%	0.000%	0.002%	0.017%	0.096%	0.000%
	Longline	9	161	138	0.039%	0.175%	0.000%	0.000%	0.042%	0.019%	0.059%	0.000%
	Longline	10	87	85	0.007%	0.085%	0.000%	0.000%	0.013%	0.011%	0.007%	0.000%
	Pot	4 & 5	43	41	0.000%	0.104%	0.000%	0.000%	0.000%	0.002%	0.002%	0.000%
	Pot	6	139	63	0.000%	0.060%	0.000%	0.000%	0.001%	0.008%	0.000%	0.000%
	Pot	7	186	107	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
	Pot	8	47	23	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	Pot	9	94	30	0.000%	0.974%	0.000%	0.000%	0.000%	0.052%	0.000%	0.000%
	Pot	10	30	10	0.000%	1.596%	0.000%	0.000%	0.000%	0.004%	0.000%	0.000%
2002-03	Longline	4 & 5	41	23	0.014%	0.276%	0.020%	0.000%	0.000%	0.031%	0.069%	0.000%
	Longline	6	92	58	0.044%	0.652%	0.000%	0.000%	0.017%	0.149%	0.187%	0.000%
	Longline	7	106	52	0.125%	0.843%	0.000%	0.000%	0.005%	0.050%	0.088%	0.000%
	Longline	8	101	69	0.058%	0.717%	0.000%	0.000%	0.004%	0.026%	0.161%	0.000%
	Longline	9	145	127	0.042%	0.179%	0.000%	0.000%	0.046%	0.020%	0.064%	0.000%
	Longline	10	70	63	0.009%	0.114%	0.000%	0.000%	0.018%	0.015%	0.009%	0.000%
	Pot	4 & 5	43	41	0.000%	0.104%	0.000%	0.000%	0.000%	0.002%	0.002%	0.000%
	Pot	6	139	63	0.000%	0.060%	0.000%	0.000%	0.001%	0.008%	0.000%	0.000%
	Pot	7	186	107	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
	Pot	8	47	23	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	Pot	9	89	29	0.000%	0.927%	0.000%	0.000%	0.000%	0.054%	0.000%	0.000%
	Pot	10	15	3	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

Table 6.--Bycatch ratios (species lb/sablefish lb) for overfished species from observed sets in waters deeper than 150 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

Years	Gear	Month	# of sets	Sable-fish mts	Bycatch ratios							
					Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
In depths > 150 fm												
2001-03	All	All	1,174	539	0.002%	0.107%	0.000%	0.000%	0.012%	0.033%	0.014%	0.000%
2002-03	All	All	1,074	455	0.002%	0.124%	0.000%	0.000%	0.014%	0.038%	0.017%	0.000%
2001-03	Longline	All	635	280	0.004%	0.146%	0.000%	0.000%	0.023%	0.055%	0.027%	0.000%
	Pot	All	539	259	0.000%	0.065%	0.000%	0.000%	0.000%	0.009%	0.000%	0.000%
2002-03	Longline	All	555	198	0.005%	0.200%	0.000%	0.000%	0.032%	0.076%	0.038%	0.000%
	Pot	All	519	258	0.000%	0.065%	0.000%	0.000%	0.000%	0.009%	0.000%	0.000%
2001-03	All	4 & 5	84	53	0.000%	0.088%	0.000%	0.000%	0.000%	0.012%	0.000%	0.000%
	All	6	231	84	0.004%	0.140%	0.000%	0.000%	0.003%	0.105%	0.038%	0.000%
	All	7	292	131	0.000%	0.109%	0.000%	0.000%	0.000%	0.018%	0.018%	0.000%
	All	8	195	93	0.007%	0.015%	0.000%	0.000%	0.001%	0.007%	0.006%	0.000%
	All	9	255	118	0.000%	0.200%	0.000%	0.000%	0.049%	0.035%	0.012%	0.000%
	All	10	117	60	0.000%	0.035%	0.000%	0.000%	0.005%	0.016%	0.000%	0.000%
2002-03	All	4 & 5	84	53	0.000%	0.088%	0.000%	0.000%	0.000%	0.012%	0.000%	0.000%
	All	6	231	84	0.004%	0.140%	0.000%	0.000%	0.003%	0.105%	0.038%	0.000%
	All	7	292	131	0.000%	0.109%	0.000%	0.000%	0.000%	0.018%	0.018%	0.000%
	All	8	148	43	0.016%	0.000%	0.000%	0.000%	0.001%	0.008%	0.013%	0.000%
	All	9	234	108	0.000%	0.220%	0.000%	0.000%	0.054%	0.038%	0.013%	0.000%
	All	10	85	37	0.000%	0.056%	0.000%	0.000%	0.009%	0.026%	0.000%	0.000%
2001-03	Longline	4 & 5	41	14	0.000%	0.046%	0.000%	0.000%	0.000%	0.041%	0.000%	0.000%
	Longline	6	92	22	0.015%	0.463%	0.000%	0.000%	0.011%	0.370%	0.143%	0.000%
	Longline	7	106	24	0.000%	0.591%	0.000%	0.000%	0.000%	0.097%	0.097%	0.000%
	Longline	8	148	70	0.010%	0.019%	0.000%	0.000%	0.001%	0.009%	0.008%	0.000%
	Longline	9	161	94	0.000%	0.130%	0.000%	0.000%	0.061%	0.027%	0.015%	0.000%
	Longline	10	87	55	0.000%	0.037%	0.000%	0.000%	0.006%	0.017%	0.000%	0.000%
	Pot	4 & 5	43	39	0.000%	0.103%	0.000%	0.000%	0.000%	0.002%	0.000%	0.000%
	Pot	6	139	62	0.000%	0.022%	0.000%	0.000%	0.000%	0.008%	0.000%	0.000%
	Pot	7	186	107	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
	Pot	8	47	23	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	Pot	9	94	24	0.000%	0.474%	0.000%	0.000%	0.000%	0.065%	0.000%	0.000%
	Pot	10	30	4	0.000%	0.015%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
2002-03	Longline	4 & 5	41	14	0.000%	0.046%	0.000%	0.000%	0.000%	0.041%	0.000%	0.000%
	Longline	6	92	22	0.015%	0.463%	0.000%	0.000%	0.011%	0.370%	0.143%	0.000%
	Longline	7	106	24	0.000%	0.591%	0.000%	0.000%	0.000%	0.097%	0.097%	0.000%
	Longline	8	101	20	0.034%	0.000%	0.000%	0.000%	0.003%	0.017%	0.029%	0.000%
	Longline	9	145	84	0.000%	0.147%	0.000%	0.000%	0.069%	0.031%	0.017%	0.000%
	Longline	10	70	34	0.000%	0.060%	0.000%	0.000%	0.010%	0.029%	0.000%	0.000%
	Pot	4 & 5	43	39	0.000%	0.103%	0.000%	0.000%	0.000%	0.002%	0.000%	0.000%
	Pot	6	139	62	0.000%	0.022%	0.000%	0.000%	0.000%	0.008%	0.000%	0.000%
	Pot	7	186	107	0.000%	0.000%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%
	Pot	8	47	23	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
	Pot	9	89	24	0.000%	0.474%	0.000%	0.000%	0.000%	0.065%	0.000%	0.000%
	Pot	10	15	3	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%

Table 7.--Coefficients of variation for overfished species' bycatch ratios from observed sets in waters deeper than 100 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

				Sable-	Bycatch ratio coefficients of variation (CVs)							
Years	Gear	Month	# of sets	fish mts	Canary	Ling-cod	Widow	Bocaccio	Pac. Oc. perch	Dark-blotched	Yellow-eye	Cow-cod
In depths > 100 fm												
2001-03	All	All	1,174	756	27	12	100		37	26	16	
2002-03	All	All	1,074	660	27	13	100		37	27	16	
2001-03	Longline	All	635	482	27	15	100		37	29	16	
	Pot	All	539	275		19			100	37	100	
2002-03	Longline	All	555	393	27	15	100		37	30	16	
	Pot	All	519	267		21			100	37	100	
2001-03	All	4 & 5	84	65	77	37	100			56	70	
	All	6	231	121	33	22			58	49	33	
	All	7	292	159	52	32			100	61	37	
	All	8	195	148	33	33			25	49	29	
	All	9	255	168	66	18			51	41	35	
	All	10	117	95	100	31			58	50	71	
2002-03	All	4 & 5	84	65	77	37	100			56	70	
	All	6	231	121	33	22			58	49	33	
	All	7	292	159	52	32			100	61	37	
	All	8	148	92	33	34			25	56	30	
	All	9	234	157	66	19			51	41	35	
	All	10	85	66	100	36			58	52	71	
2001-03	Longline	4 & 5	41	23	77	54	100			61	74	
	Longline	6	92	58	33	22			63	51	32	
	Longline	7	106	52	52	31			100	63	37	
	Longline	8	148	125	33	33			24	48	29	
	Longline	9	161	138	65	28			51	58	35	
	Longline	10	87	85	100	36			58	52	71	
	Pot	4 & 5	43	41		46				100	100	
	Pot	6	139	63		60			100	52		
	Pot	7	186	107						100		
	Pot	8	47	23								
	Pot	9	94	30		23				49		
	Pot	10	30	10		41				100		
2002-03	Longline	4 & 5	41	23	77	54	100			61	74	
	Longline	6	92	58	33	22			63	51	32	
	Longline	7	106	52	52	31			100	63	37	
	Longline	8	101	69	33	34			25	56	30	
	Longline	9	145	127	65	29			51	58	35	
	Longline	10	70	63	100	36			58	52	71	
	Pot	4 & 5	43	41		46				100	100	
	Pot	6	139	63		60			100	52		
	Pot	7	186	107						100		
	Pot	8	47	23								
	Pot	9	89	29		24				49		
	Pot	10	15	3								

Table 8.--Coefficients of variation for overfished species' bycatch ratios from observed sets in waters deeper than 100 fathoms during the tier-limit fixed-gear sablefish fishery, for several combinations of years, gears, and months.

Years	Gear	Month	# of sets	Sablefish mts	Bycatch ratio coefficients of variation (CVs): Canary	Lingcod	Widow	Bocaccio	Pac. Oc. perch	Darkblotched	Yelloweye	Cowcod
In depths > 150 fm												
2001-03	All	All	1,174	539	56	23			48	29	37	
2002-03	All	All	1,074	455	56	23			48	30	37	
2001-03	Longline	All	635	280	56	30			47	33	37	
	Pot	All	539	259		29				37		
2002-03	Longline	All	555	198	56	31			47	33	37	
	Pot	All	519	258		29				37		
2001-03	All	4 & 5	84	53		45				65		
	All	6	231	84	71	41			71	51	62	
	All	7	292	131		68				67	66	
	All	8	195	93	75	100			76	54	76	
	All	9	255	118		30			52	41	83	
	All	10	117	60		59			100	52		
2002-03	All	4 & 5	84	53		45				65		
	All	6	231	84	71	41			71	51	62	
	All	7	292	131		68				67	66	
	All	8	148	43	75				75	80	76	
	All	9	234	108		30			52	41	83	
	All	10	85	37		60			100	51		
2001-03	Longline	4 & 5	41	14		100				72		
	Longline	6	92	22	71	44			70	53	61	
	Longline	7	106	24		68				69	66	
	Longline	8	148	70	75	100			75	53	76	
	Longline	9	161	94		47			52	58	83	
	Longline	10	87	55		60			100	51		
	Pot	4 & 5	43	39		50				100		
	Pot	6	139	62		71				52		
	Pot	7	186	107						100		
	Pot	8	47	23								
	Pot	9	94	24		37				49		
	Pot	10	30	4		69						
2002-03	Longline	4 & 5	41	14		100				72		
	Longline	6	92	22	71	44			70	53	61	
	Longline	7	106	24		68				69	66	
	Longline	8	101	20	75				75	79	76	
	Longline	9	145	84		47			52	58	83	
	Longline	10	70	34		60			100	51		
	Pot	4 & 5	43	39		50				100		
	Pot	6	139	62		71				52		
	Pot	7	186	107						100		
	Pot	8	47	23								
	Pot	9	89	24		37				49		
	Pot	10	15	3								

Table 9.--Comparison of sablefish discard and bycatch of overfished species among depth strata, using only sets where sablefish was the designated target, **weighted** [2] **using all years**, for both gear types.

	Depth category of set						
	0-100 fm	100-125 fm	125-150 fm	>150 fm	>125 fm	>100 fm	All depths
Number of sets observed	51	81	52	296	348	430	480
Sablefish							
catch (lb)	53,385	104,916	74,157	424,961	499,119	604,034	657,419
% of all depths	8%	16%	11%	65%	76%	92%	100%
retained (lb)	46,274	95,474	67,295	346,430	413,725	509,198	555,472
% of all depths	8%	17%	12%	62%	74%	92%	100%
discard / catch	13.3%	9.0%	9.3%	18.5%	17.1%	15.7%	15.5%
Lingcod							
catch (lb)	1,362	882	453	483	936	1,818	3,180
bycatch ratio [1]	2.551%	0.841%	0.611%	0.114%	0.188%	0.301%	0.484%
Widow rockfish							
catch (lb)	3	4	0	0	0	4	7
bycatch ratio [1]	0.005%	0.004%	0.000%	0.000%	0.000%	0.001%	0.001%
Canary rockfish							
catch (lb)	306	86	61	9	70	156	461
bycatch ratio [1]	0.572%	0.082%	0.082%	0.002%	0.014%	0.026%	0.070%
Yelloweye rockfish							
catch (lb)	221	162	94	64	158	320	541
bycatch ratio [1]	0.414%	0.155%	0.127%	0.015%	0.032%	0.053%	0.082%
Bocaccio rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch							
catch (lb)	2	4	14	50	64	68	70
bycatch ratio [1]	0.004%	0.004%	0.019%	0.012%	0.013%	0.011%	0.011%
Darkblotched rockfish							
catch (lb)	0	6	12	150	162	168	169
bycatch ratio [1]	0.000%	0.006%	0.017%	0.035%	0.033%	0.028%	0.026%

[1] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

[2] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.25.

Table 10.--Comparison of sablefish discard and bycatch of overfished species among depth strata, using only sets where sablefish was the designated target, from **all years**, for both gear types.

	Depth category of set						
	0-100 fm	100-125 fm	125-150 fm	>150 fm	>125 fm	>100 fm	All depths
Number of sets observed	155	221	142	811	953	1,174	1,329
Sablefish							
catch (lb)	159,465	279,651	199,378	1,187,915	1,387,293	1,666,944	1,826,410
% of all depths	9%	15%	11%	65%	76%	91%	100%
retained (lb)	138,960	254,222	180,436	971,497	1,151,933	1,406,155	1,545,115
% of all depths	9%	16%	12%	63%	75%	91%	100%
discard / catch	12.9%	9.1%	9.5%	18.2%	17.0%	15.6%	15.4%
Lingcod							
catch (lb)	4,331	2,415	1,240	1,273	2,514	4,929	9,260
bycatch ratio [1]	2.716%	0.864%	0.622%	0.107%	0.181%	0.296%	0.507%
Widow rockfish							
catch (lb)	7	10	0	0	0	10	18
bycatch ratio [1]	0.005%	0.004%	0.000%	0.000%	0.000%	0.001%	0.001%
Canary rockfish							
catch (lb)	855	231	173	22	195	426	1,280
bycatch ratio [1]	0.536%	0.082%	0.087%	0.002%	0.014%	0.026%	0.070%
Yelloweye rockfish							
catch (lb)	615	420	247	166	413	833	1,448
bycatch ratio [1]	0.386%	0.150%	0.124%	0.014%	0.030%	0.050%	0.079%
Bocaccio rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch							
catch (lb)	6	12	36	141	178	189	195
bycatch ratio [1]	0.004%	0.004%	0.018%	0.012%	0.013%	0.011%	0.011%
Darkblotched rockfish							
catch (lb)	1	16	34	389	422	438	439
bycatch ratio [1]	0.000%	0.006%	0.017%	0.033%	0.030%	0.026%	0.024%

[1] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

Table 11.--Comparison of sablefish discard and bycatch of overfished species among depth strata, using only sets where sablefish was the designated target, from **2002-03**, for both gear types.

	Depth category of set						
	0-100 fm	100-125 fm	125-150 fm	>150 fm	>125 fm	>100 fm	All depths
Number of sets observed	106	204	132	738	870	1,074	1,180
Sablefish							
catch (lb)	121,840	267,389	184,198	1,003,921	1,188,119	1,455,508	1,577,348
% of all depths	8%	17%	12%	64%	75%	92%	100%
retained (lb)	103,250	242,422	167,095	800,754	967,849	1,210,271	1,313,521
% of all depths	8%	18%	13%	61%	74%	92%	100%
discard / catch	15.3%	9.3%	9.3%	20.2%	18.5%	16.8%	16.7%
Lingcod							
catch (lb)	2,264	2,020	1,209	1,242	2,452	4,471	6,736
bycatch ratio [1]	1.858%	0.755%	0.657%	0.124%	0.206%	0.307%	0.427%
Widow rockfish							
catch (lb)	7	10	0	0	0	10	18
bycatch ratio [1]	0.006%	0.004%	0.000%	0.000%	0.000%	0.001%	0.001%
Canary rockfish							
catch (lb)	853	231	173	22	195	426	1,279
bycatch ratio [1]	0.700%	0.086%	0.094%	0.002%	0.016%	0.029%	0.081%
Yelloweye rockfish							
catch (lb)	615	420	229	166	395	815	1,430
bycatch ratio [1]	0.505%	0.157%	0.124%	0.017%	0.033%	0.056%	0.091%
Bocaccio rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch							
catch (lb)	6	12	36	141	178	189	195
bycatch ratio [1]	0.005%	0.004%	0.020%	0.014%	0.015%	0.013%	0.012%
Darkblotched rockfish							
catch (lb)	0	15	34	382	415	431	431
bycatch ratio [1]	0.000%	0.006%	0.018%	0.038%	0.035%	0.030%	0.027%

[1] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

Table 12. Comparison of sablefish discard and bycatch of overfished species among depth strata, using only sets that were designated as sablefish target sets from all years, for **longline** gear.

	Depth category of set						
	0-100 fm	100-125 fm	125-150 fm	>150 fm	>125 fm	>100 fm	All depths
Number of sets observed	105	192	125	318	443	635	740
Sablefish							
catch (lb)	126,187	255,858	188,494	617,359	805,853	1,061,712	1,187,899
% of all depths	11%	22%	16%	52%	68%	89%	100%
retained (lb)	108,240	235,191	171,574	509,086	680,660	915,851	1,024,091
% of all depths	11%	23%	17%	50%	66%	89%	100%
discard / catch	14.2%	8.1%	9.0%	17.5%	15.5%	13.7%	13.8%
Lingcod							
catch (lb)	2,320	1,753	1,101	902	2,003	3,756	6,076
bycatch ratio [1]	1.839%	0.685%	0.584%	0.146%	0.249%	0.354%	0.512%
Widow rockfish							
catch (lb)	7	10	0	0	0	10	18
bycatch ratio [1]	0.006%	0.004%	0.000%	0.000%	0.000%	0.001%	0.001%
Canary rockfish							
catch (lb)	853	231	173	22	195	426	1,279
bycatch ratio [1]	0.676%	0.090%	0.092%	0.004%	0.024%	0.040%	0.108%
Yelloweye rockfish							
catch (lb)	615	418	247	166	413	831	1,446
bycatch ratio [1]	0.488%	0.163%	0.131%	0.027%	0.051%	0.078%	0.122%
Bocaccio rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch							
catch (lb)	6	12	34	141	175	187	193
bycatch ratio [1]	0.005%	0.005%	0.018%	0.023%	0.022%	0.018%	0.016%
Darkblotched rockfish							
catch (lb)	0	15	34	340	374	389	389
bycatch ratio [1]	0.000%	0.006%	0.018%	0.055%	0.046%	0.037%	0.033%

[1] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

Table 13. Comparison of sablefish discard and bycatch of overfished species among depth strata, using only sets that were designated as sablefish target sets from all years, for **pot** gear.

	Depth category of set						
	0-100 fm	100-125 fm	125-150 fm	>150 fm	>125 fm	>100 fm	All depths
Number of sets observed	50	29	17	493	510	539	589
Sablefish							
catch (lb)	33,278	23,793	10,884	570,556	581,440	605,233	638,511
% of all depths	5%	4%	2%	89%	91%	95%	100%
retained (lb)	30,720	19,031	8,862	462,412	471,273	490,304	521,024
% of all depths	6%	4%	2%	89%	90%	94%	100%
discard / catch	7.7%	20.0%	18.6%	19.0%	18.9%	19.0%	18.4%
Lingcod							
catch (lb)	2,011	662	139	372	511	1,173	3,184
bycatch ratio [1]	6.043%	2.784%	1.276%	0.065%	0.088%	0.194%	0.499%
Widow rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Canary rockfish							
catch (lb)	2	0	0	0	0	0	2
bycatch ratio [1]	0.005%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Yelloweye rockfish							
catch (lb)	0	2	0	0	0	2	2
bycatch ratio [1]	0.000%	0.008%	0.000%	0.000%	0.000%	0.000%	0.000%
Bocaccio rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish							
catch (lb)	0	0	0	0	0	0	0
bycatch ratio [1]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch							
catch (lb)	0	0	2	0	2	2	2
bycatch ratio [1]	0.000%	0.000%	0.019%	0.000%	0.000%	0.000%	0.000%
Darkblotched rockfish							
catch (lb)	1	1	0	49	49	50	50
bycatch ratio [1]	0.002%	0.003%	0.000%	0.009%	0.008%	0.008%	0.008%

[1] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

Table 14.--Comparison of sablefish tier limits and projected bycatch implications for overfished species from alternative annual weightings of observer data and alternative depths in which fishing is allowed.

	Weighted 2001-2003 discard rate [3]			Unweighted 2001-2003 discard rate			Unweighted 2002-2003 discard rate		
Depths where fishing is allowed ->	>150 fm	>125 fm	>100 fm	>150 fm	>125 fm	>100 fm	>150 fm	>125 fm	>100 fm
Total catch allocated (mt)	**2,755**	**2,755**	**2,755**	**2,755**	**2,755**	**2,755**	**2,755**	**2,755**	**2,755**
Observed sablefish discard rate	18.5%	17.1%	15.7%	18.2%	17.0%	15.6%	20.2%	18.5%	16.8%
Assumed discard mortality rate [1]	**3.7%**	**3.4%**	**3.1%**	**3.6%**	**3.4%**	**3.1%**	**4.0%**	**3.7%**	**3.4%**
Assumed discard mortality (mt)	102	94	87	100	93	86	112	102	93
Landed catch target (mt)	**2,653**	**2,661**	**2,669**	**2,655**	**2,662**	**2,669**	**2,644**	**2,653**	**2,662**
Amount allocated to:									
DTL (mt)	398	399	400	398	399	400	397	398	399
Primary fishery (mt)	**2,255**	**2,262**	**2,268**	**2,257**	**2,262**	**2,269**	**2,247**	**2,255**	**2,263**
Primary fishery tier limits (lb)									
Tier 1	69,532	69,730	69,934	69,570	69,751	69,942	69,278	69,524	69,768
Tier 2	31,606	31,696	31,788	31,623	31,705	31,792	31,490	31,602	31,713
Tier 3	18,060	18,112	18,165	18,070	18,117	18,167	17,994	18,058	18,121
Bycatch ratios [2]									
Lingcod	0.114%	0.188%	0.301%	0.107%	0.181%	0.296%	0.124%	0.206%	0.307%
Widow rockfish	0.000%	0.000%	0.001%	0.000%	0.000%	0.001%	0.000%	0.000%	0.001%
Canary rockfish	0.002%	0.014%	0.026%	0.002%	0.014%	0.026%	0.002%	0.016%	0.029%
Yelloweye rockfish	0.015%	0.032%	0.053%	0.014%	0.030%	0.050%	0.017%	0.033%	0.056%
Bocaccio rockfish [4]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Cowcod rockfish [4]	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Pacific ocean perch	0.012%	0.013%	0.011%	0.012%	0.013%	0.011%	0.014%	0.015%	0.013%
Darkblotched rockfish	0.035%	0.033%	0.028%	0.033%	0.030%	0.026%	0.038%	0.035%	0.030%
Projected bycatch impacts (mt)									
Lingcod	3.1	5.2	8.3	3.0	5.0	8.1	3.4	5.7	8.5
Widow rockfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canary rockfish	0.1	0.4	0.7	0.1	0.4	0.7	0.1	0.5	0.8
Yelloweye rockfish	0.4	0.9	1.5	0.4	0.8	1.4	0.5	0.9	1.5
Bocaccio rockfish [4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cowcod rockfish [4]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacific ocean perch	0.3	0.4	0.3	0.3	0.4	0.3	0.4	0.4	0.4
Darkblotched rockfish	1.0	0.9	0.8	0.9	0.8	0.7	1.0	1.0	0.8

[1] As in previous years, the rate of mortality for discarded sablefish in the fixed-gear fishery is assumed to be 20%.

[2] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.

[3] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.25.

[4] Please note that the observer data on which these rates are based include no observations from south of Ft. Bragg, CA, so these are likely underestimates of true bycatch.

Exhibit C.4.a
Attachment 3
April 2004

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT
TO THE GROUNDFISH MANAGEMENT TEAM
ON THE GROUNDFISH OBSERVER DATA AND BYCATCH MODEL FOR 2004

Dr. Jim Hastie summarized updates to the bycatch model for analyses that will be conducted in 2004. The major update to the bycatch model was the addition of the second full year of observer data from the Northwest Fisheries Science Center's West Coast Groundfish Observer Program (WCGOP) in 2003. New bycatch ratios were estimated for both the limited-entry trawl fishery and limited-entry fixed-gear sablefish fishery.

The Scientific and Statistical Committee (SSC) has the following comments on the proposed updates to the fixed-gear bycatch model:

1. Bycatch ratios should be implemented separately for the two fixed gears (pots and longlines).

2. The ratio of active pot permits to active longline permits should be examined for trends in recent years.

Dr. Hastie proposed three changes to the bycatch model for the limited-entry trawl fishery:

- Bycatch ratios will be calculated with reference to total catch of the target species instead of landed catch.
- Bycatch ratios for depth strata deeper than 150 fathoms will be calculated using a dividing line of 40o10' N. Lat. to delineate northern and southern bycatch ratios for all species and depths (with the exception of darkblotched rockfish occurring in depths greater than 150 fathoms).
- Seasonal stratification will be defined as two, 6-month (winter/summer) seasons for all depth strata less than 100 fathoms and three, 4-month (winter/transition/summer) seasons for depth strata greater than 150 fathoms.

The SSC endorses these proposed changes to the bycatch model.

The SSC recommends that bycatch ratios for the limited-entry trawl fishery model be calculated as a weighted average of the two annual rates (mean of the ratios from 2002 and 2003) instead of weighting the annual components of the ratio and then combining them as currently proposed. In addition, the mortality rate for sablefish discards should be re-examined as there is some recent unpublished research information that may be informative.

Although the SSC agrees with the concept of weighting recent observer data more heavily than older observer data, it recommends that a more standardized method of establishing the weights assigned to each year be explored. For example, geometric averaging should be examined as this would be less subjective and would allow the weighting factors for future years, as more observer data become available, to be defined prior to data collection.

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON OBSERVER DATA AND MODEL IMPLEMENTATION

Dr. Jim Hastie from the National Marine Fisheries Service Northwest Fisheries Science Center updated the Scientific and Statistical Committee (SSC) on progress with the bycatch models for the limited entry trawl and fixed gear sectors. Dr. Hastie described revisions to models for both sectors based on recommendations made by the SSC in March 2004 (Exhibit C.4.a, Attachment 3).

In addition, for the trawl bycatch model:

1. Lingcod discard mortality was revised downward from 70% to 50%.

2. Catch histories from retired permits (following buyback) were transferred to recently acquired permits.

For the fixed gear bycatch model, following SSC recommendations, bycatch rates have been estimated separately for pot and longline gears. According to Dr. Hastie, the percentage split in landings between these gear types has been similar over time in the observer data for the limited entry fixed gear sector. The percentage split for the limited entry sector has been applied to the open access fishery in the bycatch model.

The SSC discussed how to incorporate bycatch estimates into the stock assessment process and emphasized the need for consistency in these estimates across all species for the upcoming assessment cycle. These issues, and appropriate stratification of data for both trawl and fixed gear sectors (e.g., depth and time of year), should be resolved before the data workshop planned for July 2004.

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POLICY ON GROUNDFISH MANAGEMENT INFORMATION USAGE

Situation: During recent groundfish seasons, with the advent of the observer program data and new stock assessments, the Council has struggled with the issue of when and how to incorporate new management information into its inseason management process. With the advent of the multi-year groundfish management cycle beginning in 2005-2006, resolving this new data incorporation issue has become even more important as new observer data and modeling updates occur within the multi-year framework (Attachment 1). In recognition of this growing problem, the Council has formed an ad hoc committee to prepare recommendations for Council consideration in setting a policy to resolve the new data incorporation issue.

The Groundfish Information Policy Committee (GIPC) was formed in February 2004 and met for the first time on March 23, 2004 in Portland. The members of the committee are: Phil Anderson, Elizabeth Clarke, Neal Coenen, Eileen Cooney, Don Hansen, Bill Robinson, and Marija Vojkovich. The agenda for this meeting is attached (Exhibit C.5.a, Attachment 1: Draft Agenda for the March 23, 2004 GIPC meeting). The GIPC will report to the Council on the results of this first meeting and present recommendations to the Council on resolving the data incorporation issue.

Council Action:

1. Consider Recommendations of the GIPC.

Reference Materials:

1. Exhibit C.5.a, Attachment 1: Draft Agenda for the March 23, 2004 GIPC meeting.
2. Exhibit C.5.b, Supplemental Report of the GIPC.

Agenda Order:

a. Agendum Overview — Ed Waters
b. Report of the Ad Hoc Groundfish Information Policy Committee (GIPC)
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Consider Recommendations of the GIPC

PFMC
03/22/04

Exhibit C.5.a.
Attachment 1
April 2004

DRAFT PROPOSED AGENDA

Ad Hoc Groundfish Information Policy Committee

Pacific Fishery Management Council
Sheraton Portland Airport Hotel
8235 NE Airport Way
Portland, OR 97220
(503) 249-7642
March 23, 2004

Public comment will be accepted during each agenda item at a time determined by the chair.

TUESDAY, MARCH 23, 2004 - 8:30 A.M.

A. *Call to Order and Administrative Matters*
(*8:30 a.m.*)

1. Roll Call, Introductions, Announcements, etc. — Don Hansen, Chair
2. Committee's Charge
3. Decision Rules
4. Approve Agenda.

B. *Background: Review of Relevant 2003 Events and Other Council Policy Processes*
(*9 A.M.*)

1. April Council Meeting and Trawl Observer Data
2. June Council Meeting and Bocaccio Stock Assessment
3. September Council Meeting and Target Species Observer Data
4. November Council Meeting and California Sport Data
5. The Red-Light Green-Light Policy Addendum to Amendment 17
6. Standards and Criteria for Reviewing Rebuilding Plans.

C. *Categorizing Groundfish Information*
(*10 A.M.*)

1. Current Types and Sources of Information for Groundfish Management
   a. Fishery Dependent Data
      i. Observer Data
      ii. EFP Data
      iii. Harvest Monitoring (Commercial, Recreational and Tribal)
   b. Fishery Independent Data (e.g., Survey Data)
   c. Fishery Models
      i. Stock Asessments
      ii. Rebuilding Analyses
      iii. Harvest Impact Projection Models (Bycatch Models, QSM, Recreational Models)
   d. Other Information.
2. Anticipated Future Information

D. Guidelines for Updating Management Information
(*1 P.M.*)

1. Information Review Requirements
    a. Information Quality
        i. Report Formats
        ii. Standards for Completeness.
    b. Review and Comment Procedures
        i. Council Advisory Bodies
        ii. Independent Review Board
        iii. Public Input
    c. Council Adoption of Reviewed Information
2. Process for Incorporating New Management Information
3. Process for Replacing or Augmenting Existing Information
4. Possible Limitations on Use of New Information
5. Examples of Information Policies in Other Councils

E. Recommended Implementation Timeline
(*3 P.M.*)

1. Timing Issues
    a. Facilitating the Groundfish Multiyear Management Process
    b. Minimizing Potential for Harm to the Species of Concern
    c. Minimizing Potential for Disruption to the Fishery
2. Recommendations for 2005-2006 and beyond.

F. Other

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03/22/04

DRAFT REPORT
Ad Hoc Groundfish Information Policy Committee

Meeting Date: March 23, 2004

Meeting Venue: Sheraton Portland Airport Hotel, 8235 NE Airport Way, Portland, OR 97220.

Members Present: Mr. Don Hansen (Chair), Ms. Marija Vojkovich, Mr. Neal Coenen, Mr. Phil Anderson, Dr. Elizabeth Clarke, Mr. Bill Robinson, Ms. Eileen Cooney.

Others Present: Mr. Brian Culver, Ms. Michele Robinson, Mr. Rod Moore, Mr. Peter Huhtala, Mr. Dan Wolford, Dr. Guy Fleischer, Mr. Shannon Davis, Dr. Don McIsaac, Mr. Mike Burner, Mr. Dan Waldeck, Mr. Jim Seger, Dr. John Coon, Dr. Ed Waters, Mr. John DeVore.

Meeting Handouts: Materials provided to the committee members and public included: (1) Time line of Recent Management Information Issues, (2) NWFSC 11/03 Presentation on Observer Data Flow 2004-2006, (3) GMT 11/03 report on Observer Data Flow for 2004-2006, (4) GMT 11/03 Report on Off-year Science Activities, (5) Excerpts from GMT/SSC minutes regarding Mid-Course Corrections under Multi-Year Management, (6) Excerpt from Gulf of Mexico FMC Administrative Handbook regarding Policy on New Information, (7) NOAA Information Quality Guidelines.

Background: In January 2003 a workshop was held in Seattle, Washington to review the methodology used to estimate bycatch and to consider how new West Coast Groundfish Observer Program observer data will be incorporated to improve future estimates of fishing mortality and bycatch. The workshop report and a design for an updated trawl bycatch model were forwarded to the Scientific and Statistical Committee (SSC) for review and approval.

At its April 2003 meeting, the Council considered the new bycatch information from the observer program. In general, the preliminary observer-based bycatch rate information showed significantly higher estimated bycatch of certain overfished species than had been assumed previously. Application of the observer-based bycatch rates in April led the Council to adopt extensive inseason changes to commercial trawl fisheries, including modifying the configuration of Rockfish Conservation Areas, limiting nearshore open periods, and altering trip limits.

In June the preliminary observer-based trawl bycatch rates adopted in April were confirmed, but no new observer data was presented for inseason management. Responding to a more optimistic assessment of bocaccio, including a 10 to 26 fold increase in the bocaccio optimum yield (OY) for 2004, the Council recommended several inseason adjustments. As a result, bocaccio mortality for the 2003 fishing year was estimated to slightly exceed the 2003 OY. The Council requested, for discussion at the November Council Meeting, presentation of a long-term schedule showing when new observer data will be processed and presented to the Council for decision-making during the multi-year management cycle.

In September, observer-based discard rates for trawl target species were presented to the Council. While the Council elected not to use this new information for inseason management, these target species discard rates, as well as the bycatch rates for overfished species adopted in April, were incorporated for modeling the 2004 groundfish annual specifications. Further, in response to concerns about a proliferation of new information presented at Council meetings, the Council requested an ad hoc committee prepare a report for the March 2004 Council meeting on policy regarding the use of new information from the observer program (and other sources) for fisheries management.

In November, NMFS Northwest Fisheries Science Center (NWFSC) presented a proposed schedule of when new observer data will be available for modeling and management decision making over the next several Council meetings. This schedule was generally supported by the Groundfish Management Team (GMT) and incorporated into planning for the 2005-2006 annual specifications process. Also in November, there was some controversy about whether to consider incorporating recreational catch estimates generated by a California recreational fishing organization, the Coastside Fishing Club.

Context: Current types and sources of information for groundfish management primarily include data products from ongoing data collection and monitoring programs and the outputs from fishery models that incorporate these data as inputs. Examples of current data collection efforts include: The West Coast Groundfish Observer Program, data collected from exempted fishing permits (EFPs), harvest monitoring programs (commercial, recreational and tribal), and periodic scientific surveys. These data and other parameters derived using expert judgement are combined in varying proportions to produce several types of fishery models, including: stock assessments, rebuilding analyses, and harvest impact projection models (e.g., bycatch models, quota species monitoring [QSM], and recreational fishery models). In addition, from time to time information from other sources may enter the management process either formally or informally. Examples include Enforcement Consultants (EC) reports on illegal catch, data or analyses brought forward by nongovernment organizations (NGOs), and anecdotal reports by fishers.

Emerging issues have necessitated that policy directives be formulated regarding the schedule and process by which information enters the Pacific Fishery Management Council (Council) groundfish management system. Recent developments pushing in this direction include: adoption of multi-year management for groundfish under fishery management plan (FMP) Amendment 17, the need to coordinate delivery of stock assessment information to be in phase with the multi-year specification setting process, development of models using observer data for estimating and monitoring bycatch of all directed groundfish fisheries, and the need to periodically monitor progress toward attainment of rebuilding goals for overfished species under FMP Amendment 16.

These issues have been highlighted as the Council develops multi-year management specifications for the 2005-2006 period, and beyond.

Policy Development: The Ad Hoc Groundfish Information Policy Committee (GIPC) expressed a desire to develop a written policy statement for submission to the Council in the future. Specific questions identified by the GIPC that should be addressed in a comprehensive information policy include:

1. **Observer data and bycatch modeling:** What is the best time frame for collecting observer data? When is the deadline to deliver bycatch models using observer data to the Council? When can bycatch models be used for inseason management, second season management (the second year of a multi-year management period), or updates to multi-year management plans?

2. **Stock assessments and rebuilding analyses:** When is the deadline to deliver stock assessments and rebuilding analyses to the Council? If stock assessments or rebuilding analyses for certain species arrive later than this, can adoption be postponed until the next management cycle? Can stock assessments or rebuilding analyses be submittted and adopted before the deadline? How many stock assessments can reasonably be completed and incorporated each cycle ? (Current plan is for 23 stock assessments to be completed between May and November 2005). Which stocks don't need to be assessed each cycle? How is that decided? What is the process and schedule for monitoring progress for rebuilding species?

3. **Multi-year second season management:** What events can trigger a change in the second season OY adopted under multi-year management for a particular species? Can optimistic stock assessment events trigger an increase in an adopted OY?

4. **Other information:** What should be the cutoff date (e.g., briefing book deadline?) for submission of information eligible for consideration at a Council meeting? What is the process for receiving and reviewing data and analyses from NGOs? Can we design a process to solicit needed, supplementary information from NGOs? How does information not currently in the process get "approved?"

Intended Policy Direction:

The GIPC identified two tracks for information policy development:

Track 1, for immediate development, identifies the data collection time frame to be used by the groundfish observer program, specifies when new data should be incorporated into the bycatch models, and stipulates what types of management action the output from those models can be applied toward. The GIPC formulated a draft observer data-bycatch model schedule, shown in the table below.

Track 2, for longer term development, would use the lessons learned from formulating and implementing the 2004 annual and 2005-2006 multi-year management specifications to restructure and schedule the other main information components, including setting time lines for stock assessments, limiting the number of species to be assessed each management cycle, determining stock assessment thresholds for triggering second season OY changes, setting a process and schedule for monitoring rebuilding species, and determining a process for incorporating supplemental information from outside sources and NGOs.

The GIPC resolved to meet again between the April and June Council meetings to continue the dialogue and formalize portions of their recommended information policy statement.

DRAFT Proposed Observer Data and Bycatch Model Schedule for Multi-Year Management				
Date	Fishing Year	Observer Data Period	Groundfish Bycatch Models	Actions
April 2004	2004	9/02 - 8/03	LE Trawl, LE Fixed Gear (new)	2004 inseason 2005-2006 spex
April 2005	2005	9/03 - 8/04	OA (new)	2005 inseason
Nov 2005	2006	1/04 - 12/04 [a/]	LE Trawl, LE Fixed Gear, OA	2005 inseason 2006 2nd season [b/] 2007-2008 spex
Nov 2006	2007	1/05 - 12/05	LE Trawl, LE Fixed Gear, OA	2006 inseason 2007 update [c/]
Nov 2007	2008	1/06 - 12/06	LE Trawl, LE Fixed Gear, OA	2007 inseason 2008 2nd season 2009-2010 spex
Nov 2008	2009	1/07 - 12/07	LE Trawl, LE Fixed Gear, OA	2008 inseason
Nov 2009	2010	1/08 - 12/08	LE Trawl, LE Fixed Gear, OA	2009 inseason 2010 2nd season

a/ Note shift in observer data period.
b/ "2nd season" denotes the second year of a multi-year management cycle.
c/ "Update" denotes check and possible refinement of management measures after adoption of the multi-year spex, but prior to the first season of a multi-year management period.

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON POLICY ON GROUNDFISH MANAGEMENT INFORMATION USAGE

The Groundfish Advisory Subpanel (GAP) reviewed the results of the Ad Hoc Groundfish Information Policy Committee meeting, focusing on the proposed data model for April 2005 and beyond.

The GAP supports the proposed schedule as presented in the committee report. We believe that synchronizing the use of new data with the management process will enhance our ability to make sound management decisions.

PFMC
04/06/04

Exhibit C.6
Situation Summary
April 2004

GROUNDFISH ESSENTIAL FISH HABITAT ENVIRONMENTAL IMPACT STATEMENT ANALYTICAL MODEL

Situation: Since the Council's last briefing on the Pacific Coast Groundfish Essential Fish Habitat (EFH) Environmental Impact Statement (EIS) in June, 2003, analytical methods for mapping the distribution of habitat types have been substantially completed (see C.6.b, Attachment 1 and 2), and progress has been made on the analytical component for evaluating fishing-related habitat impacts. The Ad Hoc Groundfish Habitat Technical Review Committee (TRC) held a teleconference on August 4, 2003; and subsequently convened a workshop in Santa Cruz, California, November 20-21, 2003, to review progress to date and provide advice on further development of these two analytical components. The Groundfish Subcommittee of the Scientific and Statistical Committee met February 23-24, 2004 in Seattle, to review the Analytical Framework and reported to the full Scientific and Statistical Committee (SSC) with their recommendations during the March Council meeting. Exhibit C.6.c, Attachment 1 is the SSC Groundfish Subcommittee's review of the EFH designation component of the Analytical Framework.

The Council has three tasks before it as part of this agendum: (1) to hear an update on further changes in the EIS development schedule; (2) to hear from the EIS project team, the SSC, and other advisory bodies who may comment about the status of the Analytical Framework and decide whether to approve its use identifying designations for groundfish EFH; and (3) assign the Groundfish Fishery Management Plan Environmental Impact Statement Oversight Committee (EIS Oversight Committee) the task of developing a range of alternatives for the EIS EFH, according to the revised schedule.

Exhibit C.6.b, Attachment 3 presents the revised timeline; C.6.b, Attachment 4 is the previous timeline. The key changes occur over the next six months and are in response to delays in completing the impacts modeling component of the Analytical Framework. (These changes will not keep NMFS from meeting its court-mandated deadline of completing the EFH EIS by April 2006 when publication of the final rule implementing the Council-recommended alternative is published.) For this reason, the EFH EIS project team is splitting the task of developing and approving EIS alternatives into two steps. The first step is to identify the range of alternatives for EFH designation. The team would like to hold a meeting with the Oversight Committee in advance of the next Council meeting (June 2004) to develop the preliminary range of alternatives. The SSC Groundfish Subcommittee would also meet during this time period, if logistically possible, to review the completed fishery-related habitat impacts model component of the Analytical Framework. Based on SSC advice, the EIS project team will deliver the completed impacts model component for approval by the Council at the June meeting. At that meeting, the Council would then be in a position to consider approving EFH designation alternatives for further analysis, along with adoption of a completed impacts model. A second meeting of the Oversight Committee would then be convened in advance of the September Council meeting to develop a range of alternatives for mitigating impacts to EFH and designating habitat areas of particular concern (HAPCs). In September, the Council would adopt the final set of alternatives—including both designation and mitigation options—for further analysis in the EIS.

The SSC is scheduled to provide advice to the Council as to the use of the EFH identification component of the Analytical Framework for developing and evaluating the alternatives that will be included in the EFH EIS. During this agendum the EIS project team will also report to the Council on the current status of the Framework and its use in developing EIS alternatives.

The Council may wish to discuss the logistical issues related to assigning the Oversight Committee the EIS alternative formulation task and their first meeting. During this meeting the Oversight Committee will work with the EFH EIS team and outputs from the EFH designation component of the Analytical Framework to craft a set of alternatives. Approximately two days would be needed for this task. Ideally, this meeting could occur at about the same time as the SSC Groundfish Subcommittee meeting to review the impacts component of the Framework. This would allow the team to work with both groups.

Council Action:

1. **Approve using the EFH identification component of the Analytical Framework to develop alternatives for EFH designation.**

2. **Authorize the Groundfish FMP EIS Oversight Committee to develop a preliminary range of alternatives for the EFH EIS.**

Reference Materials:

1. Exhibit C.6.b, Attachment 1: Pacific Coast Groundfish EFH Analytical Framework.
2. Exhibit C.6.b, Attachment 2: Appendices to EFH (on CD-ROM).
3. Exhibit C.6.b, Attachment 3: Revised Draft Timeline and Major Milestones for the Environmental Impact Statement on Essential Fish Habitat for Pacific Coast Groundfish.
4. Exhibit C.6.b, Attachment 4: Previous Draft Timeline and Major Milestones for the Environmental Impact Statement on Essential Fish Habitat for Pacific Coast Groundfish
5. Exhibit C.6.c, Attachment 1: A Review of Analytical Portions of the Environmental Impact Statement for Designating Groundfish Essential Fish Habitat; A Report of the SSC Groundfish Subcommittee (DRAFT)

Agenda Order:

a.	Agendum Overview	Kit Dahl
b.	NMFS Report	Steve Copps
c.	SSC Report	Kevin Hill
d.	Reports and Comments of Advisory Bodies	
e.	Public Comment	
f.	**Council Action:** Approve EFH Identification Model, and Authorize Groundfish FMP EIS Oversight Committee to Develop a Preliminary Range of Alternatives	

PFMC
03/22/04

Exhibit C.6.b
Attachment 1
April 2004

Pacific Coast Groundfish EFH

Identification of Essential Fish Habitat for the Pacific Groundfish FMP

Prepared for

Pacific States Marine Fisheries Commission

By

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Table of Contents

List of Tables

List of Figures

1 INTRODUCTION

1.1 The purpose of this document

NOAA Fisheries is developing an Environmental Impact Statement (EIS) that responds to a court directive and settlement agreement to complete new NEPA analyses for Amendment 11 to the Pacific Coast Groundfish FMP.A decision-making process for the EIS has been designed for policy to flow from assessment. A rigorous assessment of groundfish habitat on the west coast has been undertaken to set the stage for policy development. The EIS and the Council process will be the vehicles for developing policy in response to the assessment. This careful division of the scientific assessment from policy is pictured in the draft Decision-making Framework for the Pacific Coast Groundfish Essential Fish Habitat Environmental Impact Statement (Figure 1).

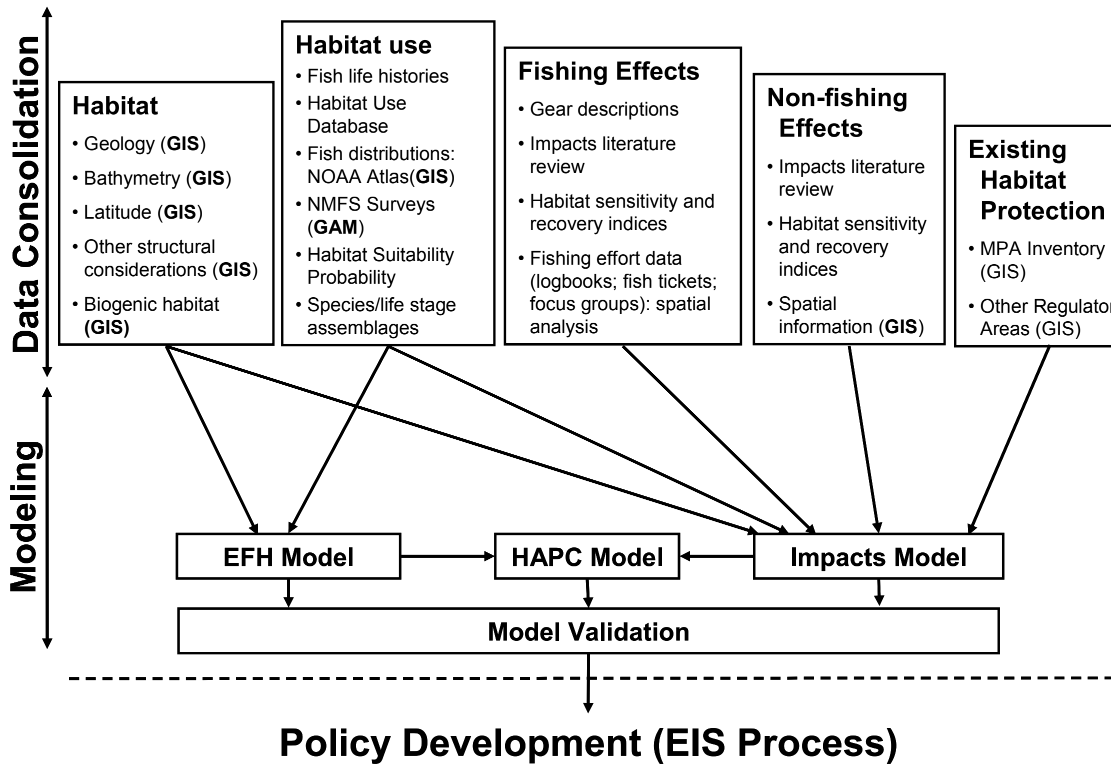

Figure 1 Draft framework for the assessment stage of the Pacific Coast Groundfish EFH EIS showing data inputs and separation of the assessment and policy components

Three models are depicted in Figure 1: EFH, HAPC and Impacts. Together these represent the analytical framework that is being developed to support preparation of the EIS and more specifically the development of Alternatives by the Council and NMFS. While these components are clearly integrated, it is possible, and perhaps desirable to address them initially one at a time, due to the complex and wide ranging scope of the issues they address. The first step in the process is the identification and description of EFH. This document therefore provides the details of the analysis of information on habitat and the use of habitat by groundfish that will lead to the development of alternatives for EFH for the Groundfish FMP.

The construction and implementation of the impacts model that will support the development of alternatives to prevent, mitigate, or minimize the adverse effects of fishing and fishing gear on EFH, to the extent practicable, will be presented separately as part of the full Analytical Framework.

The assessment has been proceeding along three major tracks: data consolidation, proof of concept, and full implementation. The results of the data consolidation phase for the EFH model are discussed in Chapter 2. Proof of concept ended in February 2003 with the endorsement of the preliminary assessment methodology. Full implementation of the EFH model is described in Chapters 3 and 4.

2 MAJOR DATA SOURCES

To consolidate the available data for describing and identifying EFH, NOAA Fisheries in cooperation with the Pacific States Marine Fisheries Commission (PSMFC) initiated a multi-faceted project that included:

1. Development of a GIS database that displays habitat types in comparison with known groundfish distribution/abundance and fishing effort;
2. Conduct of a literature review and development of a database on groundfish habitat associations;

Sections 2.1 and 2.2 describe the major attributes of the GIS and other databases that have been compiled for the EFH component of the overall project. These sections are organized in the same groups as shown in Figure 1 (the decisionmaking framework):

- West Coast fish habitat
- Use of habitat by groundfish

Preceding this, the following section provides some additional detail regarding the complexity of the data consolidation task with specifically respect to the development of the GIS.

2.1 GIS deployment in the EFH process

This project has launched a major GIS effort to synthesize and generate spatial information previously unavailable at the Pacific Coast scale. Whether creating new GIS data (i.e. groundfish fishing regulations) or mining existing data and using it in innovative ways (i.e. invertebrate data from trawl surveys) this EFH process has been the driving force behind compiling disparate biological, regulatory, and catch data into a single GIS. Upon completion, this GIS is designed to seamlessly interact with the Bayesian Belief Network model (Section 3.3) and will be an invaluable tool for data visualization and regulatory decision making.

2.1.1 Challenges Encountered While Compiling EFH GIS

Compiling comprehensive datasets covering the range of West Coast Groundfish has proven to be an enormously complex and time-consuming task. Listed below are the issues and constraints encountered repeatedly while developing the EFH GIS data layers.

- Locating Quality Data
  Every GIS undertaking of this magnitude faces longstanding challenges to data sharing and integration. Compiling a GIS for a 822,000 square km study area requires navigating a complex web of federal, state and local agencies in an effort to locate the best available data. Ideally, data sets sought out for inclusion were comprehensive for the west coast where possible, already in GIS format, free, readily available, and redistributable. However, more often than not, meeting all these criteria proved impossible. Balancing cost and time requirements to meet the EIS schedule, it is important to note the data incorporated does not always represent the best data, but the best data available to the project in the timeframe dictated.

- Uniting Disparate Data Sets
  Reconciling data from disparate sources into a unified, coherent database presents a multitude of technical challenges, requiring decisions about seemingly arcane, yet critical, details. Almost all EFH data was available only as geographic subsets to the study area. Ideally, these data would be "stitched" together at their edges using straightforward GIS commands. In practice, however, combining these geographic subsets into one comprehensive GIS layer required additional processing including:

  1. modifying attribute definitions to make them identical,
  2. eliminating overlapping areas by determining which subset has priority,
  3. filling in data gaps between subsets,
  4. understanding and reconciling different source scales and spatial extents,
  5. validating coding,
  6. updating coding as new information is provided, and
  7. projecting data to a common west coast projection.

  During these procedures, the goal has been to remain as consistent as possible with the intent of the source data while also creating comprehensive data coverage for the area of interest. To facilitate this process, automated procedures were used in lieu of more time-consuming manual editing procedures.

- Scale and Detail Exceed Software Capacity
  The large spatial extent of this project combined with the need for highly detailed GIS data has resulted in the creation of GIS datasets that exceed the capacity of essential software algorithms. To address this issue, alternative processing procedures were required to process and recompile these datasets into usable a format.

2.1.2 GIS, Modeling, and Management

The scale, scope, and complexity of this project have repeatedly pushed the limits of standard GIS technologies and existing spatial data, requiring the team to utilize innovative tools and multiple programming languages to develop the best possible GIS on which to base the EFH, Impact, and HAPC models. Relying on their expertise in the marine sciences, the team developed the spatial framework upon which these models are based. The result is a system that easily moves baseline data into the modeling process, facilitates model validation through results visualization, and displays the model outputs. In addition, the GIS will allow for the mapping of management alternatives to allow decision makers and the public to identify preferred alternatives.

2.2 West Coast Fish Habitat

The EFH model (Section 3.3.6) uses information on habitat preferences of species and life stages in the Groundfish FMP for three habitat characteristics; benthic habitat (including biogenic habitat), depth and latitude, to support the development of alternatives for identifying EFH. Accordingly, the following sections describe the data collected and processed in these three main categories. Benthic habitat is characterized primarily on the basis of the physical substrate (Section 2.2.1.1). Information on the distribution of biogenic structures and other organisms, which may form an essential, and potentially sensitive, component of habitat is less readily available, but is included to the extent possible at this stage (Section 2.2.1.3).

Many species in the Groundfish FMP have pelagic phases in their life cycles. Information on pelagic habitat such as temperature regimes, dissolved oxygen content, primary productivity and other components of water mass structures and movements is available, and could possibly be used to identify EFH for these species and life stages. However, as a priority, the project team has focused on the identification of EFH through species associations with benthic habitat and we have not attempted to use pelagic habitat characteristics in the same way. This is in part because the risk from impacts is expected to be greater for benthic habitats than for pelagic habitats and hence the former have received greater priority in terms of the identification of EFH. In addition, the transient and dynamic nature of pelagic habitats make it very difficult to delineate static geographic areas of the ocean and coast that are more or less important for groundfish than other areas. Hence, consideration of the pelagic habitat would naturally lead to the identification of most, if not all of the potential range of the pelagic phases of groundfish as EFH. As will be described later, the EFH model can accommodate this by considering information on depth and latitude ranges only of species and life stages that are not specifically associates with benthic habitat (see also Section 2.2.4).

2.2.1 Benthic Habitat

2.2.1.1 Physical substrate

Marine geology experts have developed GIS data delineating bottom-types and physiographic features associated with groundfish habitats. Benthic habitat data for Washington and Oregon were developed by the Active Tectonics and Seafloor Mapping Lab, College of Oceanic and Atmospheric Sciences at Oregon State University (Appendix 1). Data for California were developed by the Center for Habitat Studies at Moss Landing Marine Laboratories (Appendix 2). TerraLogic was responsible for merging and cleaning these two data sources to create a seamless west coast coverage. All lithologic and physiographic features were classified according to a deep-water benthic habitat classification system developed by Greene *et al*. (1999). Detailed documentation about the classification system and mapping methods are included in Appendix 2.

In general, the benthic habitat is classified according to its physical features in several levels of a hierarchical system. The levels, in order, are: megahabitat, seafloor induration, meso/macrohabitat, and modifier(s). For the west coast, the following types have been delineated:

Level 1: Megahabitat:
- Continental Rise/Apron;
- Basin Floor;
- Continental Slope;
- Ridge, Bank or Seamount;
- Continental Shelf.

Level 2: Seafloor Induration:
- Hard substrate;
- Soft substrate.

Level 3: Meso/macrohabitat:
- Canyon wall;
- Canyon floor;
- Exposure, bedrock;
- Gully;
- Gully floor;
- Ice-formed feature;
- Landslide.

Level 4: Modifier:
- Bimodal pavement;
- Outwash;
- Unconsolidated sediment.

Each unique combination of these four characteristics defines a unique benthic habitat type. For the west coast EFH project, 35 unique benthic habitat types have been delineated. These are plotted for illustrative purposes in Figure 2.

Table 1 Unique benthic habitat types delineated in the West Coast EFH GIS

Habitat Code	Habitat Type	Mega Habitat	Habitat Induration	Meso/Macro Habitat	Modifier
Ahc	Rocky Apron Canyon Wall	Continental Rise	hard	canyon wall	
Ahe	Rocky Apron	Continental Rise	hard	exposure	
As_u	Sedimentary Apron	Continental Rise	soft		unconsolidated
Asc/f	Sedimentary Apron Canyon Floor	Continental Rise	soft	canyon floor	
Asc_u	Sedimentary Apron Canyon Wall	Continental Rise	soft	canyon	unconsolidated
Asg	Sedimentary Apron Gully	Continental Rise	soft	gully	
Asl	Sedimentary Apron Landslide	Continental Rise	soft	landslide	
Bhe	Rocky Basin	Basin	hard	exposure	
Bs_u	Sedimentary Basin	Basin	soft		unconsolidated
Bsc/f_u	Sedimentary Basin Canyon Floor	Basin	soft	canyon floor	unconsolidated
Bsc_u	Sedimentary Basin Canyon Wall	Basin	soft	canyon wall	unconsolidated
Bsg	Sedimentary Basin Gully	Basin	soft	gully	
Bsg/f_u	Sedimentary Basin Gully Floor	Basin	soft	gully floor	unconsolidated
Fhc	Rocky Slope Canyon Wall	Slope	hard	canyon wall	
Fhc/f	Rocky Slope Canyon Floor	Slope	hard	canyon floor	
Fhe	Rocky Slope	Slope	hard	exposure	
Fhg	Rocky Slope Gully	Slope	hard	gully	
Fhl	Rocky Slope Landslide	Slope	hard	landslide	
Fs_u	Sedimentary Slope	Slope	soft		unconsolidated
Fsc/ f_u	Sedimentary Slope Canyon Floor	Slope	soft	canyon floor	unconsolidated
Fsc_u	Sedimentary Slope Canyon Wall	Slope	soft	canyon wall	unconsolidated
Fsg	Sedimentary Slope Gully	Slope	soft	gully	
Fsg/f	Sedimentary Slope Gully Floor	Slope	soft	gully floor	
Fsl	Sedimentary Slope Landslide	Slope	soft	landslide	

Habitat Code	Habitat Type	Mega Habitat	Habitat Induration	Meso/Macro Habitat	Modifier
Rhe	Rocky Ridge	Ridge	hard	exposure	
Rs_u	Sedimentary Ridge	Ridge	soft		unconsolidated
Shc	Rocky Shelf Canyon Wall	Shelf	hard	canyon wall	
She	Rocky Shelf	Shelf	hard	exposure	
Shi_b/p	Rocky Glacial Shelf Deposit	Shelf	hard	ice-formed feature	bimodal pavement
Ss_u	Sedimentary Shelf	Shelf	soft		unconsolidated
Ssc/f_u	Sedimentary Shelf Canyon Floor	Shelf	soft	canyon floor	unconsolidated
Ssc_u	Sedimentary Shelf Canyon Wall	Shelf	soft	canyon wall	unconsolidated
Ssg	Sedimentary Shelf Gully	Shelf	soft	gully	
Ssg/f	Sedimentary Shelf Gully Floor	Shelf	soft	gully floor	
Ssi_o	Sedimentary Glacial Shelf Deposit	Shelf	soft	ice-formed feature	outwash

In addition, for Oregon, the marine geologists delineated areas on the continental slope that were "predicted rock." These predicted rock areas were determined using multibeam bathymetry data having slopes greater than 10 degrees. Areas meeting this criterion "have been found from submersible dives, camera tows, and sidescan sonar data to nearly always contain a high percentage of harder substrates" (Goldfinger *et. al*. 2002). Predicted rock areas are included with other rocky habitats in the classification, but retain an additional identifier indicating that it was predicted.

2.2.1.2 Estuaries

Estuaries are known to be important areas for some groundfish species, such as kelp greenling, starry flounder and cabezon. However, estuarine seafloor types were generally not mapped by the marine geologists during the initial data consolidation phase of the project. Only those habitats that are specifically mapped can be incorporated into the EFH model (Section 3.3.6). Specific substrates within estuaries are not mapped, however, because of their significance as groundfish habitat, estuaries are included as a separate mapped category of their own, so that they can form part of the area identified as EFH. The only drawback of this approach is that an entire estuary is either identified as EFH or not. It is not presently possible to identify only part of an estuary, because there is no information in the GIS to distinguish between one part of an estuary and another. As information becomes available in GIS format, however, this will change.

GIS boundaries for west coast estuaries were compiled during the 1998 EFH process. The boundaries were derived primarily from the U.S. Fish and Wildlife Service's National Wetlands

Inventory (NWI). Where digital data for the NWI were unavailable, data from NOAA's Coastal Assessment Framework were used. Because these data were readily available, it was decided to merge them with the existing seafloor habitat data. In most cases, the areas delineated as estuaries do not overlap the areas that have geological substrate and/or bathymetry mapped, so the depths and bottom types are currently undescribed within the GIS.

We encountered some challenges during the merging process due to the differences in shoreline boundaries used for the seafloor habitat and estuaries. There were both gaps and areas of overlap between the two data sets. Often these gaps or overlaps are not 'real', but artifacts of the mis-alignment between the layers (Figure 3). Because we did not have the resources for extensive manual editing to align these boundaries, we developed some decision rules for dealing with data inconsistencies in the areas of overlap. Gaps between the data sets remain because there was not an acceptable automated method for either filling or removing them.

Figure 2 shows the various combinations of seafloor habitat and estuary habitat codes that occur once the two data sets are combined. In a couple situations, one data set delineates an area as land (indicated by the code, 'Island'), and the other data set delineates the same area as potential EFH (either estuary or benthic habitat). Because terrestrial areas are not potentially EFH, land areas are removed prior to input to the EFH model. However, any areas that were ambiguous (i.e. at least one of the datasets identified them as potential EFH) were retained.

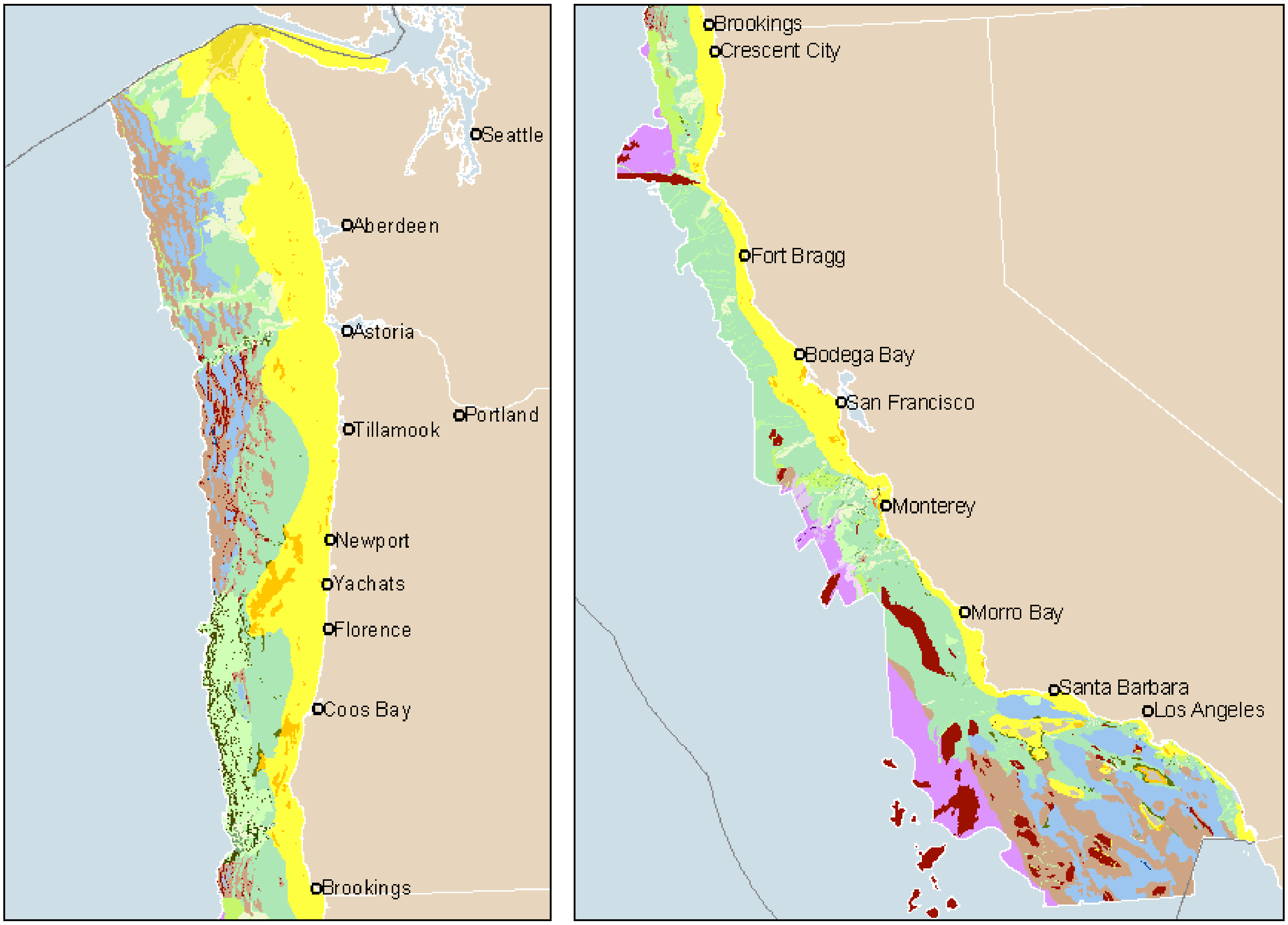

Figure 2. Thirty five (35) unique benthic types off the coasts of Washington, Oregon and California. Graphics created from data provided by MLML (CA) and OSU (OR, WA).

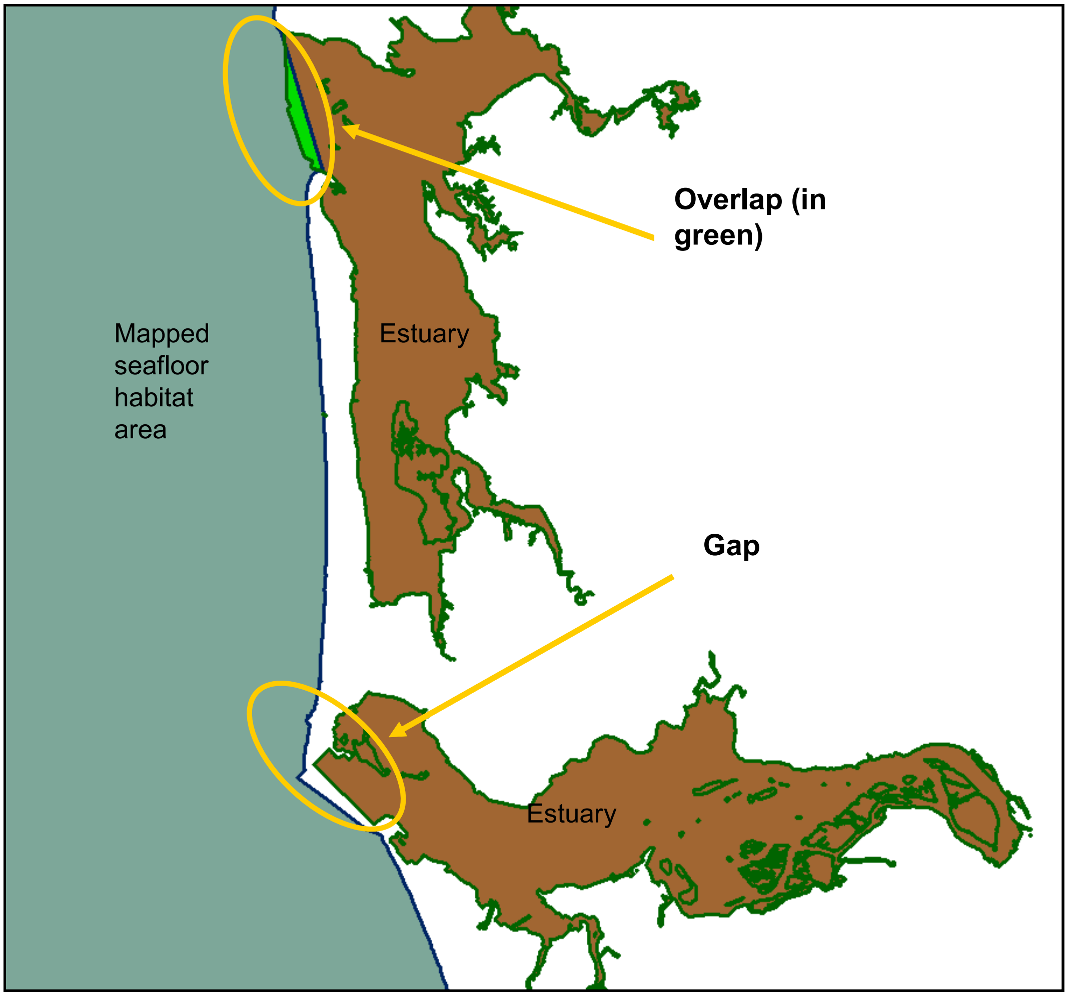

Figure 3. Examples of gaps and overlapping between data sets with respect to delineation of estuaries.

Table 2. Combinations of Seafloor Habitat and Estuary Habitat Codes.

Seafloor Habitat (hab_code)	Estuary Habitat (est_hab_code)	Ambiguous?	Input to EFH Model?
	Estuary	No	Yes
	Island	No	No
Island	Estuary	Yes	Yes
Island	Island	No	No
She, Ss_u (non-island seafloor habitat)	Estuary	No	Yes
She, Ss_u (non-island seafloor habitat)	Island	Yes	Yes
no data	Estuary	No	Yes
no data	Island	No	No
non-island seafloor habitat		No	Yes

A Primer on Geographic Information Systems

Almost 40 years ago a group of geographers developed a system for storing and organizing spatial information in a computer. This system, now known as GIS, allows a virtually unlimited amount of information to be tied to a single location in space. A GIS allows users to view layers of data at the coast wide, state, or estuary level with unprecedented clarity. Displaying information as varied as bathymetry, substrate, fishing effort, pollution sources, and oil and gas leases has lent a powerful tool to marine scientists. Information that was once only available as columns of numbers or charts is now being placed into geographic context, allowing scientists, members of the public, and decision makers to see at a glance the relationships between identified problems and the solutions proposed.

It is important to note a GIS is not simply a computer system for making maps, a GIS is also an analytical tool that allows users to query a collection of spatial and tabular data depicting the location, extent, and characteristics of geographic features. GIS allows users to answer questions that deal with issues of location, condition, trends, patterns, and strategic decision-making, such as Where is it?; What patterns exist?; What has changed since...?;; What if...? Because GIS uses geography, or space, as the common key between data sets, users can rapidly analyze multiple conditions over wide areas.

Due to its ability to synthesize large, disparate data sets, GIS is being used increasingly in coastal and marine research and management efforts worldwide. GIS and related technologies such as the global positioning system (GPS) and remote sensing provide a means to collect, aggregate, and analyze data generated by multiple sources. Today, GIS technology is rapidly replacing the traditional cartographic techniques that have typified most coastal mapping and resource inventory projects, affording users the ability to assess and display different scenarios prior to choosing a preferred management alternative.

2.2.1.3 Biogenic habitat

Biological organisms also play a critical role in determining groundfish habitat use and preference. In some cases, the biological component of the habitat is the most important feature that makes the habitat suitable for a particular species/life stage. GIS data has been compiled for several essential biological habitat components, specifically canopy kelp, seagrass, and benthic invertebrates.

Limited information is available to spatially delineate these biological habitats coastwide. However, because these habitats are so important, the project team felt that incomplete coverage was preferable to leaving these data out of the GIS. Therefore, presence of a biological habitat polygon is a good indicator that the particular feature is there, or was there in the past. However, lack of a biological habitat polygon could mean two things: (1) the habitat type does not occur in that location, or (2) GIS data was not available for that area.

2.2.1.3.1 Canopy Kelp Beds

Kelp beds have been shown to be important to many groundfish species, including several rockfish species. GIS data for the floating kelp species, *Macrocystis* spp. and *Nereocystis* sp., are available from state agencies in Washington, Oregon, and California. These data have been compiled into a comprehensive data layer delineating kelp beds along the west coast. The kelp source data were provided for each state by the following agencies: Washington Department of Natural Resources (WDNR), Oregon Department of Fish and Game (ODFW), and California Department of Fish and Game (CDFG). Source data were collected using a variety of remote-sensing techniques, including aerial photos and multispectral imagery. Because kelp abundance and distribution is highly variable, these data do not necessarily represent current conditions. However, data from multiple years were compiled together with the assumption that these data would indicate areas where kelp has been known to occur. Washington state has the most comprehensive database, covering 10 years of time (1989-1992, 1994-2000), and surveying the Straits of Juan de Fuca and the Pacific Coast every year. Oregon did a coastwide survey in 1990, and then surveyed select reefs off southern Oregon in 1996-1999. A comprehensive kelp survey in California was performed in 1989, and additional surveys of most of the coastline occurred in 1999 and 2002. Distribution of kelp beds is shown in Figure 4.

2.2.1.3.2 Seagrass

Despite their known importance for many species, seagrass beds have not been as comprehensively mapped as kelp beds. An excellent coastwide assessment of seagrass has been recently published by Wyllie-Echeverria and Ackerman, 2003. This assessment identifies sites known to support seagrass and estimates of seagrass bed areas, however, it does not compile existing GIS data. Therefore, GIS data for seagrass beds had to be located and compiled for the EFH project.

Potential data sources for seagrass were identified through internet database searches as well as intial contacts provided by NMFS EFH staff and Sandy Wyllie-Echeverria at the University of

Washington. Twenty-eight individuals or organizations were contacted for seagrass data or to provide further contacts.

Seagrass species found on the west coast of the U.S. include eelgrass (Zostera spp., Ruppia sp.) and surfgrass (Phyllospadix spp.). Eelgrass is found on soft-bottom substrates in intertidal and shallow subtidal areas of estuaries. Surfgrass is found on hard-bottom substrates along higher energy coasts.

Eelgrass mapping projects have been undertaken for many estuaries along the west coast. These mapping projects are generally done for a particular estuary, and many different mapping methods and mapping scales have been used. Therefore, the data that have been compiled for eelgrass beds are an incomplete view of eelgrass distribution along the west coast. Data depicting surfgrass distribution are very limited – the only GIS data showing surfgrass are in the San Diego area.

In order to complete the EFH model by the required deadlines, acquisition of data on seagrass was ended in March 2004. Any data that were not made available by this date were could not be included in the coastwide seagrass GIS layer. The spatial distribution of seagrass data incorporated into the GIS is shown in Figure 5. Table 3 lists the geographic coverage, time period, and sources of the seagrass data sets that were compiled.

2.2.1.3.3 Structure-forming Invertebrates

Structure forming invertebrates, such as sponges, anemones and cold water corals, can be an important and potentially vulnerable component of fish habitat. An example within the US EEZ is the Oculina Bank on the Atlantic coast of Florida. On the West Coast, however, the significance of associations between structure forming invertebrates and groundfish species, in terms of being essential fish habitat, has not been clearly identified.

Information recorded in the habitat use database (see Section 2.3.4.2) indicates that one or more species in the Groundfish FMP have been recorded as occurring with 10 separate categories of invertebrates that could be regarded as structure forming, or habitat creating. These are basketstars, brittlestars, mollusks, sea anemones, sea lilies, sea urchins, sea whips, sponges, tube worms and vase sponges. This does not imply that fish use these structure forming invertebrates as habitat. It also does not assume that ALL species in the various groups form structure or that those that do form structure do so all the time. Further, this is most certainly only a partial list and is incomplete – some significant groups are missing, e.g., cold water corals, including gorgonians and antipatharians, and other octocorals that form structure to an elevation of 4 meters above the seafloor.

Data on the presence of sponges, anemones, and cold water corals (including gorgonians, black corals, and sea pens) are available from the NOAA Fisheries bottom trawl surveys on the West Coast shelf and slope (Figure 4). These data form the basis for the only coast-wide source of distributional information for structure forming invertebrates (see Morgan and Etnoyer, 2003). However, there are some serious limitations to this information. Firstly, it should be noted that only presence data have been plotted in Figure 6; those trawl samples without structure forming invertebrates (i.e., absence data) have not been plotted. Secondly, the trawl samples are notoriously biased toward "trawlable", soft bottom, low relief habitats, and therefore complex rock structure, which is known to be important habitat for many structure forming invertebrates, is not well represented. The coral category, denoted on the map in blue, includes both soft-bottom sea pen species and also species that occur primarily on complex rocky substrata.

Given the dearth of existing information on systematics, distribution, and abundance of structure forming invertebrates (particularly in deep water) on the West Coast, a number of investigators have initiated relatively comprehensive surveys of these organisms. Notably, habitat-specific studies of structure forming invertebrates and associated fish assemblages are underway both in the Southern California Bight and off the Oregon Coast (Heceta Bank and Astoria Canyon). The association between fishes and these invertebrates, and more importantly what might be considered essential aspects of these associations, remains to be demonstrated.

Figure 4. Distribution of kelp beds (*Nereocystis* sp. And *Macrocystis* sp.) delineated in green. Note: Kelp bed polygons drawn with thick lines to allow visualization at this map scale. Data sources: WDNR, ODFW, and CDFG

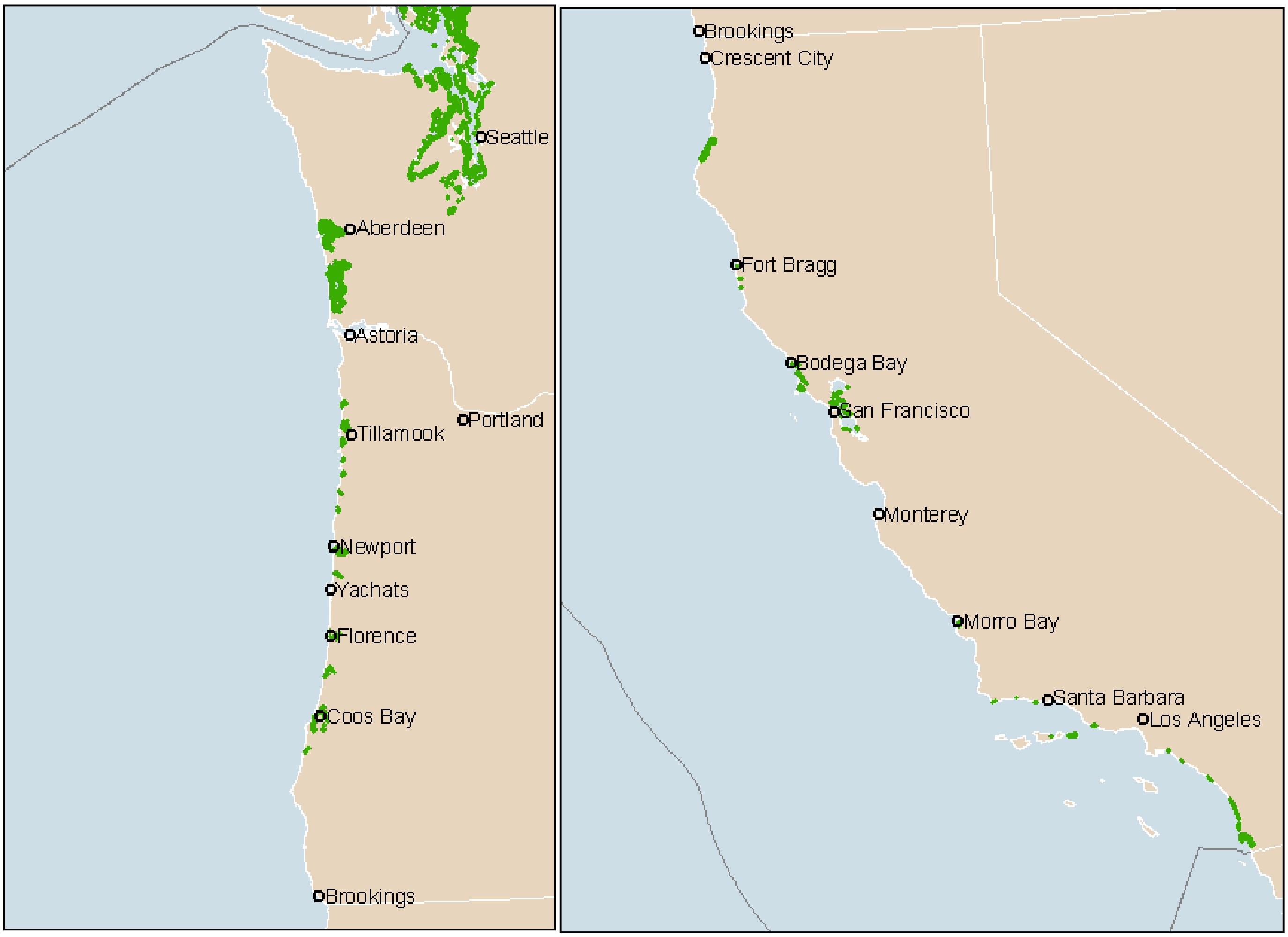

Figure 5 Distribution of seagrass along the west coast of the United States. Note: Seagrass polygons drawn with thick lines to allow visualization at this map scale. Seagrass data sources are listed in Table 3.

Table 3. Summary of seagrass data sets compiled as of February 2004.

State	Geographic Coverage	Time Period	Description	Source
WA	all coastal and estuarine areas	1994-2000	Shorezone Inventory – aerial video interpretation	Washington Department of Natural Resources
WA	Skagit, Whatcom Counties	1995 1996	Nearshore Habitat Inventory – multispectral image analysis	Washington Department of Natural Resources
WA	Hood Canal	2000	multispectral image analysis	Point No Point Treaty Council
OR	coastal estuaries	1987	Oregon Estuary Plan Book maps	Oregon Department of Land Conservation and Development
OR	Tillamook Bay	1995	multispectral image analysis	Tillamook Bay National Estuary Program and Tillamook County
CA	Northern and Southern California, and San Francisco Bay	1994 1995 1998	Environmental Sensitivity Index data – compilation of various existing data sets	NOAA, NOS, Office of Response and Restoration (ORR)
CA	Tomales Bay	1992 2000-2002	aerial photo interpretation	California Department of Fish and Game and NOAA, NOS, ORR
CA	San Diego region, Dana Point to Mexican border	2002	multispectral image analysis and multibeam acoustic backscatter data	San Diego Nearshore Habitat Mapping Program
CA	Alamitos Bay	2000	SCUBA and boat-based GPS survey	NMFS, Southwest Region (data developed by Wetlands Support)
CA	Morro Bay	1998	aerial photo interpretation	Morro Bay National Estuary Program (data provided by NMFS, SWR)
CA	San Diego Bay	2000	single-beam sonar interpretation	U.S. Navy and Port of San Diego (data provided by NMFS, SWR)

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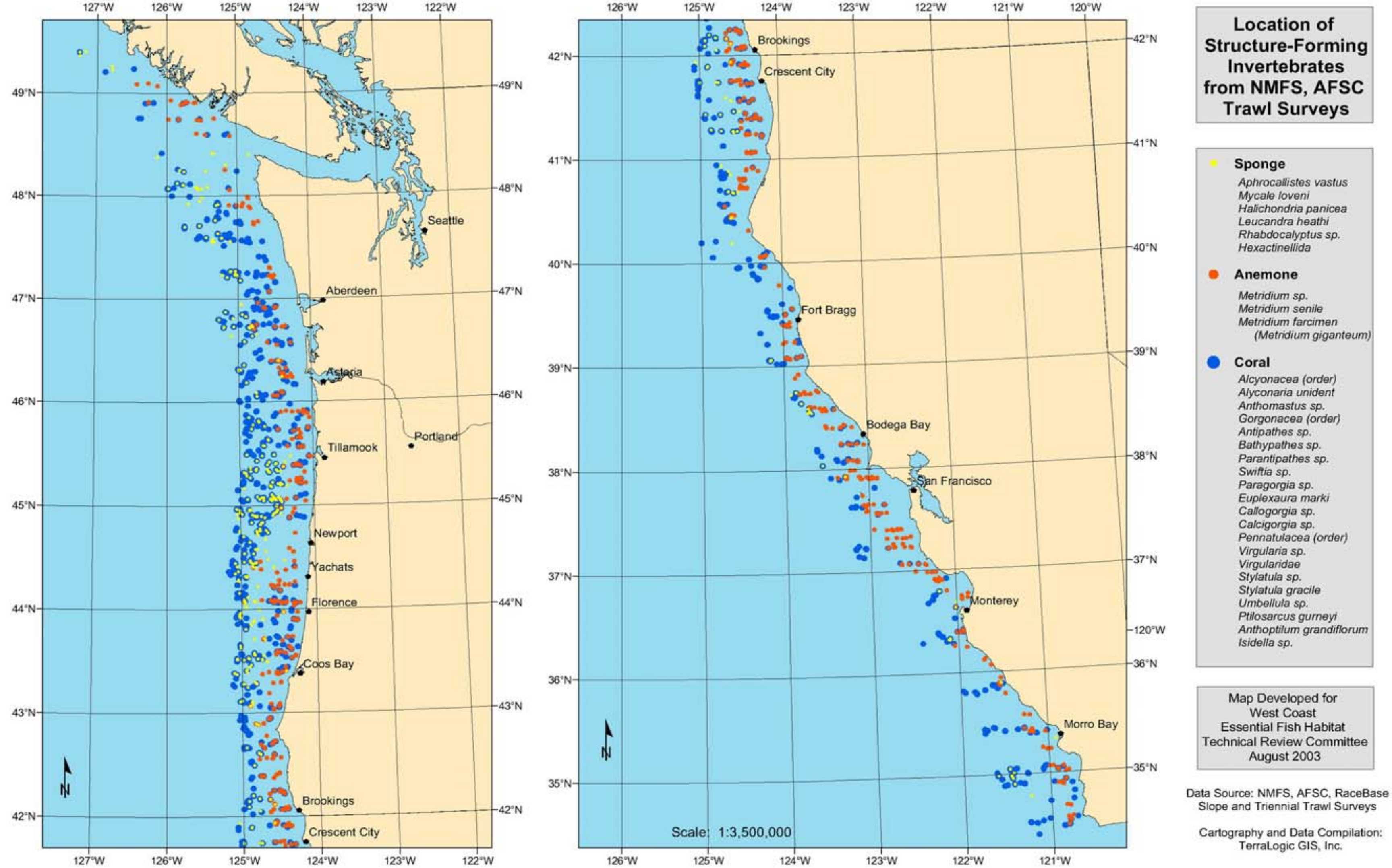


Figure 6. Locations of sponges, anemones and corals from NMFS AFSC trawl surveys.

2.2.2 Bathymetry

Water depth is one of the three habitat characteristics used in the EFH model to calculate habitat suitability values (Section 3.3). A single west coast bathymetric data layer was therefore targeted for development. After collecting bathymetry from numerous sources, each was individually contoured to 10-meter depth intervals. Using an innovative technique, these contour lines were converted to polygons to facilitate analysis with additional polygonal datasets. This process proved exceptionally challenging, surpassing the limitations of the GIS software. A split and stitch approach was adopted to clip the universal coverage down to manageable regions and recompile the data after the polygons were formed. The resulting GIS coverage contains polygons with 10-meter depth ranges. The geographic extent of the final bathymetry data was set to the same extent as the benthic habitat data, including using the same shoreline delineated by the benthic habitat data (i.e., 0-meter depth contour) for the bathymetry data.

Moss Landing Marine Lab provided 10-meter depth contours for California. These contours were derived from a publicly-available 200-meter bathymetry grid from the California Department of Fish and Game, Marine Region GIS Unit. For Oregon, up to 46° latitude, Oregon State University provided 10-meter depth contours. These contours were generated from a 100-meter bathymetry grid developed by combining and resampling multiple in-house data sets. Data sources and processing procedures for these contours are described in Appendix 1 (Goldfinger et. al. 2002). Bathymetry data for the remaining areas, (Washington and the southern-most portion of the EEZ), were developed from free, publicly-available sources. For most of Washington, a 20-meter bathymetry grid was acquired from Washington Department of Fish and Wildlife and contoured to 10-meter depths. The remaining data gaps were filled with 10-meter contours developed from the gridded Naval Oceanographic Digital Bathymetric Data Base – Variable Resolution (DBDB-V). A small data gap between Oregon and Washington, approximately 100 to200 meters across, was bridged by extending the contour lines to meet the shared boundary.

Due to the disparate nature of the bathymetry sources, the depth zones are discontinuous at the boundaries between data sources. No manual adjustments have been made to the compiled bathymetry data to remove these discontinuities. Due to software processing constraints and the extremely large size of the contour data files for California, these contours were algorithmically smoothed to remove extra vertexes within a maximum distance of 150 meters. By visual assessment, this generalization process had minimal impact on the contour locations.

2.2.3 Latitude

Along the west coast, latitude is used as one of the three habitat characteristics in the EFH model to calculate habitat suitability values (Section 3.3). Initially, boxes delineating 1’ latitudinal zones were created and overlaid with bathymetry and benthic habitat data to create a set of unique physical habitat polygons. During the development of the EFH model, it was concluded that species distributions change more gradually over latitude, and that 10’ latitudinal zones would be a more appropriate level of detail. Therefore, a new GIS coverage depicting 10' latitude zones was developed and merged with other habitat components.

2.2.4 Pelagic Habitat

There are a number of species and life stages in the Groundfish FMP that occur in the water column, but do not have any association with benthic substrate. While the water column is likely to be much less sensitive to fishing impacts than benthic substrate it is still necessary to identify EFH for these components of the groundfish assemblage. There may, for example be non-fishing impacts such as pollution that may have adverse effects. However, mapping EFH in the pelagic zone is even more difficult and less exact than for the seabed. The features of the water column that are likely to be of importance include biological, physical and chemical oceanographic processes that are hard to map. Frontal boundaries, temperature regimes and biological productivity all vary on seasonal and inter-annual scales that make identification of a static two dimensional designation of a boundary such as is required for EFH problematic. For these reasons, we have not attempted to map these features in the GIS in the same way as for the benthic substrate. Where possible, the habitat of species and life stages residing in the water column is mapped instead on the basis of latitudinal and depth ranges reported in the literature.

2.2.5 Data Quality

An important feature of the Bayesian approach to the modeling of habitat suitability probability (Section 3.2) is that the level of uncertainty in data inputs can be included explicitly. For example, while we have observations of habitat features such as the physical substrate and the depth, these are not known with certainty, and depending on how the observations were made the quality of the data will vary. The EFH model is structures to accommodate data of varying quality, providing information on that quality is available (Section **Error! Reference source not found.**). The information available on data quality is described in the following sections.

2.2.5.1 Physical substrate

The maps of physical substrate have been interpreted and compiled from various types of source data, including existing geologic maps, sediment samples, sidescan sonar imagery, seismic reflection data, and multibeam bathymetry. As with any type of mapping, there is some uncertainty involved in mapping benthic habitats.   Each data source has its own strengths and weaknesses, as well as a specific spatial resolution. In general, when more than one source of information is available, or the data source is highly detailed, the interpretation will be of higher quality and accuracy.

A 'data quality' GIS layer was developed to indicate the degree of certainty that the mapped seafloor type represents the 'real' seafloor type. For the Washington and Oregon benthic habitat maps, the Active Tectonics and Seafloor Mapping Lab at OSU provided a data quality layer created by developing four separate 100-meter grids for each data type (bathymetry, sidescan sonar, substrate samples, seismic reflection) and ranking the data sources on a scale of 1 to 10. OSU geologists created an overall substrate data quality layer by summing the values from the four individual data quality layers, creating a new layer with values from 1-40. Detailed documentation about the Washington/Oregon data quality layer is provided as Appendix 3. For modeling purposes, these data were grouped into four categories of data quality corresponding to the values 1-10, 11-20, 21-30, and 31-40. Figure 7 shows the four-level data quality layer for Oregon and Washington. No data quality layer is available for benthic habitat in California.

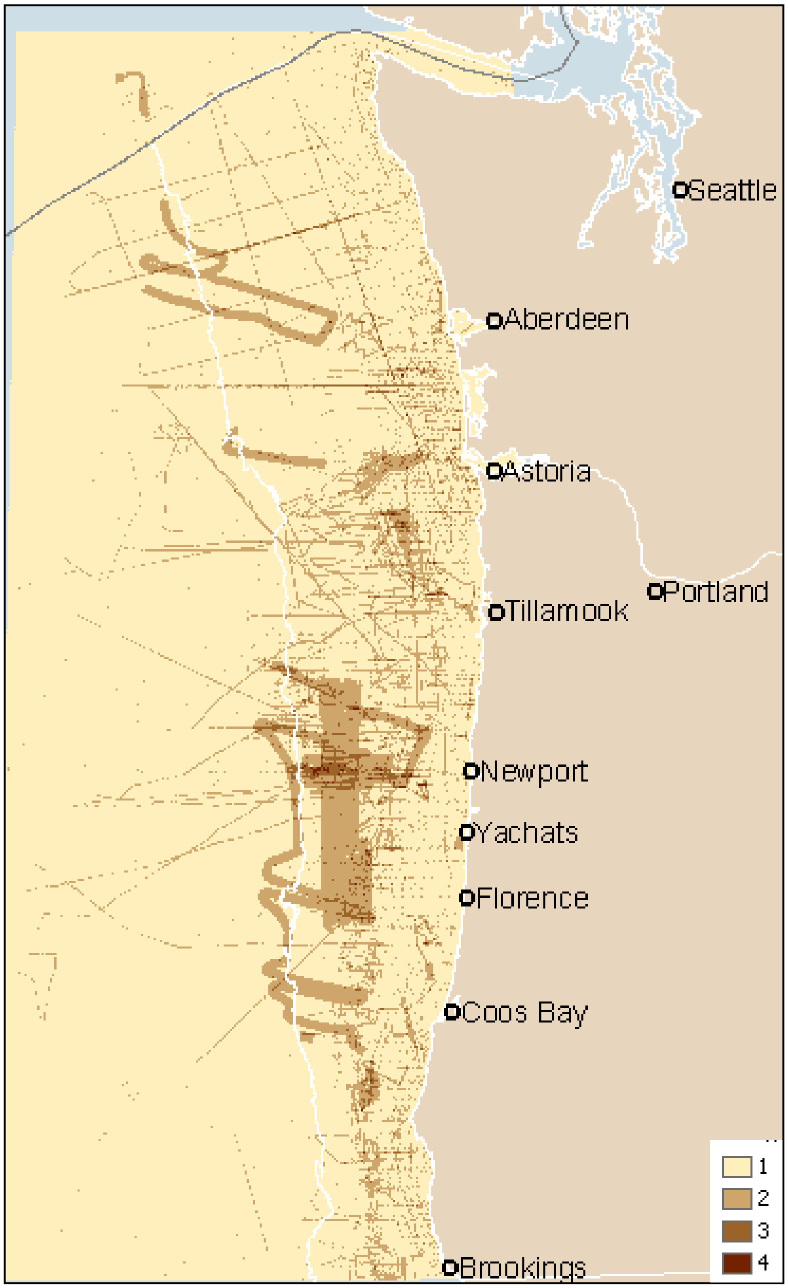


Figure 7 Four-level data quality layer for physical substrate off Oregon and Washington.

2.2.5.2 Bathymetry

Bathymetric data quality is affected by the source data's spatial resolution, spatial accuracy, and attribute accuracy and precision. A general data quality layer for bathymetry has been developed by TerraLogic GIS. The boundaries for each bathymetry data source have been delineated and the overall quality of each data source can be ranked on a relative scale. The bathymetry data from Oregon are the highest quality, the data from California are 2nd best quality, the 3rd quality level are the data from Washington (WDFW), while the lowest quality data is from the Naval Oceanographic Office used to fill gaps off Washington and Southern California. Within each data source, there are also variations in data quality. However, other than Oregon, there is not adequate information to delineate these within-source variations. Therefore, we used a single quality rank for each source.

Discussion at the Pacific Fishery Management Council's SSC Groundfish Sub-Committee review meeting in February 2004 suggested that the influence of the bathymetry data quality on the outcome of the modeling process would be limited because of the scale on which depth was being considered in the model (30 meter depth intervals – see Section XX) generally exceeded the scale of the error in even the worst data areas. At the March Council meeting the SSC therefore recommended that work on the bathymetry data quality layer should be suspended. The data quality layer for bathymetry was therefore included in modeling process.

2.3 Use of Habitat by Groundfish

2.3.1 NMFS trawl surveys

Trawl surveys can provide valuable information on fish distribution, and hence provide source data for estimating the suitability of habitat within the area covered by the FMP. Bottom trawl surveys have been conducted on the continental shelf and upper slope off the west coast (Washington, Oregon and California) since 1977. These surveys provide the primary source of abundance and trend information for most stock assessments conducted on west coast groundfish. In all, there are three survey series that have operated in the study area, which are described below. A summary comparison of the details of these surveys in 2001 is provided in Table 4. Survey coverage is illustrated in Figure 8.

The shelf survey (30-200 fathoms) by the Alaska Fisheries Science Center (AFSC) uses larger (120 to 130ft) chartered fishing vessels and has been conducted triennially since 1977. This is commonly known as the triennial shelf survey. The ninth and final survey in the series was conducted in 2001[1]. From 1977 through 1986, the surveys were aimed at estimating rockfish abundance. The five latter surveys from 1989 to 2001 shifted the emphasis more toward better assessing a broader range of groundfish species. From 1987 to 1992, the depth range of the survey was 55 to 366m. In 1995, the lower depth was increased to 500m in order to cover the habitat of slope rockfish more completely. The final 2001 survey encompassed the coastal waters from Pt. Conception, California, to central Vancouver Island, British Columbia (34°30'-49°06'N). A total of 527 stations were occupied, of which 506 were successfully sampled. Catches included over 166 fish species representing more than 57 families (Weinberg et al. 2002).

[1] The triennial shelf survey years were therefore 1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998 and 2001.

A second survey series also conducted by AFSC was initiated in 1984. This survey aimed at covering the slope (100-700 fathoms) and was motivated by the need for information on the commercially important species inhabiting that region (Lauth et al. 1998). These species, comprising the “deep water complex” include Dover sole, sablefish, shortspine thornyhead, and longspine thornyhead. The survey has been conducted annually since 1988 using primarily the 225 ft NOAA Research Vessel Miller Freeman. The spatial coverage of the surveys has varied. In 1997, for the first time, the entire west coast from Point Conception to the US-Canada border was surveyed.

In 1998 the Northwest Fisheries Science Center (NWFSC), initiated a new bottom trawl survey of the commercial groundfish resources in the slope zone (100 - 700 fathoms). Conducted in the summer months, this survey uses chartered local West Coast trawlers ranging in size from 60 to 100 ft. In 1998, the survey covered the area from Cape Flattery, Washington (48°10' N), to Morro Bay, California (35°N), between August 20 and October 16. This survey has been conducted annually since 1998. Although the survey aims to sample the slope, in 2001 the design was changed for one year to cover the shelf. The survey in all other years (1998 to 2000 and 2002) has been a segmented transect design that divides the US Pacific coast into 10deg, equidistant sections north to south & 10 east-west segments based on depth. The area covered in 1998-2000 was 34deg 15min to 48deg 15min latitude. In 2002, the area covered expanded at the southern margin to 32deg 30min (i.e. south of Point Conception) and contracted very slightly at the northern margin to 48deg 10min latitude.

For all these surveys, haul locations are stored both as points indicating the vessel’s start position and trawl mid-point, as well as straight lines connecting the vessel’s start and end point. The tabular data associated with each haul, such as species code and species weight are stored in related database tables. The information in these related tables can be queried geographically, or tabular queries can be performed and then the results displayed geographically.

The data from these trawl surveys have been compiled and converted to GIS format. They can be used in geographic overlays with other information, such as fishing effort or habitat, to validate model outputs or assess the relationship between various layers.

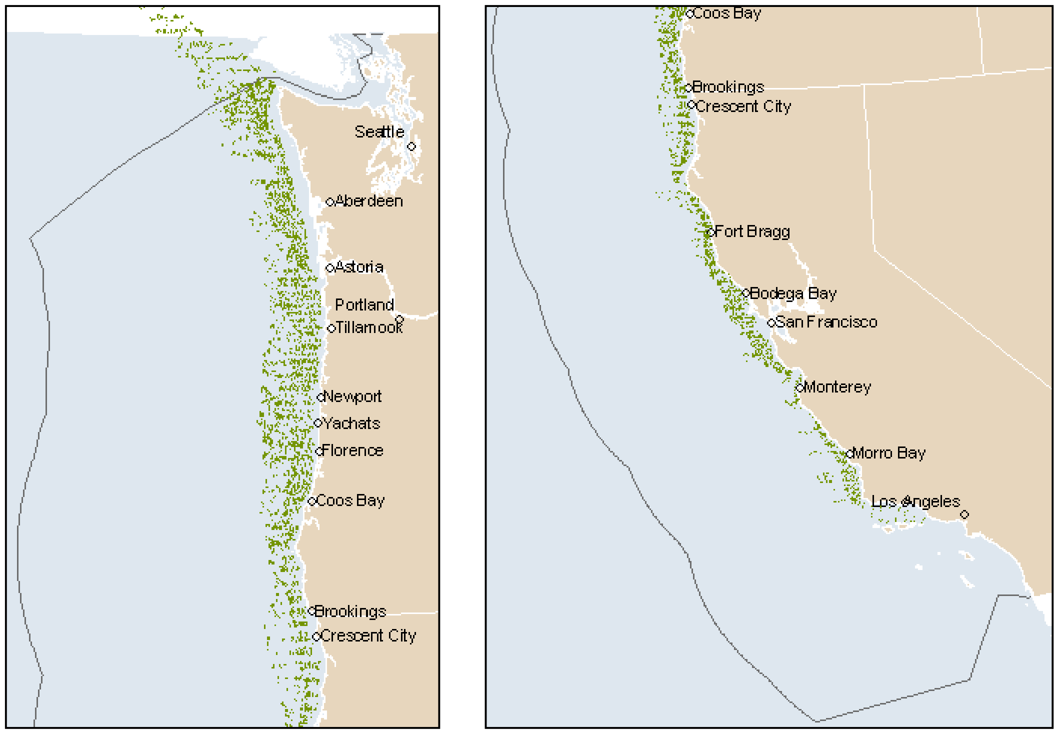
The survey data can also be analyzed to characterize the preferences of species and life stages for different components of the habitat. For example it is possible to explore the relationships between catch per unit effort (cpue) and habitat attributes such as latitude and depth (see Sections 2.3.4.3 and 0)

Table 4 Comparison of the three trawl survey series covering the west coast of the US. Information provided by NOAA Fisheries.

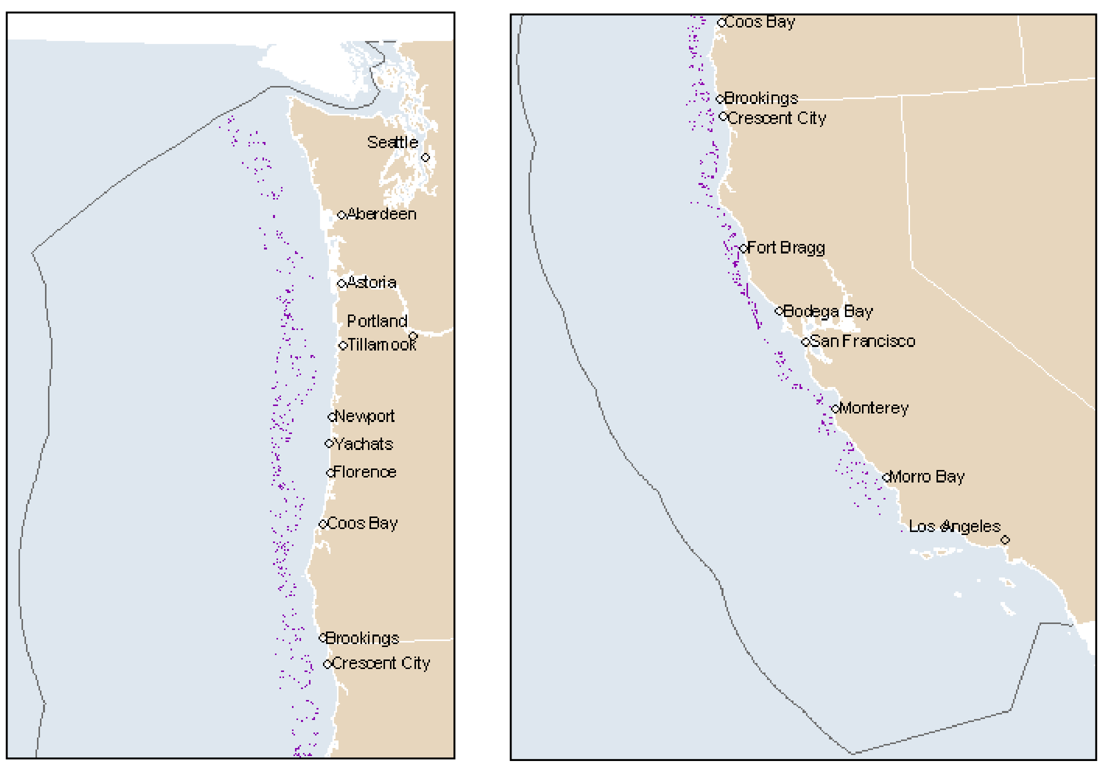
Item (year=2001)	NWFSC Slope Survey	AFSC Triennial Shelf Survey	AFSC Slope Survey
Vessel Type	Chartered West Coast trawler	Chartered Alaska Trawler	Fisheries Research Vessel
Period	1998-ongoing	1977-2001	1984-ongoing
Frequency	Annual	Triennial	Annual since 1988

Item (year=2001)	NWFSC Slope Survey	AFSC Triennial Shelf Survey	AFSC Slope Survey
Survey Type and depth	Slope (100-700 fathoms)	Shelf (30-200 fathoms)	Slope (100-700 fathoms)
LOA Vessel	68-92 ft.	125-128	225
Survey Design	Stratified by lat & depth/random by depth & proximity	Stratified by lat & depth, somewhat fixed stations	Stratified by lat & depth, somewhat fixed stations
Yearly use of same survey vessels	Yes in some instances but not intent of design	Yes, if possible	Yes
Survey Time of the Year	Summer	Summer	Fall
No of vessels available for hire	Approx. 40 (Have used 9 vessels to date)	At least 100	1
No of scientists on board	3	6	12
No of hours vessel worked/day fishing (daytime or round the clock)	14 (daytime only sampling)	14 (daytime only sampling)	24 (round the clock sampling)
Days At Sea (2001)	166	130	28
Average no of tows/day (2001)	2.01	3.89	7.43
Number of attempted tows (exclude experimental)	408	539	216
Number of valid tows*	334	506	208
Net Mensuration	Yes	Yes	Yes
All Fish Species Identified	Yes	Yes	Yes
Invertebrate Species ID	No, only crab identified	Yes, all invert spp.	Yes, all invert spp.
No of different length spp.	4 primary, 15 total	28 primary, 77 total	9 primary, ? total
Average no of lengths collected/tow	196	510	545
Average no otoliths collect/haul/vessel	18	15	40
Commercial fish retained?	Yes	No	No
Targeted Tow Duration	15 mins	30 mins	30 mins
Average lift off-lag time (minutes)	4.5	0.4	"almost immediately"
Range of Lift off-lag times	1-20 minutes	0-2 minutes	NA
Average no of weather days	0.5	0.75	0

* Difference in number of valid tows is highly correlated to whether tow location is fixed or random from year to year



(a)



(b)

Figure 8. Survey station locations for the AFSC Slope and Shelf Surveys (a) and the NWFSC Slope Survey (b). Graphics created by TerraLogic GIS Inc.

2.3.2 Ichthyoplankton surveys

In this section we describe surveys that have been undertaken that could provide some information on the distribution of planktonic phases of groundfish species. In fact, data from these surveys have not been used in the EFH model. They do not provide a comprehensive coast wide coverage and, where possible, fish habitat in the water column has been described using information on the latitude and depth ranges of the species and life stages in question (see Section 2.2.4).

2.3.2.1 CalCOFI Ichthyoplankton Surveys

The California Cooperative Oceanic Fisheries Investigations unit has conducted standardized ichthyoplankton surveys, primarily offshore of California and Baja California since 1951. Survey methods and results are described by Moser, et al. (1993). GIS maps of egg and larval distributions of managed species have been developed from data collected during these surveys (NMFS 1998).

2.3.2.2 NMFS Icthyoplankton Surveys

Research surveys extending from the Strait of Juan de Fuca to northern California and offshore to the boundary of the Exclusive Economic Zone (200 miles) were conducted periodically during the 1980s. They were intended to complement the egg and larval data obtained from the CalCOFI ichthyoplankton surveys and NMFS conducted these surveys cooperatively with the Soviet Pacific Research Institute. Survey methods and their results are described by Doyle (1992). Data on egg and larval distribution were used to develop the GIS maps of NMFS ichthyoplankton survey results in the 1998 EFH Appendix.

2.3.3 NOAA Atlas

In the late 1980's, NOAA compiled information about several commercially-valuable groundfish species on the west coast. This information was synthesized into a hand-drawn map atlas format showing the species distribution for various life stages (NOAA, 1990). The source data for these maps included NMFS' RACEBASE, commercial and recreational catch statistics, state or regional agency data, and expert review. The scale of these maps is generally 1:10,000,000. In the 1990's these atlas maps were converted to GIS format. This conversion included clipping the species polygons with a 1:2,000,000 land polygon. The 13 groundfish species and life stages that are available in GIS format are listed in Table 5.

Table 5. Groundfish distributions mapped in the NOAA Atlas (1990).

COMMON NAME	SPECIES NAME	Life History Stage: adult	juvenile	mating	old juvenile	young juvenile	spawning	release of young	range
arrowtooth flounder	Atheresthes stomias	x	x						
Dover sole	Microstomus pacificus	x	x				x		
English sole	Parophrys vetulus (=Pleuronectes vetulus)	x			x	x	x		
flathead sole	Hippoglossoides elassodon	x	x				x		
lingcod	Ophiodon elongatus	x	x				x		x
Pacific cod	Gadus macrocephalus	x			x	x	x		
Pacific hake (prev. Pacific whiting)	Merluccius productus	x				x	x		
Pacific ocean perch	Sebastes alutus	x		x	x			x	
petrale sole	Eopsetta jordani	x			x	x	x		
sablefish	Anoplopoma fimbria	x	x				x		
spiny dogfish	Squalus acanthias	x		x	x	x			
starry flounder	Platichthys stellatus	x			x	x	x		
widow rockfish	Sebastes entomelas	x	x	x				x	

2.3.4 Fish/habitat functional relationships

Using habitat distribution information to identify EFH requires some knowledge of the functional relationships between the species of interest (in this case the Pacific Coast Groundfish Fishery Management Unit (FMU)) and the habitats they use. This section describes the information available to describe these relationships.

2.3.4.1 The Updated Life Histories Descriptions Appendix

In 1998, A Life Histories Appendix to Amendment 11 to the Pacific Coast Groundfish FMP described the life histories and EFH designations for each of the 83 individual species that the FMP manages. The appendix was prepared by a team led by Cyreis Schmitt[2] (at the time, affiliated with the Northwest Fisheries Science Center). The primary sources of information for the life history descriptions and habitat associations were published reports and gray literature. GIS maps of species and life stage distributions generated in the format of ArcView were included.

[2] The EFH Core Team for West Coast Groundfish: Ed Casillas, Lee Crockett, Yvonne deReynier, Jim Glock, Mark Helvey, Ben Meyer, Cyreis Schmitt, and Mary Yoklavich, and staff: Allison Bailey, Ben Chao, Brad Johnson, and Tami Pepperell

The Life Histories Appendix was intended to be a "living" document that could be changed as new information on particular fish species became available, without using the cumbersome FMP amendment process. The EFH regulations state that the Councils and NMFS should periodically review and revise the EFH components of FMPs at least once every 5 years. In response to this requirement for periodic review, the life history descriptions were recently updated by Bruce McCain with assistance from Stacey Miller and Robin Gintner of the NOAA Fisheries, Northwest Fisheries Science Center (NOAA Fisheries 2003). The update was compiled by conducting literature searches using the *Cambridge Scientific Abstracts Internet Database Service* and by reviewing recently completed summary documents, such as the California Department of Fish and Game's Nearshore Fishery Management, the Oregon Department of Fish and Wildlife's Nearshore Fisheries Management Plan, and *The rockfishes of the Northeast Pacific* by Love *et al*. (2002). Within the updated appendix, the current 82 FMP groundfish species are sequenced alphabetically according to the common names (Appendix 4). This document also includes nine summary tables and a list of references cited.

The Life Histories Appendix provides an extensive and detailed reference on species/life stage and habitat interactions. However, detailed bathymetry information for all species' life stages is incomplete at present. Furthermore, the information on substrate is somewhat patchy, and the classification of substrates and habitats is inconsistent across species. Some of these problems are unavoidable. For example, although most groundfish species are demersal, some life stages (for example, eggs and larvae) are sometimes pelagic. It is therefore difficult in some instances to associate these life stages with a particular habitat.

The updated Appendix has been presented to the PFMC in draft form so that NOAA Fisheries can consider appropriate comments prior to its inclusion in the EIS. Specifically, comments are being sought on the types of habitat preferred by various life history stages of the FMP species, and on species-habitat relationships not adequately addressed in this draft.

2.3.4.2 The habitat use database

The Life Histories Appendix (NOAA Fisheries 2003) also provides a valuable compilation of information on the habitat preferences of all the species and life stages in the Pacific Coast Groundfish FMP to the extent known. However, the text format in which the information is presented does not lend itself well to analysis of habitat usage across many habitat types or many species and life stages.

A Pacific Coast Groundfish Habitat Use Relational Database was therefore developed to provide a flexible, logical structure within which information on the uses of habitats by species and life stages could be stored, summarized, and analyzed as necessary. The database is designed primarily to capture the important pieces of information on habitat use by species in the Pacific Groundfish FMP as contained in the Updated Life History Descriptions Appendix compiled by NMFS (see Section 2.2.2.1). This Appendix contains information on each of the species in the groundfish FMP, and includes range, fishery, habitat, migrations and movements, reproduction, growth and development, and trophic interactions. Certain elements of this information need to be captured in a database format so that habitat use data can be analyzed both by species and habitat to provide input into various components of the analysis of EFH, HAPCs and fishing impacts (See Appendix 8 - Manual of the Habitat Use Database).

2.3.4.3 Habitat Suitability Modeling

Habitat suitability modeling (HSM) is a tool for predicting the quality or suitability of habitat for a given species based on known affinities with habitat characteristics, such as depth and substrate type. This information is combined with maps of those same habitat characteristics to produce maps of expected distributions of species and life stages. One such technique is termed habitat suitability index (HSI) modeling. A suitability index provides a probability that the habitat is suitable for the species, and hence a probability that the species will occur where that habitat occurs. If the value of the index is high in a particular location, then the chances that the species occurs there are higher than if the value of the index is low. HSI models use regression techniques to analyze data on several environmental parameters and calculate an index of species occurrence. This methodology has potential for use in designating EFH and HAPC, and an example application by scientists from the National Ocean Service (NOS) is described in Appendix 5. It is also described in more detail in various scientific publications (see for example Christensen *et al*. 1997, Clark *et al*. 1999, Coyne and Christensen 1997, Rubec *et al*. 1998, Rubec *et al*. 1999, Monaco and Christensen 1997 and Brown *et al*. 2000).

Habitat suitability indices are an important component of the EFH model described in Section 0. Use of this approach, and particularly the modeling of NMFS survey data, to obtain the indices are described in that section.

3 MODELING EFH

3.1 Introduction

The EFH Final Rule provides regulations and guidance on the implementation of the EFH provisions of the M-S Act. It includes information on the types of information that can be used for describing and identifying EFH. In this study, we have developed a modeling approach for assessing the likely importance of habitats for each species and life stage in the FMP, to the extent that data are available to do so. This is done by evaluating the probability that particular habitats are suitable for particular species and life stages, based on available data sources; the NMFS groundfish surveys (Section 2.3.1) for as many species as possible, and information on habitat associations from the habitat use database (Section 2.3.4.2) for other species and life stages. The model is required to provide a scientific method for assessing Pacific coast groundfish habitat and developing management alternatives for identification of EFH.

The model has been designed to take advantage of the GIS data and literature review under development by NOAA Fisheries. It was recognized at the outset that this assessment was occurring in a data-poor environment and therefore output had to be expressed in terms of probabilities rather than absolute numbers. Presentations of the methodology have been made to the TRC and the SSC of the Pacific Fishery Management Council. Adjustments to the methodology have been made based on input of these committees.

3.2 Network models

Bayesian Belief Networks (BBN), a particular type of network model, were chosen as a suitable analytical tool for developing the EFH model. The essential features of BBN models and the reasons why this approach was used are described in the following sections.

3.2.1 Why Network Models?

Traditional statistical modeling defines and builds models for a response (outcome) in terms of sets of explanatory variables (attributes). Each explanatory variable in a model is seen as *directly* impacting on the response variable. With explanatory variables x_1, x_2, …, x_p, and response y, the situation can be represented by the diagram in
Figure 9.

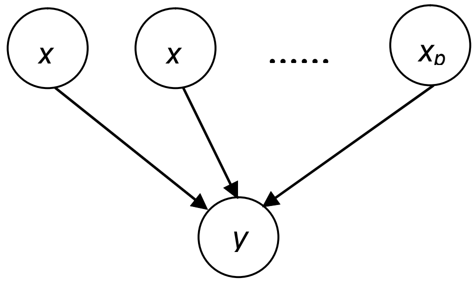


Figure 9 . Explanatory variables directly impacting on a response variable.

In reality, however, it can happen that the relationships between variables are not as simple as this model allows. The effect of one *x*-variable on the response *y* may be mediated through another *x*-variable, or through two or more *x*-variables. It could also happen that some of the *x*-variables affect some of the others. Indeed, with datasets containing many variables, it is easy to envisage quite complex patterns of association. The roles of “response” and “explanatory” become blurred, with variables taking on each role in turn. In a simple example, illustrated in Figure 10, variables *E* and *D* could be regarded as “responses”, and *A* and *B* as “explanatory.” But *C* seems to play both roles. It looks like a response with *A* and *B* acting as explanatory variables, and it is an “explanatory” variable for *E*. The variables are modeled as random variables and the links are probabilistic. A link from *A* to *C* would be interpreted as meaning that the value of *A* affects the value of *C* by means of influencing the probability distribution of *C*.

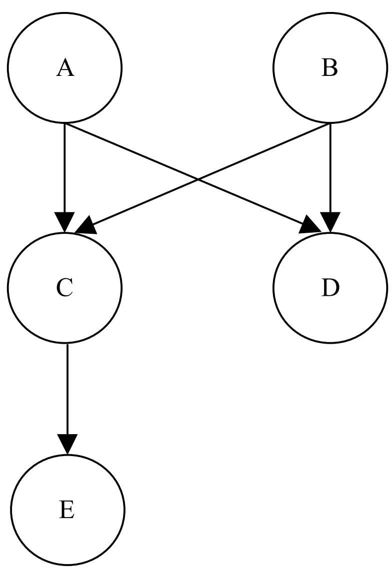


Figure 10. Indirect mediation of effects of explanatory variables.

Historically, these models evolved largely in the artificial intelligence (AI) community, and form the basis of *expert systems*. Generally they are not tools for statistical inference but rather they are mechanisms for encoding probabilistic causal relationships and making predictions from them. Because of their AI background, it is not surprising that the current terminology of network models is quite different from statistical terms, and is perhaps less familiar. Sometimes there is an exact correspondence between an AI term and a statistical one, the two terms being different names for the same concept.

3.2.2 Bayesian Networks

Early applications of Bayesian networks (BN) were in medical diagnosis and genetics, but recently there has been an explosion in their use, including for environmental impact assessment, tracing faults in computer systems and software, robotics, and many other areas (see Appendix 6 for sources of information on BNs). A growing area of interest is the management of natural resources under uncertainty. For example, a BN model was developed for assessing the impacts of land use changes on bull trout populations in the USA (Lee 2000). Another recent application of BNs is modeling uncertainties in fish stock assessment and the impact of seal culling on fish stocks (Hammond & O'Brien 2001). Marcot *et al*. (2001) have used BNs for evaluating population viability under different land management alternatives, while Wisdom *et al*. (2002) used BNs in conservation planning for the greater sage-grouse.

The network models that we are using consist of a number of *nodes* (random variables) connected by *directed* links. A node that has a directed link leading from it to another node is called a *parent* node; the latter is a *child* node. Cycles are not permitted: that is, it is not possible to start from any node and, following the directed links, end up back at the same node. Most of the currently available software for building and analyzing BNs requires that the nodes are discrete, taking only a finite set of possible values, and we assume this to be the case in what follows. Continuous variables can be accommodated by grouping their values into class intervals. An introductory account of BNs is given by Jensen (1996) while a more rigorous and complete treatment is Cowell *et al*. (1999).

To explain the basic ideas, consider the simple example from Figure 10. For simplicity, assume that all of the nodes are binary variables, taking values T or F (true or false). The probabilistic mechanism that governs the relationship between, say, *E* and its parent *C* is the *conditional probability distribution* of *E* given *C*. This can be expressed as a table:

	E	
C	*F*	*T*
F	p_{00}	p_{01}
T	p_{10}	p_{11}

The table of conditional probabilities for node *C*, which has parents *A* and *B,* would have the following form:

		C	
A	*B*	*F*	*T*
F	*F*	p_{000}	p_{001}

F	*T*	p_{010}	p_{011}
T	*F*	p_{100}	p_{101}
T	*T*	p_{110}	p_{111}

A node with no parents (*A* or *B* in the example) would have just a *prior* probability table:

A	
F	*T*
p_0	p_1

The complete specification of a BN consists of

(a) the set of nodes,
(b) the directed causal links between the nodes,
(c) the tables of conditional probabilities for each node.

3.2.3 Estimating the Conditional Probabilities

In practice, there are several possible ways of obtaining estimates for the conditional (and prior) probabilities. If sufficient data are available then cross-tabulating each node with its parents should produce the estimates. There are alternatives to deriving the probabilities from data, however. It is possible to use *subjective* probabilities or *degrees of belief*, usually encoded from expert opinions. In many of the early applications of BNs in medical diagnosis this was generally the approach that was used. There has been some recent research into developing systematic ways of *eliciting* prior beliefs from experts and building probability distributions from them (O'Hagan 1998).

3.2.4 Evidence and Updating

In the simple example of Figure 3, if the states of the nodes (i.e. the values of the variables) *A* and *B* were known, then it would be possible to use the rules of probability to calculate the probabilities of the various combinations of values of the other nodes in the network. This kind of reasoning in a BN can be called "prior to posterior," in the sense that the reasoning follows the directions of the causal links in the network. Suppose now that the state of node *E* were known. What could be said about the other nodes? The *updating algorithm* of Lauritzen and Spiegelhalter (1998) allows us to calculate the posterior probabilities of all other nodes in the network (and this works for *any* BN), given the known value at *E*, or indeed, given any combination of known nodes. In the jargon of expert systems, "knowing" the value of a node is called "entering evidence." This is "posterior to prior" reasoning and allows us to infer something about the states of nodes by reasoning *against* the direction of the causal links. The updating algorithm is a very powerful tool in BNs and enables us to make useful predictions and examine "what if" scenarios with ease. Various software packages are available which facilitate the construction of BNs and implement the updating algorithm. For this project, we are using the program Netica (Norsys 1998).

3.3 The EFH Model

3.3.1 Introduction

The M-S Act defined EFH to mean "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (M-S Act § 3(10)). This defines EFH, but does not specify how to distinguish among various parts of a species' range to determine the portion of the range that is essential. The EFH Final Rule (50CFR Part 600) elaborates 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 process of distinguishing between all habitats occupied by managed species and their EFH requires one to identify some difference between one area of habitat and another. In essence, there needs to be a characterization of habitats and their use by managed species that contains sufficient contrast to enable distinctions to be drawn, based on available information. This needs to be a data driven exercise, and the methodology we have developed aims to use all available data with which to make such a determination.

In this context, we also note that if a species is overfished and habitat loss or degradation may be contributing to the species being identified as overfished, all habitats currently used by the species may be considered essential. We note, however, that fish stocks depleted by overfishing, or by other factors, are likely to use less of the available habitat than a virgin stock or a stock at "optimum" biomass would use. Indeed, other species may have expanded their range to fill some of these ecological niches. Certain historic habitats that are necessary to support rebuilding the fishery and for which restoration is technologically and economically feasible may also be considered as essential. Once the fishery is no longer considered overfished, the EFH identification should be reviewed and amended, if appropriate (EFH Final Rule CFR 600.815(a)(1)(iv)(C)).

3.3.2 Habitat characteristics of importance for fish

Habitat characteristics comprise a variety of attributes and scales, including physical (geological), biological, and chemical parameters, location, and time. It is the interactions of environmental variables that make up habitat that determine a species' biological niche. These variables include both physical variables such as depth, substrate, temperature range, salinity, dissolved oxygen, and biological variables such as the presence of competitors, predators or facilitators.

Species distributions are affected by characteristics of habitats that include obvious structure or substrate (e.g., reefs, marshes, or kelp beds) and other structures that are less distinct (e.g., turbidity zones, thermoclines, or fronts separating water masses). Fish habitat utilized by a species can change with life history stage, abundance of the species, competition from other species, environmental variability in time and space, and human induced changes. Occupation and use of habitats by fish may change on a wide range of temporal scales: seasonally, inter-annually, inter-decadal (e.g. regime changes), or longer. Habitat not currently used but potentially used in the future should be considered when establishing long-term goals for EFH and species productivity. Habitat restoration will be a vital tool to recover degraded habitats and improve habitat quality and quantity, enhancing benefits to the species and society.

Fish species rely on habitat characteristics to support primary ecological functions comprising spawning, breeding, feeding and growth to maturity. Important secondary functions that may form part of one or more of these primary functions include migration and shelter. Most habitats provide only a subset of these functions. The type of habitat available, its attributes, and its functions are important to species productivity and the maintenance of healthy ecosystems.

3.3.3 Identifying EFH for the FMP

According to the M-S Act, EFH must be described and identified for the fishery as a whole (16 U.S.C. §1853(a)(7)). The EFH Final Rule clarifies that every FMP must describe and identify EFH for each life stage of each managed species. As further clarification, NOAA General Counsel has stated that "Fishery" as used in the M-S Act in reference to EFH refers to the FMU of an FMP. The EIS must therefore develop alternatives for EFH based on individual species/life stages aggregated to a single EFH designation for Pacific Coast Groundfish. In the EIS, a single map will be used to describe and identify EFH for the fishery. However, the analysis that produces that map will include the preparation of electronic maps of EFH for as many species and life stages as possible.

Designation of EFH for a fishery is therefore achieved through an accounting of the habitat requirements for all life stages of all species in the FMU. Prior to designating EFH for a fishery, the information about that fishery needs to be organized by individual species and life stages. If data gaps exist for certain life stages or species, the EFH Final Rule suggests that inferences regarding habitat usage be made, if possible, through appropriate means. For example, such inferences could be made on the basis of information regarding habitat usage by a similar species or another life stage (50 CFR Pt. 600.815(a)(iii)). All efforts must be made to consider each species and life stage in describing and identifying EFH for the fishery and to fill in existing data gaps using inferences prior to determining that the EFH for the fishery does not include the species or life stage in question. As explained in Section 2.1.2, the CEQ Regulations mandate a process for dealing with incomplete or unavailable information

While identification of EFH is carried out at the fishery (FMP) level, the determination of whether an area should be EFH depends upon habitat requirements at the level of individual species and life stages. Potentially, only one species/life stage in the FMU may be required to describe and identify an area as EFH for the FMP. Many areas of habitat, however, are likely to be designated for more than one species and life stage. The composite habitat requirements for all the species in the Pacific coast groundfish FMP are likely to result in large areas of habitat being described and identified as EFH, due to the overlay multiple species habitat needs. The FMP for the groundfish fishery includes 82 species (Appendix 4). Descriptions of groundfish fishery EFH for each of the 82 species and their life stages resulted in over 400 EFH identifications in the 1998 EFH Amendment. When these individual identifications were taken together, EFH for the groundfish FMP included all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon and California seaward to the boundary of the U.S. Exclusive Economic Zone.

The identification of substantial portions, if not all of the EEZ as EFH has been seen as a weakness in the EFH mandate, because if "everything" is EFH then the designation process apparently fails to focus conservation efforts on habitats that are truly "essential." However, this conclusion does not take into consideration that the distinction between all habitats occupied by a species and those that can be considered "essential" is made at the species and life stage level. The designation of EFH at the FMP level delineates a static two dimensional boundary for consultation purposes. A consultation process will be triggered when an agency plans to undertake an activity that potentially impacts habitat within the boundary of the area designated as EFH. The resulting consultations will consider how the proposed action potentially impacts EFH. The detailed characteristics of the habitat in the relevant location will be an important part of this analysis. In this context, it is possible to envision that an area of EFH that has been designated as such for a particularly large number of species and life stages, or is particularly rare, or stressed or vulnerable might be of particular concern. In recognition of this, the Final Rule encourages regional Fishery Management Councils to identify habitat areas of particular concern (HAPC) within areas designated as EFH (600.815(a)(8)).

3.3.4 Use of information for identifying EFH

The EFH Final Rule explains that the information necessary to describe and identify EFH should be organized at four levels of detail, level 4 being the highest and level 1 the lowest:

Level 4 – production rates by habitat are available
Level 3 – growth, reproduction, or survival rates within habitats are available
Level 2 – habitat-related densities of the species are available; and
Level 1 – distribution data are available for some or all portions of the geographic range of the species.

The table below provides additional detail on the meanings to be inferred from this list.

Layer	Possible units/information sources
Level 4: Production rates	Overall production rates can be calculated from growth, reproduction and survival rates. However, using this information to describe and identify EFH requires not only that production rates have been calculated, but also that they have been calculated for different patches of habitat that can then be distinguished from each other. According to the EFH Final Rule, 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. Essential habitats are those necessary to maintain fish production consistent with a sustainable fishery and the managed species' contribution to a healthy ecosystem.

Layer	Possible units/information sources
Level 3: Growth, reproduction or survival rates	Similar to information on overall production rates, it can be used to describe and identify EFH. Growth, reproduction and survival rates would need to have been calculated for different patches of habitat that can then be distinguished from each other. According to the EFH Final Rule, at this level, data are available on habitat-related growth, reproduction, and/or survival by life stage. The habitats contributing the most to productivity should be those that support the highest growth, reproduction, and survival of the species (or life stage).
Level 2: Density	Relative density information may be available from surveys, or it could perhaps be inferred from catch per unit effort data, although only for those areas that have been fished. According to the EFH Final Rule, at this level, quantitative data (i.e., density or relative abundance) are available for the habitats occupied by a species or life stage. Because the efficiency of sampling methods is often affected by habitat characteristics, strict quality assurance criteria should be used to ensure that density estimates are comparable among methods and habitats. Density data should reflect habitat utilization, and the degree that a habitat is utilized is assumed to be indicative of habitat value. When assessing habitat value on the basis of fish densities in this manner, temporal changes in habitat availability and utilization should be considered.
Level 1: Distribution	Distribution information is available from surveys, catch/effort data, and evidence in the biological literature, including ecological inferences (e.g. - a habitat suitability index, HSI). According to the EFH Final Rule, distribution data may be derived from systematic presence/absence sampling and/or may include information on species and life stages collected opportunistically. In the event that distribution data are available only for portions of the geographic area occupied by a particular life stage of a species, habitat use can be inferred on the basis of distributions among habitats where the species has been found and on information about its habitat requirements and behavior. Habitat use may also be inferred, if appropriate, based on information on a similar species or another life stage.

In developing a process for identifying EFH we have built a model that expresses the probability that a particular location contains suitable habitat for species in the groundfish FMP (see Section 0), based on our knowledge of the habitat conditions at that location and of the habitat preferences of those species. As recognized in the EFH Final Rule, the only true measure of habitat suitability is obtained through measurement of demographic parameters (production, mortality, growth, and reproductive rates – levels 4 and 3 described above). For example, EFH could be defined as areas with above-average survival, growth or recruitment (which for ease of exposition we will refer to as areas of high growth potential). However, data on these parameters across a range of habitats are extremely difficult to obtain. Fish population density, or even presence/absence in data-poor situations (levels 2 and 1 respectively) are often used as a proxy for growth potential. However, growth potential and density are not necessarily well correlated. For example, in source-sink systems, source populations may have lower densities than sink populations (because they are exporting propagules), even though they are the basis for the overall population’s growth potential (Lundberg and Jonzen 1999a, b).

In a spatially heterogeneous system, in which source-sink dynamics are likely to be occurring, EFH should be protecting source areas, and not inadvertently protecting sink areas. There is a risk that this can occur if population density is used as a proxy for growth potential. The risk is further exacerbated under harvesting pressure, if source populations are being more heavily fished than sink areas (Tuck and Possingham 1994). Similarly, in a heavily perturbed system, in which external factors such as pollution may be distorting the natural spatial patterns of growth potential, current population density may be a poor proxy for EFH under protected conditions. The question then is whether EFH or HAPC designations should be acting to protect areas that would have high growth potential if protected, or whether they should be protecting areas that currently have higher growth potential regardless of their intrinsic value as EFH. By using data on presence/absence or population density that are collected in a perturbed system under current conditions, we are attempting to do the latter, but without a clear understanding of the relationship between density and growth potential.

The EFH Final Rule requires using the highest level of information (production rates) first if it is available, followed by the second highest level (growth, reproduction or survival rates) and so on. Information at levels 2 through 4, if available, should be used to identify EFH as the habitats supporting the highest relative abundance; growth, reproduction, or survival rates; and/or production rates within the geographic range of a species. The guidelines also call for applying this information in a risk-averse fashion to ensure adequate areas are protected as EFH. The most complete information available should be used to determine EFH for the FMP, accounting for all species and their life stages that it contains. If higher level information is available for only a portion of the species/life stage range then is should be used for at least that portion. A decision also needs to be made regarding if and how the information could be used to extrapolate to the rest of the range. Information at lower levels should be used only where higher-level information is unavailable and cannot be validly extrapolated.

There is an implicit link between the level of information available for species and life stages and the extent of EFH that is likely to be designated for that species/life stage. Figure 11 illustrates the expectation that on a relative scale, if information is available at level 4, it is likely to be possible to identify a smaller portion of the overall range of a species as EFH, than if we are relying on less precise or proxy information at lower levels. For example, an identification of EFH based on areas where of production rates are highest is likely to result in a smaller area than one based on basic distribution data, because production rates are unlikely to be at their highest level throughout the species range. Rather they will be highest where habitat conditions are optimal for the species and life stage in question.

Figure 11 is, however, an oversimplification. It is not always the case, for example, that the EFH identified based on the higher level of information will be entirely within the area identified based on the lower level. As indicated above in the discussion of source-sink dynamics, EFH identified on the basis of areas of highest density (level 2) might not necessarily encompass the areas of highest productivity for some life stages. It does demonstrate, however, that if we are relying on information at lower levels, it is important to use that information in such a way that it does provide sufficient contrast to offer a range of alternatives for identifying as EFH what are believed to be the most important parts of the range of each species and life stage in the FMP. Although identifying a large area as EFH would seem to be the most risk averse approach, it is not sufficient to do this without adequate justification. As mentioned previously, the EFH Final Rule (600.815(a)(1)(iv)(A)) requires that FMPs explain how EFH for a species is distinguished from all habitats potentially used by that species, in order to improve understanding of the basis for the designations.

If only Level 1 information is available, distribution data should be evaluated (e.g., using a frequency of occurrence or other appropriate analysis) to identify EFH as those habitat areas most commonly used by the species. FMPs should explain the analyses conducted to distinguish EFH from all habitats potentially used by a species. Such analyses should be based on geo-referenced data that show some areas as more important than other areas, to justify distinguishing habitat and to allow for mapping. The data must at least show differences in habitat use or in habitat quality that can be linked to habitat use.

If no information for a species/life stage is available at the lowest level (distribution) and it is not possible to infer distribution from other species or life stages, then EFH cannot be identified for that species designated (600.815(a)(1)(iii)(B)). CEQ regulations (1502.22) require agencies to make clear when information is lacking.

3.3.5 Types of information available for identifying EFH

There are two main categories of information available that can be used to describe and identify EFH:

- Empirical geo-referenced data on species distributions, densities, and/or productivity rates derived from analyses of surveys and commercial catches. These data are essentially independent of the underlying habitat.

- Information about associations and functional relationships between species/life stages and habitat that can be used to make inferences about species distributions, density and/or productivity rates, based on the distribution of habitat.

Information at all four levels of detail described in the EFH Final Rule may exist in both of these categories. Examples of such are provided Table 6. Only the shaded cells of Table 6 contain information that is currently available for identifying EFH under the Groundfish FMP. Virtually no information exists at levels 3 and 4 and none of the information that does exist at these levels could be used to distinguish between different areas of habitat with sufficient contrast to indicate that one should be identified as EFH and another should not.

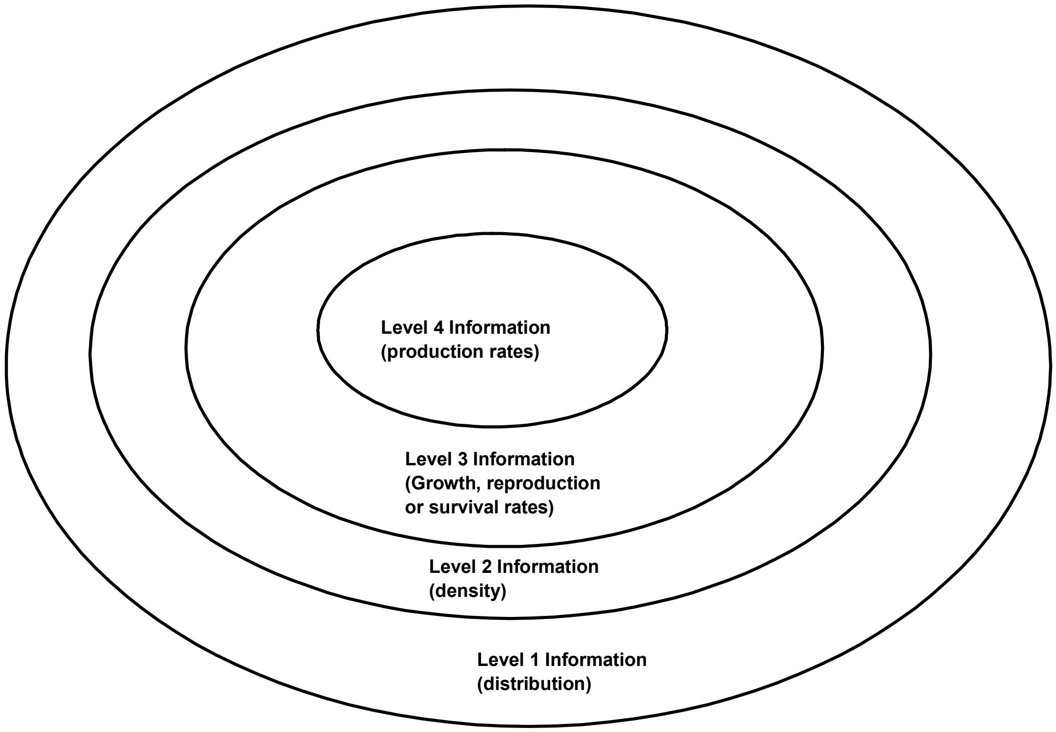


Figure 11. Diagrammatic representation of the effect of levels of information and the relative extent of the area of EFH likely to be identified for an individual species/life stage (not to scale).

Table 6. Types of information that could be used at the four levels of detail described in the EFH Final Rule (only the shaded cells contain information that is currently available for identifying EFH).

	Empirical geo-referenced information	**Species-Habitat relationship modeling**
Level 4 – production rates by habitat	*In situ* physiological experiments and mortality experiments	Life history-based meta-population models
Level 3 – growth, reproduction, or survival rates within habitats	Tagging data (growth) Fecundity data by area	Spatially discreet stock/recruitment relationships; Bio-energetics models
Level 2 – habitat-related densities of the species	Survey/fishery related CPUE as proxy for density	Spatial modeling of habitat suitability probability, based on cpue (proxy for density)
Level 1 – distribution data	Trawl survey data and the NOAA Atlas (Sections 2.2.1 and 2.2.2)	Habitat-species associations (Section 2.2.3); Spatial modeling of habitat suitability probability, based on presence/absence

3.3.6 BN model for identification of EFH

Robust methods need to be devised for identifying EFH in a climate of uncertainty. Various sources of data are available for doing this (Section 3.3.4, Table 6). The approach adopted in the BN model for identification of EFH falls under the heading of spatial modeling of habitat suitability probability (Levels 1 and 2 under species-habitat relationship modeling in Table 6).

The BN model takes information about the preferences of species/life stages for certain habitat conditions, in the form of Habitat Suitability Indices (HSIs), and uses this to plot habitat suitability probabilities (see Section 3.3.6.1) across the habitat parcels mapped in the GIS. Three habitat attributes or parameters are used in the west coast model to describe the habitat conditions: depth, latitude and habitat type, where habitat type comprises two characteristics: substrate and topography. Taken together, these three parameters are considered to provide a reasonable basis for predicting the habitat suitability probability for all species and life sages in the groundfish FMP.

3.3.6.1 Habitat suitability probability

The model therefore requires suitability indices for depth, latitude and habitat type, taking into account any interactions that might exist between them (for example, a species preferred depth range may vary with latitude).

A habitat suitability probability (HSP) is a measure of the likelihood that a habitat with given characteristics is suitable for a given fish species/life stage or species/lifestage assemblage. HSP is the output of the Bayesian network model for determining essential fish habitat (EFH). It represents the quantitative link between habitat characteristics (habitat type, depth and latitude) and the probability of occurrence of species in the FMP (3.3.6.1).

The overall HSP is calculated from separate probabilities derived from HSIs for each habitat characteristic, which can be derived from various sources. To date, most approaches have been based on linear regression modeling of abundance data (Clark *et al* 1999, Rubec *et al* 1999, Brown *et al* 2000, Rubec *et al* 1998, Christensen *et al* 1997). However, the association between fish abundance and quantitative habitat characteristics is typically non-linear, and possibly quite complex.

National Ocean Service (NOS) scientists have developed draft habitat suitability models for 18 fish and 1 invertebrate for the biogeographic assessment of the three central California marine sanctuaries. Bathymetry (meters) and bottom substrate were used as the habitat parameters to examine habitat quality for benthic species. Mean sea surface temperature and bathymetry were used to model pelagic species (See Appendix 5 for details of the HSI methodology used by NOS). At the February meeting of the TRC, the possibility of using the NOS HIS data directly in the BN model was discussed. Although these data do provide a useful guide for the BN model, substantial additional work has been needed to develop a complete model of EFH for the FMP. The NOS HSI data cover only a few of the species in the FMP and the study was for a limited geographic area, and hence does not include the effect of latitude. Some concerns have also been expressed regarding the methodology used in the NOS model. The models of the relationships between abundance and habitat characteristics are somewhat rudimentary (e.g. a polynomial regression curve fit of mean log abundance (survey data) by categorical bathymetric class) and not always well representative of the data. Also, the combined HSI values are calculated using the geometric mean, which gives potentially unintended results when one of the individual indices is very low. A more detailed discussion of these issues is presented in Appendix 5.

In recent years, there has been increasing interest in generalized additive models (GAMs) (Hastie & Tibshirani, 1990) which have been particularly useful in modeling fish abundance and related parameters (Swartzman *et al* 1992, Augustin *et al* 1998, Borchers, Richardson *et al*, 1997, Borchers, Buckland *et al*, 1997). The basic idea of a GAM is to fit a regression model in which the explanatory variables are modeled by smooth curves; the fitting algorithm actually estimates the functional form (shape) of these curves.

The NMFS surveys provide a valuable source of data on the occurrence and density (measured as catch per area swept by the net) of fish at sampled locations (stations). The survey data routinely record depth and latitude at sampling stations, but not substrate. Hence they cannot be used directly to describe the effect of all three habitat characteristics of interest in the BN model. A way around this problem would be to use the GIS to overlay the survey stations on the bottom substrate layer and thereby allocate a substrate type to each sample station. This would enable substrate type to be used as a third explanatory variable alongside latitude and depth in a GAM. However, there are several potential problems with this approach that would take some time to resolve. Some of these problems are:

- individual tows cover an area large enough to have a variety of different substrate characteristics;
- the survey records the location of the vessel, not the trawl and the variability in towing conditions makes it very difficult to estimate the actual position of the net on the bottom; and
- the location of sampling stations is not random with respect to substrate because the trawl cannot operate over some substrates (e.g. rocky terrains).

It was therefore decided to use the survey data to develop a model incorporating depth and latitude only and to add in the effect of substrate separately within the network model, based on information recorded in the habitat use database, and other expert opinion (see below). The basic relationships in the BN model for identifying EFH are shown, in a slightly simplified form, in Figure 12.

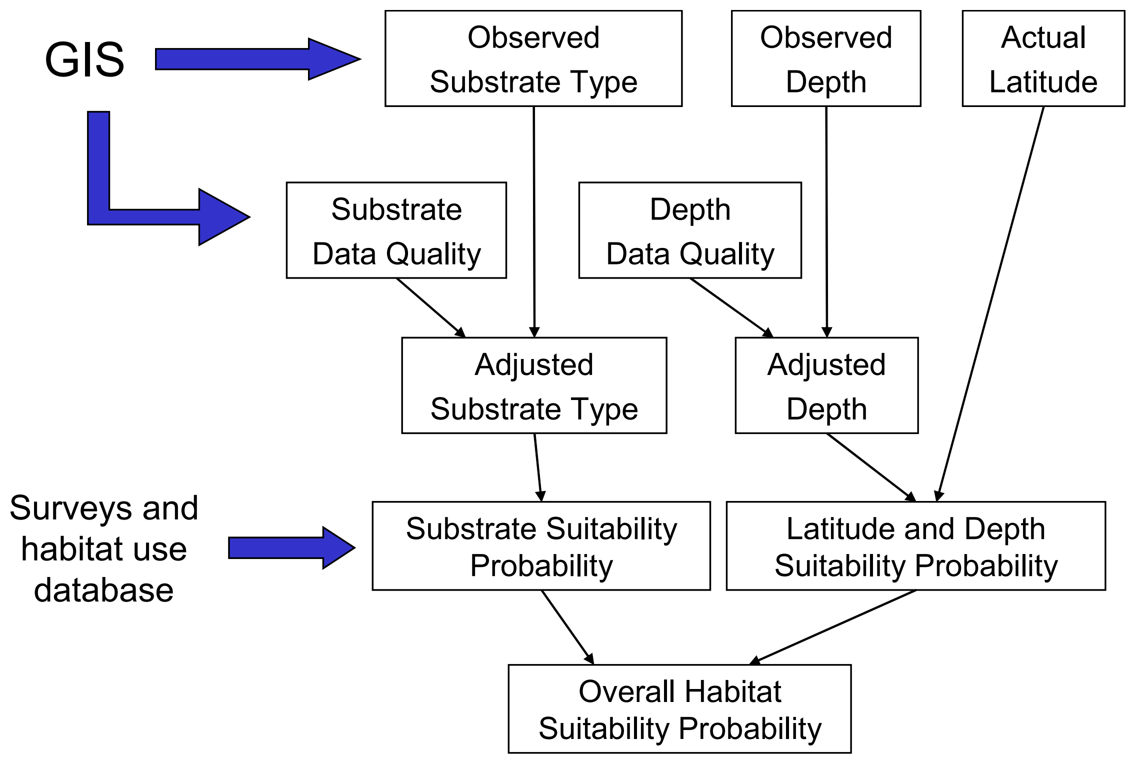


Figure 12. Simplified relationships in the BN model to identify EFH.

3.3.6.1.1 Modeling habitat suitability based on depth and latitude

(i) Using NMFS survey data

An extensive exploratory data analysis was undertaken to investigate the best approach to analyzing the NMFS survey data for the purpose of identifying EFH through the BN model (Appendix 7). Initial runs involved using GAMs to model the effects of depth and latitude on relative abundance (cpue)[3], however, a number of problems were encountered. The first few species analyzed revealed a problem with over dispersion in the cpue data, which are often characterized by a large number of zero values and a very few large values. As described in Section 3.3.4, population density may in fact be a poor proxy for growth potential. Rather than pursue the analysis of the cpue data, it was therefore decided to model the effects of habitat on the presence/absence of fish species in the FMP. In addition to avoiding the problems of over-dispersion in cpue data that were present for some species, this approach was preferred because fitted values are directly interpretable as probabilities that the habitat is suitable for the fish (based on the likelihood that the fish are present), and hence directly applicable to the identification of EFH (See Appendix 7).

[3] There was also an expectation that there would be an interaction between the effects of depth and latitude, which was also investigated.

Following discussion with the Council's SSC, it was noted that GAMs and GLMs that can accommodate zero catches have been commonly used to obtain indices of abundance using West Coast trawl survey data for stock assessment. There are limitations in using presence/absence information to infer the locations of EFH habit. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area. The project team agreed, but had previously concluded that the use of presence-absence from a large number of surveys would provide the most robust result at this stage, even though technically it means that the model essentially discarded level 2 data in favor of level 1 data. While noting also that the analysis of depth and latitude ranges is only part of the input into the EFH model (it uses information on substrate preference also), EFH designations resulting from this analysis can be considered to be reasonable approximations that will need to be refined as additional information becomes available and more sophisticated analyses become possible. [4]

Preliminary results using GLMs to model presence/absence resulted in an over smoothing of the data, giving insufficient contrast in the probability profiles. It was therefore decided to use GAMs rather than GLMs due to the GAMs greater smoothing flexibility. A GAM incorporating a cubic smoother with 6 degrees of freedom was found to smooth the data most adequately [5].

The response was modeled as a Binomial variable (0 = non-present and 1 = present) and the data were fitted by a GAM with a logit link function (See Appendix 7 for details of the development of the modeling approach):

$$P_{(\mathrm{Pr}\,esent))} = \begin{cases} 0 & ;\text{no fish are present in haul} \\ 1 & ;\text{one or more fish are present in haul} \end{cases}$$

In addition to describing the exploratory data analyses, Appendix 7 provides a report on the GAM analysis conducted for the 20 species that were completely covered by the survey data A further 40 species required additional expert opinion to complete heir profiles, because the surveys did not sample in the 0-30 meters depth range. 16 of these have been completed to date. The other 24 species could not be completed, because the experts could not provide the necessary information. The remaining 22 species in the FMP are not covered at all by the NMFS surveys. Profiles on the habitat ranges of the 46 species that could not be completed from the NMFS survey was derived from the habitat use database, described later in this section.

An example of the modeling output (HSP) for depth and latitude is provided in Figure 13. In all cases, the interaction terms between these two explanatory variables proved to be statistically non-significant. This analysis therefore provides values of HSP given depth and latitude. The addition of the effect of physical substrate and biogenic habitat to the model is described in Section 3.3.6.1.2.

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[4] We also note that the NMFS survey data were used for only a minority of the species and life stages mapped.

[5] These decisions regarding the modeling approach were taken by MRAG Americas in consultation with NMFS following discussions at the August 4 meeting of the TRC and subsequent discussions between MRAG Americas and NMFS.

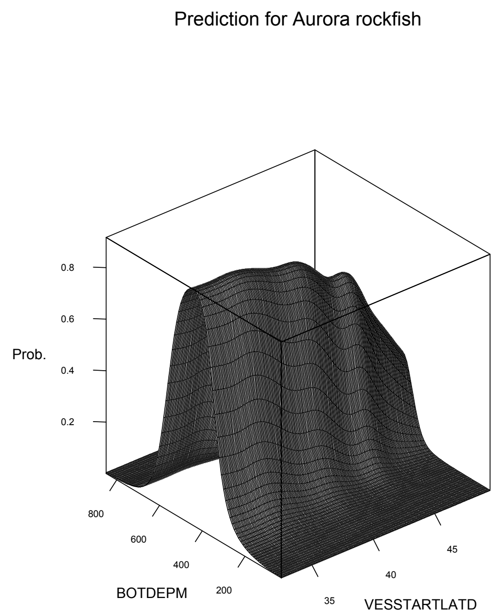

Figure 13. HSP for aurora rockfish.

(ii) Using the Habitat Use Database (HUD)

It was only possible to produce 36 complete habitat suitability probability profiles from the NMFS trawl survey data (including those completed with additional expert opinion). These are considered to be indicative of the HSP for only the adult life stages of the 36 species covered, because of the sampling gear used on the surveys. The habitat preferences of the 82 species are broken down by four life stages: eggs, larvae, juveniles and adults and the identification of EFH needs to account for all of these stages to the extent possible. Therefore, there is a theoretical total of 328 possible HSP profiles (82 x 4). Size composition data are available for many groundfish from the surveys and these could be used to distinguish juveniles from adults in the survey hauls, however, such a detailed analysis was outside the scope of the current study and the size composition data were not used.

The Habitat Use Database (HUD) contains absolute and preferred depth and latitude values for most of the species in the FMP and their life stages. Of the 328 possible combinations, No data are recorded in the HUD for a total of 74 species/life stage combinations, 56 of which are eggs and 17 of which are larvae. A further 94 combinations (mainly larvae and juveniles) have so little data in the HUD that it is not possible to develop profiles. This leaves 124 combinations for which profiles could be developed from the HUD. We therefore developed a method to convert the information on depth and latitude preferences in the HUD into HSP profiles that could be used in the EFH model. This is described in more detail in Appendix 7.

There are up to 4 different values recorded for depth and latitude in the HUD. These are:

AbsMinDepth	Absolute minimum depth
PrefMinDepth	Preferred minimum depth
PrefMaxDepth	Preferred maximum depth
AbsMaxDepth	Absolute maximum depth
AbsMinLat	Absolute minimum latitude
PrefMinLat	Preferred minimum latitude
PrefMaxLat	Preferred maximum latitude
AbsMaxLat	Absolute maximum latitude

Assuming that the habitat will be most suitable somewhere between the preferred minimum and preferred maximum values a fifth value, termed the optimum was created for both depth and latitude.

For simplicity, the discussion below will discuss the depth observations since the same principle will be applied to the latitude observations. Here we use Pacific Ocean perch (adults) to illustrate the approach, because it is a species for which we have both the survey data results and a full complement of data in the HUD. The optimum value in Table 7 is calculated as

$$Optimum_{depth} = \frac{\text{PrefMinDepth} + \text{PrefMaxDepth}}{2}$$

i.e. the mean value between PrefMinDepth and PrefMaxDepth. An index value, which is a proxy for the habitat suitability probability calculated from the survey data is then assigned to each of the five depth points. This has the value of 0.0 at AbsMinDepth and AbsMaxDepth. The optimum is given the value of 1 (the maximum possible value). It then remains to assign index values for the PrefMinDepth and PrefMaxDepth. Following discussions with the SSC's Groundfish Sub-Committee, it was decided to calculate these values from the 36 profiles completed from the survey data. We have the actual habitat suitability probability values at the PrefMinDepth and PrefMaxDepth for these species. We took the averages of these values and used those for the HUD species. These values were 0.19 at PrefMinDepth and 0.236 at PrefMaxDepth.

Table 7: Observed values from the HUD and their assigned HSP index values for Pacific ocean perch Adults.

	Abs Min Depth	Pref Min Depth	Optimum	Pref Max Depth	Abs Max Depth
Value in HUD	25	100	275	450	825
HSP index value	0.0	0.19	1	0.236	0.0

The five points (depth, HSP index) are then plotted in Figure 14 and four lines drawn between them (the line labeled "Habitat"). Data points are extracted from these four lines and fed to a GAM that smoothes the data (the line labeled "Smooth"). The line labeled "Survey" in Figure 14 is the profile that was produced from the GAM analysis of the survey data and is included in the plot to compare with the results obtained from the HUD data. The depth profile in Figure 14 (Smooth) is then extrapolated over the latitude 32 to 49 and the result is shown in Figure 15.

The same procedure is performed for the latitude data and the two profiles are then multiplied together and scaled up so the maximum HSP index value yields 1.

$$HUD_{index} = Depth_{index} \cdot Latitude_{index}$$

Note: these are not probabilities, but rather index values that are scaled up to "1" to be comparable to the probability profiles produced from the NMFS survey data. The final index profile is shown in Figure 16.

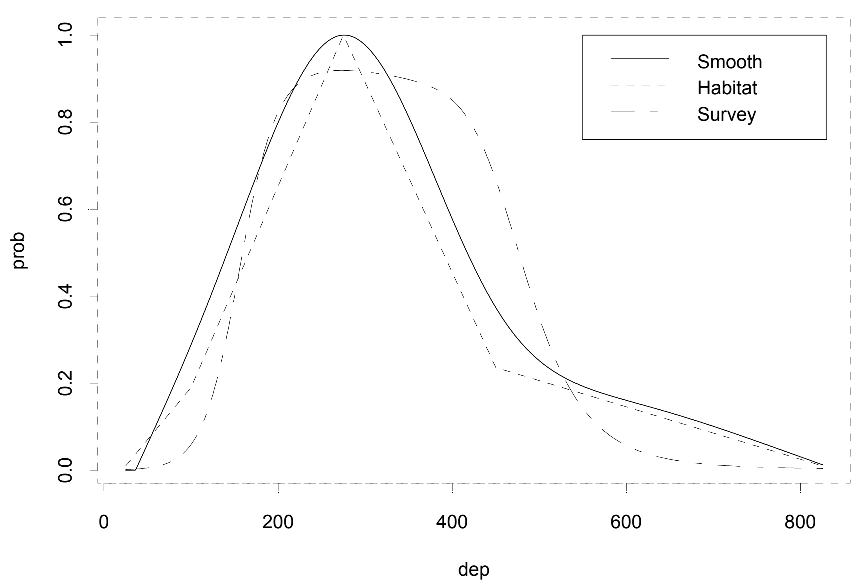

Figure 14: Comparison of probability profiles for depth based on the

survey data and the HUD
(smoothed and unsmoothed)

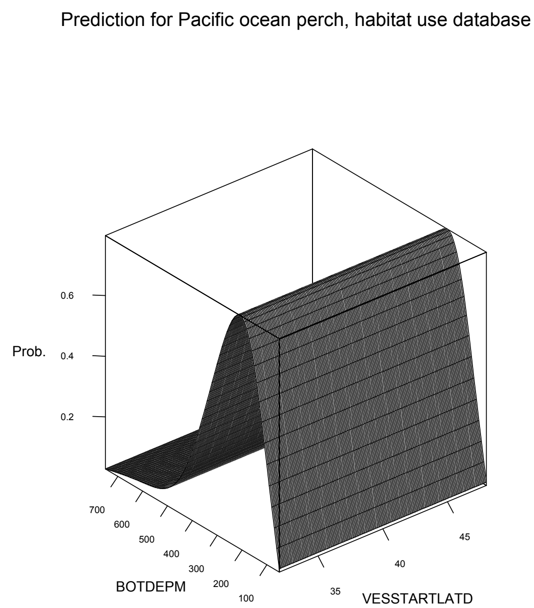

Figure 15: HUD depth profile extrapolated over the latitude interval 32-49 degrees.

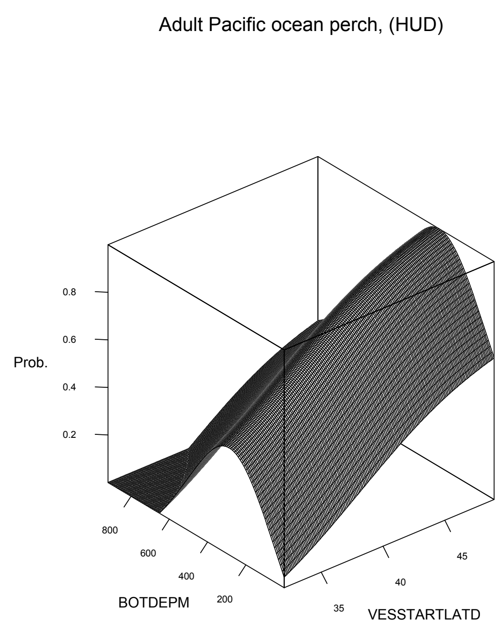

Figure 16: Index profile for adult pacific ocean perch, based on the observations in the HUD.

Figure 17 shows a summary of the outcome of the modeling of depth and latitude profiles for species and life stages in the Groundfish FMP.

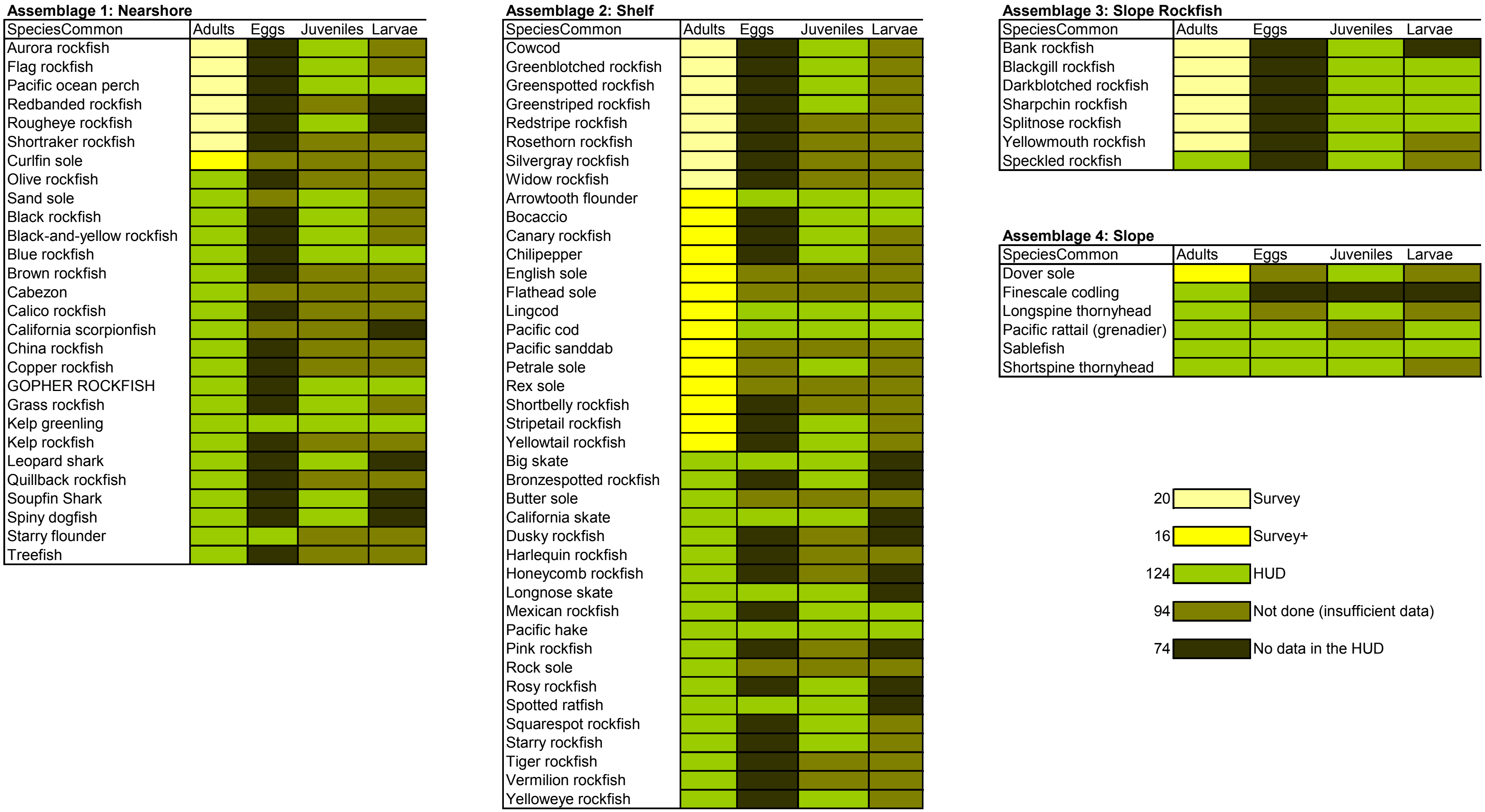

Figure 17 Summary of the species and life stages in the Groundfish FMP, separated into four putative assemblages showing the disposition of methods for modeling the depth/latitude profiles.

3.3.6.1.2 Modeling habitat suitability based on benthic substrate

The habitat use database (Section 2.3.4.2.) contains data on the association between species in the FMP and substrate type. This association is measured in terms of a four point scale: unknown, weak, medium and strong. Unknown refers to the situation where there is no information linking the species with the substrate type. For the purposes of this analysis, this is interpreted as meaning there is no association between the two. In order to incorporate information about substrate preferences into the BN model, the four point scale was translated into habitat suitability probabilities as follows: unknown = 0.33[6], weak = 0.33, medium = 0.66 and strong = 1. These probabilities differ from the probabilities derived from the surveys in that they are subjective and not based directly on actual observational data. They are, however, based on the best scientific evidence available in the literature and currently represent the best available data for including substrate in the BN model. As part of the future analysis, the sensitivity of the output to the assumed probability levels will be investigated, along with the possibility of including a measure of uncertainty into the model. This could be achieved, for example, by expressing the probabilities as ranges or distributions rather than fixed points.

The habitat use database contains a substrate classification system that differs from the system used in the GIS. The latter was devised by Gary Greene (Moss Landing Marine Lab) and is described in Section Appendix 2. The former is based on the Our Living Oceans habitat classification and is shown in Table 8. In order to reconcile the different habitat definitions used in the habitat use database and the GIS we devised a system of correspondence between the two systems. This is described below.

[6] Where the habitat association was recorded as "unknown" in the HUD we assumed that the habitat suitability should be at the same level as if it had been recoded as "weak". This is because there must have been some level of association recorded for the information to be entered into the database, even if the strength of the association is unknown. An alternative approach that was considered was to give these records a score of zero, but this would have eliminated them from the analysis, thereby giving these habitat types no chance of being identified as EFH for these species and life stages.

Table 8 Four level classification of substrate types (geological and biogenic) in the habitat use database, based on the OLO classification system.

Level 1	Level 2	Level 3
Abyssal Plain	Basin	Abyssopelagic Zone
Coastal Intertidal	Benthos	Artificial Structure
Estuarine	Ice	Bathypelagic Zone
Island Shelf	Intertidal Benthos	Biogenic
Shelf	Seamount	Biogenic Reef
Slope/Rise	Submarine Canyon	Epipelagic Zone
Slope/Rise/Plain	Subtidal Benthos	Fast Ice
Unknown	Unknown	Hard Bottom
	Water Column	Mesopelagic Zone
		Mixed Bottom
		Pack Ice
		Tide Pool
		Unconsolidated
		Unknown
		Vegetated Bottom

Level 4		
Algal Beds/Macro	Gyre	Sea anemones
Algal Beds/Micro	Macrophyte Canopy	Sea Lilies
Artifical Reef	Marine Moss	Sea Urchins
Basketstars	Mixed mud/sand	Sea whips
Bedrock	Mollusk Reef	Seasonal Fast Ice
Boulder	Mud	Seasonal Pack Ice
Brittlestars	Mud/Boulders	Seawater surface
Clay	Mud/Cobble	Silt
Cobble	Mud/gravel	Silt/Sand
Coral Reef/Barrier Reef	Mud/Rock	Soft bottom/Boulder
Coral Reef/Fringe Reef	Oil/Gas Platform	Soft Bottom/rock
Coral Reef/Patch Reef	Permanent Fast Ice	Sponges
Current System	Permanent Pack Ice	Tube worms
Demosponges	Piers	Unknown
Drift Algae	Rooted Vascular	Upwelling Zone
Emergent Wetlands	Sand	Vase Sponges
Fronts	Sand/Boulders	Worm Reef
Gooseneck barnacles	Sand/Cobble	
Gravel	Sand/Gravel	
Gravel/Cobble	Sand/Gravel/Cobble	
Gravel/rock	Sand/Mud/Rock	
	Sand/Rock	

The habitat codes in the GIS data comprise four levels as shown in Table 2: Mega Habitat, Habitat Induration, Meso/Macro Habitat and Modifier. These are copied here for ease of reference:

Mega habitat:

A	Continental Rise
B	Basin
F	Slope
R	Ridge
S	Shelf

Induration:

h	Hard
s	Soft

Meso/Macro habitat :

c	Canyon
e	Exposure
c/f	Canyon floor
g	Gully
g/f	Gully floor
i	Iceformed
l	Landslide
(blank)	Sedimentary

Modifier:

u	Unconsolidated
b/p	Bimodal
o	Outwash

The last level (Modifier) is largely redundant and does not add very much to the information, since each combination of the other 3 fields only has at most one value of the Modifier field. The habitat use database uses four levels (see above), but level four represents more detail than is really needed for mapping the GIS habitats. Only some of the categories in levels 1 to 3 relate directly to the GIS classification. In the following mapping scheme, the letters refer to the letters used in the GIS classification.

F (Slope) should be mapped to Slope/Rise, and S (Shelf) to Shelf. Also B (Basin) maps to Slope/Rise, Basin. Mapping A (Continental Rise) and R (Ridge) is less straightforward – should they both be Slope/Rise, or does A correspond to Abyssal Plain?

h (Hard) maps to Hard Bottom and s (Soft) to Unconsolidated, but Mixed Bottom in the habitat use database is not specified in the GIS data. In almost all cases where it occurs in the database there are also values for either Hard or Unconsolidated. In these cases it can perhaps be ignored given that it cannot be mapped directly. It could, however, be represented as a level of uncertainty in the BN model, since there is a non-zero probability that the fish in question will be associated with both hard and soft bottoms. In cases where it occurs without a value for either hard or unconsolidated both s and h in the GIS data were given the value for Mixed Bottom.

Both c (Canyon) and c/f (Canyon Floor) map to Submarine Canyon in the habitat use database. The other Meso/Macro Habitat values have no obvious corresponding values in the habitat use database, but can be treated as Benthos. The habitat use database does not have any Basin or Canyon data, so it is unclear whether to put this with Basin or Slope Canyon.

The current correspondence between the two databases is as follows:

Habitat Use Database	**GIS habitat codes**
Shelf, Benthos, Hard	She, Shi_b/p
Shelf, Benthos, Soft	Ss_u, Ssg, Ssg/f, Ssi_o
Shelf, Canyon, Hard	Shc
Shelf, Canyon, Soft	Ssc_u, Ssc/f_u
Slope, Benthos, Hard	Fhe, Fhg, Fhl, (Rhe, Ahe)
Slope, Benthos, Soft	Fs_u, Fsg, Fsg/f, Fsl, (Rs_u, As_u, Asg, Asl)
Slope, Canyon, Hard	Fhc, Fhc/f, (Ahc)
Slope, Canyon, Soft	Fsc_u, Fsc/f_u, (Asc/f, Asc_u)
Slope, Basin, Hard	Bhe
Slope, Basin, Soft	Bs_u, Bsg, Bsg/f_u, (Bsc/f, Bsc_u)

Codes in parentheses are considered to be hard to correspond between the two databases.

Some Level 2 and 3 habitats in the habitat use database are given as Unknown. The level 2 unknowns all have a probability of 0, so they can safely be ignored. The level 3 unknowns apply to only a few species, and in most cases the type of substrate can be inferred from other habitats or the NMFS Life Histories Appendix as follows:

Species	**Habitat**
Galeorhinus	Probably Soft
Antimora	No information
Coryphaenoides	Soft
Sebastolobus	Soft
Sebastes helvomaculatus	Hard
S. diploproa	Soft/ Mixed?
S. ruberrimus	Unclear – probably Hard/Mixed
S. reedi	Hard

As noted in Section 2.2, there are several species/life stages in the Groundfish FMP that have no association with a benthic substrate type, but instead occur in the water column. There are values for minimum and maximum latitude recorded in the HUD for these species/life stages to the extent that these are known. For some there are also minimum and maximum depths recorded. These depth ranges are intended to indicate geographic distribution rather than position in the water column (Bruce McCain pers. Comm.). It is therefore possible to model habitat suitability for these cases using the methodology described in Section 3.3.6.1.1. There is, however, no substrate component, and at present, no other way of further refining the probability profile, beyond what is provided by the depth and latitude ranges. This results in habitat suitability profiles that contain much less contrast and also cover wider areas than for the species and life stages that are associated with benthic substrates.

3.3.6.2 Current BN model specification

Figure 18 shows the BN model use to calculate HSP for a GIS polygon with observed values of substrate type, depth and latitude.

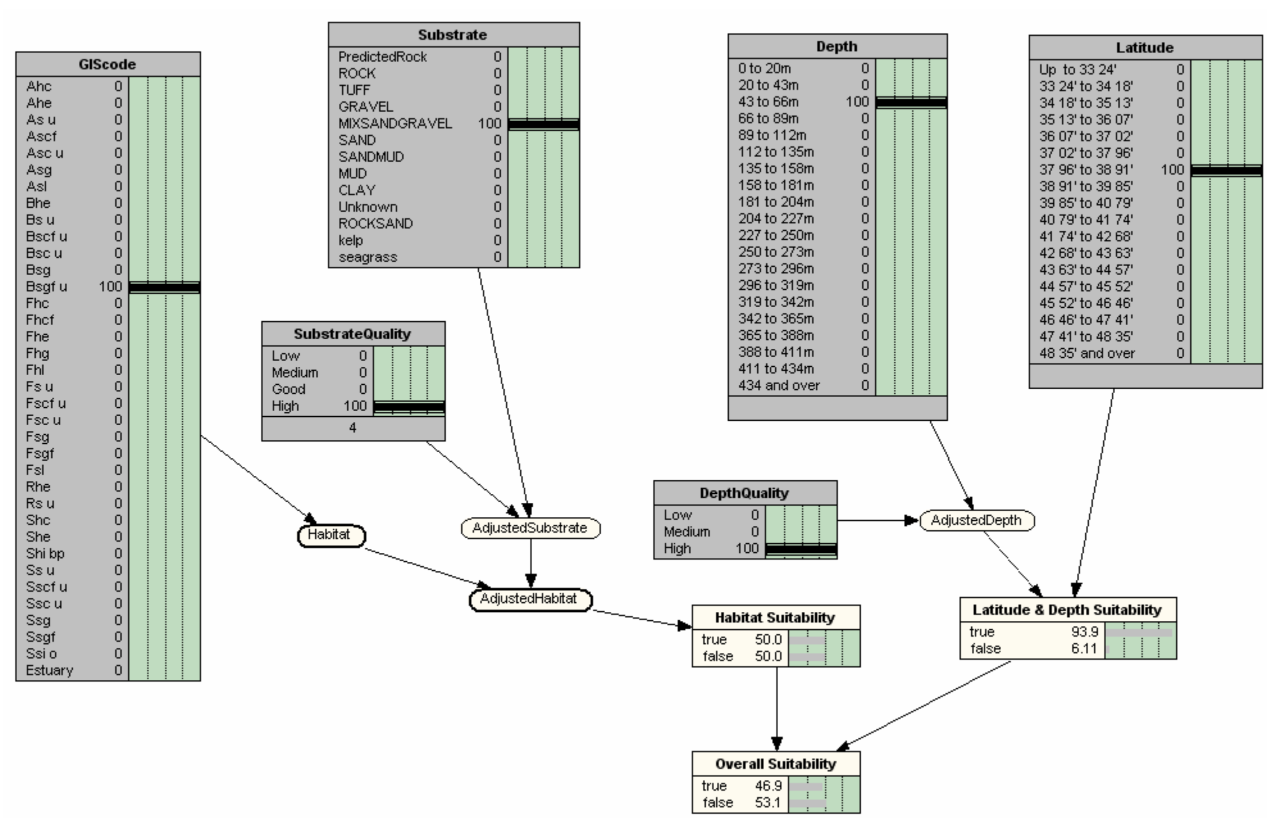

Figure 18. The EFH model showing substrate, depth, latitude and data quality nodes

For the given GIS polygon, the habitat code, substrate, depth and latitude are entered into the appropriate nodes in the BN. Uncertainty in the substrate classification is accommodated in the model by means of the *SubstrateQuality* node which represents the quality of the substrate data (low/medium/good/high). This assigns a probability distribution (elicited from expert judgements) of possible true substrates, given an observed substrate. The resulting substrate type is in the *AdjustedSubstrate* node in the BN. A similar facility for allowing for uncertainty in depth observations has been included in the model, but this is not being used at present (the depth data quality indicator is permanently set to "High", which leaves the depth in the *AdjustedDepth* node the same as the observed depth).

The Substrate Suitability node calculates the Habitat Suitability Probability (HSP) corresponding to the Adjusted Substrate. The node uses suitability probabilities obtained from the habitat use database (see Section 3.3.6.1). Similarly, the Latitude & Depth Suitability node uses the combined HSP value estimated by GAM modelling (see Section 3.3.6.1).

Finally, the Overall Suitability node calculates the estimated joint HSP value of the polygon by multiplying the Substrate and Latitude/Depth HSPs, thus:

$$\text{HSP(overall)} = \text{HSP(substrate)} \times \text{HSP(depth, latitude)}$$

This specification of the model treats depth/latitude and substrate as independent factors in determining the overall habitat suitability probability. This assumes that there is no interaction between them, such that the HSP for a particular depth/latitude combination does not depend on substrate.

HSP values are calculated for a given species/life stage for all the habitat polygons in the GIS, which are uniquely identified by their substrate type, depth range (every 10m) and latitude range (every 10 minutes) (Figure 19). A computer program has been written to read the polygon data, pass them efficiently to the model, and to produce a file of the resulting HSP values. These HSP values are then plotted for the entire coast in the form of a contour plot (see example in Figure 20). EFH can then be identified on the basis of the areas mapped, for example by selecting an area where the HSP is above a pre-determined threshold level, the selection of which is a policy choice for resource managers (see Section 4).

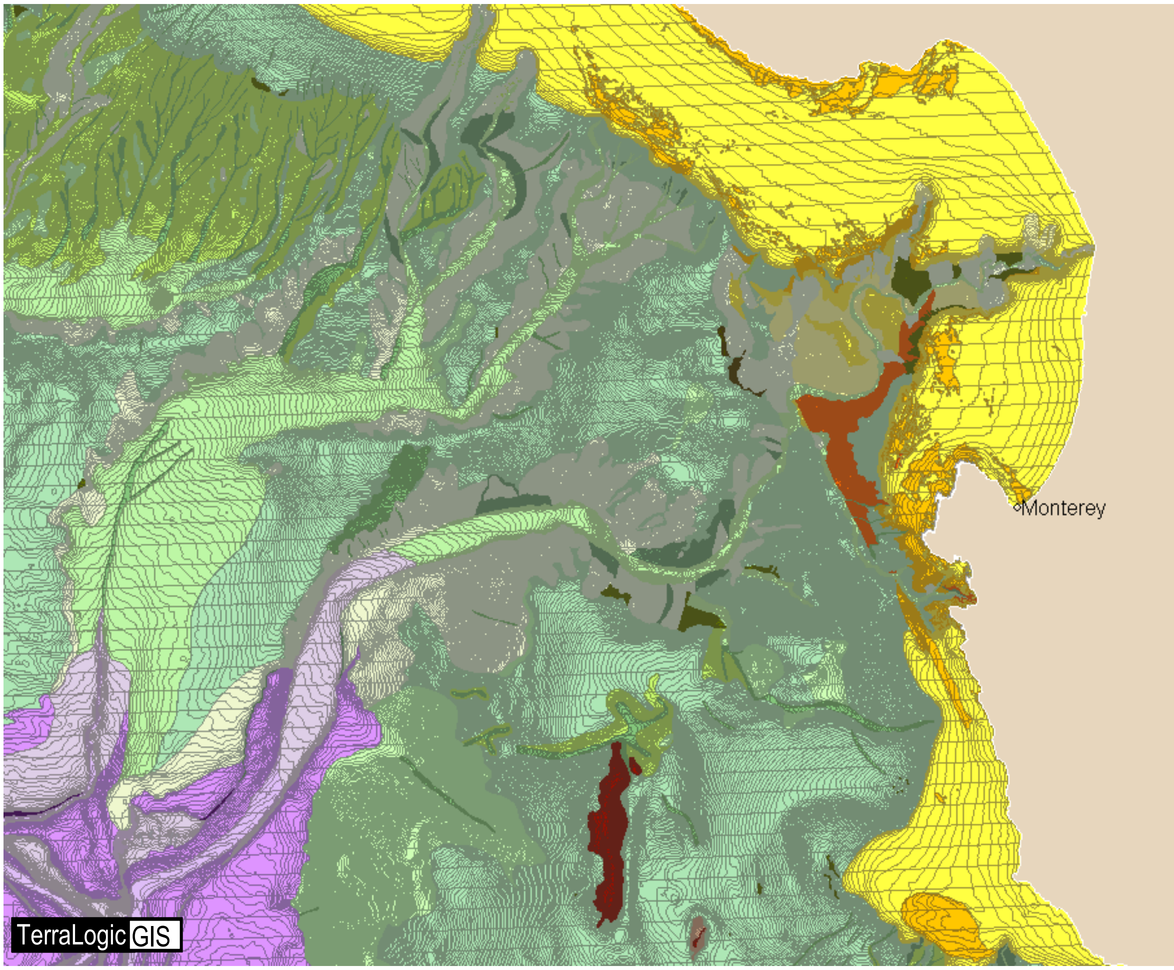

Figure 19. Portion of the Pacific Coast showing the division of the study area into polygons of unique habitat characteristics. the colors represent different substrate types.

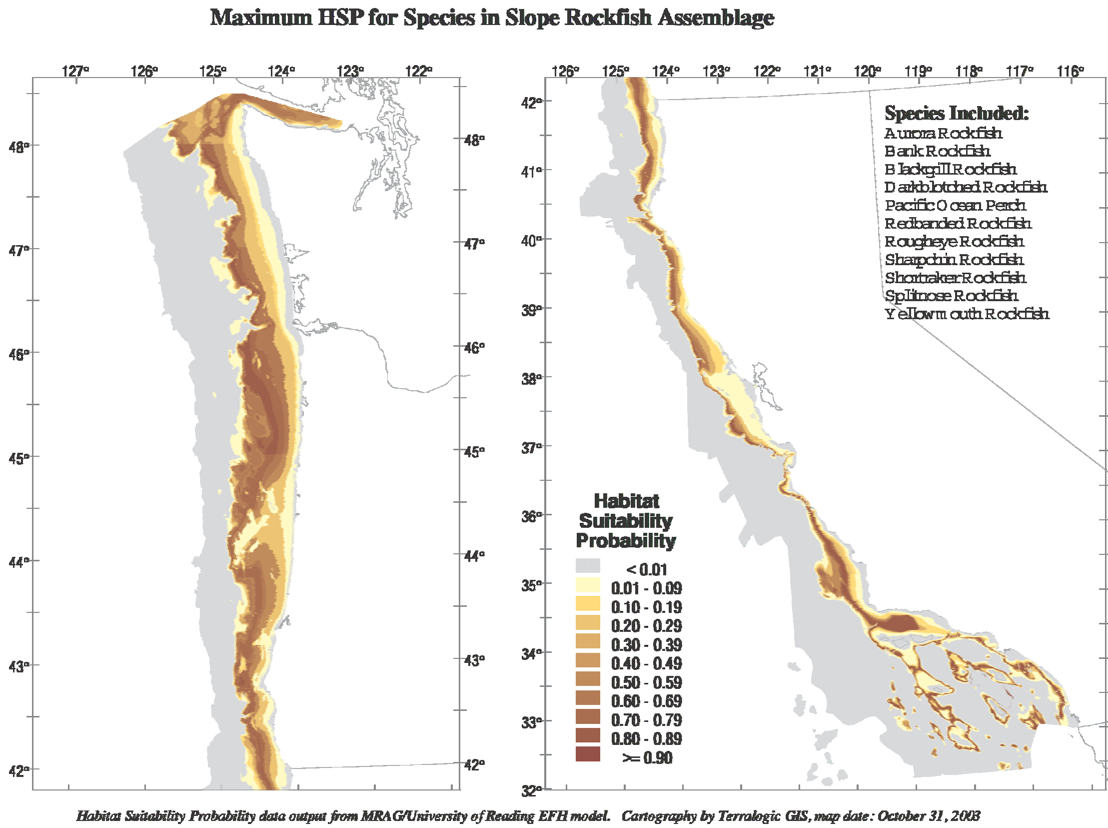

Figure 20. Example plot of habitat suitability probability for the slope rockfish assemblage. Map based on preliminary HSP values derived from NMFS Survey data.

4 RESULTS

4.1 Maps of habitat suitability

Maps resulting from the BN model for EFH are produced separately from this document to preserve image quality, and will be made available on a CD ROM. Maps include the following species/lifestages:

kelp greenling adult
kelp greenling juvenile
kelp greenling larvae
kelp greenling eggs
greenspotted adult
greenspotted juvenile
arrowtooth juvenile
sablefish adult
Pacific Ocean perch larvae

4.2 Identification of EFH

The end result of the EFH analysis is maps by life history stage for each groundfish species that show on a qualitative scale the importance of different habitat to that species. EFH can then be determined by selecting areas of habitat with scores higher than some predetermined value. A low value would produce a broad or inclusive identification of EFH, while a high value would reduce the area identified as EFH. The decision whether to adopt an inclusive or narrow definition of EFH should be considered from a policy standpoint. Adopting an inclusive definition may be appropriate given the incomplete and indirect nature of the information used to identify EFH. However, developing workable alternatives to reduce fishing impacts may be difficult if EFH is defined broadly. Adopting a relatively narrow EHF definition may make it easier to develop effective precautionary alternatives.

The GAM models estimate true probabilities of the survey encountering species across the area they cover. The suitability profiles based on HUD database are indices scaled to have a maximum value of one. The survey result can have a maximum value considerably less than one, particularly for rare species where the probability of occurrence is low everywhere. EFH for individual species should be placed on common scale before they are combined in an EFH definition for all groundfish species. It may also helpful to produce intermediary maps showing EFH maps for various subsets of groundfish, i.e., overfished species, species guilds, or species complexes used for management.

An alternative for EFH identification proposed by the SSC would identify the best 10% (or 20%, etc) of habitat over entire assessed region for each groundfish species, and then combine these areas for an overall definition of EFH. This would neatly avoid the problem of how to combine the results of the profiles based on the survey and HUD analyses.

4.3 Validation of model results

Full validation of the results of the EFH modeling exercise has not yet been undertaken.

Appendix 8 provides a preliminary comparison between the HSP values from the BN model and the habitat preferences described in the NMFS Life Histories Appendix (Section 2.3.4.1) and comments on the final combined probability profiles. These comparisons are for the species whose depth/latitude profiles were developed from the NMFS trawl survey data.

The results obtained to date have already raised some concerns, particularly over the effect of bias in the survey data arising from the non-random coverage of substrates. Essentially the trawl is limited in its capability to sample on very rocky substrates. Species that specifically associate with such substrates will therefore not be well sampled, and may be under-represented in the survey data that are used to model the effects of latitude and depth.

Data from the NOAA Atlas (see Section 2.3.3) are available for some of the species and life stages modeled in this analysis. For those species where maps are available from both sources it is possible to create an overlay to make a comparison of the two distributions. This has not yet been undertaken.

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Exhibit C.6.b
Attachment 2
April 2004

A Review of Analytical Portions of the Environmental Impact Statement for Designating Groundfish Essential Fish Habitat

– A Report of the SSC Groundfish Subcommittee –
Based on a Meeting Held at the Alaska Fisheries Science Center, February 23-24, 2004

SSC Members Present:

Steve Ralston (chairman)
Martin Dorn (rapporteur #1)
Mike Dalton (rapporteur #2)
Steve Berkeley
Tom Jagielo
Han-Lin Lai

Introduction

NOAA Fisheries is developing an Environmental Impact Statement (EIS) in response to a court order and settlement agreement to conduct a new NEPA analysis for Amendment 11 to the Pacific Fishery Management Council's (PFMC) groundfish Fishery Management Plan (FMP). Work on the EIS officially started in March 2002, when a team of NMFS and NOS scientists convened to devise a strategy and to identify data sources and responsible parties. The team identified the comparative risk assessment model described by the NRC[1] as the conceptual starting point for the Pacific coast groundfish Essential Fish Habitat (EFH) EIS. The PFMC reviewed the decision-making framework in April 2002 and subsequently formed the PFMC's Groundfish Habitat Technical Review Committee (TRC) to guide the assessment process.

The full Scientific and Statistical Committee (SSC) received an initial briefing by the EFH analytical team in June 2003. The schedule for designation of EFH by the PFMC is mandated by court order and requires that a range of alternatives be available for consideration at the June 2004 Council meeting. Scientific input has largely been provided to the analytical team by the Technical Review Committee (TRC) convened by the council. However, given the rigid schedule that is required for adoption of EFH alternatives by the PFMC and the role of the SSC in advising the Council about scientific and technical issues, a review of analytical tool that has be developed to evaluate EFH options was requested of the groundfish subcommittee of the SSC. That review was conducted February 23-24, 2004 at the Alaska Fisheries Science Center in Seattle, Washington. A substantial set of briefing materials were provided (Appendix 1) to the six members of the SSC that were present for the review (Ralston, Berkeley, Dalton, Dorn, Jagielo, and Lai).

It is clear that considerable advancement has occurred since the SSC was initially briefed by the EIS analytical team. The most substantial progress has been made on developing methods for characterizing and designating EFH. However, at the time of the review the fishing impacts model was not yet complete (see below).

The goal of the analytical team has been to bring a completed EFH assessment to the council at the April meeting, where preliminary alternatives for designating EFH will be presented. Council staff anticipated that the review by the groundfish subcommittee would constitute a "final check" before the completed assessment is brought before the Council. Although significant progress has been made, aspects of the analysis are incomplete (i.e., the fishing impacts model), precluding SSC endorsement of the full EIS assessment. Nonetheless, the subcommittee was able to fully review the analytical tool for designating EFH, for which methods have been most fully developed.

[1]NRC (2002). Effects of Trawling and Dredging on Seafloor Habitat. National Research Council, Ocean Studies Board, National Academy Press, Washington, D. C., 136 p.

Review of Model for EFH designation

GIS layers for bathymetry and substrate

Geographic Information System (GIS) techniques are used extensively in the EFH analysis. Information in GIS is stored as “layers” that can be linked together by their geographic coordinates. Two basic layers are used to characterize benthic marine habitats: a bathymetric layer (latitude-depth) and a substrate layer (geology of the sea floor). These layers have been assembled from many sources by the EFH analytical team and are the most comprehensive datasets of bathymetry and substrate ever compiled for the West Coast. The area covered extends from the shoreline (including estuaries) to 3000 m. This area does not comprise the entire West Coast EEZ, but does encompass the nearly all of the known habitat for groundfish FMP species. Areas of potential interest further offshore include several seamounts that rise above 3000 m depth that may provide habitat for minor groundfish species such as Pacific rattail and finescale codling. Omission of seamounts is unlikely to be of consequence for the EFH analysis, although they may good candidates for HAPC designation. The technical team indicated they will close this information gap in time for the seamount data to be useful in the EIS process.

Ideally, the quality of the data in a GIS layer should be assessed when the layer is created. A data quality layer is potentially useful in subsequent analysis to incorporate uncertainty, particularly when using Bayesian Belief Networks (BBN). For Oregon and Washington, a data quality layer on a scale of 1-40 was produced for each data source, i.e., bottom grabs, side scan sonar, seismic, etc. Unfortunately, a similar layer has not been generated for California. For the bathymetry layer, a qualitative scale was proposed, whereby a single value would be assigned to the waters off each state. Uneven treatment of uncertainty by layer and by region makes it difficult to carry forward uncertainty in the analysis.

In BBN models, uncertainty is modeled with discrete misclassification matrix, which could be obtained by evaluating an imprecise data set using a more precise data set, or from expert opinion. Unless uncertainty has been evaluated when the original layers were prepared, it is difficult to treat uncertainty appropriately. One option is to simply omit the misclassification matrix to acknowledge the difficulty of treating uncertainty appropriately. Another alternative would be perform a sensitivity analysis with different levels of classification error. Parcels identified for EFH analysis are irregular in shape, and defined according to depth intervals. While the range of depths within a parcel is likely to differ somewhat from the depth intervals used to define the parcel, the entire parcel is unlikely to be belong to a deeper or shallower depth interval. Therefore, we recommend that depth uncertainty not be included in the EFH designation model.

Biogenic habitat

Biogenic habitat (e.g., kelp, sea grass, and structure-forming invertebrates) is both of potential importance to fish populations and potentially sensitive to fishing impacts. With respect to structure-forming invertebrates, however, the draft analysis only provides a map showing the locations of survey stations were these species have previously occurred. Because of the potential importance of these biogenic habitats, the subcommittee recommends additional effort to identify areas with biogenic structure, including especially the structure-forming invertebrates. The review panel is cognizant of the limitations of the NMFS surveys for this purpose, and does not intend to be prescriptive in recommending what additional analyses could be done. Several suggestions are:

1. There currently exists a GIS layer with distribution polygons that characterizes kelp cover. This layer is needed to identify essential habitat for species with specific affinity for kelp habitat. However, the spatial extent of kelp cover expands and contracts in response to environmental variability (e.g., El Niño). When habitat is dynamic in nature, defining EFH by fixed geographic coordinates is problematic. Since the compiled information on kelp cover is the maximum extent of kelp cover, the kelp GIS layer should be understood as an inclusive definition of this habitat. Sea grass habitat presents similar difficulties.

2. Some structure-forming invertebrates are found primarily on soft bottom, and would be sampled effectively in the NMFS trawl surveys. Example include sea whips and perhaps sponges. For these soft bottom invertebrates, maps of relative CPUE by station should be produced.

3. The draft analysis argues that NMFS survey data are not adequate to produce a comprehensive map of hard-bottom coral off the West Coast. It is impossible to assess the adequacy of the survey data without first taking steps to map relative abundance. This exercise could also help to emphasize the need for further research into coral distribution, and ought to be included in the final analysis. Some areas of the West Coast EEZ have been surveyed using ROVs (i.e., Hecata Bank, parts of southern California). Assessing the distribution of coral in these areas is feasible. If at all possible, information on coral distribution in these areas should be included in the EFH analysis.

Modeling fish distribution

The NMFS guidelines for EFH describe a hierarchy of information that can be used to designate EFH. At level 4 (the highest) information is available on production rates by habitat. For the West Coast (as elsewhere), the information available for EFH designation is at level 2 (habitat-related density) and at level 1 (distribution data). Trawl CPUE is not explicitly habitat-related because substrate is not determined at sampling stations. Interpretation is also problematic because not all substrates are sampled equally well using trawls. The analytical team has devised an approach based on fitting generalized additive models (GAM) to presence/absence information (level 1) from trawls by latitude and depth (i.e., level 1). This approach ignores information on relative density from trawl surveys. While there are good reasons for adopting this approach, the change from a level 2 to level 1 analysis needs to be more carefully justified in the EFH analysis.

The information from literature review entered into the Habitat Use Database (HUD) is used to establish the species-substrate association. Habitat maps produced by EFH analysts show the “habitat suitability probability,” which is calculated as the product of probability of occurrence by latitude and depth (from the GAM model) and strength of the species-substrate association. This quantity can be regarded as an estimate of how likely it is that the species will be encountered in a habitat, so perhaps the nomenclature should reflect this. Habitat suitability is a relatively vague concept that implies more about the importance of a particular habitat than is perhaps warranted.

The approach to modeling of EFH has evolved considerably from the initial NOS models used for assessment of central California marine sanctuaries. Rather than polynomial regression using the logarithm of mean survey CPUE, the EFH model is a GAM model for the probability of occurrence. The final modeling approach is based on appropriate error assumptions and careful attention to goodness of fit. Nevertheless, there is some concern that the modeling approach does not make fullest use of the survey information on relative densities. GAMs and GLMs that can accommodate zero catches have been commonly used to obtain indices of abundance using West Coast trawl survey data for stock assessment. Furthermore, the limitations of presence/absence information to infer essential habit should not be ignored. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area. Surveys provide limited information concerning the function of the habitat for a species. For example, winter spawning grounds for lingcod would not be necessarily be identified as essential habitat using summer survey data.

Existing surveys also have a strong bias towards habitats that can be trawled, and are of limited utility for identifying essential habitat for juvenile stages. For example, biogenic habitat may provide refugia from predation for juvenile fish, yet these habitats could not be identified as essential if the sampling gear does not capture juveniles. Although direct visual surveys are perhaps the best method for identifying species-habitat associations, these surveys are currently limited in scope. Size composition data are available for many groundfish from the NMFS trawl surveys. In many cases, juveniles can be reliably distinguished from adults on the basis of size. Many species occupy different habitats at different life history stages. Information about these ontogenetic shifts present in the trawl data is not being utilized in the present analysis. Therefore, while presence-absence analyses should be relatively robust, EHF designations resulting from such analysis are initial approximations that will need to be refined as additional information becomes available.

Habitat profiles have been generated for adults using GAM models and NMFS survey data for a limited number of species. Habitat profiles have not yet been obtained for egg, larval, and juvenile stages. These profiles will be generated using the HUD database, which will also be used for the adult stages of species which are not well sampled during trawl surveys. Although this work has not yet been completed, the subcommittee was able to review the proposed methods.

HUD database

The life history appendix to the previous EFH amendment to groundfish FMP has been made into relational database of habitat use (HUD). For each species, association with substrate type is characterized on a relative scale (unknown, weak, medium, strong). Depth preferences are characterized with four depths: minimum observed depth, minimum preferred depth, maximum preferred depth, and maximum observed depth. Geographic (latitude) preferences are recorded similarly. The preferred minimum and maximum depths (and latitudinal ranges) are roughly based on the 5th and 95th percentiles from surveys when these data are available.

The analytical team proposed an interpolation/smoothing procedure for inferring habitat suitability profiles using information on preferred depths and latitudes in the HUD. While trying to extract as much information as possible from limited data is laudable, there is some danger of over-interpreting data to obtain visually satisfying results. Linear interpolation is preferable to arbitrarily smoothed curves when obtained simply from preferred maximum and minimum preferred depths. Values used to control the shape of suitability profiles could be estimated objectively by comparison with survey-based profiles for species where both can be obtained.

Model for EFH designation

The Bayesian Belief Network model used for designating EFH appears to be a reasonable approach. The EFH model is a very straightforward application that does not depend heavily on BBN methodology (Fig. 1 shows the flow of information in the EFH habitat designation model.) The novelty of the approach should not be considered a significant issue.

The end result of the EFH analysis are maps by life history stage for each groundfish species that show on a qualitative scale the importance of different habitats to that species. EFH is determined by selecting habitats with scores higher than some predetermined value. A low value would produce a broad or inclusive definition of EFH, while a high value would reduce the area defined as EFH. The decision whether to adopt an inclusive or narrow definition of EFH should be considered from a policy standpoint. Adopting an inclusive definition may be appropriate given the incomplete and indirect nature of the information used to identify EFH. However, developing workable alternatives to reduce fishing impacts may be difficult if EFH is defined broadly. Adopting a relatively narrow EHF definition may make it easier to develop effective precautionary alternatives.

The GAM models estimate the probability of occurrence, while suitability profiles based on HUD database are scaled to have a maximum value of one. The probability of occurrence can have a maximum value considerably less than one, particularly for rare species where the probability of occurrence is low everywhere. EHF for individual species should be placed on common scale before they are combined in an EFH definition for all groundfish species. It may also helpful to produce intermediary maps showing EFH maps for various subsets of groundfish, i.e., overfished species, species guilds, or species complexes used for management. One promising alternative for EFH designation would identify the best 10% (or 20%, etc) of habitat over entire assessed region for each groundfish species, and then combine these areas for an overall definition of EFH.

Public comment concerning EFH

1. The final rule for NMFS guidelines discusses the need for different EFH definitions for overfished species.

2. There is concern about using a level 1 analysis (presence/absence) rather than a level 2 analysis (relative density).

3. Is HAPC contained within EFH? Answer: Criteria for defining HAPC are different than EFH. HAPC is not necessarily included in EFH.

4. There was public testimony concerning the importance of identifying areas with living structure (specifically, corals and sponges).

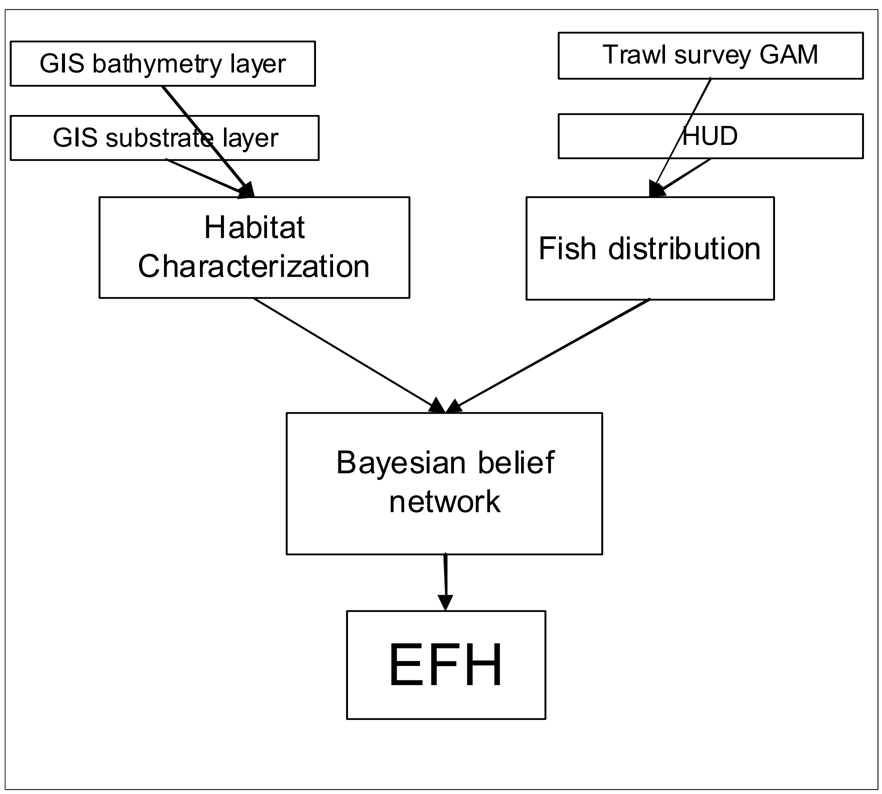


Figure 1. Flow of information for EFH habitat designation model.

SSC Review of the Impacts Model for the EFH EIS Process

Fishing Effort

Spatial data requirements of the EFH project stretch, and in many cases exceed, what are available for most West Coast fisheries. The most comprehensive spatial data for fishing effort on the West Coast are available from trawl logbooks, and work on the EFH project so far has relied exclusively on these data to measure the spatial distribution and intensity of impacts from fishing. The development of spatial data for fixed-gear sectors is an important objective for the EFH project's fisheries impacts model.

For the trawl fisheries, impacts are measured in the EFH project by total tow hours in a year at each location, or fishing block, where trawling occurred. This definition of fishing effort is appropriate for the EFH project.

No coast-wide source of spatial data for fixed-gear fisheries exists. Recently, the Ecotrust organization developed a model to estimate the coast-wide spatial distribution of fishing effort for fixed-gear and other groundfish fisheries using information from fish tickets, but the accuracy of these distributions was not tested. Wisely, the EFH project team investigated the potential reliability of using Ecotrust's effort distributions to represent spatial distributions of fishing effort in trawl, long-line, and groundfish pot fisheries. To check Ecotrust's effort distribution for one area, focus group meetings with knowledgeable fishermen were conducted to develop baseline effort maps for an area off the Oregon coast.

The focus group meetings for the EFH project were conducted under sound socioeconomic research protocols (Final Report, Pilot Project to Profile West Coast Fishing Effort). The SSC endorses the use of social science research methods to collect primary data based on fishermen's knowledge and expertise. The SSC encourages further use of these methods to continue collecting primary data on baseline fishing effort off the West Coast. These data would be used to develop baseline effort maps for other areas, and provide the best available science to the EFH-EIS process.

The focus groups produced a set of maps showing the spatial extent and intensity of fishing effort for trawl, long-line, and groundfish pot fisheries in an area between the ports of Newport and Astoria. Based on survey responses, fishermen in the focus groups were confident in the spatial extent of fishing effort depicted on the maps, but uncertain about the groups' estimates of the spatial intensity of fishing effort.

Maps from the EFH project's focus group were compared to Ecotrust's distributions of fishing effort for fixed-gear fisheries between Newport and Astoria over two recent time periods, 1997 and 2000. To show results, the EFH project team provided several maps that compare the baseline effort maps from the focus groups with Ecotrust's effort distributions. Results of the comparison are discouraging. For example, the areas reported by the focus groups for the fixed-gear fisheries were generally much larger and further from port than Ecotrust's distributions.

For the long-line fishery, Ecotrust's distributions cover 8-12% of the area reported by the focus groups. On the other hand, around 50% of each Ecotrust's distribution is outside that area. Results of the comparison for the groundfish pot fishery are worse. In this case, Ecotrust's distributions cover only 0-3% of the area reported by the focus groups, and 80-100% of each Ecotrust distribution is outside that area. In one case, the center of Ecotrust's distribution is more than 100 km from the area identified by the focus groups.

These comparisons reinforce the SSC's concerns, which have been described previously, regarding the spatial algorithm used by Ecotrust. Based on the above comparisons, the SSC is doubtful that the effort distributions derived from the Ecotrust methodology broadly represent baseline patterns of fishing effort in non-trawl fisheries. Consequently, the SSC cautions against relying on those effort distributions, to avoid biasing the estimated spatial distribution of impacts from non-trawl fisheries.

Effects of Fishing Gear on Habitat: Sensitivity and Recovery Rates

The EFH project team conducted an extensive literature review, and developed a database of gear effects for different habitat types. As with any multi-dimensional classification system, the number of cells requiring data grows quickly as more gear or habitat types are added to the database. Information to fill these cells is constrained by the literature review. To allow a reasonable number of cells, a scoring system was developed to rank gear effects with three levels each for sensitivity and recovery times (Tab. 2, p. 12, Appendix 10).

Data from the literature were standardized and a given a score in the range 0-3. For habitat sensitivity, zero represents minimal effects or no impact, and a score of three represents a major or catastrophic effects. Recovery times range from zero to periods lasting from three to seventeen or more years. For this reason, interpretation of the scores as real numbers is problematic. Nonetheless, scores are added together to calculate average scores for sensitivity and recovery rates.

The literature review provided a robust ranking of gear types by damage per unit effort, in increasing order: hook and line, pots and traps, nets, trawl, and dredges. The literature review also provided a robust ranking of habitat sensitivities to gear effects, in increasing order: soft bottom, hard bottom, and biogenic (broadly defined as having vertical biological structure).

The SSC notes the biogenic habitat category needs attention. Ideally, a refinement of this category could include corals, sea pens, or other invertebrates, but spatial data exist only to partly support this formulation. While the incomplete distributions may not be appropriate for use in the Bayesian network model, maps showing the spatial distribution of known biogenic features (e.g. corals in trawl surveys), and the distribution of fishing effort, would be useful for reference in future documents. In addition, the SSC notes that refinement of other categories, such as soft sediments, may also be advised.

Scores assigned to different gear and habitat types from the literature review involved subjective judgment. To address this issue, scores were assigned independently by a group of researchers that rated studies in the literature review. The mean of the individual scores, plus or minus a standard deviation, is used to represent low, medium, and high values for each gear and habitat type.

Overall, the SSC finds this method of constructing habitat sensitivity and recovery indices to be acceptable, but is concerned about whether data from the literature review are sufficiently representative of West Coast fisheries. Only 2 of the 89 studies included in the literature review took place in West Coast fisheries. Another potential source of bias is that 90% of the studies are about trawl or dredge gear.

Of particular concern to the SSC is the use of gear effect estimates from studies on New England trawlers to infer habitat effects from West Coast trawl vessels, which are usually smaller with different gear characteristics. Effects of trawling on hard-bottom shelf habitats are likely to be important in West Coast fisheries, and estimates of sensitivity and recovery for the hard bottom-shelf-trawl category in the EFH database are from only two studies (Tab. A10.2, Appendix 10 attachment). One study is about beam trawls, and the other was done in New England (Auster et al., 1996).

The SSC recommends investigating the relationship between gear effects and vessel size or fishing power, and if necessary controlling for this factor in the gear effects tables. A related issue that deserves further investigation is an assessment of each gear type's ability to access different habitat types.

Clarification is needed about relationships between the overall level of fishing effort and gear effects. For example in most cases, gear effects are measured for a single trawl, but replicates are sometimes used. Questions were also raised about whether replicate trawls occurred at exactly the same location. An important uncertainty in the data is that overall effort is controlled in the studies, and results may not apply, or may apply only in a limited way, to situations where effort is not controlled.

Fishing Impacts Model

The fishing impacts model for the EFH-EIS analysis is work in progress, and the SSC was unable to conduct a full review of the model at this time. The fishing impacts modeling team has a complex, and impressive, set of tasks to complete in order to accomplish its stated objectives. Fortunately, major computational challenges related to model development, and execution, have been solved, and a working version of the model and data were used to produce quantitative results for the effects of gear on fish habitat. The SSC appreciates the EFH project team's openness, particularly regarding suggestions about future model development.

Currently, the fishing impacts model is reduced to a single index value that is intended to represent a broad measure of status for fish habitat based on cumulative impacts. Fishing effort and sensitivity of habitat to gear type determine gross impacts. The fishing impacts model is dynamic, and effects of recovery and previous impacts determine net impacts. A simplifying assumption is that fishing effort is uniformly distributed over the year, which might ignore important seasonal effects. Dynamics of the habitat index value are based on a logistic difference equation, similar to population models. Parameters in the logistic equation are linked to habitat sensitivity and recovery rates from the gear effects tables described above.

The single index variable can be used with different model formulations. In one formulation, the index value represents a mean or average status for fish habitat over an entire area. An alternative formulation is to assume that fish habitat consists of many individual patches that follow a discrete two-state process between healthy and damaged conditions. Under this interpretation, the index value represents the fraction of patches in, for example, the damaged state. Either formulation has problems, and the SSC recommends developing a multivariate description of impacts, based on explicit and measurable physical effects of gear on habitat, in terms of individual species, or types of organisms.

Saturating functions for gross impacts, and logistic (S-shaped) recovery profiles are important features to be added to the fishing impacts model. The SSC notes that a stochastic or probabilistic model of fishing impacts may be appropriate. Another alternative worth considering is the development of a spatially explicit model of gear effects that incorporates the notion of a gear footprint, such as the area swept by trawls, and whether a focus group approach similar to that for fishing effort could be pursued to estimate footprints for different gear types.

Impacts from Non-fishing Activities

The EFH team's work on impacts from non-fishing activities is just starting, with some data but no model to review. Modeling the impacts of non-fishing activities is important, but the SSC recognizes these activities are outside the control of fisheries management.

Appendix 1. Briefing materials presented to members of the SSC Groundfish Subcommittee for their review of the EFH EIS analytical tool.

1. Pacific Coast Groundfish EFH – **Analytical Framework** (Version 4, February 10, 2004). Prepared for Pacific States Marine Fisheries Commission by (a) MRAG Americas, Inc., 110 South Hoover Blvd., Suite 212, Tampa, FL 33609, (b) Terralogic GIS, Inc., P.O. Box 264, Stanwood, WA 98292, (c) NMFS Northwest Fisheries Science Center, FRAM Division, and (d) NMFS Northwest Regional Office, 89 p.

2. Appendix 1: Active Tectonics and Seafloor Mapping Laboratory Publication 02-01 – Interim Seafloor Lithology Maps for Oregon and Washington (Version 1.0), by C. Goldfinger, C. Romsos, R. Robison, R. Milstein, and B. Myers, Active Tectonics and Seafloor Mapping Laboratory, College of Oceanography and Atmospheric Sciences, Oregon State Unversity, Burt 206, Corvallis, OR 97331, 11 p.

3. Appendix 2: Final Report – Essential Fish Habitat Characterization and Mapping of the California Continental Margin, by G. Greene and J. Bizzarro, Center for Habitat Studies, Moss Landing Marine Laboratories, Moss Landing, CA, 21 p.

4. Appendix 3: Organizations contacted for information on non-fishing impacts to EFH, 6 p.

5. Appendix 4: List of groundfish species in life histories appendix, 2 p.

6. Appendix 5: Gear types in the PACFIN data base, 2 p.

7. Appendix 6: Description of habitat suitability index (HSI) modeling conducted by NOS, 4 p.

8. Appendix 7: Development of profiles of habitat suitability probability based on latitude and depth for species and life stages in the Groundfish FMP, 34 p.

9. Appendix 8: Discrete time damage model for fishing impacts, 3 p.

10. Appendix 9: Useful websites on Bayesian Belief Networks, 1 p.

11. Appendix 10: Pacific Coast Groundfish EFH – The effects of fishing gears on habitat: west coast perspective (Draft 5), by MRAG Americas for the PSMFC, February 9, 2004, 32 p. + annex.

12. Appendix 11: Pacific Coast Groundfish FMP Habitat Use Database User Manual for Version 15B (Draft), 50 p.

13. Non-Fishing Impacts on Bottom Habitats – Draft 1 (February 19, 2004), 7 p.

14. Letter from Dr. M. Mangel to S. Copps (dated 17 October 2003) concerning the Ecotrust Methodology, 2 p.

15. Final Report – Pilot Project to Profile West Coast Fishing Effort Based on the Practical Experience of Fishermen, by T. Athens, A. Bailey, F. Conway, S. Copps, R. Fisher, M. Larkin, S. McMullen, and F. Recht, 31 p.

16. Fishing Effort GIS Data Exploration for West Coast Groundfish EFH EIS Project, Terralogic GIS, December 2003, 20 p. + appendices.

17. Excerpt from Northwest Power and Conservation Council's Independent Science Advisory Board Report on Salmonids Supplemental, Section 7. Benefit-Risk Assessment and Decision Making, 19 p.

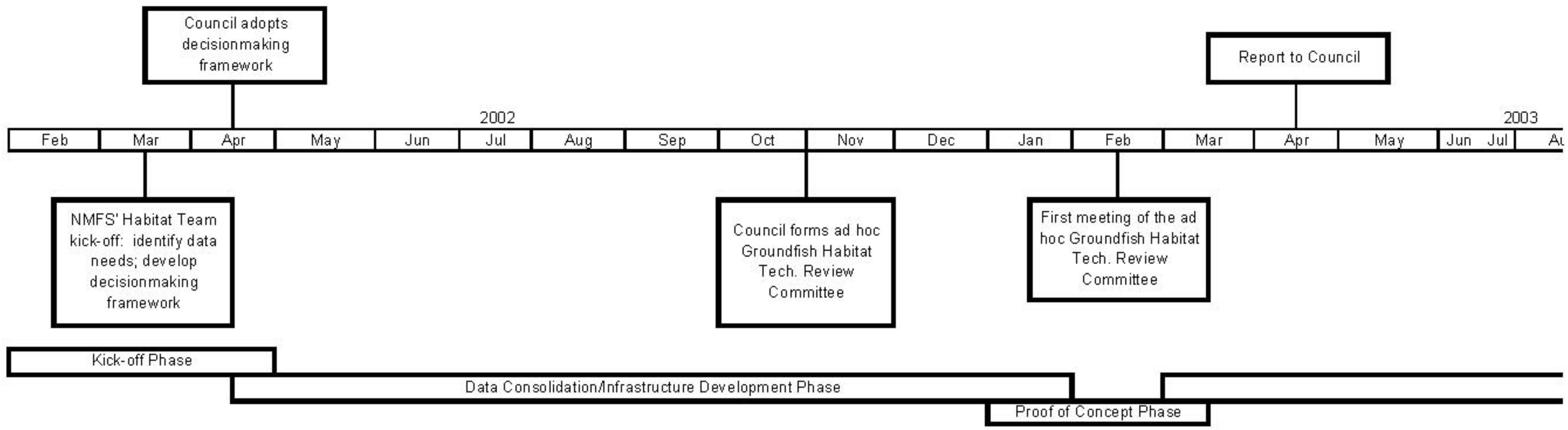
Exhibit C.6.b
Attachment 3
April 2004

Revised EFH EIS Timeline

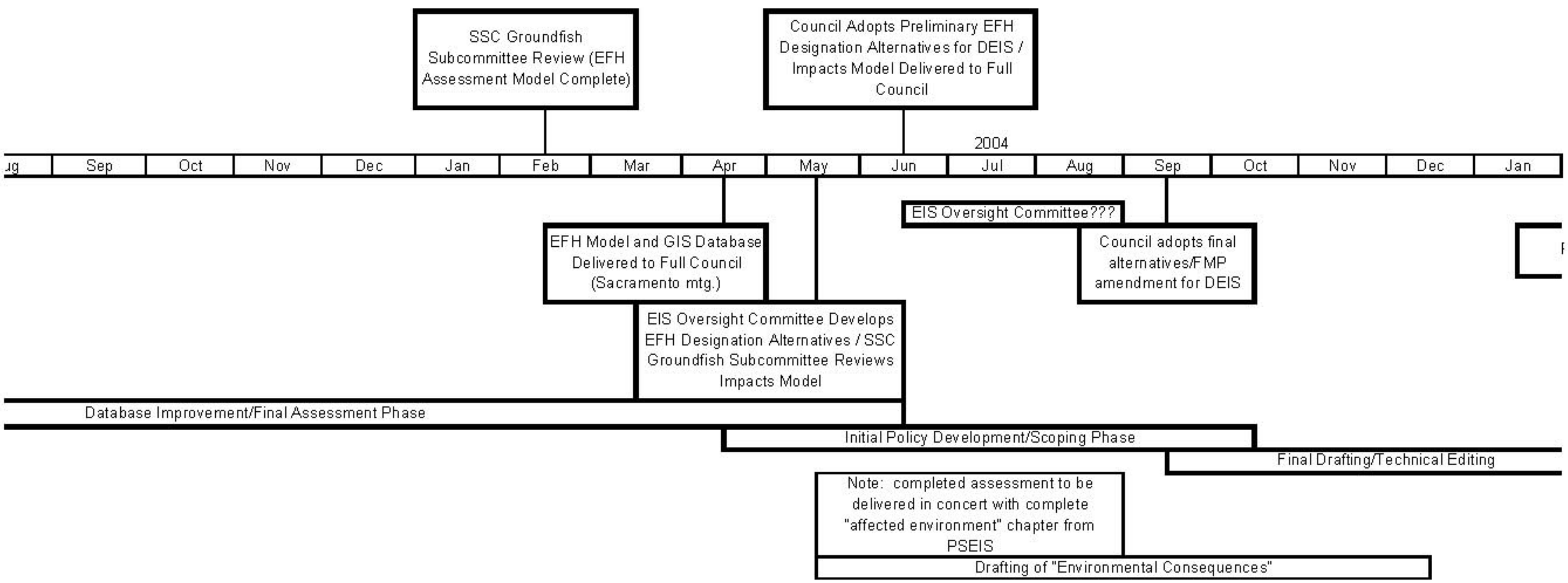
2004		
January-March	·	SSC Groundfish Subcommittee reviews Analytical Framework.
	·	**March Council meeting-** SSC Groundfish Subcommittee reports to SSC.
April-June	·	**April Council meeting-** EFH model and GIS database delivered to Council.
	·	EIS Oversight Committee develops EFH designation alternatives.
	·	SSC GF Subcommittee reviews impacts model.
	·	**June Council meeting-** Council adopts preliminary EFH designation alternatives for DEIS, impacts model delivered to Council.
July-September	·	EIS Oversight Committee develops impacts mitigation and HAPC designation alternatives.
	·	**September Council meeting-** Council adopts final alternatives/FMP amendment for DEIS.
October-December	·	Final drafting and technical editing of DEIS.
2005		
January-March	·	Publish DEIS (February).
	·	Public comment.
April-June	·	Public comment.
	·	Document improvement.
July-September	·	**September Council meeting-** Council adopts draft FEIS/FMP amendments.
October-December	·	Publish proposed rule and NOA for FMP amendment (begin Secretarial review).
	·	EPA publishes NOA for FEIS (December).
2006		
January-March	·	RA decision on FMP amendment; AA signs ROD
	·	Publish final rule (March).
April	·	Final rule becomes effective.

Draft Timeline and Major Milestones for the Environmental Impact Statement on Essential Fish Habitat for Pacific Coast Groundfish

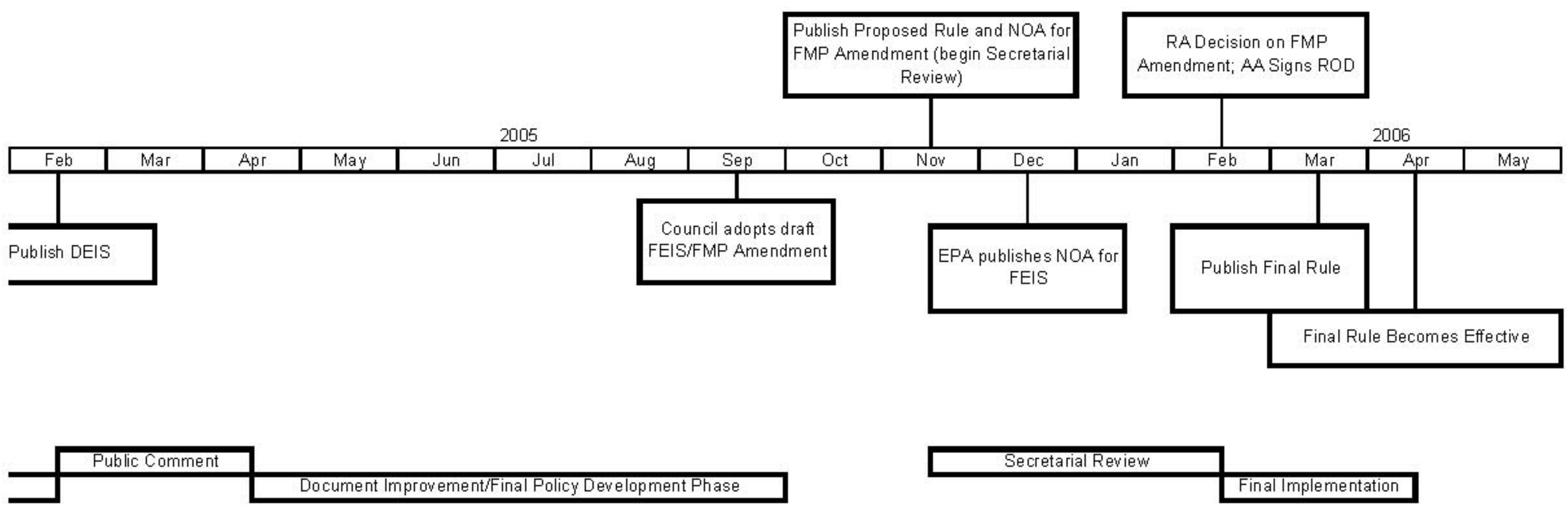
(Previous Draft)



Draft Timeline and Major Milestones for the Environmental Impact Statement on Essential Fish Habitat for Pacific Coast Groundfish



Draft Timeline and Major Milestones for the Environmental Impact Statement on Essential Fish Habitat for Pacific Coast Groundfish



APPENDIX 6: USEFUL WEBSITES ON BAYESIAN BELIEF NETWORKS

General theory of network and other graphical models, with links to other sites
http://www.ai.mit.edu/~murphyk/Bayes/bnintro.html

Software products for creating network models
http://bayes.stat.washington.edu/almond/belief.html

Website for Bayes Net project
http://www.cs.orst.edu/~dambrosi/bayesian/frame.html

Genie product
http://www2.sis.pitt.edu/~genie

Netica product
www.norsys.com

Hugin product
www.hugin.com

Microsoft belief network Product
http://www.research.microsoft.com/dtg/msbn

Online tutorial for Bayesian inference and modeling
http://b-course.cs.helsinki.fi/

Identification of Essential Fish Habitat for the Pacific Groundfish FMP

Appendix 7

Development of Profiles of Habitat Suitability Probability based on latitude and depth for species and life stages in the Groundfish FMP

Table of Contents

1 SUMMARY

The objective for this analysis was to produce habitat suitability probability tables given latitude in decimal degrees and depth in meters for as many of the species and life stages in the Groundfish FMP as possible. There are 82 species in the FMP. Considering four life history stages for each (eggs-larvae-juveniles-adults) makes a total of a possible 328 profiles. In reality, there were data available for less than half of these. At the end of the analysis, all adult phases were covered, 48 of the juvenile stages, 14 of the larval stages and 12 of the egg stages. Two major data sources were used; the catch data from the NMFS bottom trawl surveys of the area covered by the Groundfish FMP, and information on habitat-species associations in the habitat use database.

The NMFS surveys were considered to provide the best source of data and were hence analyzed first. An exploratory data analysis was undertaken to determine the best approach, using sablefish as a test case. The final model approach was then used to model the probability profiles for as many of the 82 species in the dataset that there were appropriate amount of data available for. The preliminary analysis concluded that a generalized linear model (GLM) or a generalized additive model (GAM) modeling continuous CPUE data was not suitable due to the vast amount of zero values, which violated the model assumptions. Better results were obtained by rearranging the data for the response variable as a binary variable (0 = no Sable fish in haul and 1 = Sable fish in haul), and modeling the response as a probability using a binary GLM or a binary GAM. The two prediction plots are provided in the analysis, one for the GLM and one for the GAM, showing similar patterns. The binary GAM was selected as the preferred method at this stage due to concerns that the output of the GLM showed too high a level of smoothing of the data.

Following discussion with the Council's SSC, it was noted that GAMs and GLMs that can accommodate zero catches have been commonly used to obtain indices of abundance using West Coast trawl survey data for stock assessment. There are limitations in using presence/absence information to infer the locations of EFH habit. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area. The project team agreed, but had previously concluded that the use of presence-absence from a large number of surveys would provide the most robust result at this stage. While noting also that the analysis of depth and latitude ranges is only part of the input into the EFH model, EFH designations resulting from this analysis can be considered to be initial approximations that will need to be refined as additional information becomes available and more sophisticated analyses become possible.

This document contains some of the initial exploratory data analysis as well as three of the 20 profiles for adult fish that were completed entirely from the NMFS trawl survey data. An additional 16 species were completed using expert advice on the 0-30 meters depth interval that the NMFS surveys do not cover.

A total of 36 species (adults) were modeled using the NMFS survey data. The information on species-habitat associations in the Habitat Use Database (HUD) was used to calculate index profiles for as many more species and life stages as possible. This was achieved for a further 124 species-life stage combinations. Due to the nature of the data, these profiles contained much less information that those generated from the survey data. However they do represent the best information currently available from which to develop estimates of overall habitat suitability probability (i.e. including substrate preferences) using the EFH model.

2 EXPLORATORY DATA ANALYSIS

The following is a statistical analysis for the West Coast survey data for sablefish received from Waldo Wakefield (NMFS NW Fisheries Science Center).

This document tries to establish a relationship between CPUE data and two independent variables and three factors: Depth in meters, Latitude in decimal degree, interaction between these two, survey (factor), year (factor) and month (factor). The statistical analysis and the plots presented in this document were carried out in S-PLUS. Some observations considered outliers (errors) were removed from the data set. See section 4.2 for details.

The standard method for analyzing the survey data is NOT to treat each tow as coming from a unique "box" that has a unique area. Rather, the surveys were planned and analyzed as a pseudo-stratified random design. That is, large spatial strata defined by latitude and depth were laid out and the CPUE from all tows within a stratum is averaged and treated as the mean CPUE for that entire stratum. In the early years of the shelf survey (AK1) there were frequent shifts in stratum boundaries and shifts in the allocation of sampling effort between strata (especially in 1986). For the slope surveys and for the latter years (1992-2001) of the shelf survey, the allocation of effort is more nearly uniform which provides more flexibility for post-hoc analyses. The quality on the temperature data has not been critically evaluated. It is possible that some differences exist between the sensors used on the various surveys (Richard Methot).

The efforts (net width in meters * distance sampled in meters) for the surveys AK1, AK2 and NW are plotted in Figure 1. Due to the longer tow time for the two AK-surveys (30 minutes and 60 minutes) compared to the tow time the trawl for the NW-survey (15 minutes), the area covered by the surveys differs substantially. This difference in tow duration shows up as a bimodal distribution in Figure 1. The AK-surveys approximately cover double the area of the NW-survey for each haul.

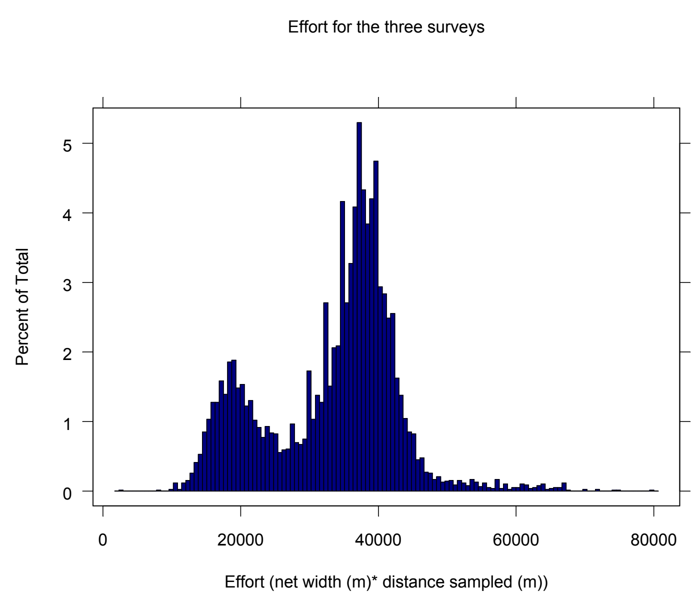


Figure 1: Histogram of the effort data used for sabelfish showing a shift in the mean for the surveys, indicating that systematical differences in tow duration for the surveys are present.

To achieve a standardize Catch Per Unit Effort (CPUE) index and eliminate the tow duration effect, the catch is divided by swept area in m^2. Due to the fact that the number of fish in each haul were generated from the catches in the earlier years, the catch data is preferred over the number data as a response variable.

$$CPUE = \left(\frac{\text{Catch (kg)}}{(\text{Distance sampled (m)} \cdot \text{Netwidth (m)})} \right) \quad \textbf{(1)}$$

To explore the data, the two independent variables Depth and Latitude are plotted versus the CPUE. The resulting scatter plot of Depth and Latitude versus CPUE are plotted in Figure 2. From these plots it is clear that the CPUE scale must be transformed due to the exponential difference in CPUE between points which will stabilize the variance too. To achieve this, equation (1) is transformed into:

$$CPUE_{\log} = \log\left(\frac{\text{Catch (kg)}}{(\text{Distance sampled (m)} \cdot \text{Netwidth (m)})} \right) \quad \textbf{(2)}$$

The two plots in Figure 3 do not reveal any clear linear relationship between $CPUE_{\log}$ and any of the 2 variables. Thus, suggesting non-linear relationships which will be tested in the proceeding using analysis of variance. Note that the observations at $CPUE_{\log} = 16$ are the zero values transformed this issue will be discussed in detail in section 3.

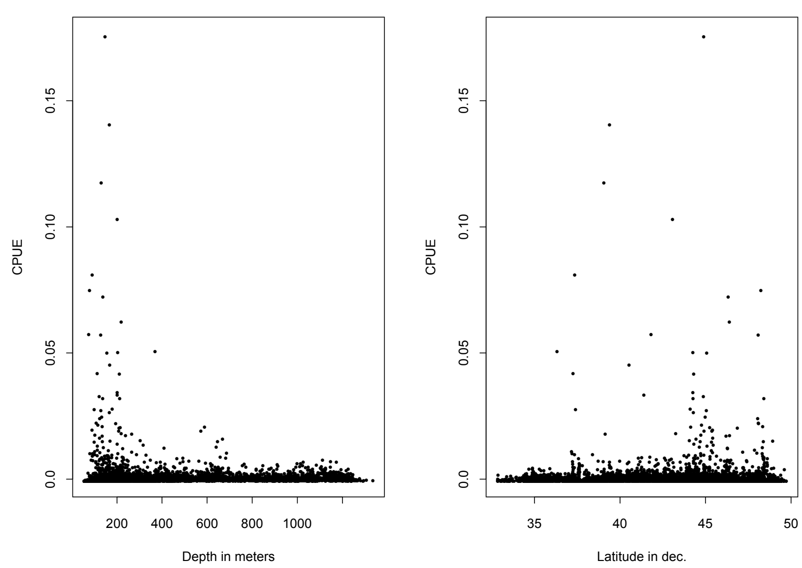


Figure 2: Scatter plots of Depth and Latitude versus CPUE.

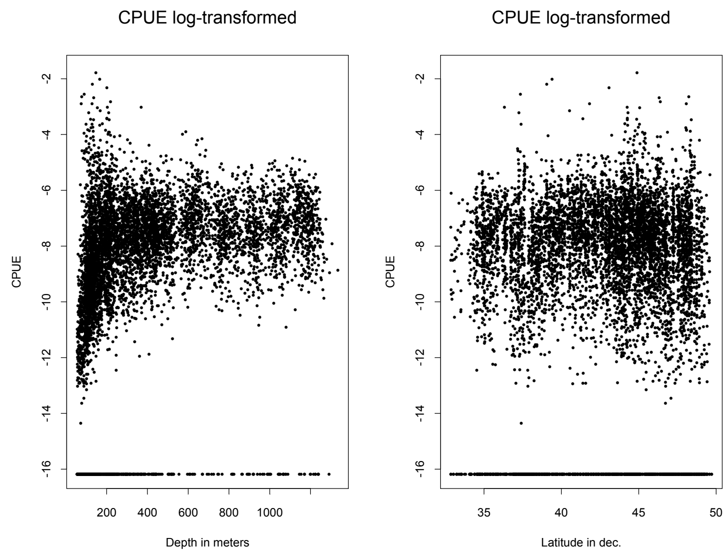


Figure 3: Scatter plots of Depth and Latitude versus log-transformed $CPUE_{\log}$.

It would be desirable to separate juveniles and adults in the data sets to test if there is a depth effect present (i.e. juveniles and adults are captured on different depths). For each haul, the count of sabelfish was dividing by the total weight and plotted in Figure 4. If the sabelfish data could be aggregated into adults and juveniles it would show up as a bimodal distribution in the plots however, which is not the case. Thus, the sable fish data can not be aggregated into juvenile and adult fish from the information given in these three data sets. To accomplish that task, the Age Length Key (ALK) and the length frequency data that is currently not available would have to be incorporated into the analysis. Due to the lack of ALK and ALD data, sable fish will be considered as one homogeneous population going forward.

There is a significant difference in the way the three surveys have been conducted through time. The two AK-surveys cover a much larger area than the NW-survey and include different designs that have a longer history as well. For these reasons, the analysis for the Sable fish will be carried out as a factor analysis where survey, year and month will be included as factors in the models.

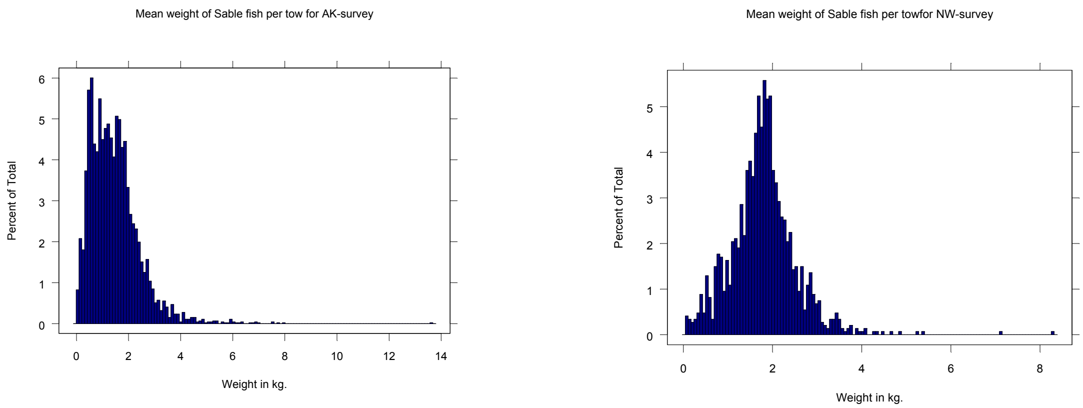


Figure 4: Histograms showing the mean weight of Sable fish in kg. per haul for the two AK-survey and the NW-survey respectively.

To explore if a non-linear relationship is present the two independent variables are plotted against their fitted values using cubic smoothing spline with 4 degrees of freedom and a loess smoother with span = 0.75. The results are presented in Figure 5.

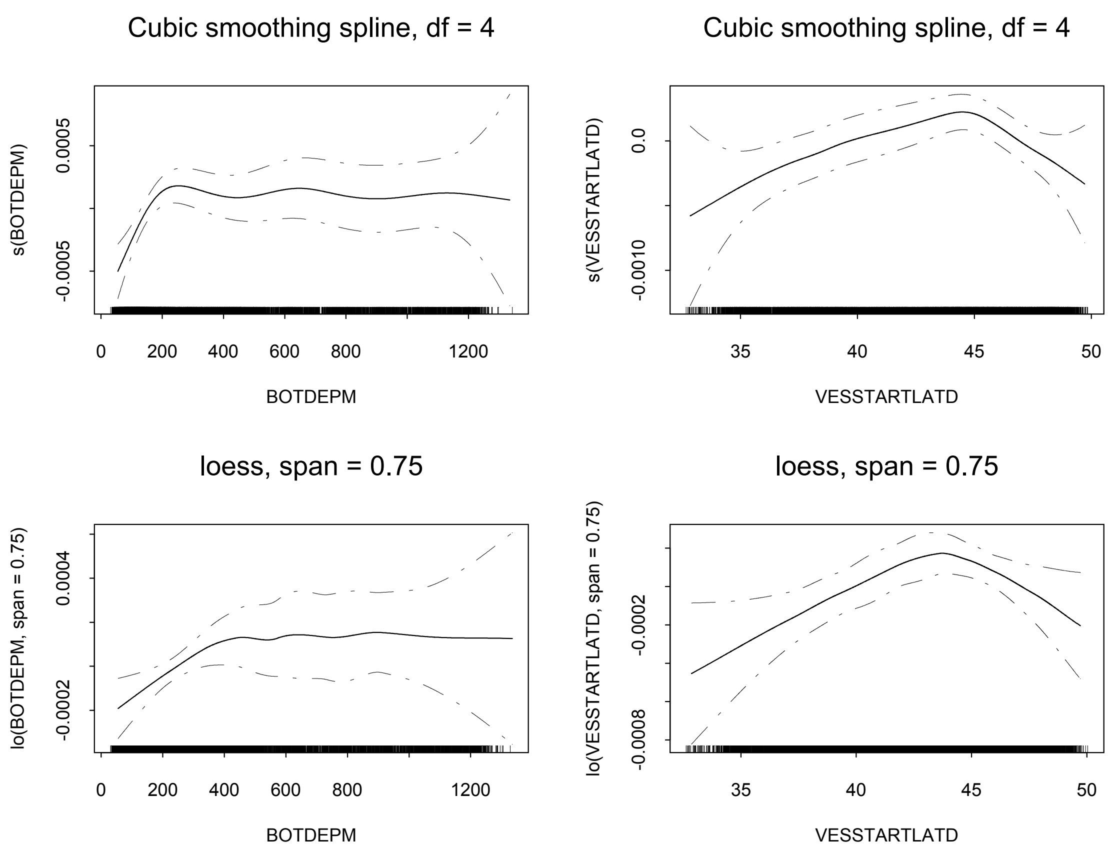


Figure 5: The result of fitting an additive model with smooth functions (cubic spline and loess) of the two predictors. The dashed lines are approximate 95% pointwise confidence intervals. The tick marks in the bottom of each plot show the location of the observation on that variable.

The general shape of the fits, produced by local regression and smoothing splines, (Figure 5) are quite similar and fits the data well. From these plots it is obvious that there is no linear relationship between log (CPUE) and depth and latitude respectively.

Because loess gives no weight to observations outside the set of nearest-neighbors in forming a local estimate of $E(y)$, it is more robust against outlying values on X than smoothing splines (Cleveland 1979). The NW, AK1 and AK2 data sets do have many extreme (outlying) values. Hence, the loess smoother should be preferred for analysis of these data sets.

The difference in the way local regression and cubic smoothing splines operate is generally overwhelmed by choices as to how much smoothing to do with a given brand of smoother. (i.e. "within smoother" variation seems to dominate "across smoother" variation. One cavas is that local regression generalizes to higher-dimensional settings more readily than spline functions. See section Annex 1 for a description and comparison of GAM and choices of smoothers.

3 MODEL TESTING (SELECTION)

Modeling continuous CPUE for sable fish can be done in many different ways, e.g. using a generalized additive model or a generalized linear model. In this section, two different model approaches will be undertaken; firstly a generalized additive model (GAM) modeling the continuous $CPUE_{\log}$ data derived in equation (2) will be presented. Thereafter a generalized linear model (GLM) with binary response will be derived and finally a GAM with binary response will be derived at the end of this section.

3.1 <u>Generalized Additive Model, continuous response</u>

To test if a linear model (LM) is appropriate for modeling $CPUE_{\log}$ the depth as an independent variable is tested for linearity by an analysis of variance; i.e. a LM is tested against a GAM model and the independent variable latitude is tested for linearity in the same manner.

$$Model1: E(CPUE_{\log}) = S + Y + M + Depth \quad \textbf{(3)}$$

and

$$Model2: E(CPUE_{\log}) = S + Y + M + loess(Depth) \quad \textbf{(4)}$$

Where S is a factor representing survey (4 levels), Y is a factor for year (1997,…,2002) M is a factor for month (6, 7, …, 11).

These two models are tested up against each other for each survey and the results of the analysis of variance (ANOVA) are presented in Table 1.

The hypothesis that there is a linear relationship between $CPUE_{\log}$ and Depth data is tested

Table 1: ANOVA table for Model1 in equation (3) tested against model2 in equation (4).

Terms	Resid. DF	RSS	Test	DF	Sum of Sq	F value	Pr(F)
Depth	7756.000	0.1322277					
Loess(Depth)	7754.733	0.1321402	1 vs. 2	1.267218	0.00008752	4.053259	0.034520

The reduction of RSS from 0.1322277 (the linear fit) to 0.1321402 Table 1 is statistical significant ($\alpha = 0.05$) with an extra 1.267218 degrees of freedom. The hypothesis that there is a linear relationship between $CPUE_{\log}$ and Depth data for the surveys is discarded.

Next, the hypothesis that there is a linear relation ship between $CPUE_{\log}$ and Latitude for the survey data is tested. The two models in equation (5) and equation (6) are tested up against each other and the results of the ANOVA are presented in table Table 2.

$$Model2 : E(CPUE_{\log}) = S + Y + M + Latitude \tag{5}$$

and

$$Model2 : E(CPUE_{\log}) = S + Y + M + loess(Latitude) \tag{6}$$

Where S is a factor representing survey (4 levels), Y is a factor for year (1997,…,2002) M is a factor for month (6, 7, …, 11).

The hypothesis that there is a linear relationship between $CPUE_{\log}$ and Latitude data for the surveys is tested

Table 2: ANOVA table for Model3 in equation **(5)** tested against model4 in equation **(6)** for the survey data.

Terms	Resid. DF	RSS	Test	DF	Sum of Sq	F value	Pr(F)
Latitude	7756.00	0.1322593					
Loess(Latitude)	7754.77	0.1320621	3 vs. 4	1.230136	0.0001972	9.4126	0.0010156

The reduction of RSS from 0.1322593 (the linear fit) to 0.1320621in Table 2 is statistical significant ($\alpha = 0.05$) with an extra 1.230136 degrees of freedom.

The hypothesis that there is a linear relationship between $CPUE_{\log}$ and Latitude data for the surveys is discarded.

These two ANOVA tests confirm what could be seen in the plots in Figure 5 that the relationships between $CPUE_{\log}$ and depth; $CPUE_{\log}$ and latitude indeed are non-linear.

The next step is to include depth, latitude and the interaction between depth and latitude and, the three-factors survey, year and month in a generalized additive model, and finally test if all the terms are significant. The full, generalized additive model is shown in equation (7).

$$E(CPUE_{\log}) = S + Y + M + loess(Latitude) + loess(Depth) + loess(Latitude, Depth) \quad \textbf{(7)}$$

Where S is a factor representing survey (4 levels), Y is a factor for year (1997,…,2002) M is a factor for month (6, 7, …, 11) .

Then an ANOVA is carried out to see if any terms can be eliminated and the result is presented in Table 3.

Table 3: ANOVA table for model 5 in equation **(7)** for the AK-survey data, added 1e-7 to all CPUE observation before log-transformation.

Terms	DF	Npar DF	Npar F	Pr(F)
Intercept	1			
MONTH	5			
SURVEY	2			
YEAR	16			
Lo(BOTDEPM)	1	1.3	542.5211	0.000000e+000
Lo(VESSTARTLATD)	1	1.2	28.6917	5.037583e-009
Lo(VESSTARTLATD, BOTDEPM)	0	3.3	180.2557	0.000000e+000

All the terms in the ANOVA table (4) are significant and cannot be removed from the model. Thus, the full model is the final one.

To see if the model violates the assumption about normal distributed errors, we look at the residuals in Figure 6 and Figure 7. It is obvious from these two figures that the choice of number added to CPUE before log transforming it $(\log(0) = -\infty)$ is very important. The reason for adding a number to all CPUE observations is to shift the axis slightly since it is not possible to take the logarithm to zero. It would be obvious to add 1 to all CPUE observations before log-transforming it since log(1)=0, but as shown in Figure 7 that would violate the assumption of normal distributed errors. The reason why *1* will not work with this data set is due to the relative small values for CPUE. The largest value for CPUE is 0.176. The decision to choose the number 1e-7 as the constant added to all CPUE observations was made by substantially testing different numbers. The number 1e-7, that is one-fifth the smallest CPUE, came out with the best looking residual plots. (Note: the line with a negative slope in the first residual plot is the residuals of the transformed zeros plotted against their fitted values) This shape occurs because the model is treating these values as constants over the fitted interval with increasing residuals. From the third plot, there is a large number of values with very high leverage (the values to the right of the vertical line in the plot). These values (the extreme catches) have very high influence on the fit and there by on the coefficients of the model and it would be advisable to exclude the 26 observations with hatvalues > 0.015. The fourth plot shows that the model fits the CPUE observations reasonably well.

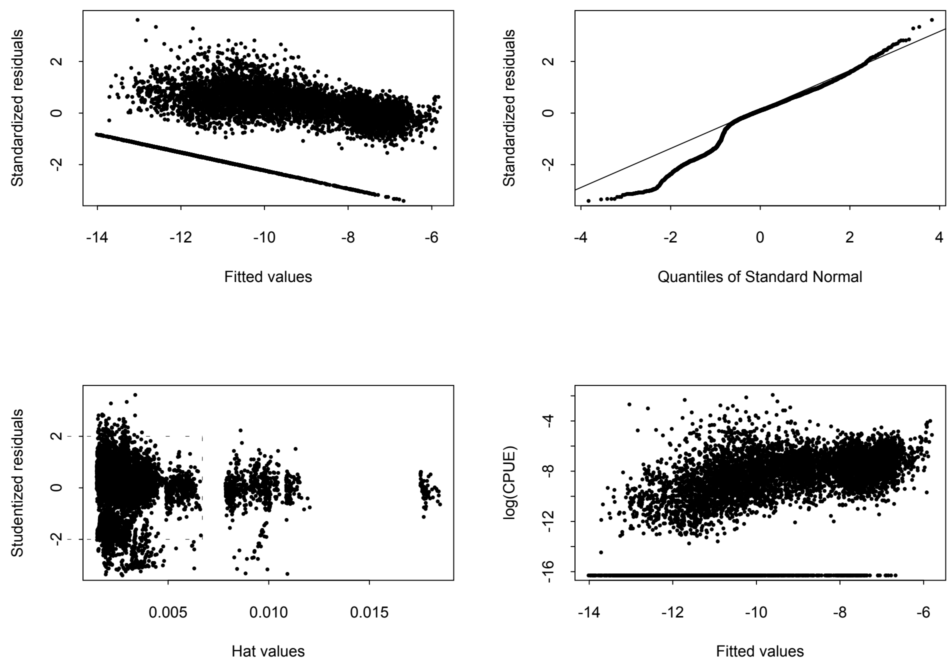


Figure 6: Residual plot for the final model in equation **(7)**, added 1e-7 to all CPUE observation before log-transformation.

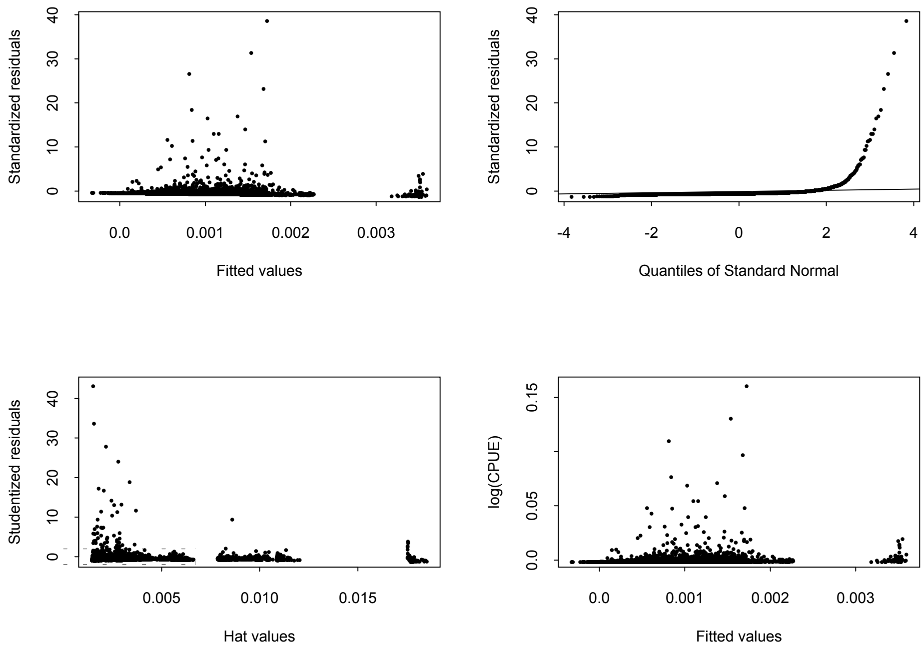


Figure 7: Residual plots for the final model in equation **(7)**, added 1 to all CPUE observation before log-transformation.

Figure 8 shows a prediction for year 2002, survey 3(NW-survey) and July month using the fitted generalized additive model from equation (7). (Note: the spike in the probability for low depth between latitude 42 and 46.) This phenomena is due to some few extreme hauls that influence the model very much and these values should be considered removed from the dataset, if the more general pattern is to be explored in full depth.

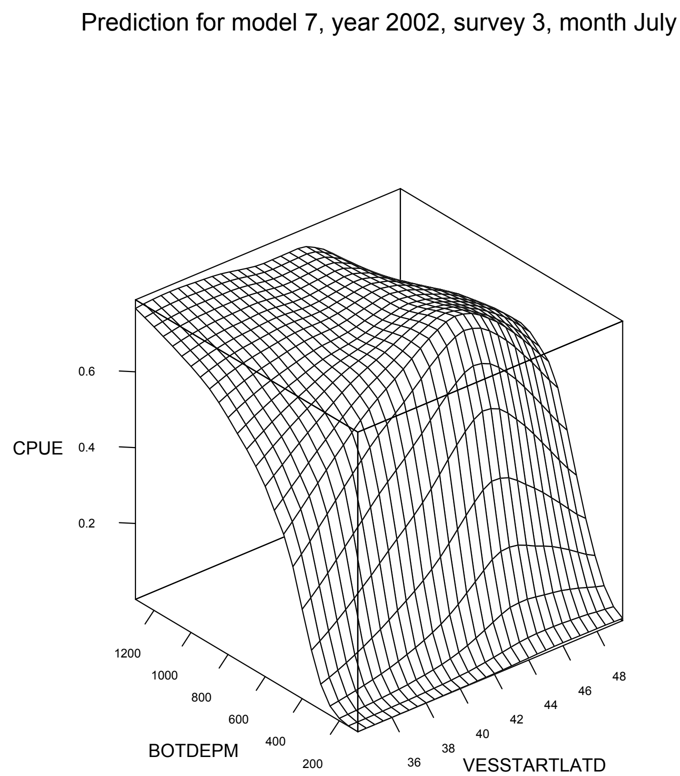


Figure 8: Prediction example for model 7, for year 2002, survey 3 (NW-survey) and month July.

To summarize these results so fare, a GAM modeling CPUE for the NMFS survey data violates the distributional assumptions and should therefore not be used.

3.2 Generalized Linear Model, binary response

Due to the many extreme values (catches over 1200 kg) and due to the large number of zero catch observations >1500, a more robust and simple model would be preferable.
A model that would not be sensitive to these extreme observations would be a generalized linear model where CPUE was modeled as a binary variable (0 if no Sable fish are present in haul, 1 if Sable fish are present in haul).

$$CPUE = \begin{cases} 0; \text{no Sable fish are present in haul} \\ 1; \text{Sable fish are present in haul} \end{cases}$$

To illustrate this point, present/non-present as a binary response variable was modeled using a GLM[1] with a logit link function. Let $p = (prob(CPUE > 0)$

First the full model in including all possible terms is modeled

$$E[\text{logit}(p)] = S + Y + M + Latitude + Depth + Latitude : Depth \quad \textbf{(8)}$$

Where S is a factor representing survey (4 levels), Y is a factor for year (1997,…,2002) M is a factor for month (6, 7, …, 11) and $\text{logit}(p) = \log(p/(1-p))$.
Fitting the GLM in equation (8) and performing analysis of deviance (see Table 4) with the "step" function in S-plus, gives the following model reduction (see equation (9)).

Table 4: Analysis of Deviance table for the generalized linear model in equation **(8)**.

STEP	Df	Deviance	Resid. Df	Resid. Dev	AIC
			7731	6124.409	6178.409
- MONTH	4	4.738981	7735	6129.148	6175.148
- BOTDEPM:VESSTARTLATD	1	1.319705	7736	6130.468	6174.468

$$E[\text{logit}(p)] = S + Y + Latitude + Depth \quad \textbf{(9)}$$

Where S is a factor representing survey (4 levels), Y is a factor for year (1997,…,2002) and $\text{logit}(p) = \log(p/(1-p))$.

[1] A good reference to an in-depth discussion of GLM's would be (McCullagh and Nelder 1989).

Fitting this model yields the following coefficients:

Table 5: Coefficient values, standard errors and t values for the reduced model in equation **(9)**.

Coefficients			
	Value	Std. Error	t value
Intercept	-1.509150737	0.4800761093	-3.1435656
YEAR1	-0.145852595	0.0776847019	-1.8774944
YEAR2	0.056511997	0.0414481813	1.3634373
YEAR3	0.138727608	0.0313849930	4.4201892
YEAR4	0.830857084	0.8705720706	0.9543806
YEAR5	-0.106693791	0.1462337091	-0.7296115
YEAR6	0.468632587	0.4645555060	1.0087763
YEAR7	-0.080407854	0.1618935525	-0.4966711
YEAR8	-0.117183713	0.0778290599	-1.5056550
YEAR9	-0.079984538	0.0968315204	-0.8260176
YEAR10	-0.072746081	0.0522472365	-1.3923431
YEAR11	0.267120360	0.1937121769	1.3789549
YEAR12	-0.124748025	0.0525882620	-2.3721648
YEAR13	-0.116078047	0.0349055916	-3.3254857
YEAR14	-0.050600105	0.0324421283	-1.5597036
YEAR15	-0.019917502	0.0292700936	-0.6804728
YEAR16	-0.023831303	0.0236303142	-1.0085055
YEAR17	-0.028614817	0.0233262161	-1.2267235
SURV1	0.511277683	0.1609899263	3.1758365
SURV2	-0.419443130	0.0613042600	-6.8419899
BOTDEPM	0.006373999	0.0003268699	19.5001112
VESSTARTLATD	0.051565244	0.0076938270	6.7021580
Null Deviance	7656.014	Df	7757
Residual Deviance	6130.468	Df	7736

Since the responses are binary, even if the model is correct, there is no guarantee that the deviance will have even an approximately chi-squared distribution, but since the deviance value is about in line with its degrees of freedom, there is no reason to question the fit. Residuals are not very informative with binary responses. A better measure is to check if the deviance is in line with the degrees of freedom.

An example of probability plotted versus latitude and depth for year 2002 and survey 3 (NW-survey) is given in Figure 9. This plot is very similar to the prediction plot for the generalized additive model in Figure 8. The binary GLM prediction average over multiple months, while the GAM prediction is shown for July only. The GLM fits very well, keeping in mind that it is a much simpler model compared to the GAM fitted on log(CPUE) response.

To summarize the results thus far, would be to suggest the use of the GLM due to simplicity and that the fitted values are directly interpretable as probabilities.

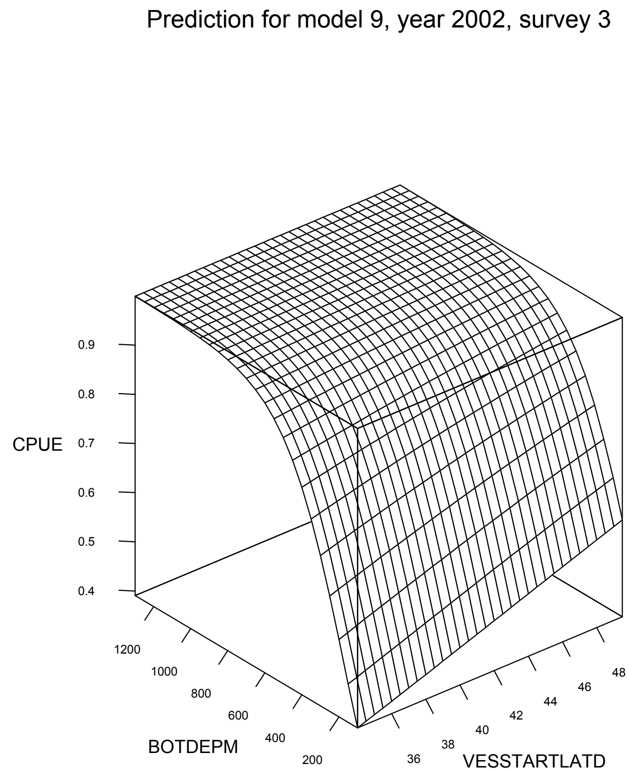


Figure 9: Prediction example for model 9, for year 2002, survey 3 (NW-survey).

3.3 Generalized Additive Model, binary response

Another model that would not be sensitive to these extreme observations would be a generalized additive model where CPUE was modeled as a binary variable P (0 if no sable fish are present in haul, 1 if sable fish are present in haul).

$$CPUE = \begin{cases} 0; \text{no Sable fish are present in haul} \\ 1; \text{Sable fish are present in haul} \end{cases}$$

To illustrate this point, present/non-present as a binary response variable was modeled using a GLM[2] with a logit link function. Let $p = (prob(CPUE > 0)$

At this point it was decided to eliminate year, month and survey as factors in the analysis, since they would not be used for prediction in the final model.

[2] A good reference to an in-depth discussion of GLM's would be (McCullagh and Nelder 1989).

Fitting the full GAM in and performing analysis of variance with the "step" function in S-plus, produces the following model reduction:

$$E[\text{logit}(p_i)] = \beta_0 + \sum_{j=1}^{2} f_j(x_{ij}) \qquad \textbf{(10)}$$

Where, $\text{logit}(p) = \log(p/(1-p)), i = 1,...,8185$ and $x_{i1} = latitude_i$ and $x_{12} = depth_i$.

In Figure 10 a prediction using the fitted model in equation (10) for sable fish is shown, the GAM uses 6 degrees of freedom for the two cubic smoothers.

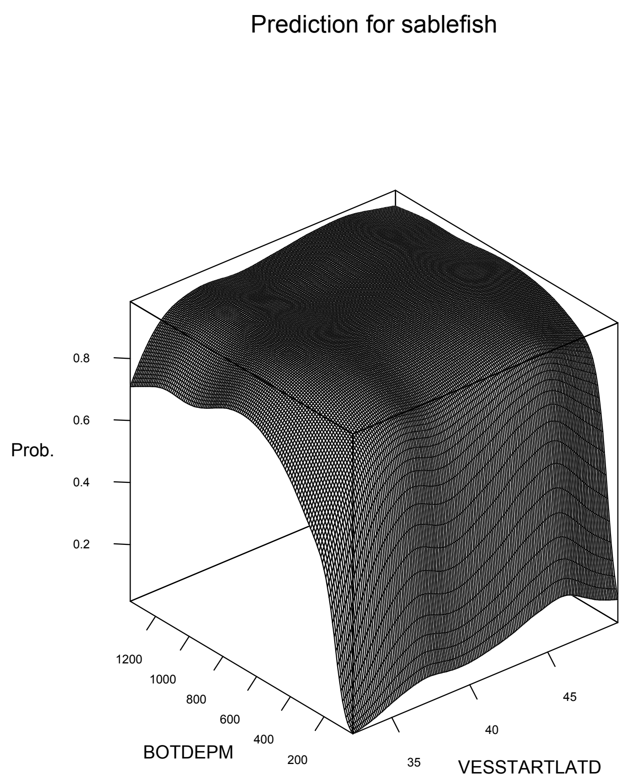


Figure 10: Prediction example for model 10, for all years.

From this preliminary data analysis it was decided that this GAM approach would be used instead of the similar GLM approach due to the higher level of smoothness induced by the GLM approach, see Figure 9. It was also decided that a cubic smoother with 6 degrees of freedom smoothed the data most accordingly.

4 COMPLETED GAM MODELS

4.1 Technical decision rules

As described in the previous section, a GAM with 6 degrees of freedom was considered to smooth the data most appropriately and the GAM in equation (11) was applied to all the available species in the NMFS surveys. In the following subsections of this section, the analysis of a subset of the 20 species that the NMFS survey data covered completely, will be given.

In the following sections technical measures for goodness of fit for each of the species in the FMP will be provided. In these sections, it will be documented which model approach, if any, was used. Further, in each section a plot of the complete Habitat Suitability Probability profile (HSP) that was used in the HSI model is given for each species. A goodness of fit estimate will be given in the following format:

	False	True
0	7368	76
1	585	156

The incorrect predictions are the off-diagonal entries where the model predicts true when the data is 0 and when the model predicts false when the data is 1. In the example above the prediction error rate was 8.1% and this table will be used as a goodness of fit measure in the following sections.

When there are sufficient data available, the following GAM will be fitted for each species in the following sections.

$$E[\text{logit}(p_i)] = \beta_0 + \sum_{j=1}^{2} f_j(x_{ij}) \qquad \textbf{(11)}$$

Where, $\text{logit}(p) = \log(p/(1-p)), i = 1,\ldots,8185$ and $x_{i1} = latitude_i$ and $x_{12} = depth_i$.

A measure of over-dispersion will also be provided for each species that was modeled using the GAM in equation (11). This measure will be significantly greater (>>) than 1 if over-dispersion is present. This means that if the dispersion is >>1 the data will be modeled using the GAM in equation (11) with a Quasi-likelihood family with logit link. When the dispersion is not substantially larger than 1 the GAM in equation (11) will be modeled with a binomial family and logit link.

4.2 Outliers

There were three records in the NW-surveys file with gear temperature equal to zero which have been removed. In the same file there were 7 observations where duration in hours was equal or less than zero which have also been removed. Moreover, 26 records with extreme CPUE where identified but kept in the dataset. The sample I.D., for the 12 most extreme values, is shown below. Richard Methot confirmed their validity, therefore, keeping these values in the dataset.

```
geartempc=0, all in NW-surveys
 SAMPLEID
----------
199801002041
199801002068
199901006044
```

```
Records with duration <=0, only found in NW-surveys.
 SAMPLEID
----------
200101006081=0
200101006088=0
200101009003=0
200101009025=0
200101009036=0
200101009040=0
200001006011 = -11.45
```

```
Records with extreme CPUE. All in the AK-surveys file.
 SAMPLEID
----------
    39637
    39679
    40984
    43322
    43338
    43644
    45532
    46083
    46101
  1090097
  1090357
  1090366
```

4.3 <u>Aurora rockfish</u>

Aurora rockfish was present in 948 hauls out of the 8,185 hauls. The HSP was developed entirely from fitting the GAM to the NMFS survey data.

Table 6: Prediction error rate.

	False	True
0	7043	194
1	239	709

From Table 6, the prediction error rate is calculated to be 5.3%, suggesting a good fit to the data.

The dispersion parameter for the Quasi-likelihood family is 0.9469618, indicating no over-dispersion.

The HSP is shown in Figure 11.

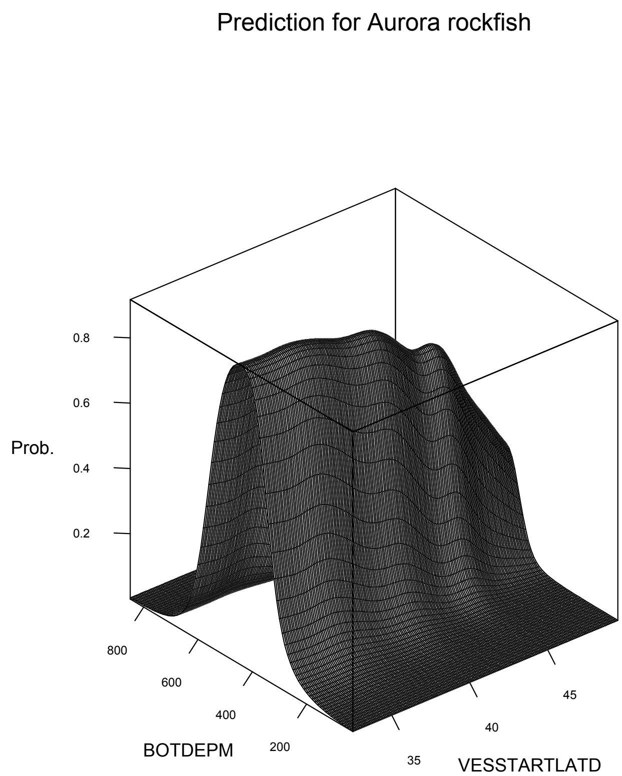


Figure 11: HSP for aurora rockfish.

4.4 Darkblotched rockfish

Darkblotched rockfish was present in 2,297 hauls out of the 8,185 hauls. The HSP was developed entirely from fitting the GAM to the NMFS survey data.

Table 7: Prediction error rate.

	False	True
0	5188	700
1	744	1553

From Table 7, the prediction error rate is calculated to be 17.6%, suggesting an average fit to the data.

The dispersion parameter for the Quasi-likelihood family is 0.9188649, indicating no over-dispersion.

The HSP is shown in Figure 12.

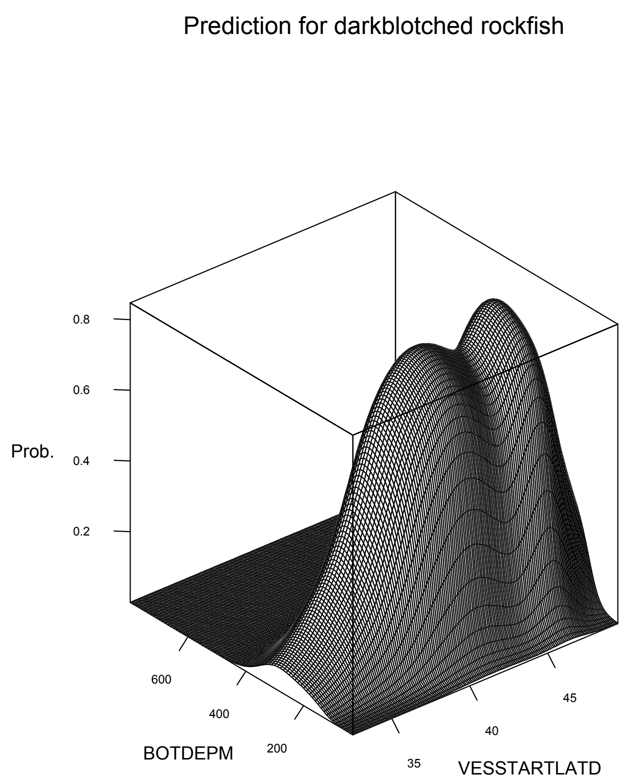


Figure 12: HSP for darkblotched rockfish.

4.5 Greenstriped rockfish

Greenstriped rockfish was present in 2,184 hauls out of the 8,185 hauls. The HSP was developed entirely from fitting the GAM to the NMFS survey data.

Table 8: Prediction error rate.

	False	True
0	5372	629
1	516	1668

From Table 8, the prediction error rate is calculated to be 14.0%, suggesting a good fit to the data.

The dispersion parameter for the Quasi-likelihood family is 1.000763, indicating no over-dispersion.

The HSP is shown in Figure 13.

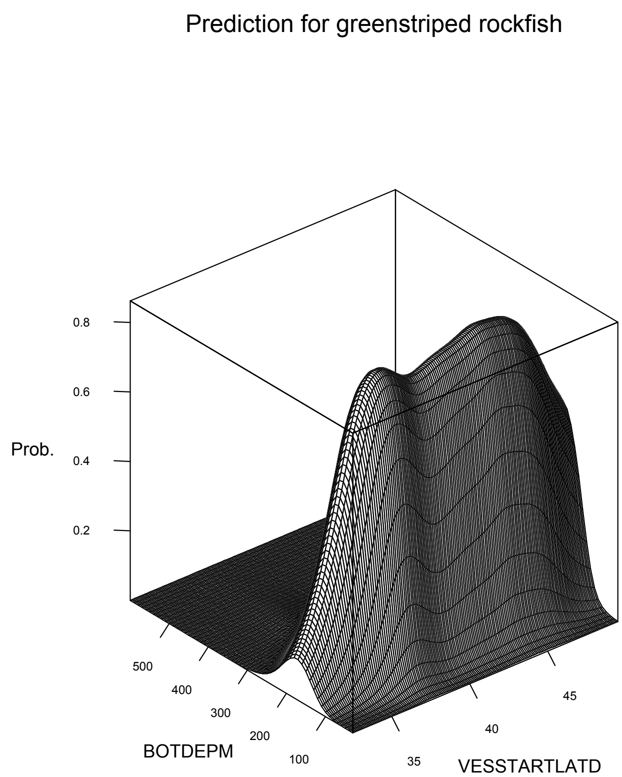


Figure 13: HSP for greenstriped rockfish.

5 SURVEY PROFILES COMPLETED USING EXPERT ADVICE

For 16 species the habitat suitability profiles created from the NMFS survey were almost complete only missing information in the 0-30 meters depth interval. Spread sheets for these species were developed and send out to expert on these specific species requesting them to complete the 0-50 meters depth interval, see Figure 14. The 40 and 30 meters column was then compared to the output from the model and the 20, 10 and 0 column were incorporated in the partially completed profile increasing the number of completed habitat suitability profiles for adults from 20 to 36.

Figure 14: Sample of spread sheets that was filled out by expert, grayed area filled out by expert.

	Depth in 10-m intervals								
Latitude (degrees)	**70**	**60**	**50**	**40**	**30**	**20**	**10**	**0**	
49	0.96023	0.97329	0.98212	0.98	0.98	0.7	0.3	0.1	Washington
48	0.95263	0.9681	0.97861	0.98	0.98	0.7	0.3	0.1	Washington
…	…	…	…	…	…	…	…	…	…
34	0.94459	0.96258	0.97486	0.75	0.5	0.2	0.1	0.1	So. Calif. Bight
32-33	0.75	0.75	0.5	0.5	0.2	0.2	0.1	0.1	So. Calif. Bight

6 THE HUD METHOD

It was only possible to produce 36 complete habitat suitability probability profiles from the NMFS trawl survey data (including those completed with additional expert opinion). All of these were assumed to be for adults only. Size composition data are available for many groundfish from the surveys and these could be used to distinguish juveniles from adults in the survey hauls, however, such a detailed analysis was outside the scope of the current study and the size composition data were not used.

In order to complete habitat suitability probability profiles for more species and life stages, a procedure was developed for using basic data on depth and latitude preferences from the HUD. Depth preferences are characterized in the HUD with four depths: minimum observed depth, minimum preferred depth, maximum preferred depth, and maximum observed depth (AbsMinDepth, PrefMinDepth, PrefMaxDepth, AbsMaxDepth repsectively). Geographic (latitude) preferences are recorded similarly (AbsMinLat, PrefMinLat, PrefMaxLat and AbsMaxLat respectively). The preferred minimum and maximum depths (and latitudinal ranges) are roughly based on the 5th and 95th percentiles from surveys when these data are available. Not all of these data are available for all species and life stages. No data are recorded in the HUD for a total of 74 species/life stage combinations, 56 of which are eggs and 17 of which are larvae. A further 94 combinations (mainly larvae and juveniles) have so little data in the HUD that it is not possible to develop profiles. This leaves 124 combinations for which profiles could be developed from the HUD.

As described above, there are up to four different values recorded each for depth and latitude in the HUD. Assuming that the habitat will be most suitable for the species somewhere between the preferred minimum and preferred maximum depth and latitude an extra point, termed the "optimum" can be created for both depth and latitude. For simplicity, the discussion going forward will be narrowed down to discuss the depth observations since the same principle will be applied to the latitude observations.

Here we use Pacific Ocean perch (adults) to illustrate the approach, because it is a species for which we have both the survey data results and a full complement of data in the HUD. The optimum value in Table 9 is calculated as

$$Optimum_{depth} = \frac{\mathrm{PrefMinDepth} + \mathrm{PrefMaxDepth}}{2}$$

i.e. the mean value between PrefMinDepth and PrefMaxDepth. An index value, which is a proxy for the habitat suitability probability calculated from the survey data in Section 4 is then assigned to each of the five depth points. This has the value of 0.0 at AbsMinDepth and AbsMaxDepth. The optimum is given the value of 1 (the maximum possible value). It then remains to assign index values for the PrefMinDepth and PrefMaxDepth. Following discussions with the SSC's Groundfish Sub-Committee, it was decided to calculate these values from the 36 profiles completed from the survey data. We have the actual habitat suitability probability values at the PrefMinDepth and PrefMaxDepth for these species. The averages of these values were calculated and these were used for the HUD species. These values were 0.19 at PrefMinDepth and 0.236 at PrefMaxDepth.

Table 9: Observed values from the HUD and their assigned index values.

Pacific ocean perch Adults	Abs Min Depth	Pref Min Depth	Optimum	Pref Max Depth	Abs Max Depth
Value	25	100	275	450	825
Index value	0.0	0.19	1	0.236	0.0

The five points (depth, index) were then plotted in Figure 15 and four lines drawn between them (the Habitat line). Data were extracted from these four lines and fed to a GAM that smoothed the data (the Smooth line). The line "Survey" in Figure 15 is the profile produced from the survey data and was included in the plot to compare the HUD approach with the binary GAM approach used for the survey data.

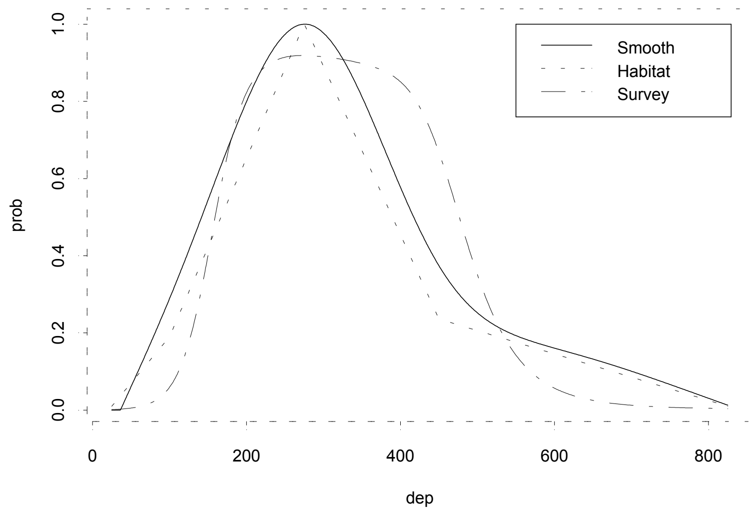


Figure 15: The HUD approach compared to the GAM (Survey) approach using Pacific Ocean perch as an example.

The depth profile in Figure 15 (Smooth) was then extrapolated over the latitude 32 to 49 and the result is shown in Figure 16.

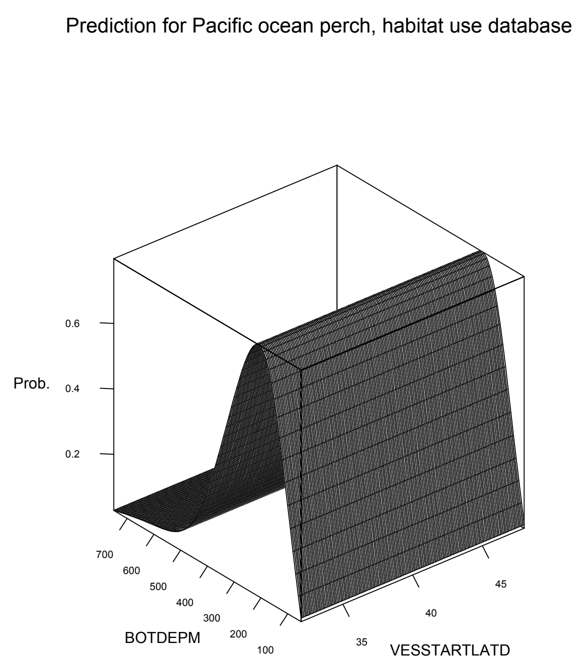


Figure 16: HUD depth profile extrapolated over the latitude interval 32-49 degrees.

The same procedure was then performed for the latitude data and the two profiles were multiplied together and scaled up so the maximum Index value yields 1.

$$HUD_{index} = Depth_{index} \cdot Latitude_{index}$$

We note that the values produced by this method are not strictly probabilities and are therefore not directly comparable with the habitat suitability probabilities derived from the survey data. They are index values that are scaled up to the maximum possible value of 1. The final index profile is shown in Figure 17.

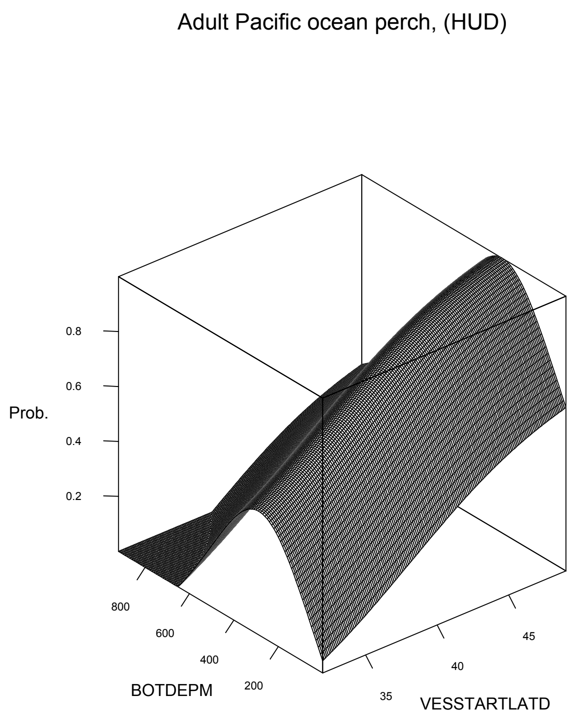


Figure 17: Index profile for adult pacific ocean perch, based on the observations in the HUD.

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ANNEX 1: A PRIMER ON GENERALIZED ADDITIVE MODELS (GAM)

Additive models recast the linear regression model

$$y_i = \alpha + \sum_{j=1}^{k} \beta_j X_{i,j} + \varepsilon_i \qquad \textbf{(12)}$$

by modeling y as an adaptive combination of arbitrary univariate functions of the independent variables and a zero mean, independent and identically distributed stochastic disturbance:

$$y_i = \alpha + \sum_{j=1}^{k} g_j(X_{i,j}) + \varepsilon_i \qquad \textbf{(13)}$$

where $E(\varepsilon_i) = 0$ and $\mathrm{var}(\varepsilon_i) = \sigma^2, i = 1,...,n.$ No distributional assumptions about the ε_i are necessary before inference (hypothesis testing, constructing confidence intervals, etc). Generalized additive models extend the framework in equation (13) in precisely the same way that generalized linear models (GLMs) (McCullagh and Nelder 1989) extend the linear regression model in equation (12) so as to accommodate qualitative dependent variables.

Interpreting GAMs

The absence of the regression parameter β_j in equation (13) reflects an important characteristic of GAMs. One does not obtain a set of regression parameters from a GAM, but rather, estimates of $g_j(X_{i,j})$ for every value of $X_{i,j}$ denoted as $\hat{g}_j(X_{i,j})$ that tells us about the relationship between X_j and the dependent variable. It is possible to extend equation (13) to accommodate for linear terms too, called a semi-parametric model:

$$y_i = \alpha + \sum_{l=1}^{m} \beta_l Z_{i,l} + \sum_{j=1}^{k} g_j(X_{i,j}) + \varepsilon_i \qquad \textbf{(14)}$$

The actual values of $\hat{g}_j(X_j)$ are not substantively meaningful *per se*: Important, is the shape of the fitted functions.
For this reason, graphical methods are used to interpret the non-parametric component of a GAM. A plot of X_j versus $\hat{g}_j(X_j)$ reveals the nature of any estimated non-linearity in the relationship between X_j and the dependent variable — holding constant the other components in the model. Standard errors and confidence regions can be calculated and plotted about $\hat{g}_j(X_j)$, providing a guide as to whether the fitted function is distinguishable from a linear fit, or increasing or decreasing in X_j.
While it may seam easier to examine tables of regression coefficients rather than scatter plots, this ease is only obtained at the cost of unwarranted, restrictive and unnecessary assumptions of linearity.

Scatterplot smoothing

The statistical theory for GAMs is complex; however, most of the key intuitions about GAMs flow from ideas having to do with bivariate, scatterplot smoothing.

Smoothing is an important tool for non-parametric regression, addressing one of the simplest, yet most fundamental questions in data analysis: "what is our best guess of y, given x?"
To define scatterplot smoothing, let $\mathbf{x}\,(x_1,...,x_n)'$ stand for the observations of an independent variable and let $\mathbf{y} = (y_1,...,y_n)'$ stand for the observations on a dependent variable. Assume that the data is sorted by **x**. A scatterplot smoother takes **x** and **y** and returns $\hat{g}(X) = \hat{y}$ also called the kernel, the kernel values sums to one. (i.e. may be negative at times).

Smoothing by local regression (loess)

Given a target point x_0

1. Identify the k nearest neighbors of x_0, i.e., the k elements of **x** closest to x_0. This set is denoted $N(x_0)$. In Splus k is controlled via a "span" argument which defines the size of the neighborhood.
2. Calculate $\Delta(x_0) = \max_{N(x_0)} |x_0 - x_i|$ the distance of the near-neighbor most distance from x_0.
3. Calculate weights w_i for each point in $N(x_0)$, using the following tri-cube weight function $W\left(\frac{|x_0 - x_i|}{\Delta(x_0)}\right)$
4. Regress **y** on **x** and a constant (for local linear fitting), using weighted least squares (WLS) with weights w_i as defined above.
5. The smoothed value $\hat{g}(x_0)$ is the predicted value from the WLS fit at x_0.

Local regression can also be applied beyond the two-dimensional setting encountered in scatterplot smoothing.

Cubic smoothing splines

Cubic smoothing splines are another popular choice for scatterplot smoothing and fitting GAMs. This smoother arises as the solution to the following optimization problem: among all functions $g(x)$ with continuous first and second order derivatives, find one that minimizes the penalized residual sum of squares

$$PRSS = \sum_{i=1}^{N} \left[y_i - g(x_i) \right]^2 + \lambda \int_a^b \left[g''(t) \right]^2 dt, \qquad \textbf{(15)}$$

Where λ is a fixed constant, and $a \leq x_1 \leq ... \leq x_N \leq b$ (Hastie and Tibshirani 1990, 27).
In equation (15) λ is analogous to the span parameter in loess, i.e., higher values of λ result in smoother fits.

APPENDIX 8: NMFS SURVEY HSP DATA COMPARISON WITH THE LIFE HISTORIES APPENDIX

This paper reports on a preliminary comparison of the HSP data derived from the NMFS survey data for depth/latitude and the HSP data derived from the Life Histories Appendix (NOAA Fisheries 2003).

General Comments

By and large, the NMFS survey data (and hence the maps) seems to tie up reasonably well with the information in the Life Histories Appendix (NOAA Fisheries 2003). However, it became clear that the areas that had very low HSP values (below 0.01) derived from the NMFS survey data for depth/latitude, were unlikely to be suitable, and that it would be better to map them as zero. The areas which had HSP values between 0.01 and 0.1 roughly corresponded to the outer depth limits of the fish distribution as given in the Life Histories Appendix, which generally quotes the extreme limits (say 100m to 600m) and then the normal range (95% between 150m and 450m). These have been abbreviated in the following in the form (100)150-450(600).

The latitude information in the Life Histories Appendix is more vague, and generally gives only the extreme limits (often well outside our area). However, on the whole these seem to correspond with the HSP 0.01 level derived from the NMFS survey data for depth/latitude. Furthermore, where further information is given in the Life Histories Appendix (e.g. more common N of Monterey), these also seem to correspond with the HSP 0.1 level.

This suggests that the maps would be better if they treated the NMFS survey data HSP values lower than 0.01 as zero, and split the HSP 0.01 to 0.2 category at 0.1 to distinguish the extreme areas from more likely ones.

The habitat data corresponded pretty well to the Life Histories Appendix. However, two of the 18 fish were not represented in the habitat data (Aurora and Darkblotched - rockfish) so they had to be made up from (somewhat vague) information in the Life Histories Appendix.

Some fish had NMFS survey data depth/latitude HSP values that were all (or almost all) low. In particular, silvergray rockfish and flag rockfish had very low values. Some others only had HSP maxima of around 0.3 or 0.4. Is there a good reason for this? A related question is whether the NMFS survey data HSP data values should be rescaled so that the maximum value is 1.

Summary: Comparison for 18 individual species

In the following summaries, depth and latitude ranges are given as described above. The following abbreviations are used for habitat types:

Ss	Shelf, soft
Sh	Shelf, hard
Scs	Shelf, canyon, soft
Sch	Shelf, canyon, hard
Fs	Slope, soft
Fh	Slope, hard
Fcs	Slope, canyon, soft
Fch	Slope, canyon, hard
Bs	Basin, soft
Bh	Basin, hard

Habitat values are given as percentages (0 to 100).

Aurora Rockfish

Depth:	NMFS survey data - (100)250-650(750); Life Histories Appendix - (125)150-500(765)
Latitude:	NMFS survey data - low values in N, very high in S, all above 0.1; Life Histories Appendix - Vancouver Is to San Diego.
Habitat:	No data (assumed Ss, Fs, Bs = 100); Life Histories Appendix – deep, soft bottom.
Comment:	NMFS survey Depth data looks okay but main part of values are a bit too high. High values in south imply that distribution stretches well beyond San Diego. Should probably have made Scs and Fcs = 100 also.
Fit:	Dubious fit.

Bank Rockfish

Depth:	NMFS survey data - (70)190-460(540); Life Histories Appendix - (31)-(247). Adults prefer >210m.
Latitude:	NMFS survey data – (45)41 – south. Peak around 36-37 degrees; Life Histories Appendix – Newport, OR to central Baja California.
Habitat:	Fh, Sh = 100, Sch, Scs, Fch, Fcs = 66; Life Histories Appendix – hard bottom, high relief or bank edges, ledge of Monterey Canyon. Also deep water over muddy or sandy bottom. Adults also on rocky/non-rocky shelf, canyon, slope, basin.
Comment:	NMFS survey Depth data does not agree with Life Histories Appendix, but Life Histories Appendix may be wrong – adult depth range seems very narrow.
Fit:	Reasonably good.

Blackgill Rockfish

Depth:	NMFS survey data - (150)250-600(680); Life Histories Appendix - (219)250-600(768)m.
Latitude:	NMFS survey data – (49)41-southwards, highest between 36-37 degrees; Life Histories Appendix – About Washington (maybe further north) to Punta Abreojos.
Habitat:	Fh = 100, Fch = 83, Sh, Sch = 66; Life Histories Appendix – Rocky, hard bottoms. Edges of canyons, seamounts.
Fit:	Good fit.

Cowcod

Depth:	NMFS survey data - (30)110-290(380); Life Histories Appendix - (21)180-275(366). Just says “common” in range 180-275m.
Latitude:	NMFS survey data – Northwards to 41(47); Life Histories Appendix – Guadalupe Is, Baja California to Mendocino, CA.
Habitat:	Fh = 100, Sh, Sch = 66; Life Histories Appendix – High relief rocky areas. Submarine canyons?
Comment:	Generally a good fit, though NMFS survey latitude data goes too far north. Max data value only 0.38.
Fit:	Good fit.

Darkblotched Rockfish

Depth:	NMFS survey data - (30)60-480(590); Life Histories Appendix - (25)50-400(600)m.
Latitude:	NMFS survey data – Increasing northwards from about 33 degrees; Life Histories Appendix – Santa Catalina Is to Bering Sea.
Habitat:	No data (assumed Ss, Scs, Fs, Fcs = 100); Life Histories Appendix – Soft bottom. Rocks, boulders, cobble surrounded by mud.
Comment:	A good fit, provided the habitat is correct.
Fit:	Good fit.

Flag Rockfish

Depth:	NMFS survey data - (130)-(440); Life Histories Appendix - (30)-(183)m.
Latitude:	NMFS survey data – (32)-(39), (42)-(46); Life Histories Appendix – Heceta Bank, OR to central Baja California.
Habitat:	Sh = 100, Sch = 66; Life Histories Appendix – Hard bottom.
Comment:	No NMFS survey data values above 0.1. Life Histories Appendix states that it is an important sport fish in S California. Clearly NMFS survey data are wrong.
Fit:	Pure.

Greenspotted Rockfish

Depth:	NMFS survey data - (30)60-360(480); Life Histories Appendix - 90-179(209)m.
Latitude:	NMFS survey data – (46)41-south; Life Histories Appendix – Copalis Head, WA to Cedros Is, Baja California.
Habitat:	Sh = 100, Ss = 83, Fh,Fs = 66; Life Histories Appendix – High relief rocky reefs and soft bottoms.
Comment:	NMFS survey data give too great a depth. Otherwise a reasonably good fit.
Fit:	Reasonably good fit.

Greenstriped Rockfish

Depth:	NMFS survey data - (30)70-320(440); Life Histories Appendix - ?(50)150-239+(409)m.
Latitude:	NMFS survey data – Increasing northwards over whole area; Life Histories Appendix – Cedros Is, Baja California to Alaska.
Habitat:	Sh = 100, Ss=83, Fh,Fs = 66; Life Histories Appendix – Rocky and soft bottom, high and low reefs.
Comment:	Some confusion in depth values Life Histories Appendix, the values given being contradictory.
Fit:	Good fit.

Pacific Ocean Perch

Depth:	NMFS survey data - (60)140-550(670); Life Histories Appendix - (25)100-450(825)m.
Latitude:	NMFS survey data – (37)39 northward; Life Histories Appendix - Aleutians to La Jolla, common from Oregon northwards.
Habitat:	Sh, Sch, Fh, Fch = 100, Ss, Scs, Fs, Fcs = 66; Life Histories Appendix – Gravel, rocky, boulders, gullies, canyons..
Comment:	NMFS survey depth data looks okay. NMFS survey latitude data does not go as far south as La Jolla. Habitat looks okay.
Fit:	?

Redbanded Rockfish

Depth:	NMFS survey data - (100)150-460(540); Life Histories Appendix - (49)150-450(625)m.
Latitude:	NMFS survey data – (32)34 - north; Life Histories Appendix – San Diego to Bering Sea.
Habitat:	Fs, Ss = 100; Life Histories Appendix – Soft substrate.
Comment:	In Life Histories Appendix, latitude uncommon S of San Francisco.
Fit:	Good fit.

Redstripe Rockfish

Depth:	NMFS survey data - (70)110-350(410); Life Histories Appendix - (12)100-350(425)m.
Latitude:	NMFS survey data – (32)41 - north; Life Histories Appendix – San Diego to Bering Sea.
Habitat:	Fh, Sh = 100; Life Histories Appendix – Rocky areas.
Comment:	There seem to be very few Life Histories Appendix polygons with suitable habitats where it has high NMFS survey data values. Is this correct?
Fit:	Good fit.

Rosethorn Rockfish

Depth:	NMFS survey data - (60)110-430(550); Life Histories Appendix - (92)100-350(550)m.
Latitude:	NMFS survey data – Increasing northwards over whole area; Life Histories Appendix – Guadalupe Is, Baja California to Alaska.
Habitat:	Fh = 100, Sh, Sch = 66; Life Histories Appendix – Rock habitat, boulders.
Comment:	As with the Redstripe rockfish, there seem to be very few Life Histories Appendix polygons with suitable habitats where it has high NMFS survey data values. Is this correct?
Fit:	Good fit.

Rougheye Rockfish

Depth:	NMFS survey data - (30)100-600(860); Life Histories Appendix - (25)50-450(875)m.
Latitude:	NMFS survey data – (34)41 northward; Life Histories Appendix - Aleutians to San Diego.
Habitat:	Sh, Ss, Fh, Fs = 100; Life Histories Appendix – soft, steeply sloped (rather unclear).
Comment:	NMFS survey depth data looks okay (perhaps a bit deep). NMFS survey latitude data looks fine, though not quite as far S as San Diego. Is it found on hard as well as soft?
Fit:	?

Sharpchin Rockfish

Depth:	NMFS survey data - (50)110-440(530); Life Histories Appendix - (25)100-350(475)m.
Latitude:	NMFS survey data – (32)34 - north; Life Histories Appendix – San Diego to Aleutians. Less common S of Monterey.
Habitat:	Sh = 100, Ss, Fs = 33; Life Histories Appendix – Can occur over soft, but prefer mud & cobble or boulder & cobble.
Fit:	Good fit.

Silvergray Rockfish

Depth:	NMFS survey data - (30)60-350(460); Life Histories Appendix - (0)100-300(375)m.
Latitude:	NMFS survey data – (38)41-north; Life Histories Appendix – Santa Barbara Is to Bering Sea, commercially important.
Habitat:	Sh, Fh = 100; Life Histories Appendix – Rocky bottom.
Comment:	Nearly all NMFS survey data values are very low. This does not seem consistent with the commercial importance, and implies that the species is rare below 41 degrees. Currently not believable.
Fit:	?

Splitnose Rockfish

Depth:	NMFS survey data - (30)70-510(590); Life Histories Appendix - ?(0)100-450(800)m.
Latitude:	NMFS survey data – Increasing northwards from about 33 degrees; Life Histories Appendix – Baja California to Alaska.
Habitat:	Ss, Fs = 100, Scs, Bs = 66; Life Histories Appendix – Non-rocky shelf, slope, basin.
Fit:	Good fit.

Yellowmouth Rockfish

Depth:	NMFS survey data - (110)170-380(500); Life Histories Appendix - (137)275-366(366)m.
Latitude:	NMFS survey data – (40)48 – north; Life Histories Appendix – Point Arena, CA to Alaska. Adults from N California northward.
Habitat:	Fh, Sh, Bh = 100; Life Histories Appendix – rough bottom, rocky shelf on slope, basin.
Comment:	Nearly all NMFS survey data values are very low, inconsistent with distribution in Life Histories Appendix, which also says that it is commercially important from BC to OR.
Fit:	?

APPENDIX 9: PACIFIC COAST GROUNDFISH FMP HABITAT USE DATABASE USER MANUAL FOR VERSION 15B (DRAFT)

Table of Contents

1 DATABASE PURPOSE

The Pacific Habitat Use Relational Database has been developed to provide a flexible, logical structure within which information on the uses of habitats by species and life stages in the west coast groundfish species complex can be stored, summarized and analyzed as necessary. This will form an important component of the information base for developing the EIS for the Essential Fish Habitat amendment to the Pacific coast groundfish fishery management plan.

The database is designed primarily to capture the important pieces of information on habitat use by species in the Pacific Groundfish FMP as contained in the Updated Life History Descriptions document compiled by NMFS. This document contains information on each of the species in the groundfish FMP that includes range, fishery, habitat, migrations and movements, reproduction, growth and development and trophic interactions. Certain elements of this information need to be captured in a database so that habitat use data can be analyzed both by species and habitat to provide input into various components of the analysis of EFH, HAPCs and fishing impacts.

Appendix 8A contains an extract from the Updated Life History Descriptions document for canary rockfish (*Sebastes pinniger*). Parts of the text in this extract have been highlighted as an example of the types of information that need to be entered into the database.

Appendix 8B contains a list of tables and forms used in the database.

2 DATA STRUCTURE

It is essential for users to grasp the principle of data structuring and how it is used in a system like this to both enforce data quality and form the basis for developing interrelated lines of analysis. It is a different concept from a simple file storage system that can only receive, store and regurgitate data for use elsewhere. This system can of course be used in that way as well but that is only utilizing a fraction of its capabilities. [Appendix 8C](#) explains in detail these essential basic principles that underlie the design and construction of this Habitat Use Database.

Figure 10 is the 'Entity Attribute Relationship' analysis diagram for the database. It shows the data tables, their fields and which of these form the 'primary keys' (in bold) and the foreign keys which link the tables together via a network of one-to-many relationships. The tables contain all the data in the database. Some contain primary data (e.g. SpeciesLifeStage and PlaceTime) and others contain reference information such as Species, which is simply a list of all the species in the FMP. All data entry forms, data checking procedures, and queries are based around this table structure.

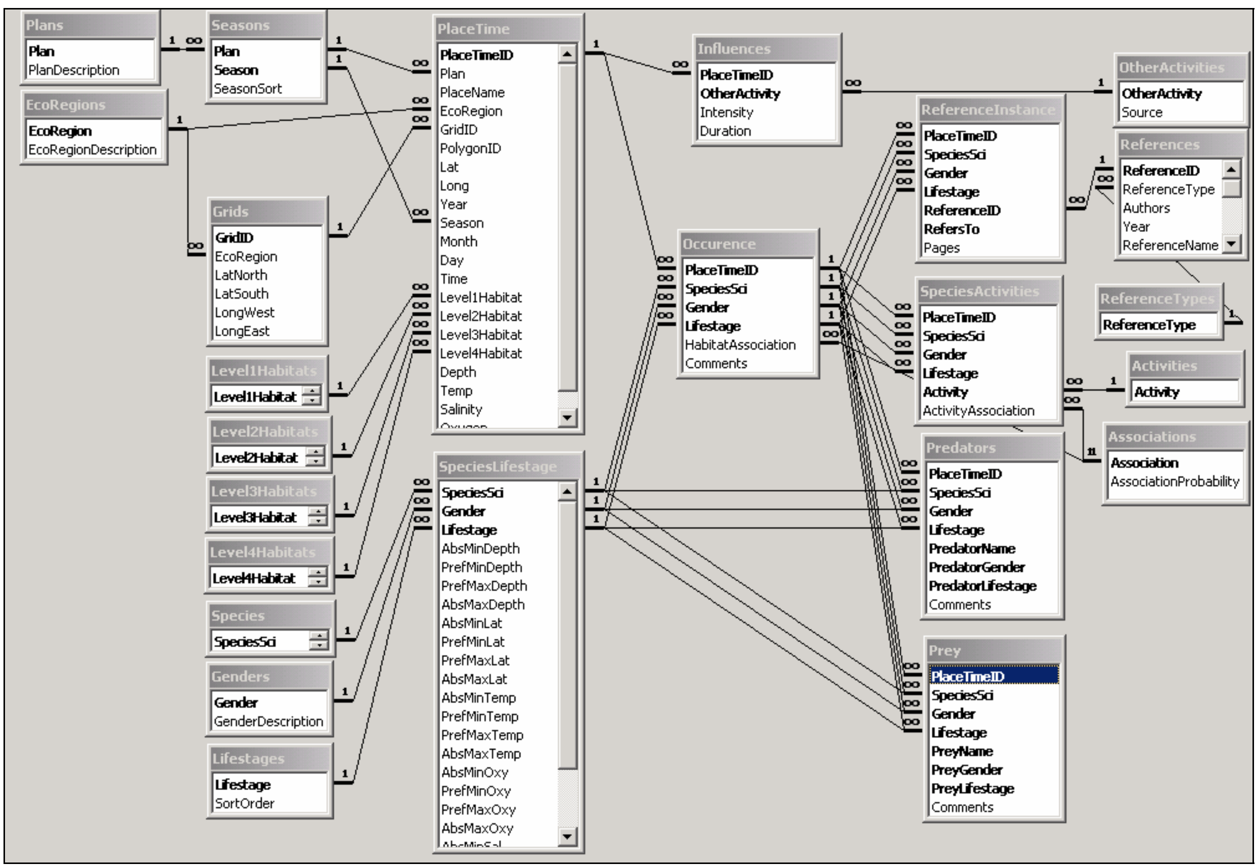


Figure 1: The structure of the data tables, their constituent fields and relationships between them.

2.1 Spatial and Temporal Data: The PlaceTime Table

The core of the database is the ‘PlaceTime’ table. This records where and when particular observations of species-habitat associations were recorded. Records in this table represent the place (or area) and time (or period) of the recorded occurrence of the species and life stage data and the habitat and physical conditions that prevailed at that time and place.

The principle is that the data being recorded are associated with some sort of time and space framework, whether this is in the most general sense such as the whole West Coast region for all time down to very fine scale data where exact times and places are known and might be used to stratify analyses. The system is therefore not dependant on exact spatial and temporal information about a particular species-habitat association. It can be used even where there are no spatial or temporal elements in the data. The information in the PlaceTime table simply allows the breakdown of analysis of species-habitat associations on a finer spatial and / or time scale than the entire range of the species/life stage should the information be available at that resolution. More detailed explanation of the implications of the different grades of spatial and temporal data are given in the following sections.

To allow such flexibility in the type of time and place data that can be recorded and to allow the combination of different types in the same table and analyses, it is necessary to uniquely identify each record in the PlaceTime table, referred to as ‘PlaceTime’ record in the preceding, with a unique number ‘PlaceTimeID.’ This forms the primary key in the table and cannot be repeated. **This means that either data should only be entered in one place or if there are multiple data entry sites then they should either co-ordinate with one another to ensure they use unique sets of numbers or access a centralized database via a network (local or wide area) or via the internet using active server pages. The other possibility is for the database to be ‘replicated’ and later ‘synchronized.’**

The remainder of the fields in this table can either by typed in directly or selected from the combo boxes provided at either table or form levels. There are also range limits on temp, salinity, depth, oxygen, latitude and longitude when their values are not null.

Frequently there is no temporal or spatial information and there may be just a series of observations of species occurring on different habitat types. We don’t know when or where these observations were taken, only that they are accurate in their recording of the types of habitat on which the species were seen. In such cases the record has an arbitrary but unique identifier in its PlaceTimeID field which has nothing to do with place or time but simply allows the habitat data to be linked to the occurrences of species and their activities (tables ‘Occurrences’ and ‘SpeciesActivities’).

Obviously for any of the given ‘PlaceTime’ records (even if it had very detailed location and date-time data) there can be multiple occurrences of different species and different life stages of the same species. These can also have multiple species and life stages of both predators and prey. The database is structured in such a way to allow the correct representation of such natural one-to-many relationships between entities.

In the PlaceTime table, the column PlaceName allows the use of place names where these are used to identify a known area or location at which observations have been made of species/habitat associations. Provided these names are used consistently (a reference set could be defined in a 'look-up' table) then they could also be used in a stratified analysis. This can be used independently, or in conjunction with grids and "EcoRegions." EcoRegions are used as a simple large scale subdivision of the area covered by the FMP so that analysis of habitat use can be broken down at a finer scale than the entire Pacific coast. Seven EcoRegions (numbered 1 to 7) have been proposed, as illustrated in Figure 11. EcoRegions are defined by their member GridIDs. In this implementation of the database no GridIDs have been identified, so EcoRegion and GridID are the same (i.e. there is only one grid per EcoRegion). Arranging it in this way means that if in the future Grids are defined, there will be no need to alter any code in queried that use the Grid/EcoRegion structure. These will run without modification both with the present scheme and when the grids are reassigned.

As shown in the data model, the allocation of results to Eco-Regions should, preferably, always be done via the Grids table. This allows the flexible re-definition of eco-regions and the grid squares they contain should this ever be necessary. There is also an EcoRegion field in the PlaceTime table into which the user can enter the value of the eco-region directly and simply analyze via this field when ignoring the Grid system. There is also a PolygonID field available in the 'PlaceTime' table for recording finer scale spatial allocations, should these be required.

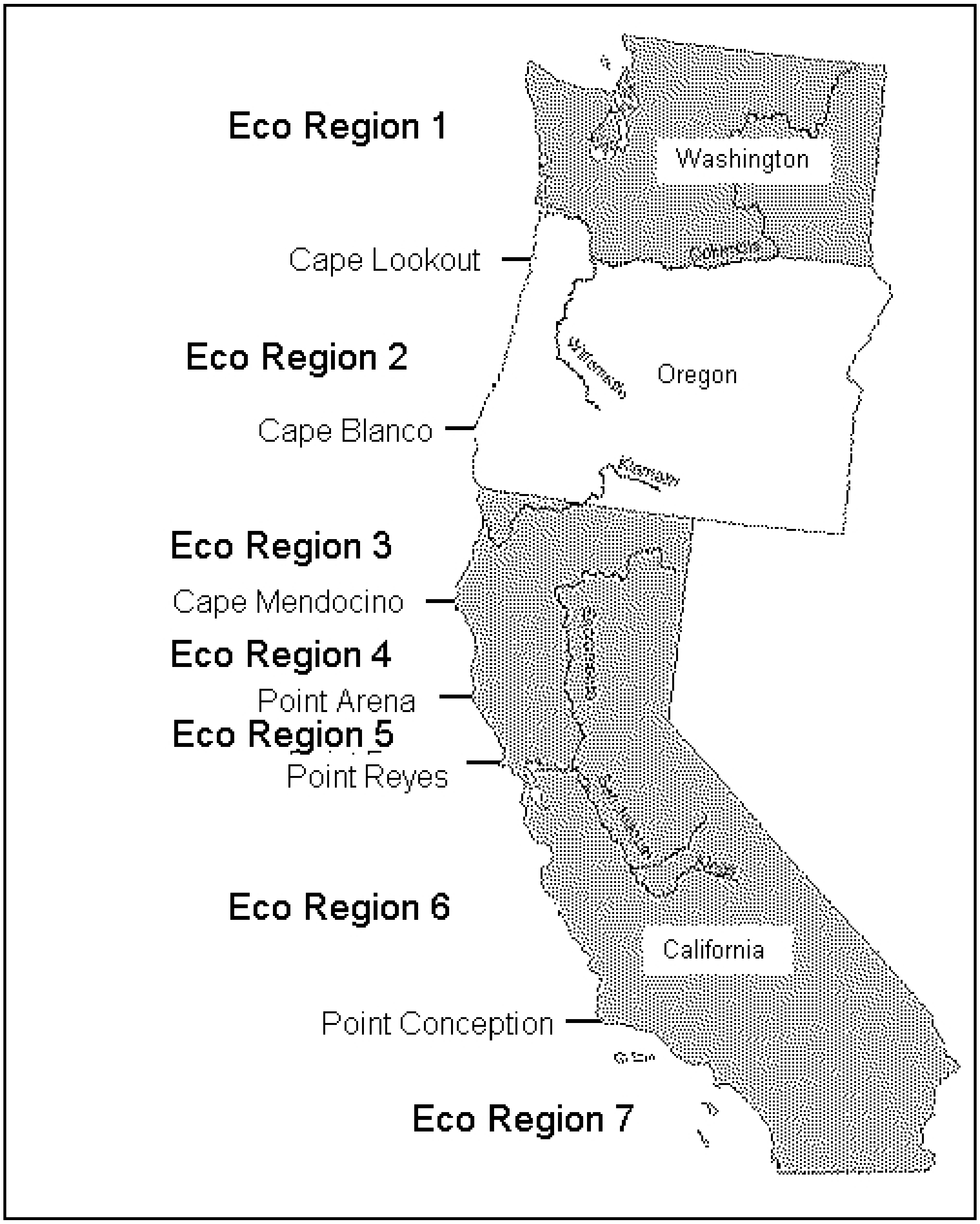


Figure 2: The Eco-Regions

The Grids table has four fields LatNorth, LatSouth, LongWest and LongEast which can be used to define a grid square in terms of its binding latitudes and longitudes. It is assumed these will be entered in a decimal as opposed to sexagesimal notation and that the upper bound for one limit will not run into / overlap with the lower bound of the adjoining limit. The GIS conventions will define the appropriate usage. As with the PlaceTime position fields, there are range limits on what can be entered based on the latitudes and longitudes that enclose the whole west Coast region.

Temporal data in the PlaceTime table include years, seasons, months, days and exact times. Data on these attributes can be entered as and when they are available and deemed to be relevant. The fields can be ignored when the data are unavailable or deemed to be irrelevant. The availability of the fields within the system and the way they are defined allows flexibility in this respect.

2.2 <u>Scaling of spatial and temporal data</u>

The hierarchy of detail available in the PlaceTime table allows data of different temporal and spatial scales to be combined in the analyses. It is important to bear in mind that a few basic assumptions must be adhered to in order to make informed use of this flexibility.

1. Data should be unique. Where data are collected on the basis of one of the finer temporal and/or spatial scales and are also available as a summary of this on one of the higher scales then the data should be entered into the database according to only one of these scales and preferably the finest scale available.
2. Where there are data of mixed temporal and/or spatial scales then care must be taken in framing analyses on two counts:
   a) when such data are combined in an analysis then the results can be stratified spatially or temporally down only to the level of the data with the broadest spatial and temporal scales, and
   b) when a stratification of results is intended on a fine scale, then 1) either all the data should have values entered for those fine scales or 2) careful conditions need to be set to exclude records that do not have values for those finer scales. Note, however, that in this latter case the analysis would not be using all of the available data.

2.2.1.1 Seasons

Seasons are defined within the management plan though it is not obligatory to utilize either of these features where they are not required or are irrelevant. It allows several concurrent seasonal regimes to be defined where management plans are based around a major species and the recognized seasonal patterns of these are different even though they occupy the same areas and times. Equally the defined seasonal regimes for different plans can also be matching, which is the simpler and more likely scenario. Where there is either no defined management plan or a single management plan, the structure allows the simple definition of a single seasonal regime. Where there is no information on seasons, or seasonal attributes are not applicable or irrelevant then the user can enter an appropriate single 'seasonal' value in the look up table such as 'All Year' or 'Unknown' or 'Not Applicable' or whatever the user chooses.

Should it ever be required in the future to extract or 'manufacture' the spatial and temporal data from the descriptive information in source documents then an example methodology is provided in Appendix 8D.

2.2.1.2 Fishery Management Plan

The system is designed to be able to represent several Fishery Management Plans by specifying the FMP in the filed "Plan" in the PlaceTime database table. The facility thus offers the opportunity to stratify analyses according to FMPs where this is required. The present implementation does not require such a facility (there is only one FMP) but it has been left in the database structure in case data from another FMP are entered into the same database at some future time. Its functionality can be ignored by always entering one single value for the 'plan' field. **As with all such 'look-up' data values (e.g. species names etc), if the names are altered the alterations are automatically 'propagated' throughout the entire database doing away with the need to manually update all the associated data with any such name changes.**

2.2.1.3 Habitats

Habitat is currently defined in the PlaceTime table under four tiers of classification. The four levels of habitat classification are currently independent and are not structured as sub sets within one another. For ease of data entry and comparison all three levels are displayed within the same form (Figure 12). As with all of this kind of 'look-up' data the user is free to add or alter the values under these classification schemes.

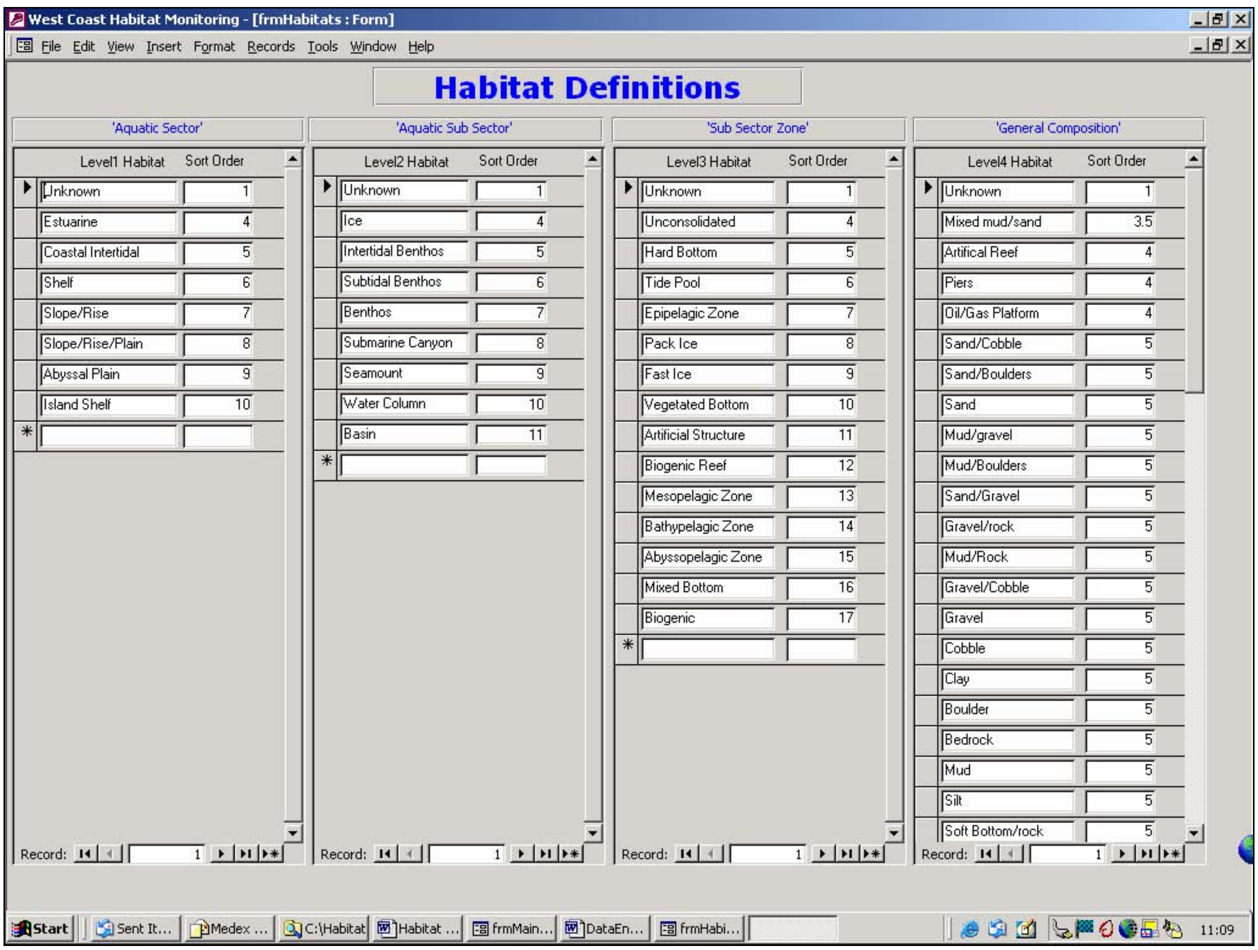


Figure 3: Habitat definitions

2.3 The Species, Genders and Life Stages Tables

These data each reside in a separate table and also in a combined SpeciesLifestage table, although the forms that serve these tables have been conveniently combined. There is also a button to call up the life stages form so that the life stages available in the Lifestages table can be added to or amended. The same is the case for genders. The design of the system also assumes that all predator and prey species and life stages are also entered in these tables. Where no life stage info is available or is deemed irrelevant then a value such as 'Unknown' or 'All' must first be entered via the Lifestages form. This will then appear as a life stage option when entering the value of the life stage for that species under the SpeciesLifestage form. The same principle applies for genders. Care must be taken to bear both data entry and later analyses in mind when deciding on values for life stages and genders at the data entry stage and on what values to filter these on during analyses, e.g., if a combination of 'Both' and 'Unknown' are used as values for gender then one or the other must be used alone with reference to a particular life stage and not both of them. If you used both of the two values it could conceivably distort results. Equally where 'Both' and 'Unknown' have been correctly applied as genders to different life stages then the two values must be used in any filter that is being applied across genders and life stages for a given species.

2.4 The Occurrence Table

The 'Occurrence' table records which species and life stages occurred in the recorded place and time frame on the recorded habitat, etc. The relational structure allows the recording of several of the life stages of the same species that may occur simultaneously and of course as many species as there were present. As explained earlier if no spatial or temporal data are available then the so-called PlaceTimeID simply refers to the habitat type only, as defined.

There is also a 'HabitatAssociation' field in the Occurrence table which records a measure of the relative strength association of that species-life stage with the habitat recorded (as strong, medium, or weak) with matching probabilities. The number and names of values and the probability figures can be changed by editing the Associations table via its form or directly in the table. All the values are the same as those presented for the degree of association of a particular 'Activity' as well.

2.5 The SpeciesActivities table

The SpeciesActivities table records the activities of the fish (spawning, breeding, feeding, or growth to maturity) on a particular habitat in a particular time and place. There may be multiple activities for any given species-life stage in a Place/Time frame. As with the habitat associations, the degree of association of that activity performed by the fish in that habitat can be recorded as strong, medium or weak.

Associations between species can be derived via a query that groups which species-life stage-activities were occurring in a given Time and Place frame for the various habitats. This is providing all data have been comprehensively entered.

2.6 The Predators and Prey Tables

The predator and prey tables have a many to one relationship with the Occurrences table. i.e. any one given species at a particular life stage can have many predators and can also itself prey on several other species. These predators and prey will themselves also be at a particular life stage. The predators and prey recorded must also be represented in the three tables 'Species', 'Lifestages' and 'SpeciesLifestage' even if they are not in the FMP species list. For convenience and simplicity of design the main predator and prey groupings have been denoted as either a member of a predator (pred) or prey grouping in the comments field. That field is then sorted in the menu choice so that these groupings appear together.

2.7 The Influences and OtherActivities Tables

The database also accommodates the recording of other activities or occurrences (impacts) that might have influenced species and their activities in a particular time and place. This is done through a sub-section 'Influences' on the bottom of the 'Place-Time Centric' by allocating these "OtherActivities" in the "Influences" table the same PlaceTimeID as in the PlaceTime table. The extent to which this facility will be used is not clear at present, but this structure will allow comparative analyses to include such influences or 'impacts' as well as habitats and the other attributes on patterns of occurrence and species activities at their various life stages.

Such things as Pelagic Fishing or Acoustic Surveying can be recorded but also natural events such as an el-Nino event or a turbidity current. The OtherActivities table also has a field 'Source' that allows the user to group these other activities according to their source. This can be employed flexibly as required. E.g. it could take only two values such as 'Human' and 'Natural' or these could be subdivided further as required according to the kind of analysis being undertaken. As with the occurrences table the value of the PlaceTimeID is automatically inherited from the parent PlaceTime table in the form used to enter data.

2.8 References

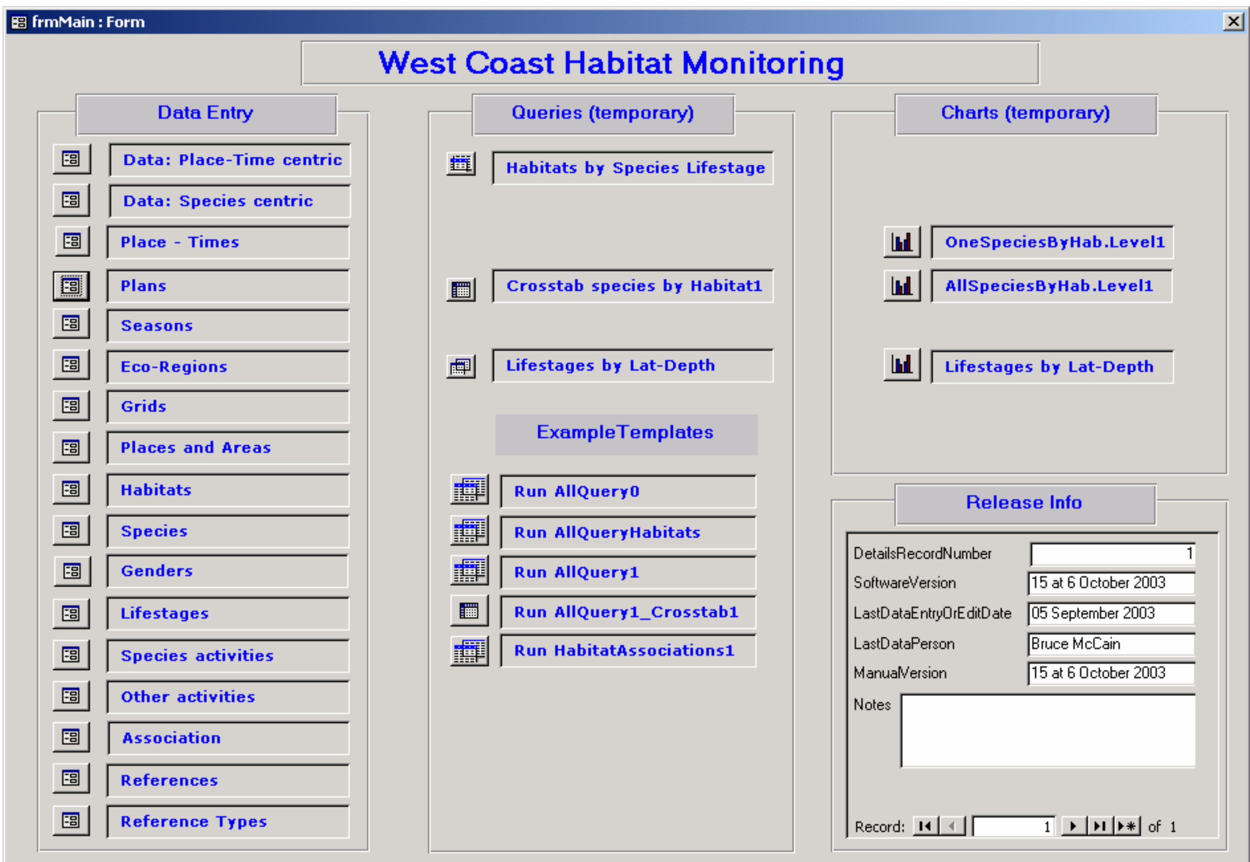
All reference materials are recorded in a single table "References." Each work should be recorded only once with a unique identifier 'ReferenceID'. The 'ReferenceInstance' table records the occurrences of that reference as and when it is referred to in relation to a given occurrence of a species-life stage for a specific time-place frame with its associated habitat and physical conditions. Thus a given reference can appear as many times as necessary in the 'ReferenceInstance' table even for the identical PlaceTime, Species and Lifestage providing it refers to different aspects as recorded in the remaining key field 'RefersTo.' For example, the same work can be recorded as a relevant reference for both Habitat and Predators.

A total of 557 references have been entered so far (October 2003). These are then also referred to from the database, thus explicitly describing the network of references and the context in which they are referred to.

3 WORKING WITH THE DATABASE

The database is designed to be as intuitive as possible with information naturally arranged in a hierarchy of 'Parent' – 'Child' tables. These tables are automatically linked in their data entry and viewing forms. For those unfamiliar with Access databases a period of practice on a dummy copy of the system will help familiarize the user with navigational controls. Liberal use of the 'Help' button should also be made.

The opening form appears as:



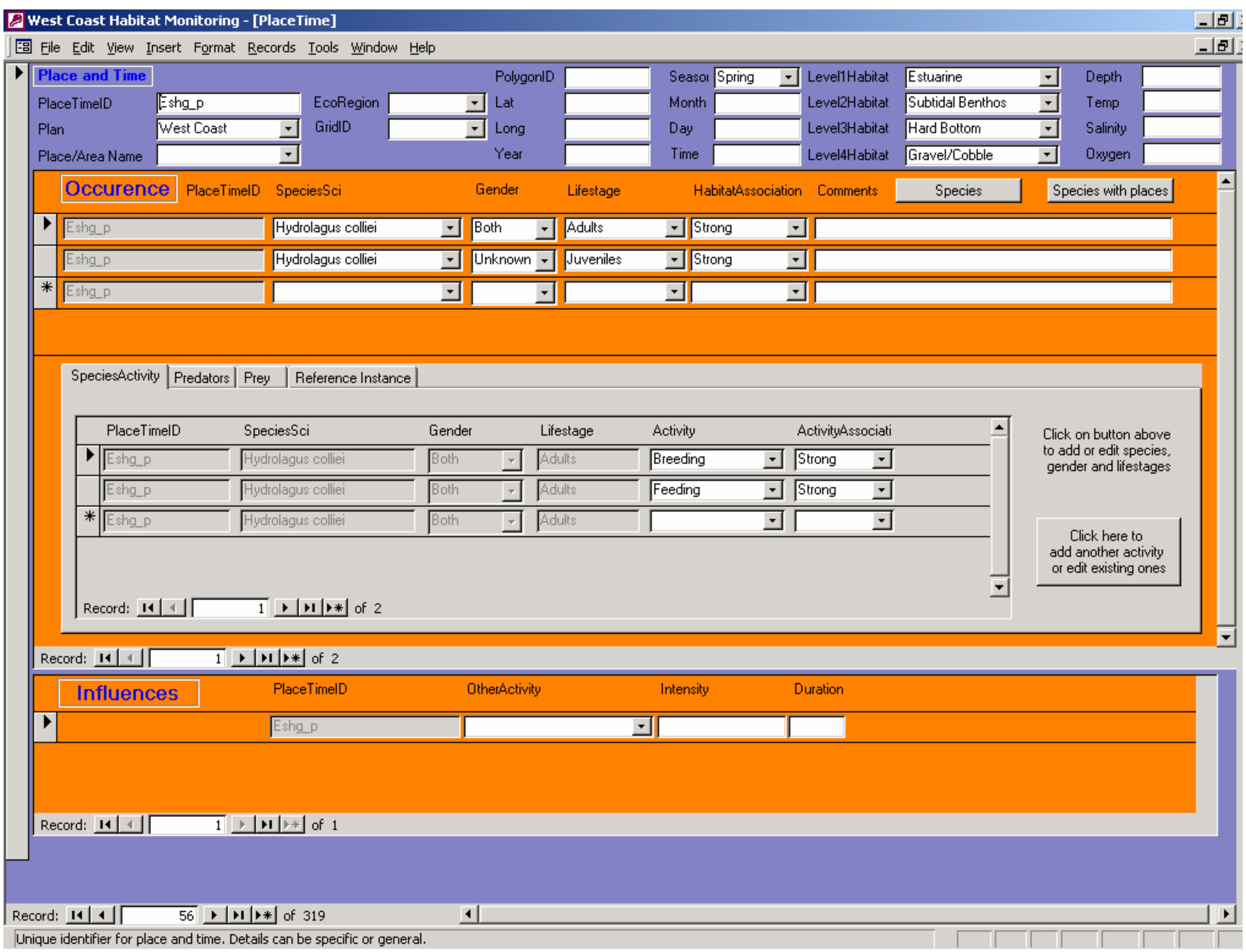
This form lists all the current options for data entry and data analysis. Additional queries and charts can be developed as required.

The 'Release Info' section presents a summary of which version of the software is under use and which data set it incorporates. This aims to reduce the danger of any copies getting out of synchrony with one another where data entry and analysis is ongoing at a number of sites. It also helps ensure the users have the correct set of documentation to go with the product.

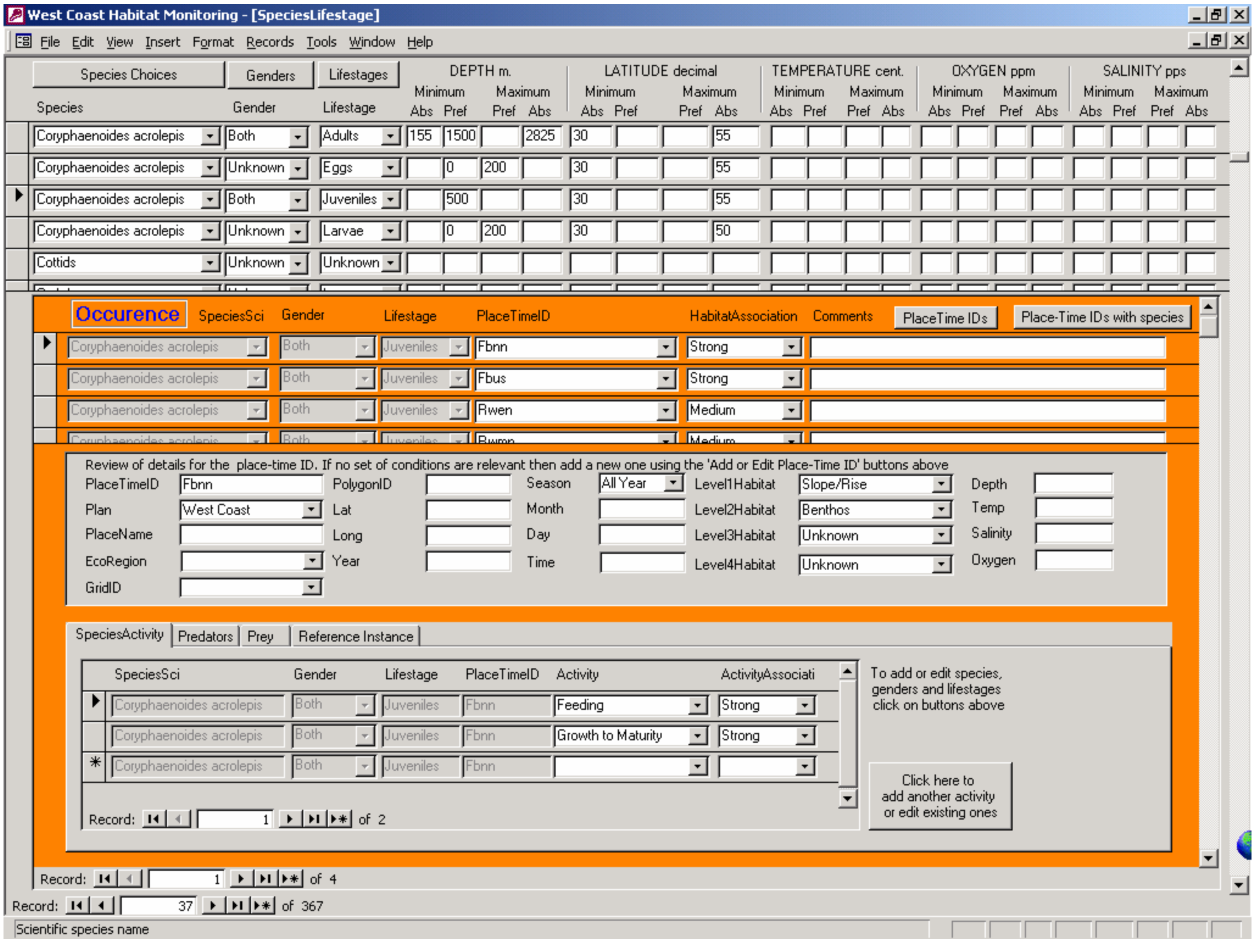
3.1 Data Entry

There are two main options for data entry: “place-time-centric” and “species-centric.” Essentially the first allows you to enter all the species-life stages for a given habitat whereas the latter allows you to do the converse and enter all the habitats for a given species-life stage. The ‘Place-Time’ scenario is more likely with data arising from a survey while the ‘Species-Centric’ approach is more likely with data arising from a literature survey. In both instances the associated, more detailed, place and time info can also be entered to the degree in which it is available. In both cases, data entry starts with a Main Data Entry Form (see below). This form is arranged in sequential sections, as emphasized by the different colors. It is important to use the correct set of record navigation buttons for each section. In the Place-Time version, the top level records for ‘Place and Time’ have a blue background with their record navigation buttons at the bottom of the form; note that there are four sets of navigation buttons in this form. The next two sections, Occurrences and Influences, are nested at the same (2^{nd}) ‘level’ and have a copper colored background. Nested within Occurrence at the third level are four sub tables, each with an independent serving form, Species Activities, Predators, Prey and Instances of References.

The place-time-centric main data entry form appears as follows:



The species-centric main data entry form appears as follows:



The species version shows similar information, but it allows data entry by species and life stage, to simplify the process of entering data from the Updated Life History Descriptions document, which will be the primary data source in the first instance.

Whichever of the forms is used, the data always end up in the same underlying data tables in a unified and consistent data structure. The only difference is how this is shown in the user interface.

In both cases, all of the various sections of the form are synchronized. Thus when the user moves on to the next place-time or species record all of the associated data that have already been entered automatically appear in other parts of the form. Note that if new data are being entered then the correct matching PlaceTimeID and Species_Sci/Life Stage are automatically copied to the occurrences table. This principle also applies to all the other linked tables at the lower levels with their key fields.

Multiple ‘Occurrences’ and ‘Influences’ can be visible for any one PlaceTime record. These two logically occupy the same level in relation to the parent PlaceTime record and are given matching background colors in the Place-Time centric to visualize that fact.

Within the ‘Occurrences’ of a single species-life stage there can be multiple activities that the species-life stage is performing on the recorded habitat. There can also be multiple predators and prey in that location and multiple references relevant to that occurrence. All of these data elements are recorded on the tabbed sub forms. These have an ‘index-card’ like appearance to maximize the amount of data available on one screen.

Most of the data are presented in forms in a table-like format with multiple rows for records. This is considered to be the most useful and practical approach for the user who is entering and reviewing data. Often corrections (and also avoidance of typing errors) involve the comparison of adjoining records, especially when the data in question has been filtered and sorted. The table-like interface is far more useful for doing this since everything is visible at once.

Having all of the inter-linked data from related tables visible at once in adjoining sections also prevents confusion and errors during data entry and simplifies the making of corrections and/or modifications after the data have been entered. It is impossible to enter the wrong data in the key fields for related tables since the foreign key constraints automatically generate an error message when the user tries to do this. The form arrangement in any case does away with the need to re-type related key field data since it is automatically copied from the ‘parent table’ section to the ‘child table’ section of the form and cannot be edited there but only viewed.

Appendix 8E is a ‘tutorial’ explaining how the information for a given species is broken down and entered as records.

The database system has its own tool bar:

Under the West Coast heading the entire functionality of the main control form is reproduced so that users can call up any data entry form or analysis direct from the menu bar without having to re-locate the opening form. All of the important functions on the tool bar and many others are also provided by the main menu bar. It is therefore not essential to use this ‘WestCoastTools’ toolbar to operate the system and it can be turned off under the menu choices ‘Tools/Customize/Toolbars/WestCoastTools’ should the user prefer not to use it. The tool-bar can also be turned on and off by right clicking on the empty area to the right of the main menu bar at the top of the screen and then ticking ‘WestCoastTools’ on or off.

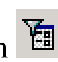
The user can unhide the main database window in order to access the underlying parts of the system directly. NB **Changes at this level should be made only by an experienced database designer or code developer who is responsible for the database.** This is especially important if there are multiple copies of the database being used which need to be synchronized. This could be where data are being entered at several different sites or data entry going on at one sight and query development at another. In such situations, requests for alterations and additions to the system should be first logged and then implemented on an organized basis so system development and the data management can proceed in a consistent and integrated fashion across sites.

3.2 Look-Up Tables

Look-Up data are those provided in tables such as Species, Genders, Lifestages, Eco-regions and Grids, Habitat Levels, and Activities. These data change less often than those in the other tables. New records are only occasionally added and existing ones are only rarely altered. When changes are made these immediately become available as data entry choices in the main data entry forms. When they are altered, all the records in the database that have the old values are updated automatically to reflect the change. Note that you can not delete one of these look-up values unless you have first deleted any records elsewhere in the database that refer back to it.

For convenience, some of the more likely look-up tables can also be called up from the main data entry forms (PlaceTime and SpeciesLifestage) via various buttons and also as sub-choices under the WestCoastTools tool-bar.

3.3 Sorting and filtering data

One important aspect is learning how to use the sorting and filtering buttons. A user can filter the data so that only records appear that have field values equal to that of the field the user is currently in. This is known as 'Filter by Selection' . Secondly a user can filter by form  by first selecting this button and then choosing from the list of available values provided by the drop down boxes that become available for ALL fields. The user would then press the apply filter button  to obtain the subset of data. The term '(filtered)' appears next to the record counters at the base of a form / table whenever a filter is in operation. Remember to check this and clear the filter afterwards by pressing the same  button again. A user can also remove the filter completely with the  'clear-filter' button. In the filter design view a user can also clear the filter grid. Most of the data are already sorted according to its key fields. In some instances there are additional sort-order fields e.g. for life stages or seasons. This allows the order that the values appear in to the user to be assigned even when using normal descriptive terms. The user can resort the data according as desired as an aid to locating particular records during editing etc.

3.4 Analyses

3.4.1.1 Overview

These are currently under development. It has been requested to provide only a few working examples of the different types of query with documentation of how these are developed and can be adapted and extended. The client then intends to use these as the basis for developing their own queries.

Attention is drawn to the sections on Data Structure and Appendix 8C which detail the essential principles and knowledge required to make the best use of this system's capabilities in this respect.

Examples of a select query, a cross-tab query and a chart which plots the results of a cross-tab are provided. Other analyses that provide lists of species and life stages according to the various habitat categories, grid squares and eco-regions can be developed if the data are broken down to this extent in the future.

The queries in the examples are plotted via a generic method whereby axes labels are formed from the category values themselves and thus always reflect the data content. Thus there is no need to create a separate explicitly labeled chart each time the selection conditions or underlying data change.

Complex patterns of trophic interdependence are represented via the conjunction of the Occurrences, Predators and Prey tables. With some thought it may be possible to develop queries that can analyze these patterns.

Where analytical requirements demand the use of mathematical and statistical modeling software, queries can be developed to produce the correctly formatted data-sets for direct input into such applications. An example of this is provided with the **'HabitatAssociations1'** query.

Further queries could also be developed to interface the database with companion systems which could both receive and provide data in integrated analyses.

If data are provided there is the opportunity to analyze for the recorded 'Influences' (or 'impacts') where these may be natural or anthropogenic.

To concentrate on the scope of the data provided so far, a series of examples follows covering different classes of queries with explanations of how these were developed and how they can be extended. In addition to the detailed instructions given here it is recommended that anyone developing such queries should have a clear grasp of the principles of relational databases and query structuring and have good Access manuals or text books available. Beware that many of the text books place the 'cart before the horse' and embark on detailed 3rd generation code examples without first clearly explaining the essential underlying relational principles of such 4th generation database environments. Despite such systems being available for 20 years or more, by and large within biological resource management the penny has still not dropped! A very good reference work would be 'Access Database design and programming' by Steven Roman, published by O'Reilly, ISBN 1-56592-626-9.

A user should not alter any of these example queries, but should instead copy and rename them and then experiment on those new queries using them as a template to develop new lines of query. That way if it all goes horribly wrong the user can simply delete them go back to the unaltered source queries and copy them afresh. In addition, a strict and documented system of regular backups should be in place as well.

A user can copy and rename the queries by right clicking on them in the queries section of the main database window, selecting 'copy,' then right clicking in an empty space in the database window and selecting copy, entering a new query name, and then working with that new query. One important thing to bear in mind is that if a query uses other queries as its source and you rename those sources then obviously the name of the source also has to be altered in the query that uses it. E.g. the query called 'AllQuery1_Crosstab1' which uses 'AllQuery1' as a source. You can also 'import' individual queries from backups if you inadvertently damage one of these source queries.

Some charted output is provided as part of the system. This is mainly to demonstrate its capabilities in that any output can be charted where appropriate. It is beyond the scope of the resources available for this manual to explain in detail how to develop charts. Also, developing the kind of generic charts demonstrated here, that label their own axes etc according to dynamic inputs, assumes some expertise in the use of Access. Any additional charts required could be developed and provided in future.

3.4.1.2 Example 1: Species-based investigation

In this example we will develop a range of queries that will look at all the available data for a particular species. Obviously one of the conditions will be the species name. Thus the queries can simply be reapplied to any other species by altering the value of the species name under that condition. The main query will stratify according to all life stages. Genders will be ignored in this case as there is very little gender specific data that has been entered so fare. For each of the life stages we will look at each defined habitat in turn and list its definitive values. Within those 'strata' we will then analyze for species activity, predators, prey and even references in the literature. In summary the complete list of strata are:

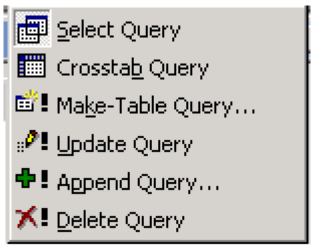
- Species
  - Life stage
    - Habitat
      - Species Activity
      - Predators
      - Prey
      - References

Note that the last four are all 'independent' attributes within habitat.

The example query is called 'AllQuery0.' The query is created from the 'Queries' section of the main database window and selecting 'Design View.' One can make good use of the 'Simple Query Wizard' and 'Crosstab Query Wizard' provided one has sufficient database experience. Care is required because it is possible to produce a working query that provides results that are nonsense if tables are linked and conditions combined in an illogical fashion.

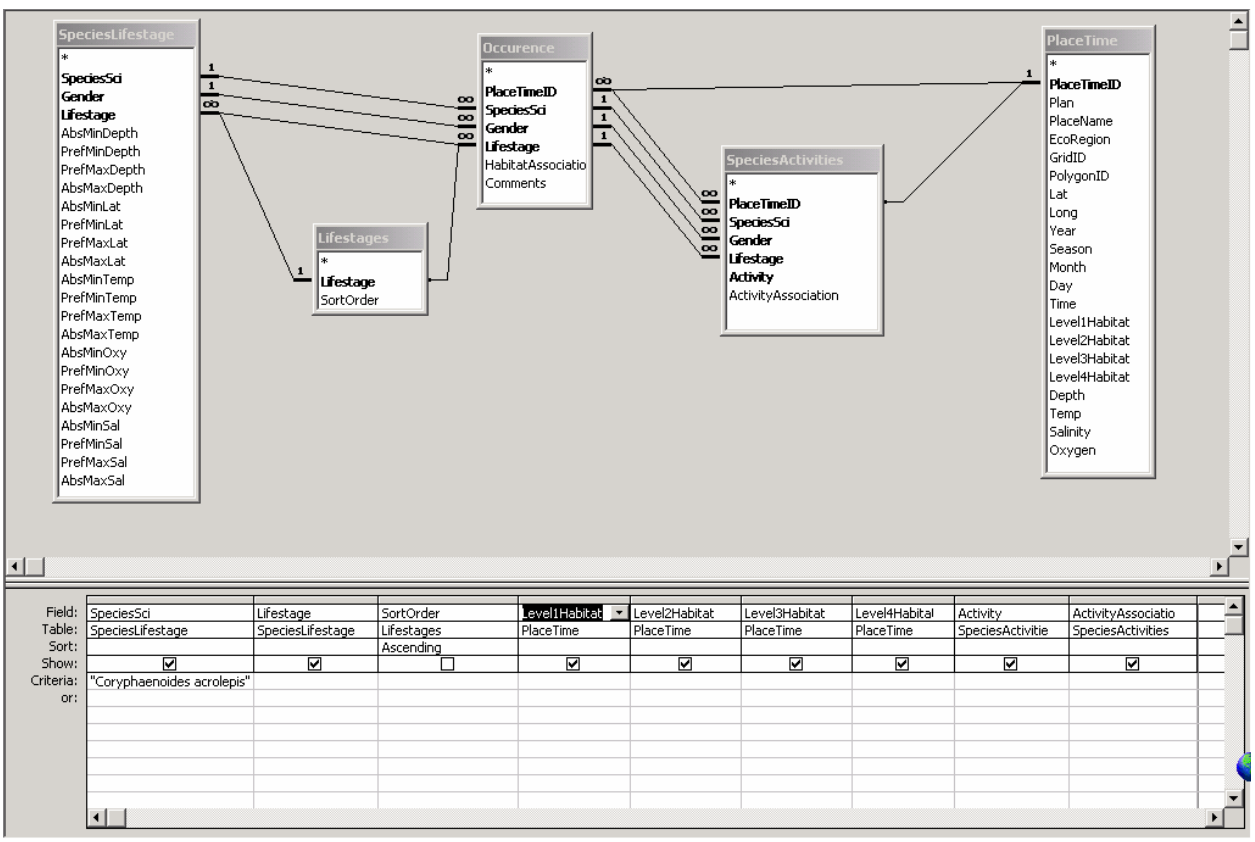
Tables are added to the design view by selecting them from the 'Show Table' list offered. Note that a user can also base a query upon another query as well.

Apart from the selection and cross-tab queries that produce a set of results a user can also alter the query type so that it adds, modifies or deletes data or even creates new tables. Make sure you know what you are doing before going down that road and have in place a religious back up procedure that is fully documented so that you can reverse out of any inadvertent disasters!



You should select the tables you require for your query by first looking at the 'map' of your database provided by the 'relationships' diagram.  This will serve to remind you of table and field names and how they relate to one another.

You should select the tables for the query from the 'Show Table' to produce a query as follows.

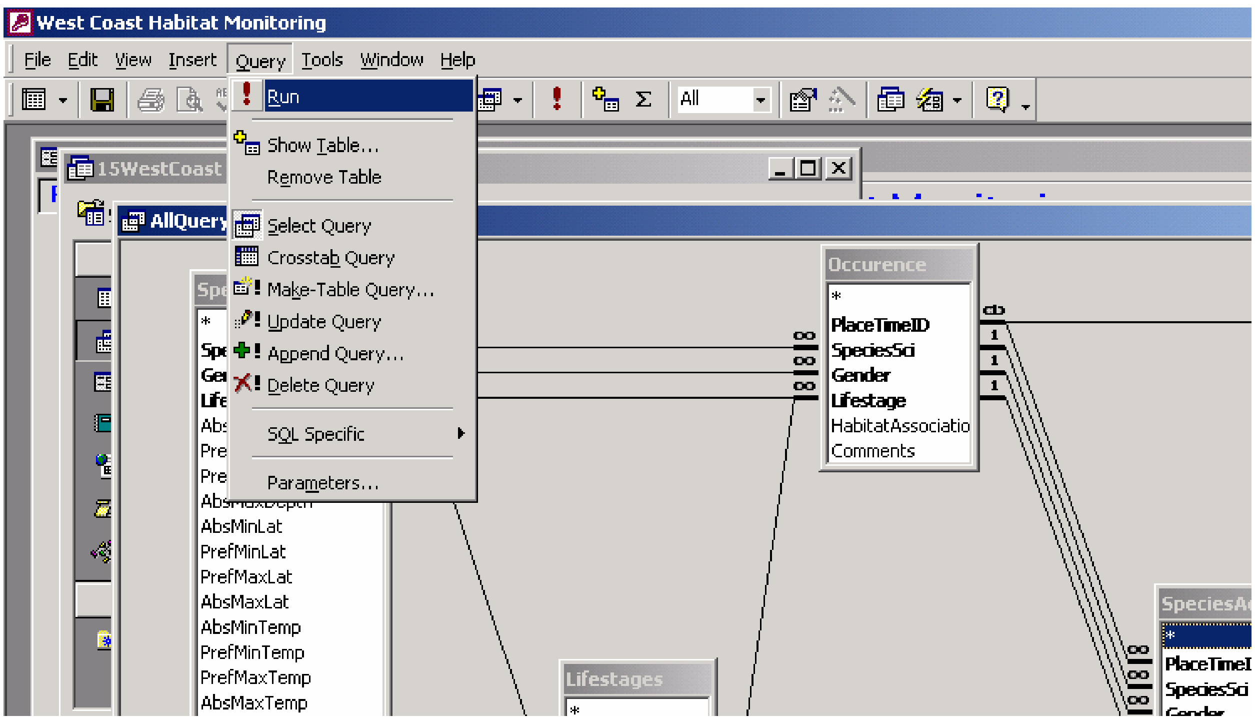


The 'foreign keys' are the lines representing the links between the tables. These are inherited from the relationships diagram. You can drag and size the tables to form the best layout.

You then double click or drag and drop the columns you require for your results. Note that a 'criterion' has been entered for the species name ('Coryphaenoides acrolepis') and that the SortOrder column of the Lifestages table has been utilized to make sure the results appear in life stage order,

You could copy this entire query to one of a new name and edit that to your preferences. You could add in or take out columns or conditions as you require. The simplest way to create your own new query is to open the AllQuery0 and use the 'File'/Save As…' option giving it the name of your choice.

You can run the query by a number of different methods the simplest being to press the red exclamation mark from the menu bar or toolbar.



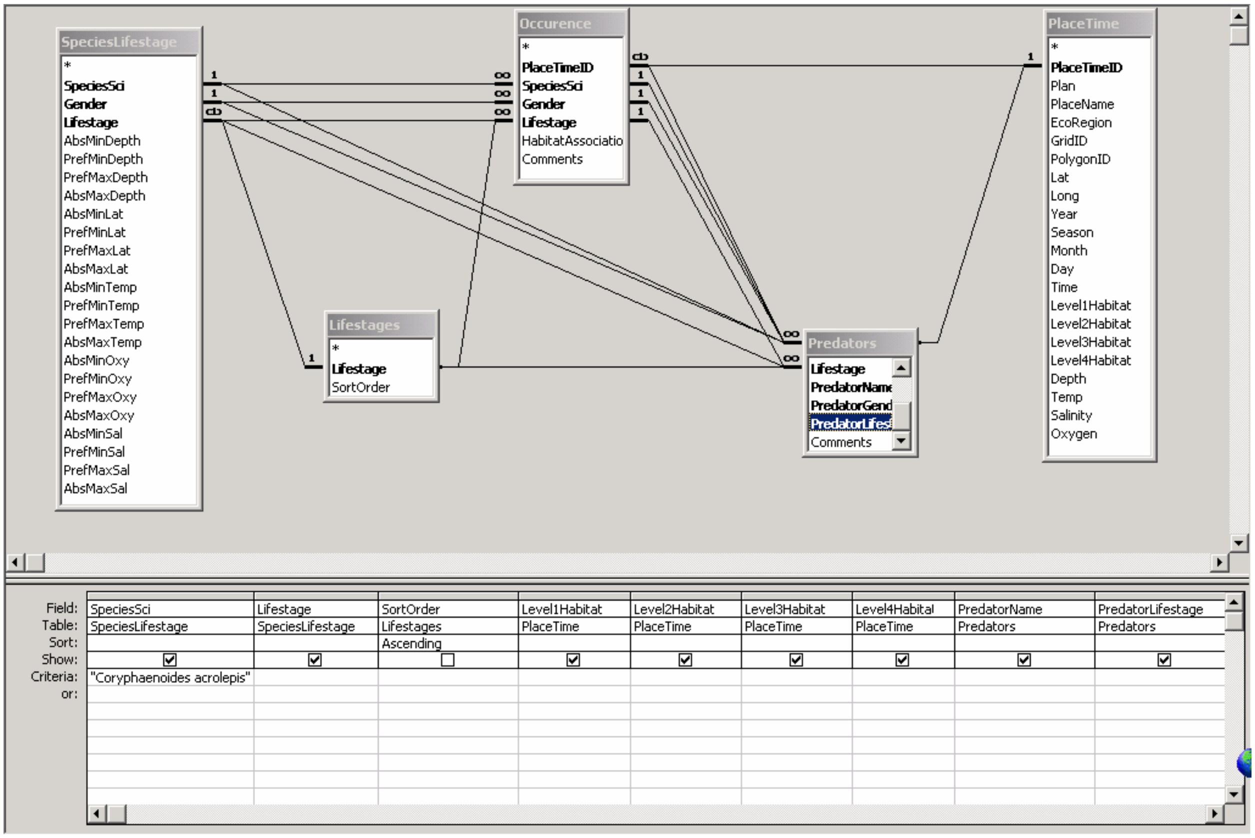
The results appear as follows:

AllQuery0 : Select Query

SpeciesSci	Lifestage	Level1Habitat	Level2Habitat	Level3Habitat	Level4Habitat	Activity	ActivityAssociation
Coryphaenoides acrolepis	Eggs	Shelf	Water Column	Epipelagic Zone	Unknown	Unknown	Unknown
Coryphaenoides acrolepis	Eggs	Slope/Rise/Plain	Water Column	Epipelagic Zone	Unknown	Unknown	Unknown
Coryphaenoides acrolepis	Larvae	Shelf	Water Column	Epipelagic Zone	Unknown	Feeding	Strong
Coryphaenoides acrolepis	Larvae	Slope/Rise/Plain	Water Column	Epipelagic Zone	Unknown	Feeding	Strong
Coryphaenoides acrolepis	Juveniles	Slope/Rise/Plain	Water Column	Mesopelagic Zone	Unknown	Feeding	Medium
Coryphaenoides acrolepis	Juveniles	Slope/Rise/Plain	Water Column	Epipelagic Zone	Unknown	Feeding	Medium
Coryphaenoides acrolepis	Juveniles	Slope/Rise	Benthos	Unknown	Unknown	Growth to M:	Strong
Coryphaenoides acrolepis	Juveniles	Slope/Rise	Benthos	Unknown	Unknown	Feeding	Strong
Coryphaenoides acrolepis	Adults	Slope/Rise	Benthos	Unconsolidated	Sand	All	Strong
Coryphaenoides acrolepis	Adults	Slope/Rise	Benthos	Unknown	Unknown	All	Strong
Coryphaenoides acrolepis	Adults	Slope/Rise	Basin	Unconsolidated	Sand	All	Strong

Record: 1 of 11

If instead you wished to investigate say predators then you would substitute the predators table for the activities table in the query design. See **'AllQuery1'**. That would appear as follows.



and the results would appear as follows:

AllQuery1 : Select Query

SpeciesSci	Lifestage	Level1Habitat	Level2Habitat	Level3Habitat	Level4Habitat	PredatorName	PredatorLifestage
Coryphaenoides acrolepis	Larvae	Shelf	Water Column	Epipelagic Zone	Unknown	Macrourids	Unknown
Coryphaenoides acrolepis	Larvae	Shelf	Water Column	Epipelagic Zone	Unknown	Coryphaenoides	Juveniles
Coryphaenoides acrolepis	Larvae	Shelf	Water Column	Epipelagic Zone	Unknown	Coryphaenoides	Adults
Coryphaenoides acrolepis	Juveniles	Slope/Rise	Benthos	Unknown	Unknown	Macrourids	Unknown
Coryphaenoides acrolepis	Juveniles	Slope/Rise	Benthos	Unknown	Unknown	Coryphaenoides	Adults
Coryphaenoides acrolepis	Adults	Slope/Rise	Benthos	Unknown	Unknown	Macrourids	Unknown
Coryphaenoides acrolepis	Adults	Slope/Rise	Benthos	Unknown	Unknown	Coryphaenoides	Adults

Record: 1 of 7

The same substitution can be done for prey species and references.

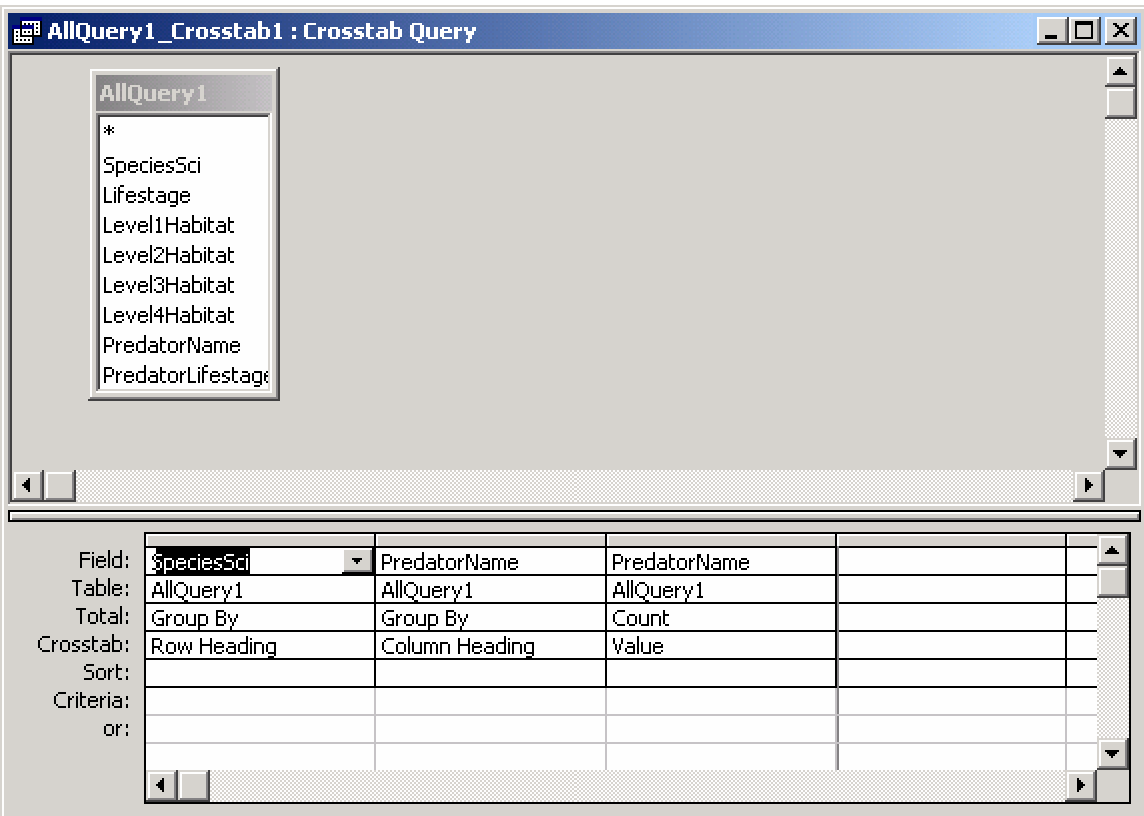
Such queries can form the source for other queries, charts that plot the results, or for exporting data to spreadsheets or other file formats for modeling etc.

One of the most common queries towards the end of a series of analyses is the cross-tab query which produces results more like a spreadsheet format. Indeed the results are often exported to spreadsheets for further manipulation.

For example, if we wished to find out which was the most common predator of a species regardless of the preys life stage or habitat setting we would form the following cross-tab query 'CrosstabAllQuery1' which takes the original query AllQuery1 as its input.

NB Remember that if you then alter such a source query you would then invalidate the cross-tab query based upon it. Care must be taken in this respect. It is often best to develop suites of parallel queries to avoid this pitfall and have some consistent naming conventions across and along the various streams to prevent the confusion that would otherwise develop.

From the main database window select the queries-new- Design View.
Select the Queries tab from the Show Table box and select AllQuery1.



Select the columns SpeciesSci once and PredatorName twice, should look as above.

Set the values in the grid as illustrated above.
Save the query as 'AllQuery1_Crosstab1' or whatever you wish to call it.

Run the query and the results will appear as follows.

revealing a total of three situations where Macrourids are the predators and 4 of cannibalism.

Note that if you remove the single species criterion from the source query AllQuery1 then you get the following results revealing what has had predator data entered and what those predators are (Column Headings), and what they eat.

SpeciesSci	Albacore	Anoplopoma f	Artedius harri	Atheresthes st	chaetognaths	Clupeids	Coryphaenoides acrolepis	Crabs
Anoplopoma fimbria								
Coryphaenoides acrolepis							4	
Eopsetta jordani								
Gadus macrocephalus								
Galeorhinus zyopterus								
Hexagrammos decagrammu								
Hydrolagus colliei								
Lepidopsetta bilineata								
Merluccius productus	2	2				3		
Microstomus pacificus	3	4						
Ophiodon elongatus								
Platichthys stellatus								
Pleuronectes vetulus								
Psettichthys melanostictus								
Scorpaenichthys marmoratu			1					
Sebastes alutus		2		2				
Sebastes atrovirens					1			
Sebastes auriculatus								
Sebastes chrysomelas					1			
Sebastes crameri	4							
Sebastes dalli					1			
Sebastes jordani								
Sebastes maliger					2			
Sebastes melanops					2			
Sebastes nebulosus					1			
Sebastes nigrocinctus					2			
Sebastes paucispinis	2							
Sebastes rastrelliger								
Sebastes serranoides					2			
Sebastes serriceps								
Sebastolobus alascanus								
Sebastolobus altivelis		1						

You could specify multiple criteria for both species and predator species to limit the results set depending on your line of investigation. The same kind of investigations could be made for Activities or prey data and all could be further refined by select only some levels of habitat classifications and only certain values within these. You could look at say only level2 habitats and only ‘benthos’ from within these.

You can further refine queries by editing the ‘SQL’ code version of them. This is particularly useful when creating more elaborate cross-tab queries and filters for charts etc.

You can select the SQL view from under View on the menu bar. The SQL for the AllQuery1 query would look like the following:

SELECT SpeciesLifestage.SpeciesSci, SpeciesLifestage.Lifestage, PlaceTime.Level1Habitat, PlaceTime.Level2Habitat, PlaceTime.Level3Habitat, PlaceTime.Level4Habitat, Predators.PredatorName, Predators.PredatorLifestage

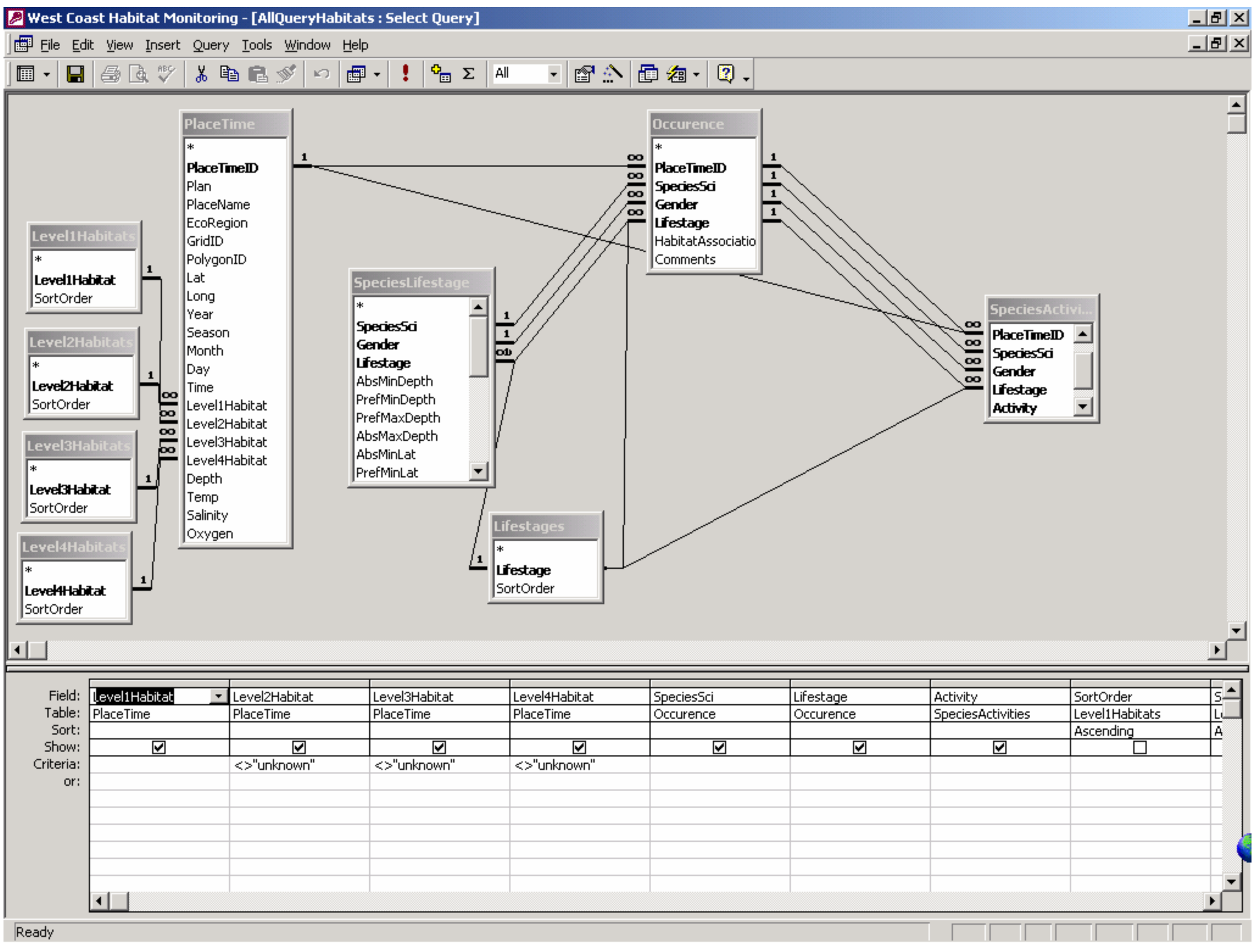
```
FROM ((Occurence INNER JOIN Lifestages ON Occurence.Lifestage = Lifestages.Lifestage)
INNER JOIN (PlaceTime INNER JOIN Predators ON PlaceTime.PlaceTimeID =
Predators.PlaceTimeID) ON (PlaceTime.PlaceTimeID = Occurence.PlaceTimeID) AND
(Occurence.Lifestage = Predators.Lifestage) AND (Occurence.Gender = Predators.Gender) AND
(Occurence.SpeciesSci = Predators.SpeciesSci) AND (Occurence.PlaceTimeID =
Predators.PlaceTimeID) AND (Lifestages.Lifestage = Predators.Lifestage)) INNER JOIN
SpeciesLifestage ON (SpeciesLifestage.Lifestage = Predators.Lifestage) AND
(SpeciesLifestage.Gender = Predators.Gender) AND (SpeciesLifestage.SpeciesSci =
Predators.SpeciesSci) AND (SpeciesLifestage.Lifestage = Occurence.Lifestage) AND
(SpeciesLifestage.Gender = Occurence.Gender) AND (SpeciesLifestage.SpeciesSci =
Occurence.SpeciesSci) AND (Lifestages.Lifestage = SpeciesLifestage.Lifestage)
WHERE (((SpeciesLifestage.SpeciesSci)="Coryphaenoides acrolepis"))
ORDER BY Lifestages.SortOrder;
```

3.4.1.3 Example 2: Habitat based investigation

This shorter example, 'AllQueryHabitats', demonstrates how to develop similar lines of queries except they are based on the perspective of habitats rather than species.

It is probably best to first look at the data from the 'Place-Time centric' data form (exactly the same data but arranged from a habitats perspective), which is chosen from the main opening form or from the drop down menu which is part of the West Coast Tools tool bar.

This query orders all habitats according to the values within the four habitat levels and assumes each level is nested within the previous. Then for each unique combination of habitats it lists the species life stages and their activities.



A portion of the results appear as follows:

Level1Habitat	Level2Habitat	Level3Habitat	Level4Habitat	SpeciesSci	Lifestage	Activity
Estuarine	Intertidal Benthos	Unconsolidated	Mud	Squalus acanthias	Juveniles	Growth to Maturity
Estuarine	Intertidal Benthos	Unconsolidated	Mud	Squalus acanthias	Adults	All
Estuarine	Intertidal Benthos	Unconsolidated	Mud	Raja inornata	Adults	All
Estuarine	Intertidal Benthos	Unconsolidated	Mud	Triakis semifasciata	Adults	All
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Hippoglossoides elassodon	Juveniles	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Errex zachirus	Juveniles	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Eopsetta jordani	Juveniles	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Platichthys stellatus	Juveniles	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Psettichthys melanostictus	Juveniles	Growth to Maturity
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Lepidopsetta bilineata	Juveniles	Growth to Maturity
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Psettichthys melanostictus	Adults	All
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Platichthys stellatus	Adults	All
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Lepidopsetta bilineata	Adults	All
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Gadus macrocephalus	Adults	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Errex zachirus	Adults	Feeding
Estuarine	Subtidal Benthos	Unconsolidated	Mixed mud/sand	Hippoglossoides elassodon	Adults	All
Estuarine	Subtidal Benthos	Unconsolidated	Sand	Lepidopsetta bilineata	Eggs	Unknown
Estuarine	Subtidal Benthos	Unconsolidated	Mud	Raja inornata	Eggs	Unknown
Estuarine	Subtidal Benthos	Unconsolidated	Sand	Microstomus pacificus	Juveniles	Growth to Maturity
Estuarine	Subtidal Benthos	Unconsolidated	Sand	Ophiodon elongatus	Juveniles	Feeding

Note that results have been filtered out where habitat values are ‘Unknown,’ which in fact is the majority of cases.

Again as with the first example, this query can be copied and renamed and then used as a template to extend and vary it, develop cross tabs and charts etc.

As with the first example from the species perspective, the SpeciesActivities table could be substituted with the Predators, Prey or references tables and the query modified to analyze the attributes in these tables instead.

3.4.1.4 Example 3: Using species level attributes

This example demonstrates an analysis of the general attributes recorded at the species level, i.e. absolute and preferred ranges of latitude, depth, temperature, salinity or oxygen.

You will have noted from the data entry screens that these attributes can be recorded at two levels of detail

a) the general ranges associated with a species, and

b) more precise values associated with a particular ‘TimePlaceID.’

How precise would depend on what level of detail is used with the PlaceTimeID. It could be a period for an area or a specific location at one exact time or for a given habitat definition. At present (October 2003) none of the facilities offered for the more detailed recording offered with b) are required or being utilized. Thus only the general species wide values are being used and it follows that these have to be applied to all locations and habitat types for all times. This affects the way the query is structured with those physiographic attributes being sourced from the SpeciesLifestage table.

In fact there is very little variation in the values of the extracted data for depth and latitude for each species; hence the results tend to be somewhat ‘uninteresting’ in terms of the variety in the query and chart output used to demonstrate the potential of these kinds of queries. Thus for the purposes of the best demonstration of the potential of these kinds of queries, the species, *Merluccius productus*, with most detailed variety has been chosen and the somewhat crude mid points of absolute ranges of latitude and depth used.

The final charted output appears as follows (Figure 13):

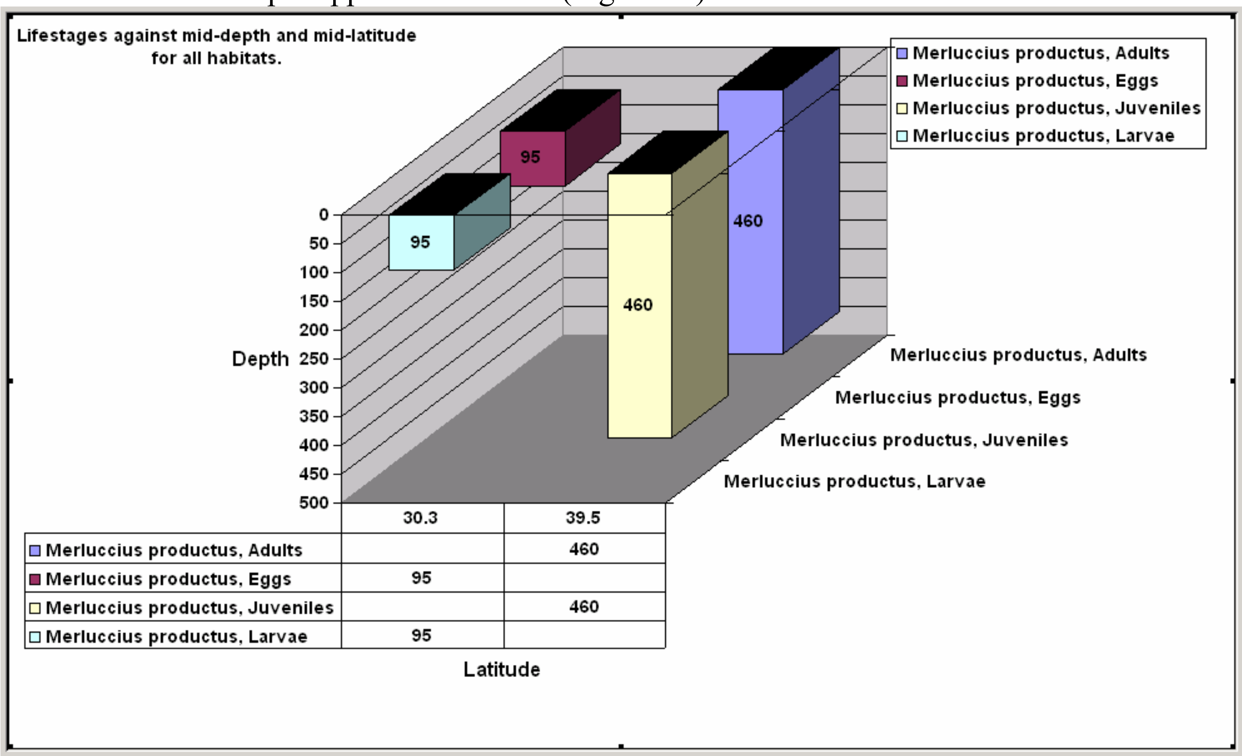


Figure 4 Life stages against mid depth and mid latitude from chart 'chtLifestageLatDepth'

This is one of the few species with where there is enough variety in the extracted depth/ latitude data to demonstrate the range of possible plotting. Most other species have the same depths and/or latitudes for each of the life stages.

This chart is also available from the main opening form under the Charts section via the button 'Lifestages by Lat-Depth'

The results of the underlying select query (which is named 'LifestageLatDepth') looks like this:

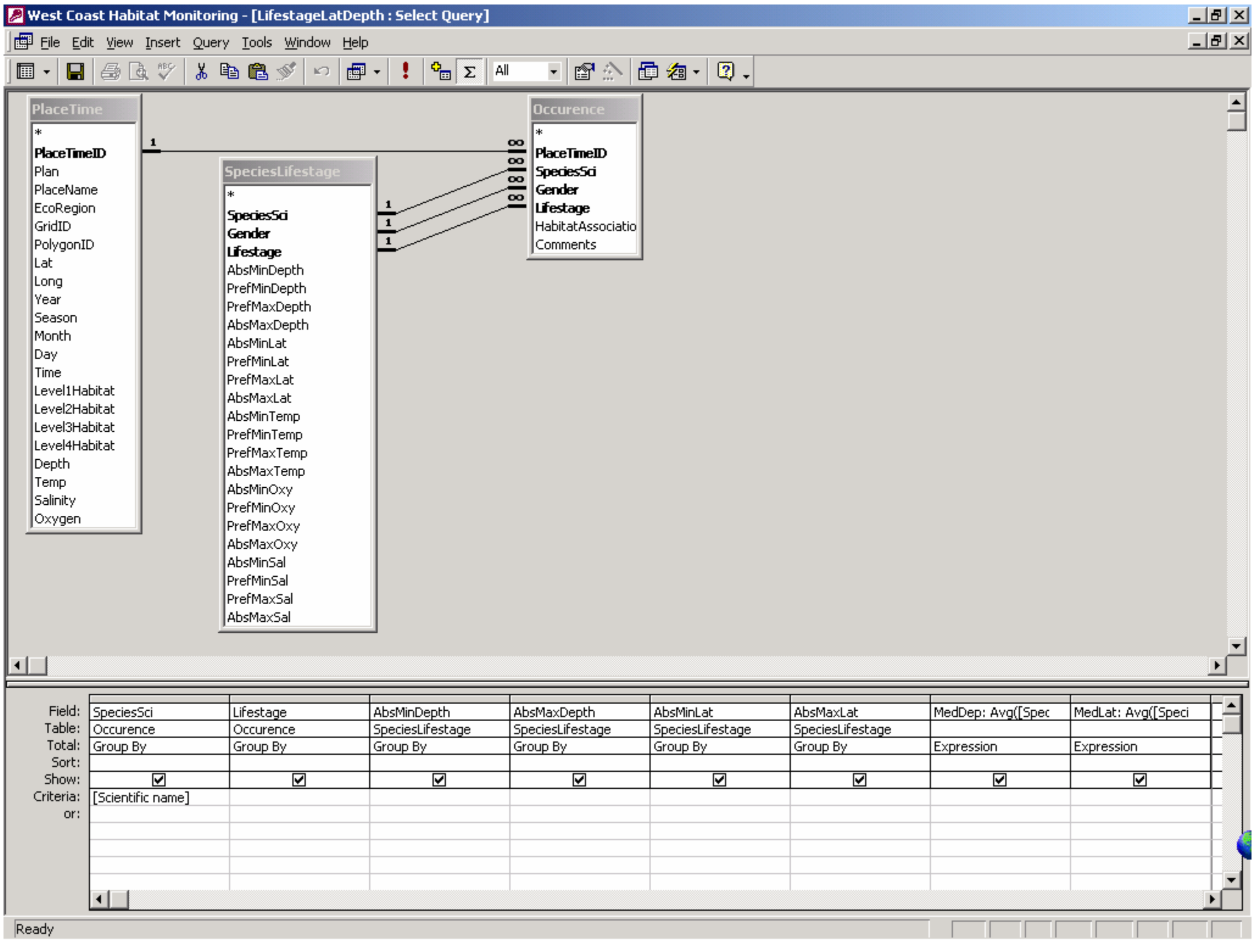
LifestageLatDepth : Select Query

SpeciesSci	Lifestage	AbsMinDepth	AbsMaxDepth	AbsMinLat	AbsMaxLat	MedDep	MedLat
Merluccius productus	Adults	0	920	24.5	54.5	460	39.5
Merluccius productus	Eggs	40	150	24.5	36	95	30.25
Merluccius productus	Juvenile	0	920	24.5	54.5	460	39.5
Merluccius productus	Larvae	40	150	24.5	36	95	30.25

Record: 1 of 4

This query is also available via the button 'Lifestages by Lat-Depth' under the Queries section on the main opening form 'frmMain'.

The query is structures as follows:



This also demonstrates the use of 'expressions' in queries. The 'MedDep' and 'MedLat' in the query. This is where an output field is based on an underlying calculation rather than a simple value or simple aggregate function of those values (a straight average, count or sum etc)

Again you can copy and rename this query and use that new copy as a template to alter and develop your own queries.

3.4.1.5 Example 4: Counts of Habitats

There are a series of other queries and charts that provide examples of how aggregate functions can be used in Access. Again the form of the examples used is more to demonstrate what is possible within Access rather than for biological analytical rigor! User can use these examples as templates to develop their own queries that are appropriate to their line of biological investigation.

The query 'Habitats by Species Lifestage' simply counts the occurrence of sub-habitats within each of the level1 habitats, for each of the SpeciesLifestages.

Habitats by Species Lifestage : Select Query

SpeciesSci	Lifestage	Level1Habitat	CountOfLevel1Habitat
Anoplopoma fimbria	Adults	Shelf	2
Anoplopoma fimbria	Adults	Slope/Rise	1
Anoplopoma fimbria	Eggs	Slope/Rise	2
Anoplopoma fimbria	Juveniles	Shelf	1
Anoplopoma fimbria	Juveniles	Slope/Rise	3
Anoplopoma fimbria	Larvae	Shelf	1
Anoplopoma fimbria	Larvae	Slope/Rise	6
Antimora microlepis	Adults	Shelf	1
Antimora microlepis	Adults	Slope/Rise	1
Atheresthes stomias	Adults	Shelf	7

The query is also available from the main opening form under the queries section via the button 'Habitats by Species Lifestage'.

You can look at it in design view to see its simple structure.

This query is used as source data for the following query 'XtabBySpeciesByHabitat' which simply cross-tabs the output using the level1 habitat values as column headings instead of leaving them as row headings. That query is also available via the button 'Crosstab species by Habitat1' on the main opening form.

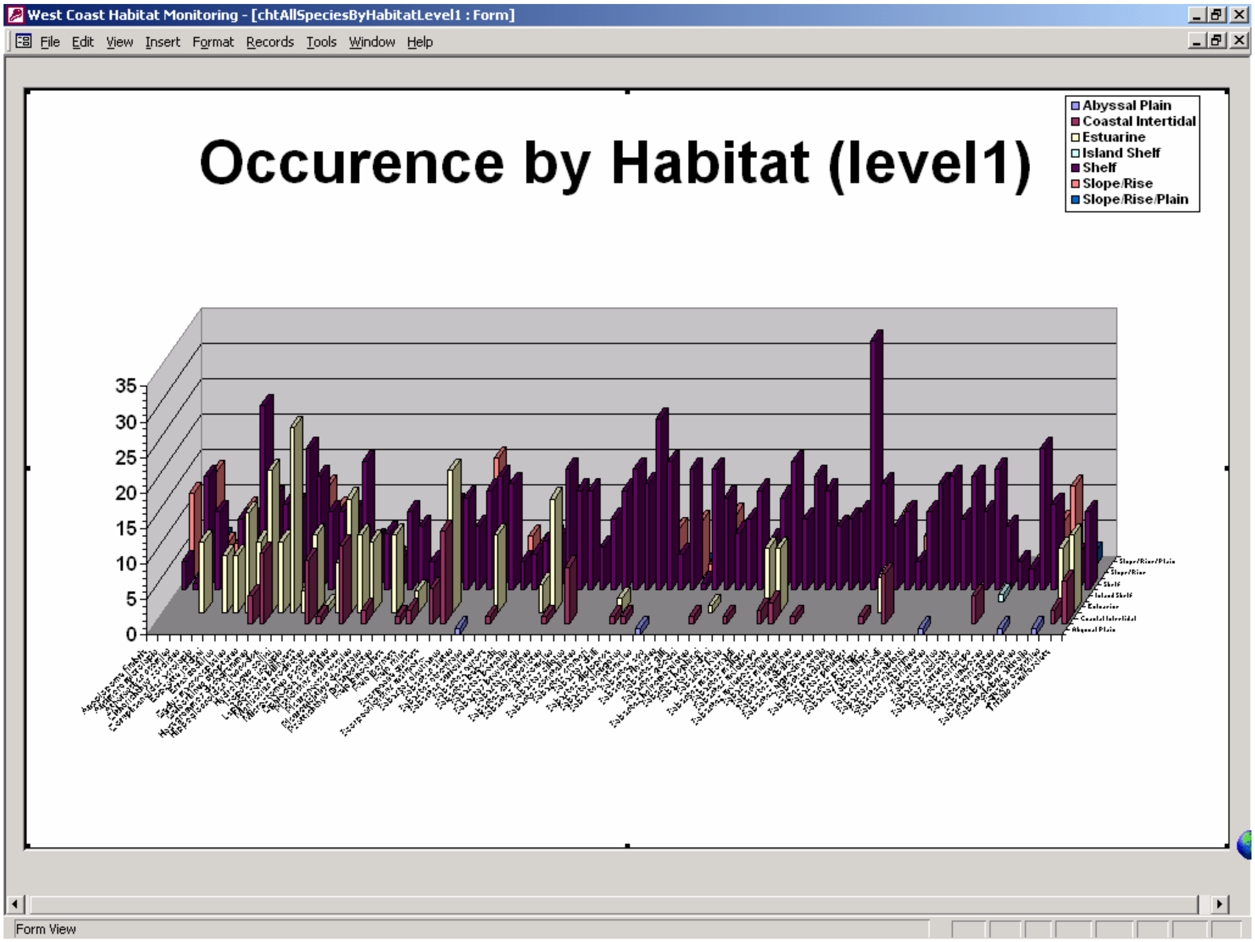
XtabSpeciesByHabitat : Crosstab Query

SpeciesSci	Abyssal Plain	Coastal Interti	Estuarine	Island Shelf	Shelf	Slope/Rise	Slope/Rise/Plain
Anoplopoma fimbria					4	12	
Antimora microlepis					1	1	
Atheresthes stomias					16	15	4
Citharichthys sordidu			10		11	5	2
Coryphaenoides acrc					2	5	4
Eopsetta jordani			8		10	10	1
Errex zachirus			8		10	8	2
Gadus macrocephalu			14		26	6	1
Galeorhinus zyopteru		4	10		13		
Hexagrammos decag		10	20		12		2
Hippoglossoides elas			10		12	8	
Hydrolagus colliei			26		20		
Isopsetta isolepis			3		16	13	

Record: 1 of 81

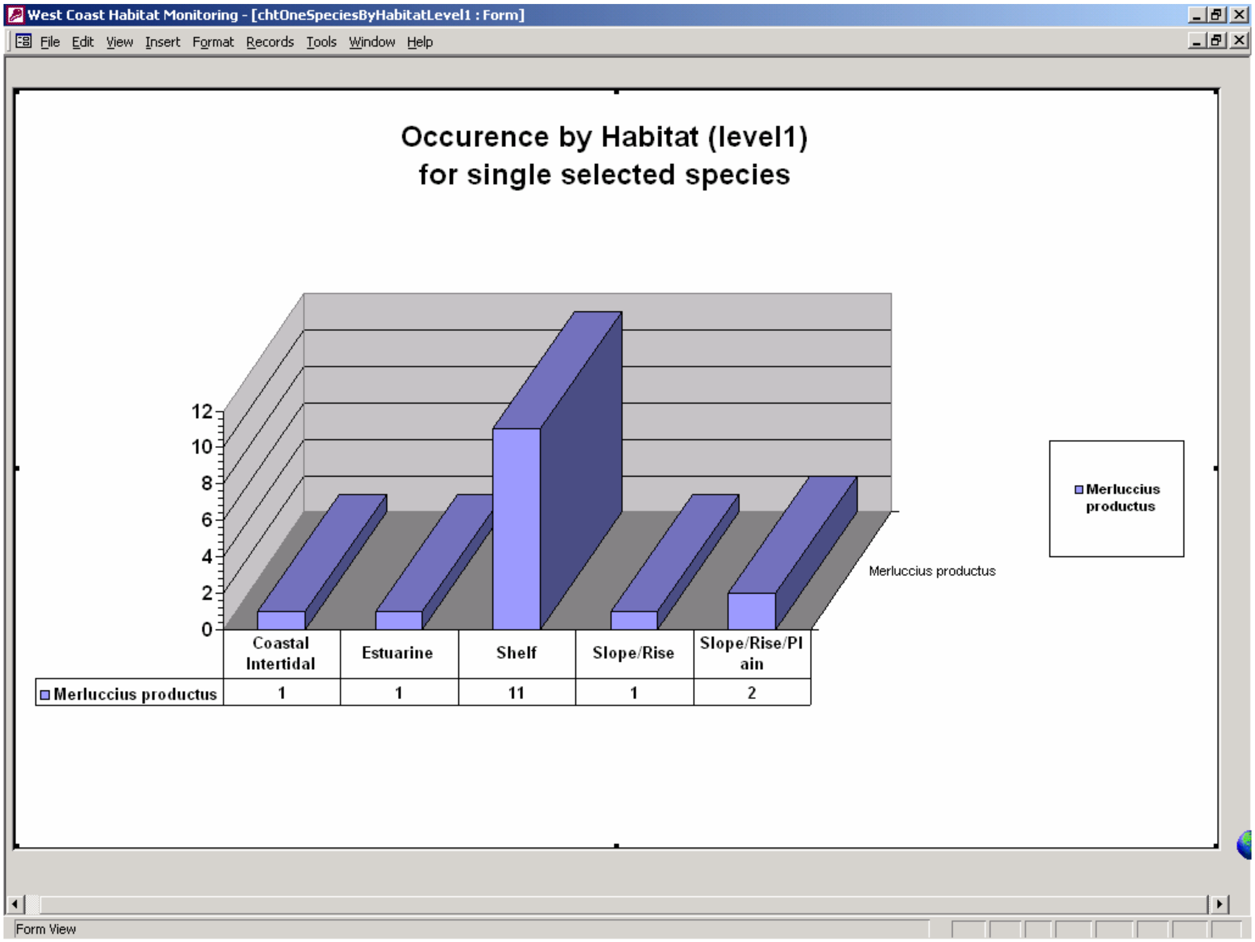
The same principle of cross-tabbing habitats by species life stage is used as the source for the two charts.

The chart 'chtAllSpeciesByHabitatLevel1' which counts and charts level 1 sub-habitat for all the species looks as follows:



This chart is also available from the main form via the button 'AllSpeciesByHab.Level1'.

There is also a chart 'chtOneSpeciesByHabitatLevel1' which does the same but, for a single species for which the user supplies the name as a parameter.



This chart is also available from the main form via the button 'OneSpeciesByHab.Level1'.

These charts are constructed within forms. Their cross-tabbed data sources are specified as SQL clauses under their 'properties.'

3.4.1.6 Example 5: Data extraction

The query 'HabitatAssociations1' was used to extract an assemblage of data required for the Bayesian modeling software.

A portion of the output appears as follows:

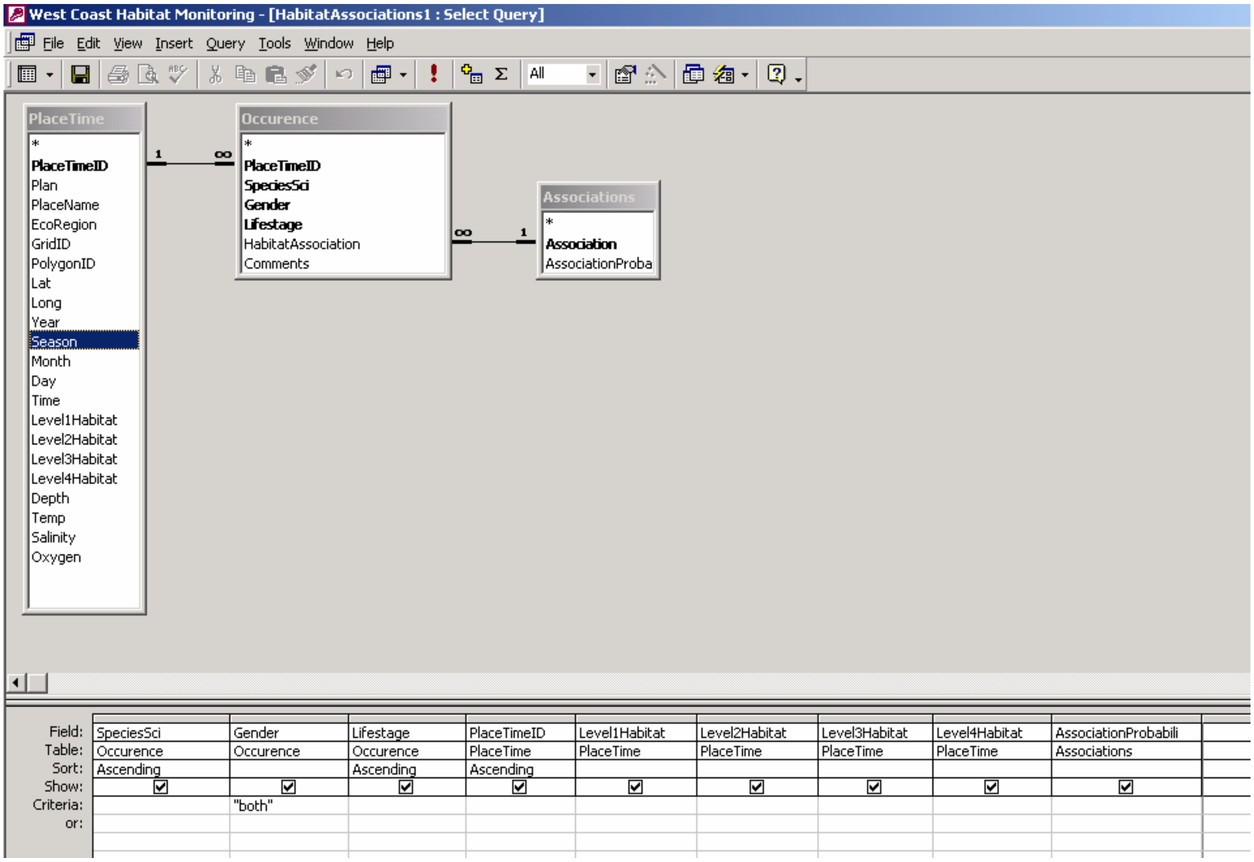
West Coast Habitat Monitoring - [HabitatAssociations1 : Select Query]

File Edit View Insert Format Records Tools Window Help

SpeciesSci	Gender	Lifestage	PlaceTimeID	Level1Habitat	Level2Habitat	Level3Habitat	Level4Habitat	AssociationProbability
Anoplopoma fimbria	Both	Adults	Fbun	Slope/Rise	Benthos	Unconsolidated	Unknown	1
Anoplopoma fimbria	Both	Adults	SbgU	Shelf	Benthos	Biogenic	Sea Urchins	0.66
Anoplopoma fimbria	Both	Adults	Ssum	Shelf	Submarine Cany	Unconsolidated	Mud	0.66
Anoplopoma fimbria	Both	Juveniles	Fbun	Slope/Rise	Benthos	Unconsolidated	Unknown	1
Anoplopoma fimbria	Both	Juveniles	Fwed	Slope/Rise	Water Column	Epipelagic Zone	Drift Algae	0.66
Anoplopoma fimbria	Both	Juveniles	Sbun	Shelf	Benthos	Unconsolidated	Unknown	1
Anoplopoma fimbria	Both	Larvae	Fbun	Slope/Rise	Benthos	Unconsolidated	Unknown	1
Anoplopoma fimbria	Both	Larvae	Fnnn	Slope/Rise	Unknown	Unknown	Unknown	0
Anoplopoma fimbria	Both	Larvae	Fwed	Slope/Rise	Water Column	Epipelagic Zone	Drift Algae	0.66
Anoplopoma fimbria	Both	Larvae	Fwen	Slope/Rise	Water Column	Epipelagic Zone	Unknown	1
Anoplopoma fimbria	Both	Larvae	Fwmn_p	Slope/Rise	Water Column	Mesopelagic Zone	Unknown	1
Anoplopoma fimbria	Both	Larvae	Fwmn_w	Slope/Rise	Water Column	Mesopelagic Zone	Unknown	1
Anoplopoma fimbria	Both	Larvae	Swen	Shelf	Water Column	Epipelagic Zone	Unknown	1
Antimora microlepis	Both	Adults	Fbnn	Slope/Rise	Benthos	Unknown	Unknown	1
Antimora microlepis	Both	Adults	Sbnn	Shelf	Benthos	Unknown	Unknown	1
Atheresthes stomias	Both	Adults	Fbcl	Slope/Rise	Benthos	Mixed Bottom	Sand/Cobble	1
Atheresthes stomias	Both	Adults	Fbcr	Slope/Rise	Benthos	Mixed Bottom	Soft Bottom/	0.33
Atheresthes stomias	Both	Adults	FbgP	Slope/Rise	Benthos	Biogenic	Sponges	0.33
Atheresthes stomias	Both	Adults	Fbub	Slope/Rise	Benthos	Unconsolidated	Mixed mud/s	1
Atheresthes stomias	Both	Adults	Fbus	Slope/Rise	Benthos	Unconsolidated	Sand	0.66
Atheresthes stomias	Both	Adults	Fbut	Slope/Rise	Benthos	Unconsolidated	Silt	0.66
Atheresthes stomias	Both	Adults	Sbcl	Shelf	Benthos	Mixed Bottom	Sand/Boulde	1
Atheresthes stomias	Both	Adults	Sbcr	Shelf	Benthos	Mixed Bottom	Soft Bottom/	0.33
Atheresthes stomias	Both	Adults	SbgP	Shelf	Benthos	Biogenic	Sponges	0.33
Atheresthes stomias	Both	Adults	Sbub	Shelf	Benthos	Unconsolidated	Mixed mud/s	1
Atheresthes stomias	Both	Adults	Sbus	Shelf	Benthos	Unconsolidated	Sand	0.66
Atheresthes stomias	Both	Adults	Sbut	Shelf	Benthos	Unconsolidated	Silt	0.66
Atheresthes stomias	Both	Juveniles	Fbcl	Slope/Rise	Benthos	Mixed Bottom	Sand/Cobble	1
Atheresthes stomias	Both	Juveniles	Fbcr	Slope/Rise	Benthos	Mixed Bottom	Soft Bottom/	0.33
Atheresthes stomias	Both	Juveniles	FbgP	Slope/Rise	Benthos	Biogenic	Sponges	0.33

It basically lists the numeric probability of habitat association for all habitats for each SpeciesLifestage and gender.

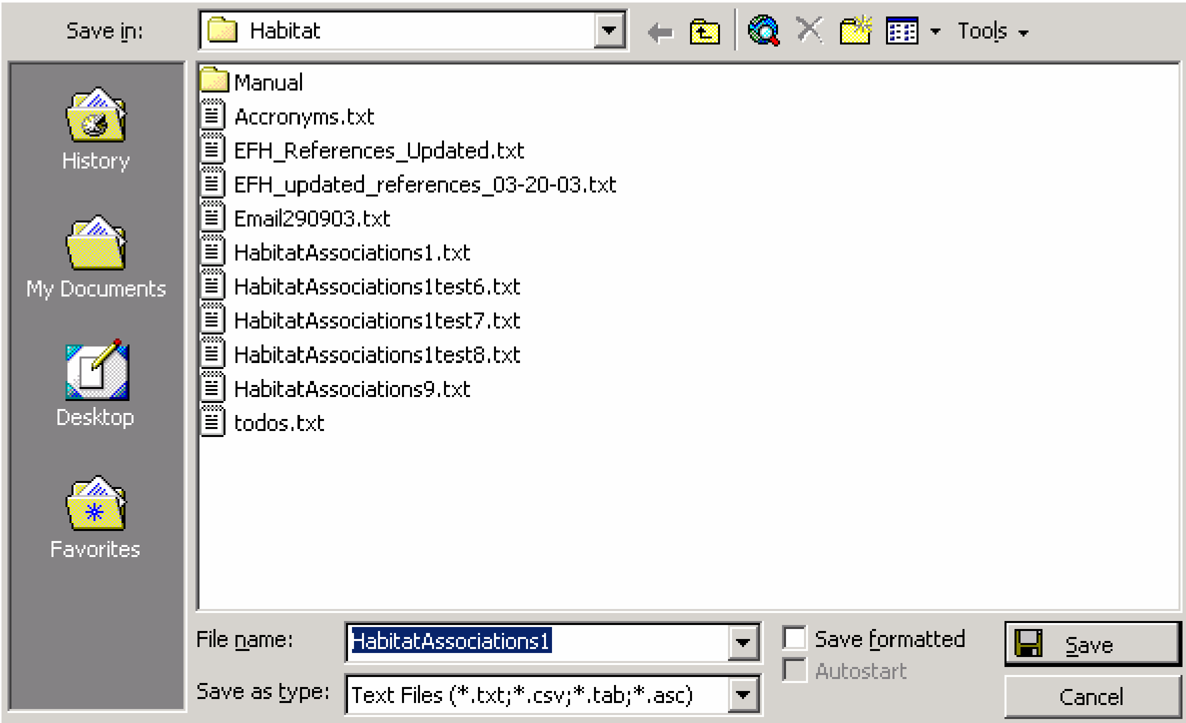
Its design view looks like this:



Once the query is written, it is used as a source for a menu-driven export routine that can export the data in a wide range of formats including that of spreadsheet files and standard comma delimited text files. The choice of format depends on the receiving software.

You can export a datasheet to a delimited or fixed-width text file; to do this, in the Database window, click the name of the table, query, view, or stored procedure you want to export, and then on the File menu, click Export.

The following screen comes up:



In the "Save as type" box, click Text Files (*.txt;*.csv;*.tab;*.asc).

Click the arrow to the right of the Save In box, and select the drive or folder to export to.

In the File Name box, enter the file name, and then click Save.

NB Make sure the 'Save formatted' box is NOT ticked.

Microsoft Access then starts the Export Text Wizard.

Follow the directions in the dialog boxes. Click Advanced to create or use an import/export specification.

You can call up this specification for re-use in future should you repeat the export procedure. You still have to go through the menu system but it at least remembers the settings you previously specified. It is also possible to save an export specification as a macro or visual basic code module. This can be done if required though for the assumed usage here we confine ourselves to the menu system which is powerful, flexible, and easy to use.

The resultant text appears as follows:

SpeciesSci,Gender,Lifestage,PlaceTimeID,Level1Habitat,Level2Habitat,Level3Habitat,Level4Habitat,AssociationProbability
Anoplopoma fimbria,Both,Adults,Fbun,Slope/Rise,Benthos,Unconsolidated,Unknown,100

Anoplopoma fimbria,Both,Adults,SbgU,Shelf,Benthos,Biogenic,Sea Urchins,66
Anoplopoma fimbria,Both,Adults,Ssum,Shelf,Submarine Canyon,Unconsolidated,Mud,66
Anoplopoma fimbria,Both,Juveniles,Fbun,Slope/Rise,Benthos,Unconsolidated,Unknown,100
Anoplopoma fimbria,Both,Juveniles,Fwed,Slope/Rise,Water Column,Epipelagic Zone,Drift Algae,66
Anoplopoma fimbria,Both,Juveniles,Sbun,Shelf,Benthos,Unconsolidated,Unknown,100
Anoplopoma fimbria,Both,Larvae,Fbun,Slope/Rise,Benthos,Unconsolidated,Unknown,100
Anoplopoma fimbria,Both,Larvae,Fnnn,Slope/Rise,Unknown,Unknown,Unknown,0
Anoplopoma fimbria,Both,Larvae,Fwed,Slope/Rise,Water Column,Epipelagic Zone,Drift Algae,66
Anoplopoma fimbria,Both,Larvae,Fwen,Slope/Rise,Water Column,Epipelagic Zone,Unknown,100
Anoplopoma fimbria,Both,Larvae,Fwmn_p,Slope/Rise,Water Column,Mesopelagic Zone,Unknown,100
Anoplopoma fimbria,Both,Larvae,Fwmn_w,Slope/Rise,Water Column,Mesopelagic Zone,Unknown,100
Anoplopoma fimbria,Both,Larvae,Swen,Shelf,Water Column,Epipelagic Zone,Unknown,100
Antimora microlepis,Both,Adults,Fbnn,Slope/Rise,Benthos,Unknown,Unknown,100
Antimora microlepis,Both,Adults,Sbnn,Shelf,Benthos,Unknown,Unknown,100
Atheresthes stomias,Both,Adults,Fbcl,Slope/Rise,Benthos,Mixed Bottom,Sand/Cobble,100
Atheresthes stomias,Both,Adults,Fbcr,Slope/Rise,Benthos,Mixed Bottom,Soft Bottom/rock,33

Etc etc …

APPENDIX 11A. EXAMPLE DATA EXTRACTION FROM UPDATED LIFE HISTORY DESCRIPTIONS

CANARY ROCKFISH (*Sebastes pinniger*)

Range

Canary rockfish are found between Cape Colnett, Baja California, and southeastern Alaska (lat. 56°N, long. 134°W) (Boehlert 1980, Boehlert and Kappenman 1980, Hart 1973, Love 1996, Miller and Lea 1972, Richardson and Laroche 1979).

Fishery

Canary rockfish are a major constituent of the commercial trawl fishery off Oregon and Washington (Boehlert 1980, Gunderson and Lenarz 1980, Love 1996). Off California, canary rockfish are caught mainly in the sport and commercial longline fisheries. They are moderately important in the party and private vessel sport fishery, from central California northward (Boehlert 1980, Love 1996).

Habitat

Canary rockfish are considered a middle shelf-mesobenthal species (Allen and Smith 1988). There is a major population concentration of canary rockfish between latitude 44° 30' and 45° 00' N off Oregon (Richardson and Laroche 1979).

Canary rockfish have a depth range from the surface (juveniles) to 274 m (Boehlert 1980, Hart 1973, Love 1996), but primarily inhabit waters 91-183 m deep (Boehlert and Kappenman 1980). Larvae and juveniles are pelagic (Boehlert and Kappenman 1980, Richardson and Laroche 1979). Larvae can be captured over a wide area, from 13-306 km offshore, and pelagic juveniles occur mostly beyond the continental shelf (Richardson and Laroche 1979).

Canary rockfish inhabit shallow water when they are young and deep water as adults (Mason 1995). Adults have two primary habitat preferences: some are semipelagic, forming loose schools above rocky areas; and some are nonschooling, solitary benthic individuals (Stein et al. 1992). Adult canary rockfish are associated with pinnacles and sharp drop-offs (Love 1996). They are also found near, but usually not on the bottom, often associating with yellowtail, widow, and silvergray rockfish (Love 1996). Canary rockfish are most abundant above hard bottoms (Boehlert and Kappenman 1980), and they have been observed among mixtures of mud and boulders (Love et al. 2002). In the southern part of its range, the canary rockfish appears to be a reef-associated species (Boehlert 1980). On Heceta Bank, near Oregon, they were commonly found in boulder and cobble fields in association with rosethorn, sharpchin, yelloweye and pygmy rockfish (Stein et al. 1992). In studies conducted off Southeast Alaska using an ROV, Johnson et al. (2003) reported finding canary rockfish primarily associated with complex bottoms composed of rocks and boulders, and a few individuals were seen near soft sediments.

Young-of-the-year rockfish can also be found in tide pools (Love 1996), and are associated with artificial reefs, and in interfaces between mud and rock (Cailliet et al. 2000). In central California, young-of-the-year (YOY) canary rockfish are first observed near the bottom at the seaward, sand-rock interface and farther seaward in deeper water (18-24 m) (Carr 1991). Their first appearance generally occurs shortly after the first upwellings of the spring (Carr 1991). They are often seen hovering above sand or small rock piles (VenTresca et al. 1996), and are seldom associated with kelp beds, although some YOY are associated with floating algae (Carr 1991).

Migrations and Movements

Canary rockfish are densely aggregating fish (Love 1996). Juveniles descend into deeper water as they mature (Love 1996). Canary rockfish move into deeper water with age and also are capable of major latitudinal movements (up to 380 nautical miles) (Lea et al. 1999). Juveniles have been reported to be associated with rocky sandy areas during the day and with sand flats during the night (Love et al. 2002).

Reproduction

Canary rockfish are ovoviviparous and have internal fertilization (Boehlert and Kappenman 1980, Richardson and Laroche 1979). Off California, canary rockfish spawn from November-March and from January-March off Oregon, Washington, and British Columbia (Hart 1973, Love 1996, Richardson and Laroche 1979). A wide range in larval sizes over a broad time span indicates that canary rockfish may have protracted and variable spawning (Richardson and Laroche 1979).

The age of 50% maturity of canary rockfish is 9 years; nearly all are mature by age 13 (Paul Reilly, personal communication). Maximum age has been estimated as 60 years (Adams 1992) to 75 years (ODFW, personal communication).

Growth and Development

The mean length of newly extruded canary rockfish larvae is 3.66 mm SL (Richardson and Laroche 1979). The transformation to pelagic juvenile occurs at sizes greater than 12.5 mm SL. Transformation to benthic juveniles occurs after 59.4 mm, during June-August (Richardson and Laroche 1979). Canary rockfish growth does not vary with latitude (Boehlert and Kappenman 1980). The maximum length canary rockfish grow to is 76 cm (Boehlert and Kappenman 1980, Hart 1973, Love 1996).

Off California, about 50% of the population is mature at 35.6 cm (5 or 6 years). A 48.3-cm long female carries approximately 260,000 young and fish 53.3- to 66-cm long carries about 1,900,000 young (Hart 1973). Canary rockfish can live to be 75 years old. A 10-year-old canary rockfish is approximately 50 cm SL (Love 1996). After age 11, females grow faster than males and mature at a larger size, but males live longer (Boehlert 1980, Boehlert and Yoklavich 1984, Love 1996).

Trophic Interactions

Canary rockfish primarily prey on planktonic creatures, such as krill, and occasionally on fish (Love 1996). Canary rockfish feeding increases during the spring-summer upwelling period when euphausiids are the dominant prey and the frequency of empty stomachs is lower (Boehlert et al. 1989).

APPENDIX 11B

List of tables:

Name
Activities
Associations
EcoRegions
Grids
Influences
Level1Habitats
Level2Habitats
Level3Habitats
Lifestages
Occurence
OtherActivities
phablist
PlaceTime
Plans
Predators
Prey
ReferenceInstance
References
Seasons
Species
SpeciesActivities
SpeciesLifestage

List of forms:

Name
frmActivities
frmAssociations
frmChart
frmEcoRegions
frmGrids
frmHabitats
frmInfluences
frmLifestages
frmMain
frmOccurence
frmOtherActivities
frmPlaceTime
frmPlans
frmPredators
frmPrey
frmReferenceInstance
frmReferences
frmSeasons
frmSpecies
frmSpeciesActivities
frmSpeciesLifestage
frmTestPlot
sfLevel1Habitats
sfLevel2Habitats
sfLevel3Habitats

APPENDIX 11C. THE DATABASE DESIGN PRINCIPLES

One of the primary aims of relational database design is to provide a system that is based around real physical entities and processes. If this principle is adhered to, it is much easier to develop a database system that is understandable to users and maintains data integrity. It also allows for much greater flexibility in analyses and future alterations and additions to the system. A critical aspect is that the complexity of the natural system being analyzed can be represented in terms of the data content rather than the data structures. Providing this is achieved then a deceptively simple system can be a powerful tool for both the environmental researcher and manager alike. It means that the resources used to both collect the data, and design the system to manage it, have been put to the best possible use. It also allows for the more effective integration with companion systems.

The integrity of the relational database is maintained through an extensive number of primary and foreign keys. The primary keys prevent the illogical addition of duplicate records. Though obviously sensible in itself, this becomes particularly important at the analysis stage since such duplicate values can cause multiplication of query results. Correctly normalized tables (to third normal form) and foreign keys that prevent many-to-many relationships between tables also guard against such errors in analysis.

Enforcing referential integrity via foreign keys also ensures the correct grouping of results during stratified analyses. These safeguards enforce certain requirements at the data entry stage. Basically these boil down to always first having a correct reference value in the reference tables before such a value can be used in the main data entry tables. For example, you cannot enter a species name in the SpeciesActivities section unless it first exists in the Species table. The same principle applies to life stages, habitat levels, grids and eco-regions, management plans and seasons and other activities. Even if one of these entities is not being used in a particular data element, at least one value such as ‘All’, ‘Unknown’ or ’Not-applicable’ must be entered in the relevant table. The system will not let you proceed with routine data entry until you have done this.

The values in these reference tables thus ensure the values entered during routine entry of the mass of data are consistent and correct. The reference values are also the source of choices offered in the drop down combo boxes which offer a choice of values to enter at both the table and form level. This saves on having to remember and type values correctly.

Having the data values presented in this way also means that full descriptive terms can be used instead of having to use meaningless codes and abbreviations. This both simplifies the database design and makes the system clearer to all users.

There are also simple rules enforced governing the allowable values for various attributes. Generally these allow either null values or ones that are within applicable physical ranges.

A system based around a sound fundamental data model is far simpler and thus comprehensible even to the non-database specialist. It also makes the definition of analyses far simpler; negating the need for hidden code modules. This gives the user far greater scope to use the system themselves as a research and management tool without constant recourse to a computing specialist.

If data are to be entered at different sites, then careful planning must be made as how to coordinate these sites to ensure the resultant data sets can be combined without compromising data integrity. The simplest option is to enter all the data into one database. It can be set up for multiple users to do this. The users can connect to it either via a local or wide area network or via the internet. For the latter option it would be necessary to develop the 'Active Server Pages' that would be required as an interface for internet data entry. The other possibility is for the database to be 'replicated' and later 'synchronized.' These strategic decisions need to be taken, communicated and enforced by those responsible for managing the database and adhered to by those using it!

APPENDIX 11D. EXAMPLE METHODOLOGY FOR GENERATING SPATIAL AND TEMPORAL DATA FROM SOURCE DOCUMENTS.

This example methodology is intended to demonstrate how spatial and temporal patterns could be extracted from the 'Updated Life History Descriptions.doc' document, if as and when this were required, and represented as hard data in the Habitat Use Database, that would then have the capability of being analyzed. For the time being these methods are not required because the database concentrates simply on mapping habitats that are capable of being matched to GIS substrates. It is, however, worth reading these sections since the principles explained are also applicable to most of the other attributes in the database, and how they all fit together in the overall framework.

The researcher should first decide on definite scales of spatial and temporal sub-division, e.g. four seasons and suitable grid squares. Then for each individual species using a chart of the West Coast region with these grids marked and isobaths marked proceed to mark on the stated ranges (maximum and preferred:- note: an additional range association field would be needed to reflect this). Also from the 'Habitat' sub heading in the document mark on the depth preferences within the range, what life stage they are, what season it is, and what they are doing at that time. Additional information on this score should also be gleaned from the sections on 'Movements and Migrations' and 'Reproduction' sections of the document.

Those plots should then be used as the basis for building up the bank of descriptive records. This should be done grid square by grid square and season by season within each grid square.

Thus wherever there is a grid square where the species occurs, we create the first record for the species. This record will list the grid square ID, the season (or value for whatever temporal attribute you have agreed upon). It need not list or assume particular values for the four habitat fields unless these are explicitly known, because this information will probably be sourced from the GIS info. However, where definite habitat data are available, they should be entered as they could later be used to refine the distribution within the grid square when matched against the substrate data from the GIS system. Where multiple habitat definitions exist within the same Grid square, then multiple PlaceTime records should be created to represent this.

All the other relevant data that are available for this grid square, at that time of year, should also be entered, i.e. any Place / Area name, EcoRegion, Lat-Long and possibly year. The depth temp salinity and oxygen values should again be gleaned of seasonal oceanographic charts where possible.

Anything can be used as a PlaceTimeID providing it is a unique value. Previous extensive discussion has agreed that this should be composed of a complex code combining the values from each of the attributes. Though such a code is never processed during analysis it is useful for comprehension during data entry and review.

e.g. for gridsquare, season, hab1, hab2, hab3, hab4, we could have a code such as G15_Sa_H1c_H2b_H3h_H4b or some such.

*(Data on 'Influences,' e.g. fishing activity, could be entered as well should you choose to use this feature. If so, duration would have to be summed according to the temporal scale that is being used, e.g. average days of fishing in the season per unit of fishing gears * 'average' numbers of fishing gears operating in that grid square during that season.)*

Then drop down into the 'Occurrence' sub form and enter the Species, Gender and Lifestage for that particular instance only.

Under 'SpeciesActivity' list the type of activity for that Species-Gender-Lifestage and likewise enter any details concerning predation and prey from the section on 'Trophic Interactions.

Enter additional records in this section for any other genders and lifestages that occur in that grid square in that season for THAT species.

Don't bother with the details for any other species at this stage as each species will be done in turn.

Then move on to the next 'PlaceTime' definition. This could be the same grid square and season but a different combination of habitat definitions within these or it might be a new season within the grid square or a new grid square altogether.

Repeat the whole process building up the description of the system Species by species, grid square by grid square, season by season, habitat by habitat, gender by gender, life stage by life stage, activity by activity.

Note that the easiest way to do this is by using the PlaceTime Centric form even though we are progressing species by species from the 'Updated Life Histories' document. Obviously as PlaceTime(habitat) definitions are built up these can be reused where applicable for other species and can be retrieved via the code and/or order of sorting provided in the drop down menu choices.

The following ‘scenarios’ will, hopefully, help explain how this method of data ‘extraction’ enables increasing complexity in the natural system to be encapsulated as an increase in data rather than an increase in data structures and database complexity. The principles are equally applicable when designing a survey to gather primary source data as they are here for use in ‘extracting’ data from secondary descriptive material.

Any given situation from the very simplest to the most complex is represented within identical data structures. The only difference is the <u>amount</u> of data required to describe the situation.

In the simplest case the entire environment could be described by a single record. There would be one life stage for one species occupying a uniform space for all time. If we introduced a

second life stage, that would double the number of records. If we then introduce a second species, also with two life stages, that would double the number of records again.
If we divide the area up into five eco-regions then that potentially increases the data by 5 times (not allowing for variable spatial distribution).
If we introduce two habitat types, that again would double the number of records (where both habitats occur).
If we introduce a 'year' then the data set is multiplied for each year recorded (not allowing for variable temporal distribution).
If we introduce a season then the number of records required is multiplied by the number of seasons (again not allowing for seasonal patterns) and so on for each new attribute that we introduce.
Each of these increases in complexity requires no alteration whatsoever to the structure of the database.

The same kind of principle applies to the linked subsidiary tables describing species activities, predators and prey.

It is useful to bear that 'scenario' in mind when breaking down the descriptive 'Updated Life Histories' document into data that is capable of analysis with this system.

Thus, if it is intended to, say, break down analyses by EcoRegions, then these must be looked for in the information available. Even if a given Species-Lifestage genuinely occupies a given habitat throughout the entire West Coast, five records must be entered to describe it correctly; one per eco-region. That would mean in practice there being five occurrence records being entered for the SpeciesLifestage each with a different PlaceTimeID. Those related PlaceTime records would be identical apart from having

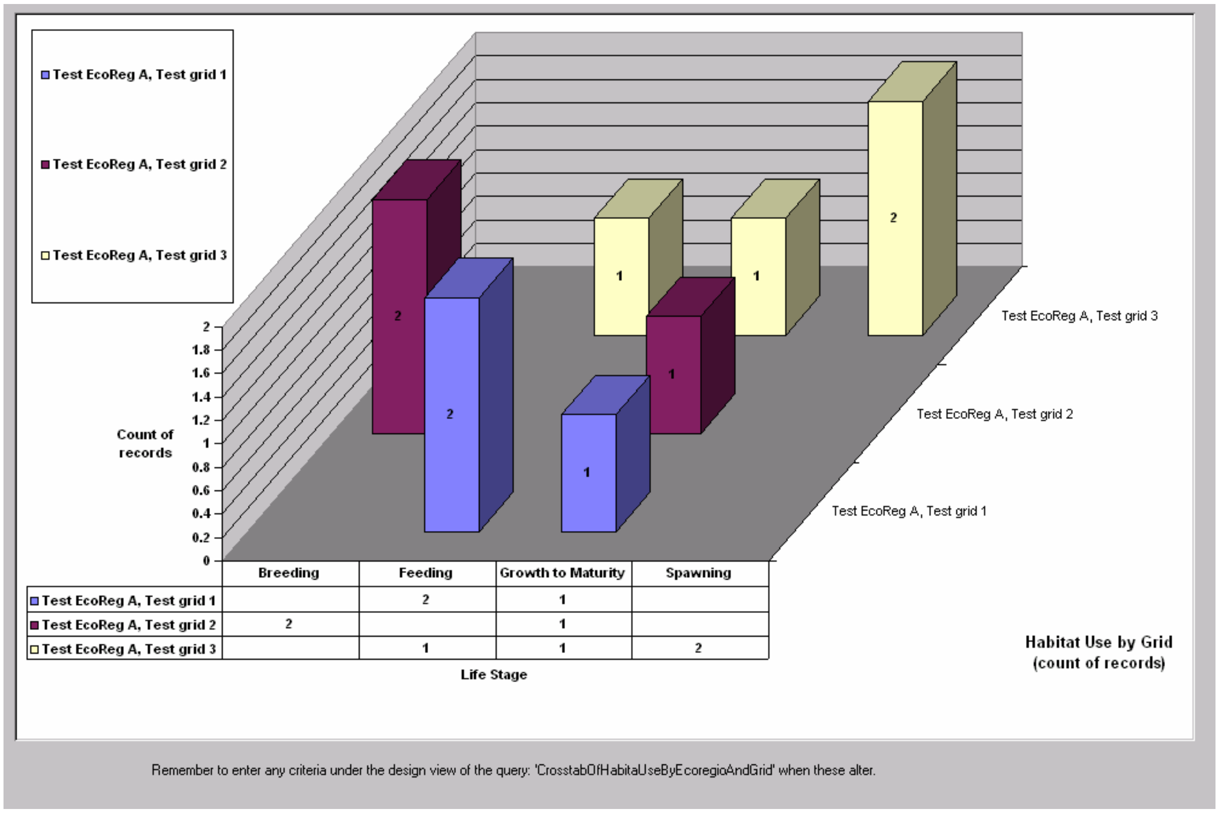
a) a different value under the EcoRegion field, and

b) a different PlaceTimeID code.

Of course in reality it is more likely that the SpeciesLifestage may for example only be recorded in three of the five EcoRegions. In this fashion real complex patterns of distribution can be correctly represented.

The principles outlined above for EcoRegions are equally applicable when dealing with Grids, Seasons, Years and the various combinations of habitats.

Here is an example of the charted output from a query analyzing test data for spatial distribution of species activity across a grid scheme within an Eco-Region for a particular species.



	Breeding	Feeding	Growth to Maturity	Spawning
Test EcoReg A, Test grid 1		2	1	
Test EcoReg A, Test grid 2	2		1	
Test EcoReg A, Test grid 3		1	1	2

If only habitat variations are intended to be used for analyses then obviously that reduces the amount of data required, there not being the need to break things down into their EcoRegion and Seasonal components.

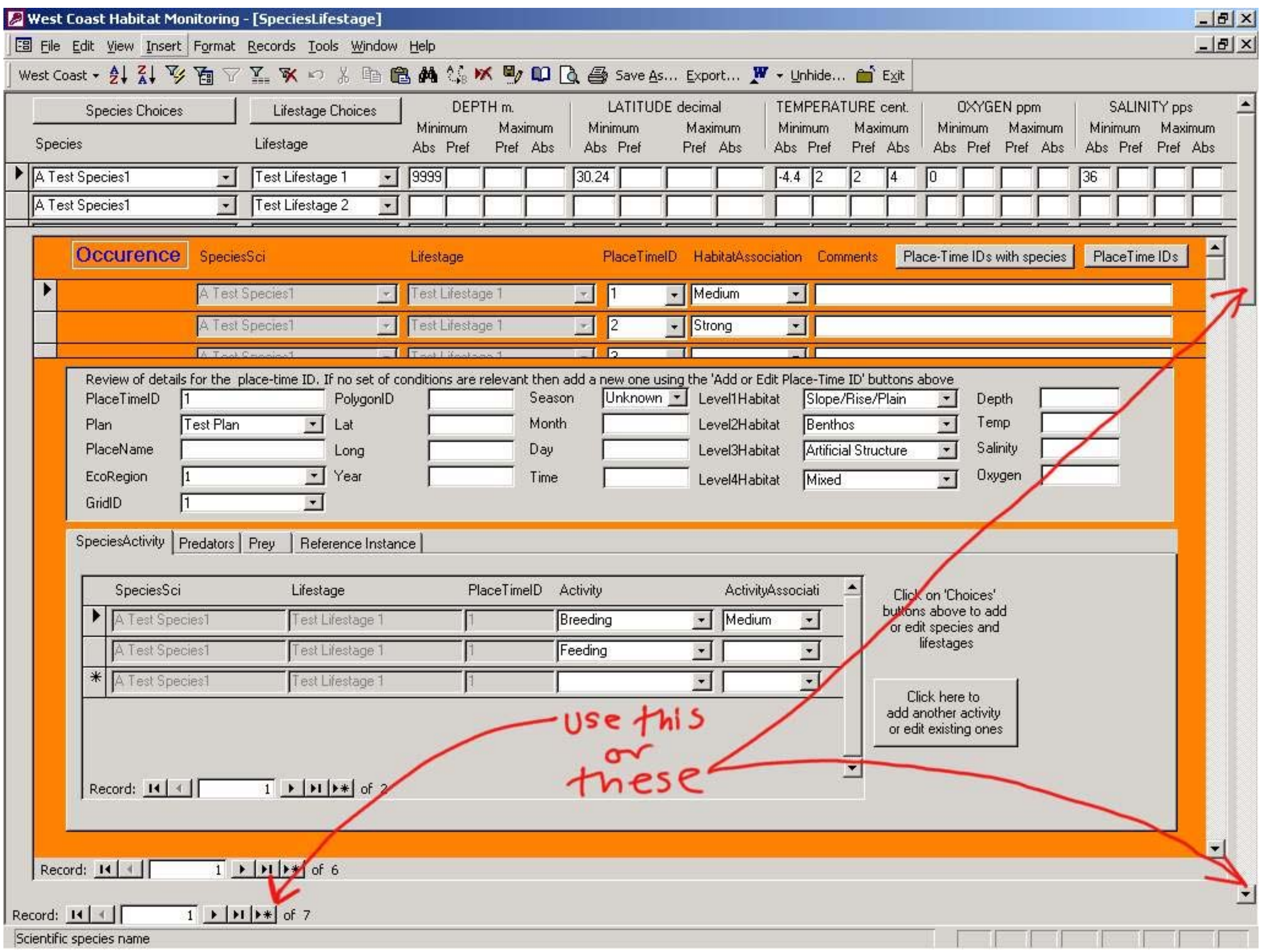
APPENDIX 11E. TUTORIAL FOR EXAMPLE DATA ENTRY

There follows a short tutorial of how data were extracted from the Updated Life Histories document for Petrale sole where it was confined to substrate classification, latitude, depth, salinity and temperature ranges. Temporal and spatial variation was ignored for the present.

The species names should all be in there to start with but you would in theory first go to species and check name. Use the Binocular ‘find’ symbol on the tool bar to search for the name you are looking for. Make sure the ‘Look In’ and ‘Match’ options are set correctly. The scientific names are also in alphabetical order in any case.

From the opening form ‘frmMain’ open the ‘Data: Species centric’ form by selecting that button.

Chose the new record button from the navigation buttons of the ‘outer’, ‘parent’ Species-Lifestage form as illustrated below:



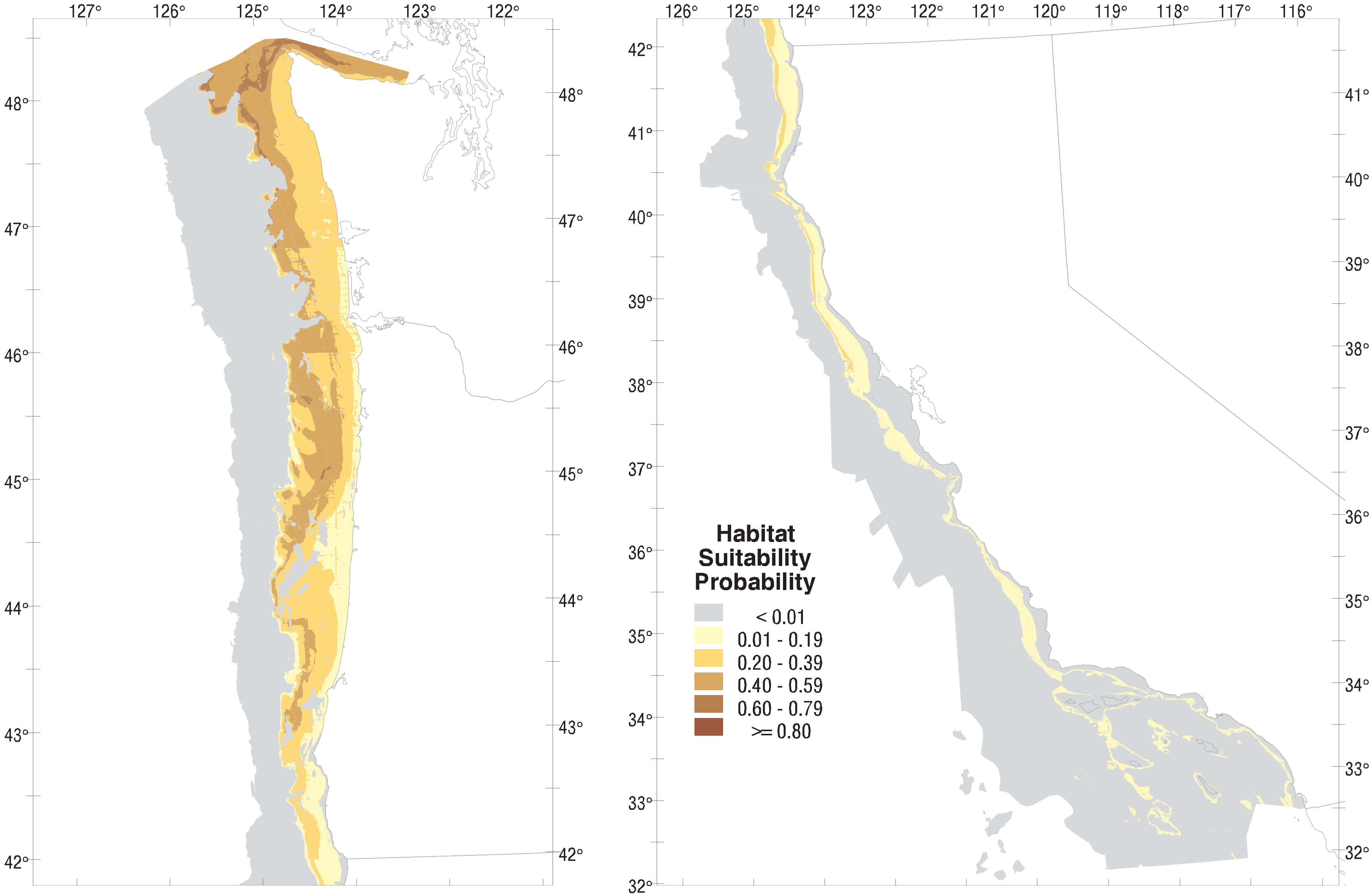
Then click the drop down box for the ‘Species Box’ and pick out the species name for entry: Eopsetta jordani in this case.

Decide whether you are going to enter the Species Lifestage attributes to represent all life stages, a selection of life stages, or all the life stages for which information is available. According to your choice you will have one record or a number to enter (one per life stage chosen). Go through the document trawling out the values for the four range limits for depth, latitude, temperature, oxygen and salinity. This is probably best done by using the word search facility for the key word in each case for the species under consideration.

For Petrale Sole the initial depth information under the ‘Fishery’ and ‘Habitat’ sections indicates that adults have a preferred range of 300 to 460m but have an absolute range of 0 to 550m. The fields are filled in accordingly. A new record is created for the juvenile life stage. The details for each of the physical characteristics can be edited in for each of the life stages at the same time or each life stage can be completed separately for all of the characteristics needed for each field before moving onto the next life stage. Whichever is most convenient for the data enterer depending on the order the data is extracted from the descriptive document.

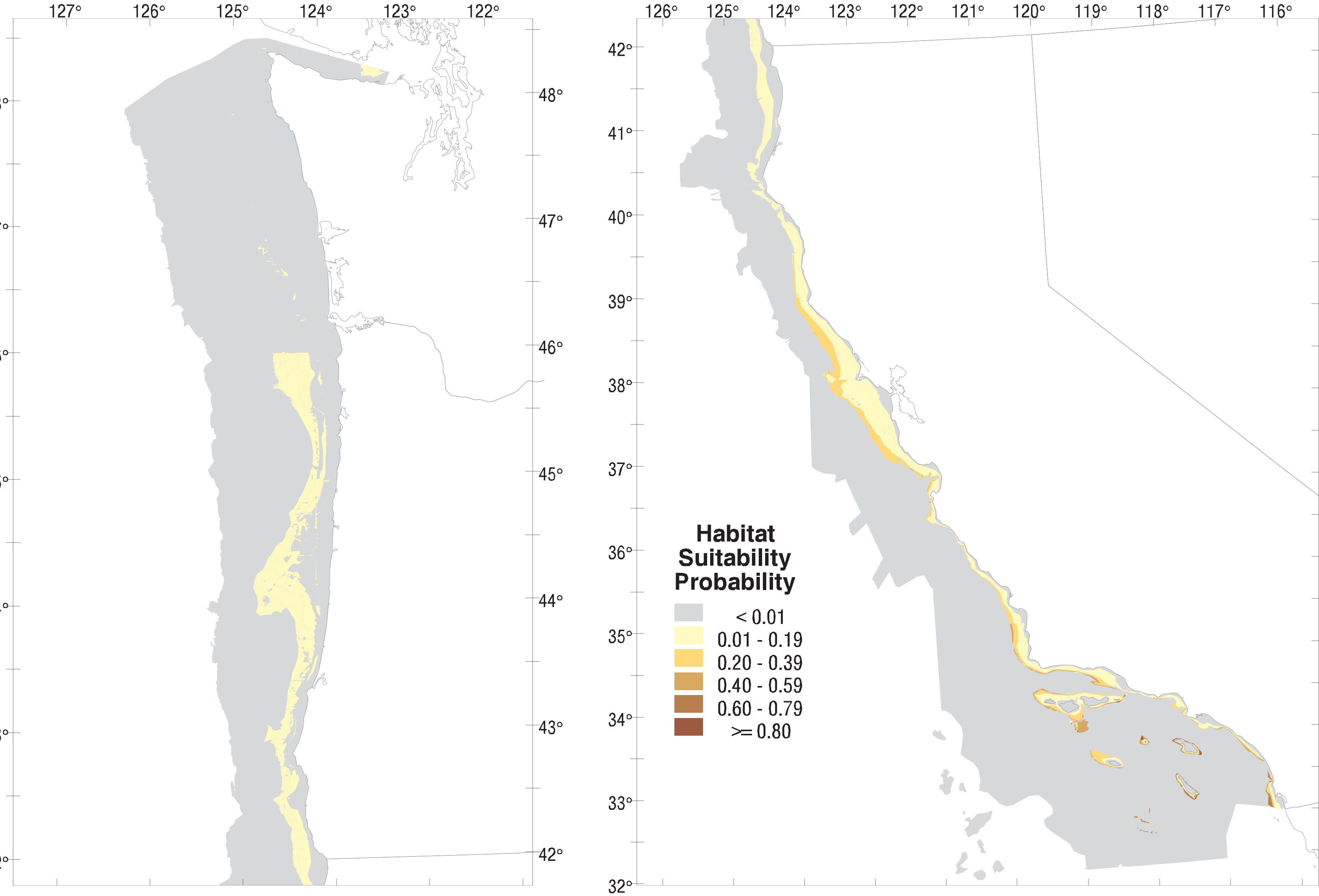
Remember entire records can be copied and pasted into the next row as a new record in order to save retyping. You obviously have to then edit the necessary key fields (e.g. here this would most likely be the ‘Lifestage’ field) so that the record is not a duplicate before that new record can be saved. It goes without saying that you would also amend any of the data in the fields for the physical characteristics where these were different from the previous record. The field above can also be copied where this is simpler by simply holding down the Ctrl and ‘C’ keys simultaneously in order to save retyping or selecting from a drop down list.

Arrowtooth Flounder - Juvenile



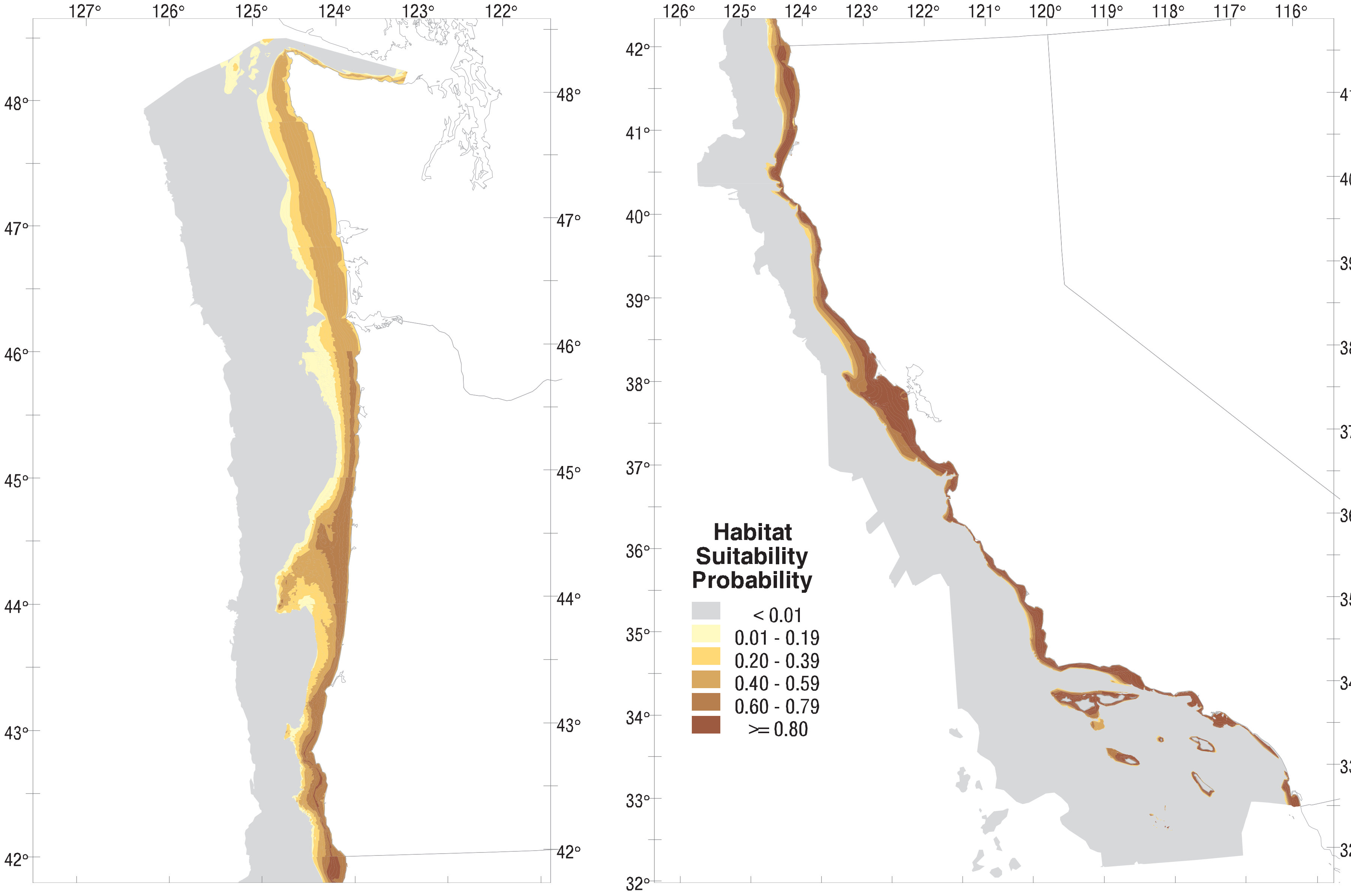
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Greenspotted Rockfish - Adult



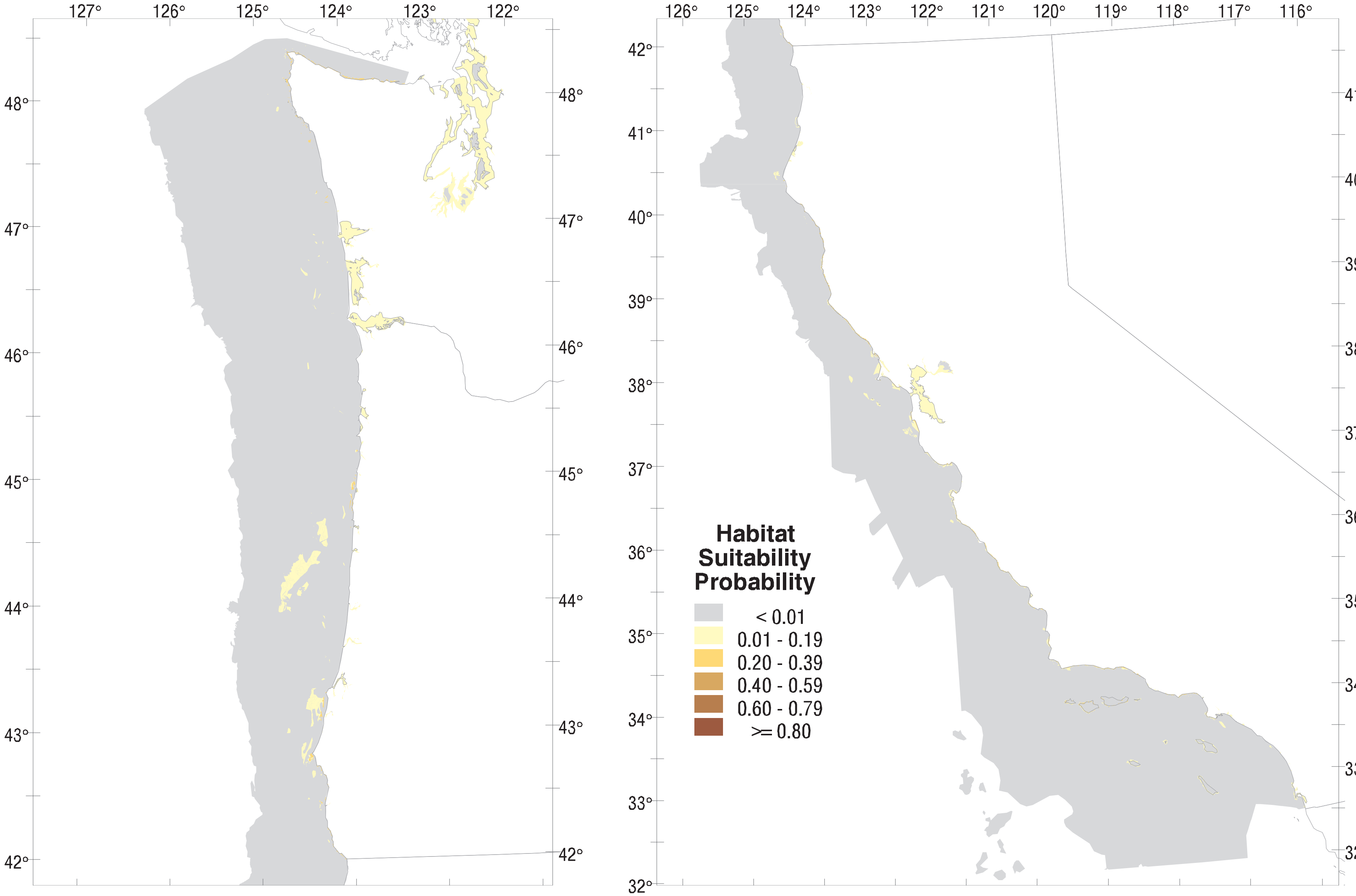
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Greenspotted Rockfish - Juvenile



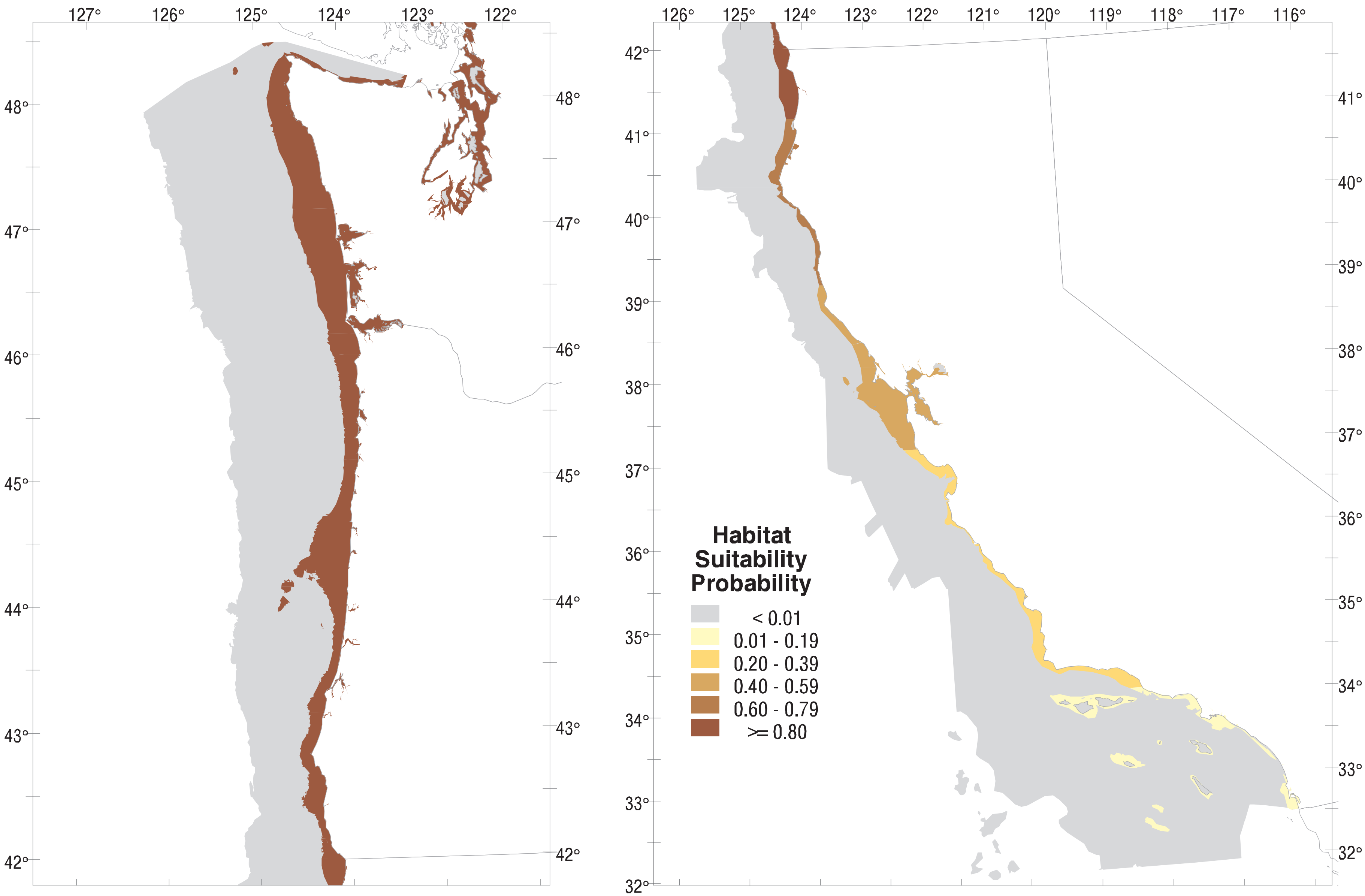
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Kelp Greenling - Adult



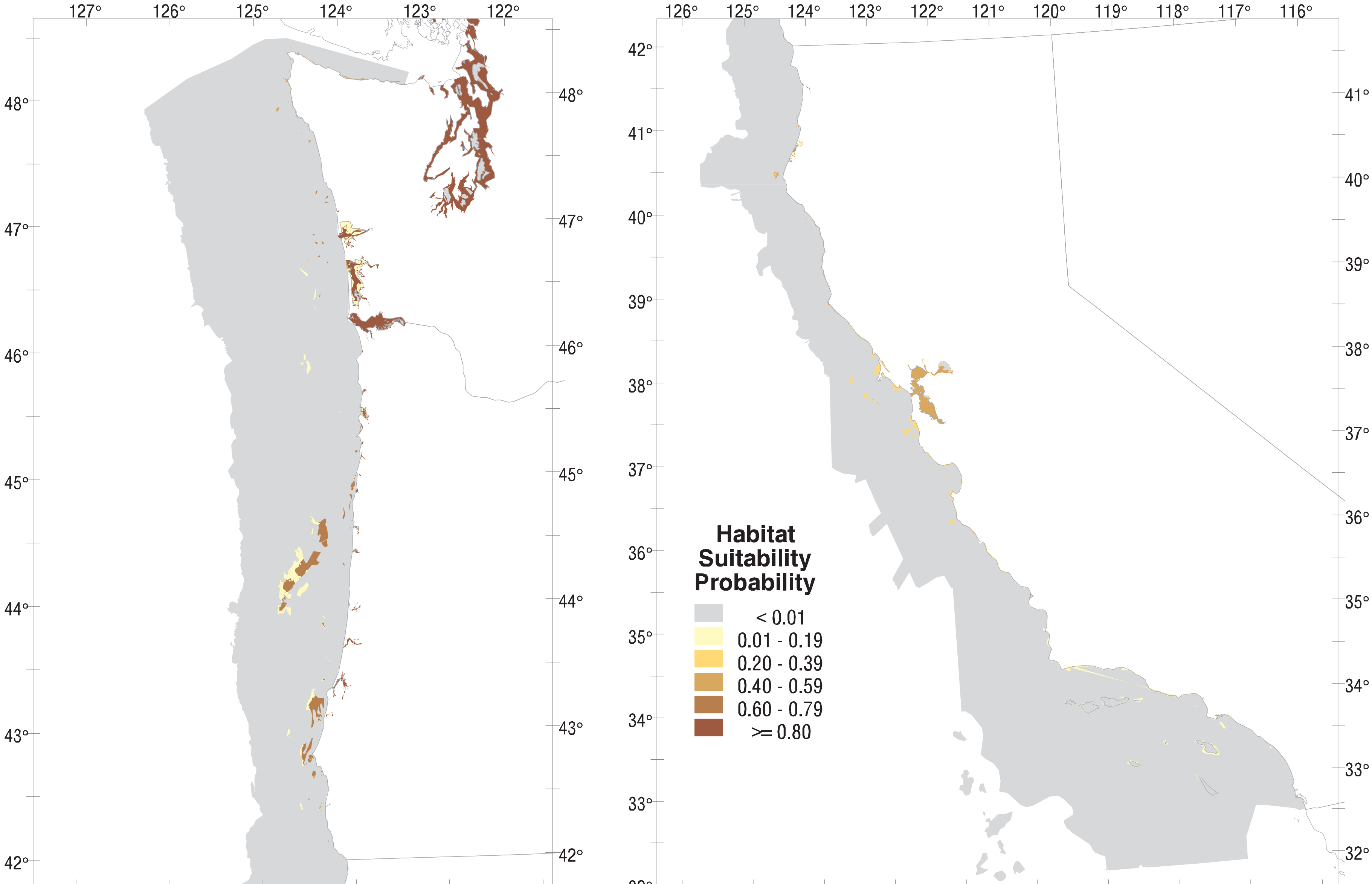
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Kelp Greenling - Eggs



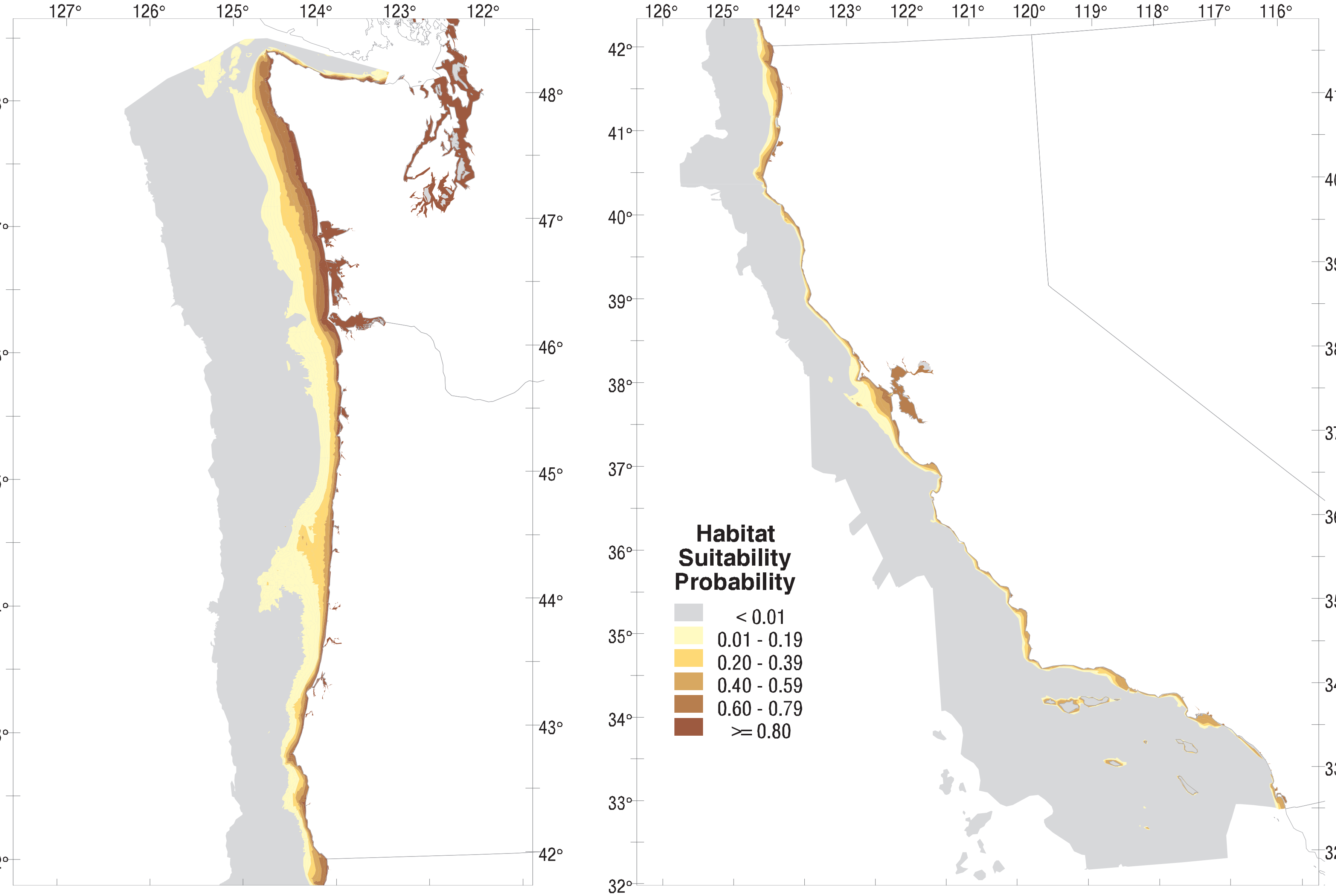
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Kelp Greenling - Juvenile



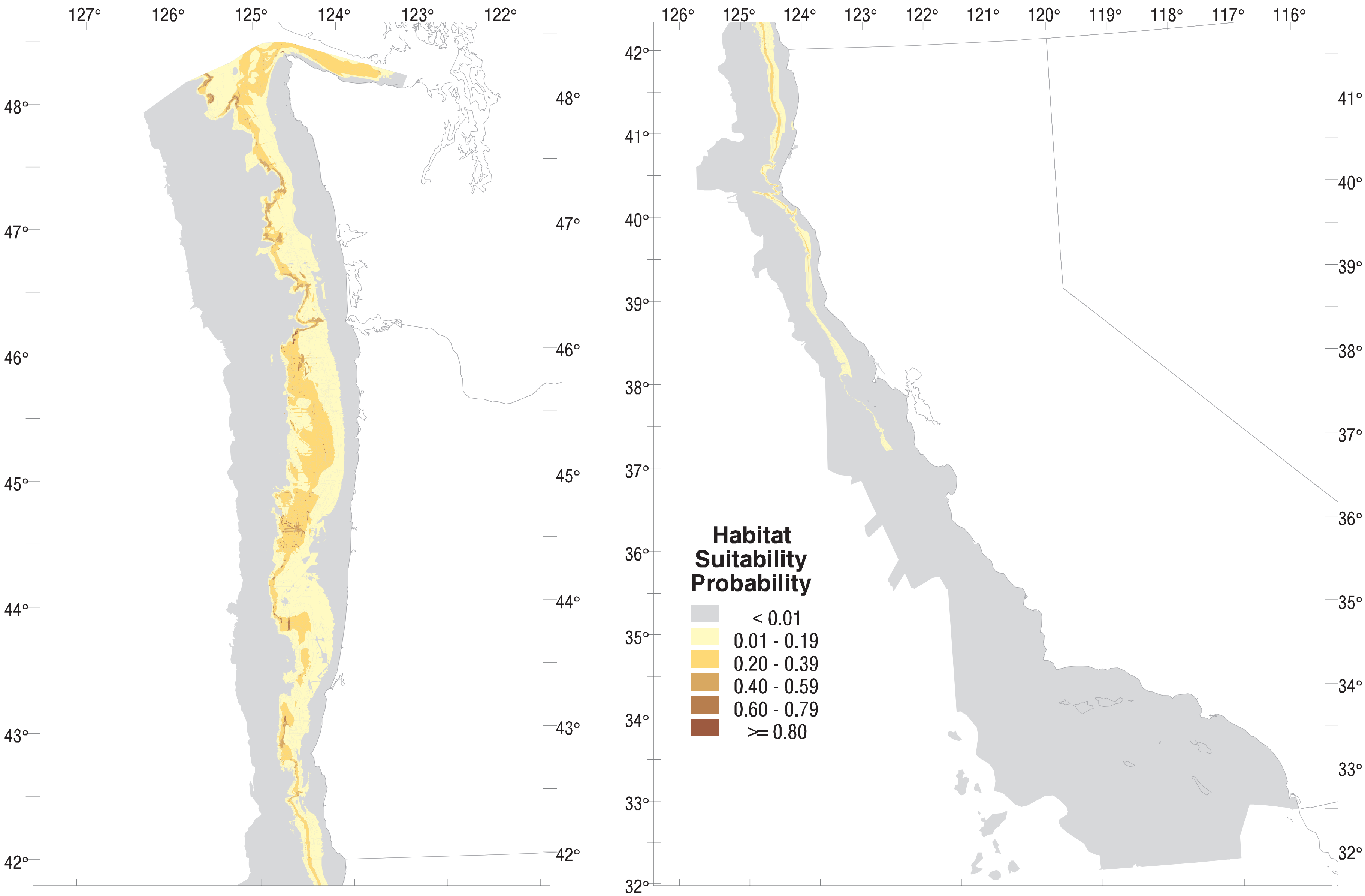
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Kelp Greenling - Larvae



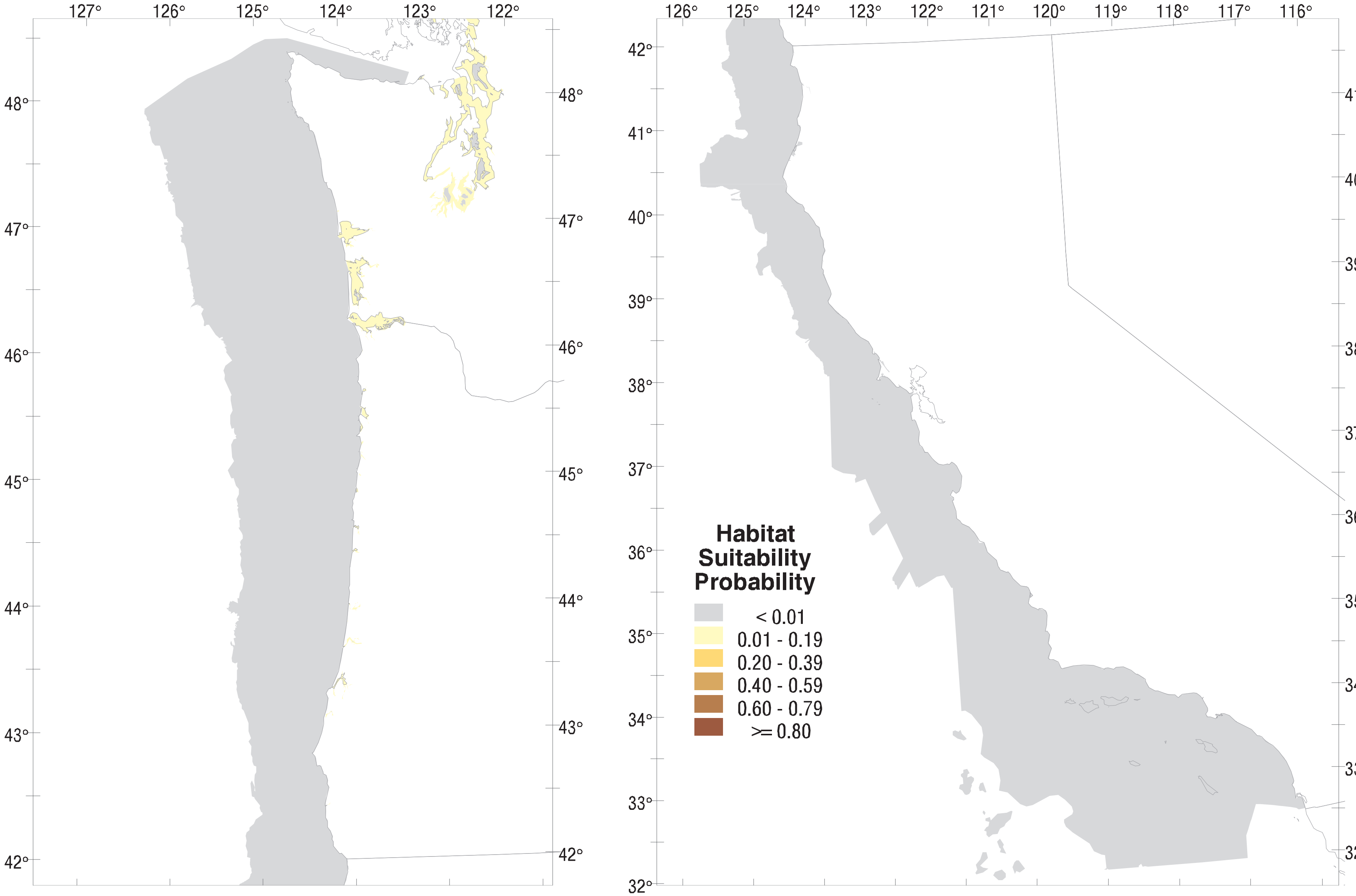
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Pacific Ocean Perch - Adult



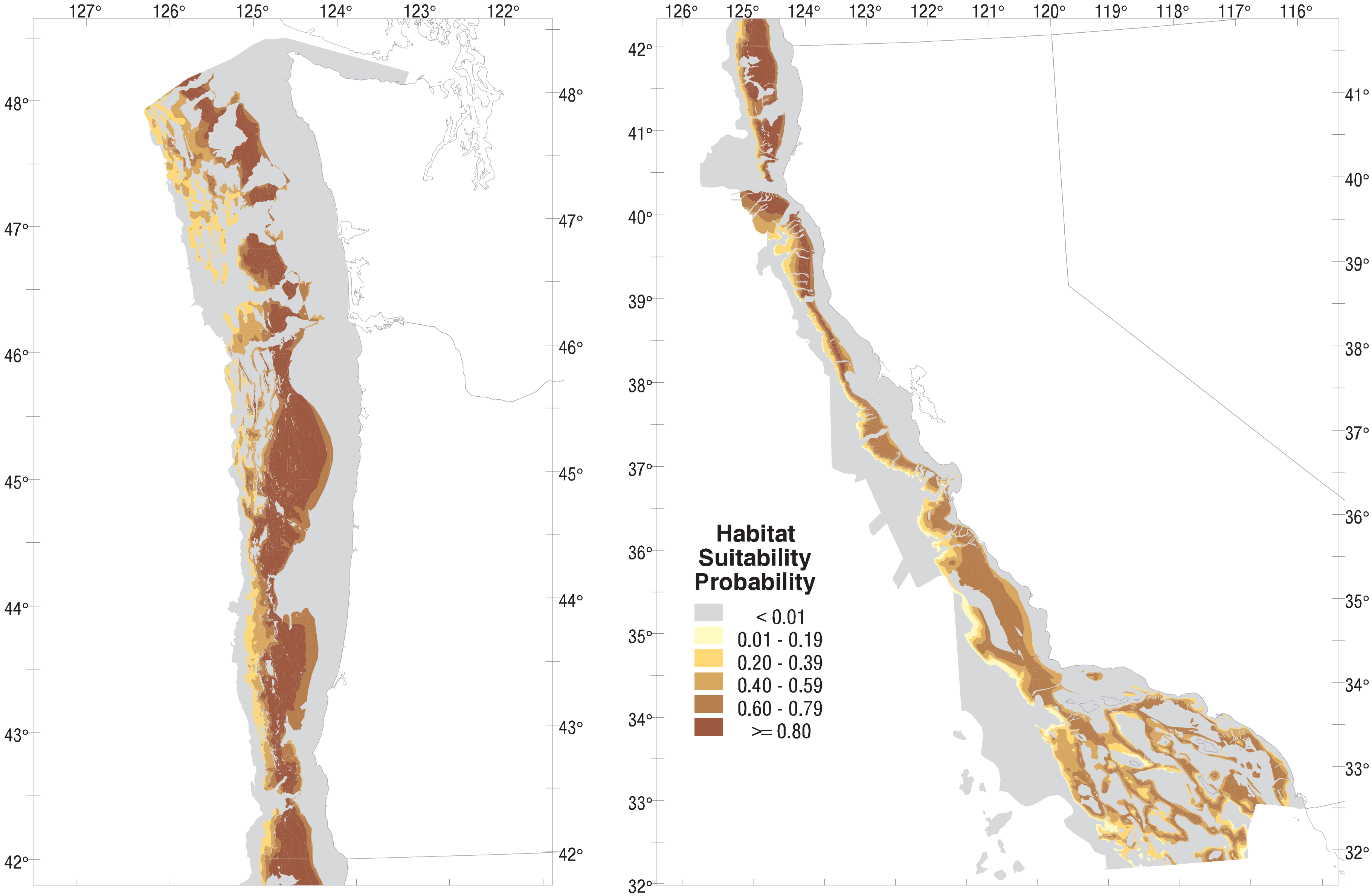
Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Pacific Ocean Perch - Larvae



Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Sablefish - Adult



Habitat Suitability Probability data output from MRAG/University of Reading EFH model. Cartography by Terralogic GIS, map date: March 19, 2004

Exhibit C.6.c
Attachment 1
April 2004

A Review of Analytical Portions of the Environmental Impact Statement for Designating Groundfish Essential Fish Habitat

– A Report of the SSC Groundfish Subcommittee –
Based on a Meeting Held at the Alaska Fisheries Science Center, February 23-24, 2004

SSC Members Present:

Steve Ralston (chairman)
Martin Dorn (rapporteur #1)
Mike Dalton (rapporteur #2)
Steve Berkeley
Tom Jagielo
Han-Lin Lai

Introduction

NOAA Fisheries is developing an Environmental Impact Statement (EIS) in response to a court order and settlement agreement to conduct a new NEPA analysis for Amendment 11 to the Pacific Fishery Management Council's (PFMC) groundfish Fishery Management Plan (FMP). Work on the EIS officially started in March 2002, when a team of NMFS and NOS scientists convened to devise a strategy and to identify data sources and responsible parties. The team identified the comparative risk assessment model described by the NRC[1] as the conceptual starting point for the Pacific coast groundfish Essential Fish Habitat (EFH) EIS. The PFMC reviewed the decision-making framework in April 2002 and subsequently formed the PFMC's Groundfish Habitat Technical Review Committee (TRC) to guide the assessment process.

The full Scientific and Statistical Committee (SSC) received an initial briefing by the EFH analytical team in June 2003. The schedule for designation of EFH by the PFMC is mandated by court order and requires that a range of alternatives be available for consideration at the June 2004 Council meeting. Scientific input has largely been provided to the analytical team by the Technical Review Committee (TRC) convened by the council. However, given the rigid schedule that is required for adoption of EFH alternatives by the PFMC and the role of the SSC in advising the Council about scientific and technical issues, a review of analytical tool that has be developed to evaluate EFH options was requested of the groundfish subcommittee of the SSC. That review was conducted February 23-24, 2004 at the Alaska Fisheries Science Center in Seattle, Washington. A substantial set of briefing materials were provided (Appendix 1) to the six members of the SSC that were present for the review (Ralston, Berkeley, Dalton, Dorn, Jagielo, and Lai).

It is clear that considerable advancement has occurred since the SSC was initially briefed by the EIS analytical team. The most substantial progress has been made on developing methods for characterizing and designating EFH. However, at the time of the review the fishing impacts model was not yet complete (see below).

The goal of the analytical team has been to bring a completed EFH assessment to the council at the April meeting, where preliminary alternatives for designating EFH will be presented. Council staff anticipated that the review by the groundfish subcommittee would constitute a "final check" before the completed assessment is brought before the Council. Although significant progress has been made, aspects of the analysis are incomplete (i.e., the fishing impacts model), precluding SSC endorsement of the full EIS assessment. Nonetheless, the subcommittee was able to fully review the analytical tool for designating EFH, for which methods have been most fully developed.

[1] NRC (2002). Effects of Trawling and Dredging on Seafloor Habitat. National Research Council, Ocean Studies Board, National Academy Press, Washington, D. C., 136 p.

Review of Model for EFH designation

GIS layers for bathymetry and substrate

Geographic Information System (GIS) techniques are used extensively in the EFH analysis. Information in GIS is stored as "layers" that can be linked together by their geographic coordinates. Two basic layers are used to characterize benthic marine habitats: a bathymetric layer (latitude-depth) and a substrate layer (geology of the sea floor). These layers have been assembled from many sources by the EFH analytical team and are the most comprehensive datasets of bathymetry and substrate ever compiled for the West Coast. The area covered extends from the shoreline (including estuaries) to 3000 m. This area does not comprise the entire West Coast EEZ, but does encompass the nearly all of the known habitat for groundfish FMP species. Areas of potential interest further offshore include several seamounts that rise above 3000 m depth that may provide habitat for minor groundfish species such as Pacific rattail and finescale codling. Omission of seamounts is unlikely to be of consequence for the EFH analysis, although they may good candidates for HAPC designation. The technical team indicated they will close this information gap in time for the seamount data to be useful in the EIS process.

Ideally, the quality of the data in a GIS layer should be assessed when the layer is created. A data quality layer is potentially useful in subsequent analysis to incorporate uncertainty, particularly when using Bayesian Belief Networks (BBN). For Oregon and Washington, a data quality layer on a scale of 1-40 was produced for each data source, i.e., bottom grabs, side scan sonar, seismic, etc. Unfortunately, a similar layer has not been generated for California. For the bathymetry layer, a qualitative scale was proposed, whereby a single value would be assigned to the waters off each state. Uneven treatment of uncertainty by layer and by region makes it difficult to carry forward uncertainty in the analysis.

In BBN models, uncertainty is modeled with discrete misclassification matrix, which could be obtained by evaluating an imprecise data set using a more precise data set, or from expert opinion. Unless uncertainty has been evaluated when the original layers were prepared, it is difficult to treat uncertainty appropriately. One option is to simply omit the misclassification matrix to acknowledge the difficulty of treating uncertainty appropriately. Another alternative would be perform a sensitivity analysis with different levels of classification error. Parcels identified for EFH analysis are irregular in shape, and defined according to depth intervals. While the range of depths within a parcel is likely to differ somewhat from the depth intervals used to define the parcel, the entire parcel is unlikely to be belong to a deeper or shallower depth interval. Therefore, we recommend that depth uncertainty not be included in the EFH designation model.

Biogenic habitat

Biogenic habitat (e.g., kelp, sea grass, and structure-forming invertebrates) is both of potential importance to fish populations and potentially sensitive to fishing impacts. With respect to structure-forming invertebrates, however, the draft analysis only provides a map showing the locations of survey stations were these species have previously occurred. Because of the potential importance of these biogenic habitats, the subcommittee recommends additional effort to identify areas with biogenic structure, including especially the structure-forming invertebrates. The review panel is cognizant of the limitations of the NMFS surveys for this purpose, and does not intend to be prescriptive in recommending what additional analyses could be done. Several suggestions are:

1. There currently exists a GIS layer with distribution polygons that characterizes kelp cover. This layer is needed to identify essential habitat for species with specific affinity for kelp habitat. However, the spatial extent of kelp cover expands and contracts in response to environmental variability (e.g., El Niño). When habitat is dynamic in nature, defining EFH by fixed geographic coordinates is problematic. Since the compiled information on kelp cover is the maximum extent of kelp cover, the kelp GIS layer should be understood as an inclusive definition of this habitat. Sea grass habitat presents similar difficulties.

2. Some structure-forming invertebrates are found primarily on soft bottom, and would be sampled effectively in the NMFS trawl surveys. Example include sea whips and perhaps sponges. For these soft bottom invertebrates, maps of relative CPUE by station should be produced.

3. The draft analysis argues that NMFS survey data are not adequate to produce a comprehensive map of hard-bottom coral off the West Coast. It is impossible to assess the adequacy of the survey data without first taking steps to map relative abundance. This exercise could also help to emphasize the need for further research into coral distribution, and ought to be included in the final analysis. Some areas of the West Coast EEZ have been surveyed using ROVs (i.e., Hecata Bank, parts of southern California). Assessing the distribution of coral in these areas is feasible. If at all possible, information on coral distribution in these areas should be included in the EFH analysis.

Modeling fish distribution

The NMFS guidelines for EFH describe a hierarchy of information that can be used to designate EFH. At level 4 (the highest) information is available on production rates by habitat. For the West Coast (as elsewhere), the information available for EFH designation is at level 2 (habitat-related density) and at level 1 (distribution data). Trawl CPUE is not explicitly habitat-related because substrate is not determined at sampling stations. Interpretation is also problematic because not all substrates are sampled equally well using trawls. The analytical team has devised an approach based on fitting generalized additive models (GAM) to presence/absence information (level 1) from trawls by latitude and depth (i.e., level 1). This approach ignores information on relative density from trawl surveys. While there are good reasons for adopting this approach, the change from a level 2 to level 1 analysis needs to be more carefully justified in the EFH analysis.

The information from literature review entered into the Habitat Use Database (HUD) is used to establish the species-substrate association. Habitat maps produced by EFH analysts show the "habitat suitability probability," which is calculated as the product of probability of occurrence by latitude and depth (from the GAM model) and strength of the species-substrate association. This quantity can be regarded as an estimate of how likely it is that the species will be encountered in a habitat, so perhaps the nomenclature should reflect this. Habitat suitability is a relatively vague concept that implies more about the importance of a particular habitat than is perhaps warranted.

The approach to modeling of EFH has evolved considerably from the initial NOS models used for assessment of central California marine sanctuaries. Rather than polynomial regression using the logarithm of mean survey CPUE, the EFH model is a GAM model for the probability of occurrence. The final modeling approach is based on appropriate error assumptions and careful attention to goodness of fit. Nevertheless, there is some concern that the modeling approach does not make fullest use of the survey information on relative densities. GAMs and GLMs that can accommodate zero catches have been commonly used to obtain indices of abundance using West Coast trawl survey data for stock assessment. Furthermore, the limitations of presence/absence information to infer essential habit should not be ignored. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area. Surveys provide limited information concerning the function of the habitat for a species. For example, winter spawning grounds for lingcod would not be necessarily be identified as essential habitat using summer survey data.

Existing surveys also have a strong bias towards habitats that can be trawled, and are of limited utility for identifying essential habitat for juvenile stages. For example, biogenic habitat may provide refugia from predation for juvenile fish, yet these habitats could not be identified as essential if the sampling gear does not capture juveniles. Although direct visual surveys are perhaps the best method for identifying species-habitat associations, these surveys are currently limited in scope. Size composition data are available for many groundfish from the NMFS trawl surveys. In many cases, juveniles can be reliably distinguished from adults on the basis of size. Many species occupy different habitats at different life history stages. Information about these ontogenetic shifts present in the trawl data is not being utilized in the present analysis. Therefore, while presence-absence analyses should be relatively robust, EHF designations resulting from such analysis are initial approximations that will need to be refined as additional information becomes available.

Habitat profiles have been generated for adults using GAM models and NMFS survey data for a limited number of species. Habitat profiles have not yet been obtained for egg, larval, and juvenile stages. These profiles will be generated using the HUD database, which will also be used for the adult stages of species which are not well sampled during trawl surveys.

Although this work has not yet been completed, the subcommittee was able to review the proposed methods.

HUD database

The life history appendix to the previous EFH amendment to groundfish FMP has been made into relational database of habitat use (HUD). For each species, association with substrate type is characterized on a relative scale (unknown, weak, medium, strong). Depth preferences are characterized with four depths: minimum observed depth, minimum preferred depth, maximum preferred depth, and maximum observed depth. Geographic (latitude) preferences are recorded similarly. The preferred minimum and maximum depths (and latitudinal ranges) are roughly based on the 5^{th} and 95^{th} percentiles from surveys when these data are available.

The analytical team proposed an interpolation/smoothing procedure for inferring habitat suitability profiles using information on preferred depths and latitudes in the HUD. While trying to extract as much information as possible from limited data is laudable, there is some danger of over-interpreting data to obtain visually satisfying results. Linear interpolation is preferable to arbitrarily smoothed curves when obtained simply from preferred maximum and minimum preferred depths. Values used to control the shape of suitability profiles could be estimated objectively by comparison with survey-based profiles for species where both can be obtained.

Model for EFH designation

The Bayesian Belief Network model used for designating EFH appears to be a reasonable approach. The EFH model is a very straightforward application that does not depend heavily on BBN methodology (Fig. 1 shows the flow of information in the EFH habitat designation model.) The novelty of the approach should not be considered a significant issue.

The end result of the EFH analysis are maps by life history stage for each groundfish species that show on a qualitative scale the importance of different habitats to that species. EFH is determined by selecting habitats with scores higher than some predetermined value. A low value would produce a broad or inclusive definition of EFH, while a high value would reduce the area defined as EFH. The decision whether to adopt an inclusive or narrow definition of EFH should be considered from a policy standpoint. Adopting an inclusive definition may be appropriate given the incomplete and indirect nature of the information used to identify EFH. However, developing workable alternatives to reduce fishing impacts may be difficult if EFH is defined broadly. Adopting a relatively narrow EHF definition may make it easier to develop effective precautionary alternatives.

The GAM models estimate the probability of occurrence, while suitability profiles based on HUD database are scaled to have a maximum value of one. The probability of occurrence can have a maximum value considerably less than one, particularly for rare species where the probability of occurrence is low everywhere. EHF for individual species should be placed on common scale before they are combined in an EFH definition for all groundfish species. It may also helpful to produce intermediary maps showing EFH maps for various subsets of groundfish, i.e., overfished species, species guilds, or species complexes used for management. One promising alternative for EFH designation would identify the best 10% (or 20%, etc) of habitat over entire assessed region for each groundfish species, and then combine these areas for an overall definition of EFH.

Public comment concerning EFH

1. The final rule for NMFS guidelines discusses the need for different EFH definitions for overfished species.

2. There is concern about using a level 1 analysis (presence/absence) rather than a level 2 analysis (relative density).

3. Is HAPC contained within EFH? Answer: Criteria for defining HAPC are different than EFH. HAPC is not necessarily included in EFH.

4. There was public testimony concerning the importance of identifying areas with living structure (specifically, corals and sponges).

SSC Review of the Impacts Model for the EFH EIS Process

Fishing Effort

Spatial data requirements of the EFH project stretch, and in many cases exceed, what are available for most West Coast fisheries. The most comprehensive spatial data for fishing effort on the West Coast are available from trawl logbooks, and work on the EFH project so far has relied exclusively on these data to measure the spatial distribution and intensity of impacts from fishing. The development of spatial data for fixed-gear sectors is an important objective for the EFH project's fisheries impacts model.

For the trawl fisheries, impacts are measured in the EFH project by total tow hours in a year at each location, or fishing block, where trawling occurred. This definition of fishing effort is appropriate for the EFH project.

No coast-wide source of spatial data for fixed-gear fisheries exists. Recently, the Ecotrust organization developed a model to estimate the coast-wide spatial distribution of fishing effort for fixed-gear and other groundfish fisheries using information from fish tickets, but the accuracy of these distributions was not tested. Wisely, the EFH project team investigated the potential reliability of using Ecotrust's effort distributions to represent spatial distributions of fishing effort in trawl, long-line, and groundfish pot fisheries. To check Ecotrust's effort distribution for one area, focus group meetings with knowledgeable fishermen were conducted to develop baseline effort maps for an area off the Oregon coast.

The focus group meetings for the EFH project were conducted under sound socioeconomic research protocols (Final Report, Pilot Project to Profile West Coast Fishing Effort). The SSC endorses the use of social science research methods to collect primary data based on fishermen's knowledge and expertise. The SSC encourages further use of these methods to continue collecting primary data on baseline fishing effort off the West Coast. These data would be used to develop baseline effort maps for other areas, and provide the best available science to the EFH-EIS process.

The focus groups produced a set of maps showing the spatial extent and intensity of fishing effort for trawl, long-line, and groundfish pot fisheries in an area between the ports of Newport and Astoria. Based on survey responses, fishermen in the focus groups were confident in the spatial extent of fishing effort depicted on the maps, but uncertain about the groups' estimates of the spatial intensity of fishing effort.

Maps from the EFH project's focus group were compared to Ecotrust's distributions of fishing effort for fixed-gear fisheries between Newport and Astoria over two recent time periods, 1997 and 2000. To show results, the EFH project team provided several maps that compare the baseline effort maps from the focus groups with Ecotrust's effort distributions. Results of the comparison are discouraging. For example, the areas reported by the focus groups for the fixed-gear fisheries were generally much larger and further from port than Ecotrust's distributions.

For the long-line fishery, Ecotrust's distributions cover 8-12% of the area reported by the focus groups. On the other hand, around 50% of each Ecotrust's distribution is outside that area. Results of the comparison for the groundfish pot fishery are worse. In this case, Ecotrust's distributions cover only 0-3% of the area reported by the focus groups, and 80-100% of each Ecotrust distribution is outside that area. In one case, the center of Ecotrust's distribution is more than 100 km from the area identified by the focus groups.

These comparisons reinforce the SSC's concerns, which have been described previously, regarding the spatial algorithm used by Ecotrust. Based on the above comparisons, the SSC is doubtful that the effort distributions derived from the Ecotrust methodology broadly represent baseline patterns of fishing effort in non-trawl fisheries. Consequently, the SSC cautions against relying on those effort distributions, to avoid biasing the estimated spatial distribution of impacts from non-trawl fisheries.

Effects of Fishing Gear on Habitat: Sensitivity and Recovery Rates

The EFH project team conducted an extensive literature review, and developed a database of gear effects for different habitat types. As with any multi-dimensional classification system, the number of cells requiring data grows quickly as more gear or habitat types are added to the database. Information to fill these cells is constrained by the literature review. To allow a reasonable number of cells, a scoring system was developed to rank gear effects with three levels each for sensitivity and recovery times (Tab. 2, p. 12, Appendix 10).

Data from the literature were standardized and a given a score in the range 0-3. For habitat sensitivity, zero represents minimal effects or no impact, and a score of three represents a major or catastrophic effects. Recovery times range from zero to periods lasting from three to seventeen or more years. For this reason, interpretation of the scores as real numbers is problematic. Nonetheless, scores are added together to calculate average scores for sensitivity and recovery rates.

The literature review provided a robust ranking of gear types by damage per unit effort, in increasing order: hook and line, pots and traps, nets, trawl, and dredges. The literature review also provided a robust ranking of habitat sensitivities to gear effects, in increasing order: soft bottom, hard bottom, and biogenic (broadly defined as having vertical biological structure).

The SSC notes the biogenic habitat category needs attention. Ideally, a refinement of this category could include corals, sea pens, or other invertebrates, but spatial data exist only to partly support this formulation. While the incomplete distributions may not be appropriate for use in the Bayesian network model, maps showing the spatial distribution of known biogenic features (e.g. corals in trawl surveys), and the distribution of fishing effort, would be useful for reference in future documents. In addition, the SSC notes that refinement of other categories, such as soft sediments, may also be advised.

Scores assigned to different gear and habitat types from the literature review involved subjective judgment. To address this issue, scores were assigned independently by a group of researchers that rated studies in the literature review. The mean of the individual scores, plus or minus a standard deviation, is used to represent low, medium, and high values for each gear and habitat type.

Overall, the SSC finds this method of constructing habitat sensitivity and recovery indices to be acceptable, but is concerned about whether data from the literature review are sufficiently representative of West Coast fisheries. Only 2 of the 89 studies included in the literature review took place in West Coast fisheries. Another potential source of bias is that 90% of the studies are about trawl or dredge gear.

Of particular concern to the SSC is the use of gear effect estimates from studies on New England trawlers to infer habitat effects from West Coast trawl vessels, which are usually smaller with different gear characteristics. Effects of trawling on hard-bottom shelf habitats are likely to be important in West Coast fisheries, and estimates of sensitivity and recovery for the hard bottom-shelf-trawl category in the EFH database are from only two studies (Tab. A10.2, Appendix 10 attachment). One study is about beam trawls, and the other was done in New England (Auster et al., 1996).

The SSC recommends investigating the relationship between gear effects and vessel size or fishing power, and if necessary controlling for this factor in the gear effects tables. A related issue that deserves further investigation is an assessment of each gear type's ability to access different habitat types.

Clarification is needed about relationships between the overall level of fishing effort and gear effects. For example in most cases, gear effects are measured for a single trawl, but replicates are sometimes used. Questions were also raised about whether replicate trawls occurred at exactly the same location. An important uncertainty in the data is that overall effort is controlled in the studies, and results may not apply, or may apply only in a limited way, to situations where effort is not controlled.

Fishing Impacts Model

The fishing impacts model for the EFH-EIS analysis is work in progress, and the SSC was unable to conduct a full review of the model at this time. The fishing impacts modeling team has a complex, and impressive, set of tasks to complete in order to accomplish its stated objectives. Fortunately, major computational challenges related to model development, and execution, have been solved, and a working version of the model and data were used to produce quantitative results for the effects of gear on fish habitat. The SSC appreciates the EFH project team's openness, particularly regarding suggestions about future model development.

Currently, the fishing impacts model is reduced to a single index value that is intended to represent a broad measure of status for fish habitat based on cumulative impacts. Fishing effort and sensitivity of habitat to gear type determine gross impacts. The fishing impacts model is dynamic, and effects of recovery and previous impacts determine net impacts. A simplifying assumption is that fishing effort is uniformly distributed over the year, which might ignore important seasonal effects. Dynamics of the habitat index value are based on a logistic difference equation, similar to population models. Parameters in the logistic equation are linked to habitat sensitivity and recovery rates from the gear effects tables described above.

The single index variable can be used with different model formulations. In one formulation, the index value represents a mean or average status for fish habitat over an entire area. An alternative formulation is to assume that fish habitat consists of many individual patches that follow a discrete two-state process between healthy and damaged conditions. Under this interpretation, the index value represents the fraction of patches in, for example, the damaged state. Either formulation has problems, and the SSC recommends developing a multivariate description of impacts, based on explicit and measurable physical effects of gear on habitat, in terms of individual species, or types of organisms.

Saturating functions for gross impacts, and logistic (S-shaped) recovery profiles are important features to be added to the fishing impacts model. The SSC notes that a stochastic or probabilistic model of fishing impacts may be appropriate. Another alternative worth considering is the development of a spatially explicit model of gear effects that incorporates the notion of a gear footprint, such as the area swept by trawls, and whether a focus group approach similar to that for fishing effort could be pursued to estimate footprints for different gear types.

Impacts from Non-fishing Activities

The EFH team's work on impacts from non-fishing activities is just starting, with some data but no model to review. Modeling the impacts of non-fishing activities is important, but the SSC recognizes these activities are outside the control of fisheries management.

Appendix 1. Briefing materials presented to members of the SSC Groundfish Subcommittee for their review of the EFH EIS analytical tool.

1. Pacific Coast Groundfish EFH – **Analytical Framework** (Version 4, February 10, 2004). Prepared for Pacific States Marine Fisheries Commission by (a) MRAG Americas, Inc., 110 South Hoover Blvd., Suite 212, Tampa, FL 33609, (b) Terralogic GIS, Inc., P.O. Box 264, Stanwood, WA 98292, (c) NMFS Northwest Fisheries Science Center, FRAM Division, and (d) NMFS Northwest Regional Office, 89 p.

2. Appendix 1: Active Tectonics and Seafloor Mapping Laboratory Publication 02-01 – Interim Seafloor Lithology Maps for Oregon and Washington (Version 1.0), by C. Goldfinger, C. Romsos, R. Robison, R. Milstein, and B. Myers, Active Tectonics and Seafloor Mapping Laboratory, College of Oceanography and Atmospheric Sciences, Oregon State Unversity, Burt 206, Corvallis, OR 97331, 11 p.

3. Appendix 2: Final Report – Essential Fish Habitat Characterization and Mapping of the California Continental Margin, by G. Greene and J. Bizzarro, Center for Habitat Studies, Moss Landing Marine Laboratories, Moss Landing, CA, 21 p.

4. Appendix 3: Organizations contacted for information on non-fishing impacts to EFH, 6 p.

5. Appendix 4: List of groundfish species in life histories appendix, 2 p.

6. Appendix 5: Gear types in the PACFIN data base, 2 p.

7. Appendix 6: Description of habitat suitability index (HSI) modeling conducted by NOS, 4 p.

8. Appendix 7: Development of profiles of habitat suitability probability based on latitude and depth for species and life stages in the Groundfish FMP, 34 p.

9. Appendix 8: Discrete time damage model for fishing impacts, 3 p.

10. Appendix 9: Useful websites on Bayesian Belief Networks, 1 p.

11. Appendix 10: Pacific Coast Groundfish EFH – The effects of fishing gears on habitat: west coast perspective (Draft 5), by MRAG Americas for the PSMFC, February 9, 2004, 32 p. + annex.

12. Appendix 11: Pacific Coast Groundfish FMP Habitat Use Database User Manual for Version 15B (Draft), 50 p.

13. Non-Fishing Impacts on Bottom Habitats – Draft 1 (February 19, 2004), 7 p.

14. Letter from Dr. M. Mangel to S. Copps (dated 17 October 2003) concerning the Ecotrust Methodology, 2 p.

15. Final Report – Pilot Project to Profile West Coast Fishing Effort Based on the Practical Experience of Fishermen, by T. Athens, A. Bailey, F. Conway, S. Copps, R. Fisher, M. Larkin, S. McMullen, and F. Recht, 31 p.

16. Fishing Effort GIS Data Exploration for West Coast Groundfish EFH EIS Project, Terralogic GIS, December 2003, 20 p. + appendices.

17. Excerpt from Northwest Power and Conservation Council's Independent Science Advisory Board Report on Salmonids Supplemental, Section 7. Benefit-Risk Assessment and Decision Making, 19 p.

Exhibit C.6.c
Supplemental SSC Report
April 2004

SCIENTIFIC AND STATISTICAL COMMITTEE STATEMENT ON GROUNDFISH ESSENTIAL FISH HABITAT ENVIRONMENTAL IMPACT STATEMENT ANALYTICAL MODEL

Mr. Steve Copps presented a brief summary and progress reports on the development of the Essential Fish Habitat-Environmental Impact Statement (EFH-EIS) analysis at both the March and April, 2004 Council meetings. In March, the groundfish subcommittee reviewed their report for the Scientific and Statistical Committee (SSC) that summarized their February 23-24, 2004 meeting with the EFH model development team (Exhibit C.6.c, Attachment 1).

There are two components to the EFH Analysis; (1) designation of EFH and (2) determination of fishing impacts. Both components utilize a Geographic Information System (GIS) platform that allows presentation of disparate datasets in an intuitive visual format that allows for real time data processing and display. EFH designation reflects the likelihood of occurrence of each species by depth, latitude, and substrate type. The greatest obstacle in developing a methodology for designating EFH is in constructing a comprehensive coastwide database applicable to all species in the groundfish fishery management plan (FMP). This requirement severely limits the possible approaches for designating EFH. For example, while detailed habitat and species associations are available from submersible surveys, these data are restricted spatially precluding their use coastwide. Despite the limitations of available data, the SSC endorses the use of this analytical tool and the underlying data as the best available science for evaluating EFH. The SSC notes the model development team has assembled the most comprehensive dataset of bathymetry and substrate ever compiled for the West Coast, which will be a valuable resource in the future.

Notwithstanding this endorsement, the SSC is concerned that uncertainty in the underlying data on species' depth and habitat preferences will not be reflected in the final GIS output maps. The distribution and habitat preferences of some species are well known, while others are poorly known. However, the output from the model (GIS maps) will be similar regardless of the quality of the underlying data. The SSC recommends that each output map contain an expression of the uncertainty, even if only qualitative, and this be considered in EFH designation.

There are a number of weaknesses inherent in the model as it currently exists. These are outlined below:

1. Biogenic habitat is both of potential importance and potentially susceptible to fishing impacts. The current model does not consider some of these habitats (e.g., corals, sponges, sea pens) in EFH designation. While this reflects the lack of comprehensive data on the distribution of these species, this, nonetheless, remains a concern.

2. The use of presence-absence information rather than relative abundance may result in failure to detect EFH with precision. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area.

3. Species that exhibit seasonal movement patterns by depth or latitude may not be adequately characterized by presence-absence data from trawl surveys. For example, the inshore winter spawning and nesting grounds of lingcod would not be identified as EFH using summer trawl survey data.

4. Existing surveys have a strong bias towards habitats that can be trawled. Thus, species associated with untrawlable habitat will not be adequately sampled. Likewise, juvenile fish are not well sampled by trawl surveys, and their distributions and habitat preferences are often poorly known, yet these may be the most critical life history stages. Biogenic habitats may provide refugia from predation for juvenile stages, but these habitats would not be identified as EFH if the sampling gear does not capture juveniles.

5. Many species occupy different habitats at different life history stages. Information about these ontogenetic shifts present in the trawl data is not being utilized in the present analysis. Therefore, while presence-absence analyses should be relatively robust, EFH designations resulting from such analyses are initial approximations that will need to be refined as additional information becomes available. The SSC notes that the model is constructed to allow for these updates and refinements, and considers this one of the strengths of the current approach.

Fishing Impacts Model

The fishing impacts model is still under development, thus the SSC is unable to provide a review at this time. The fishing impacts model has two components; (1) determining fishing effort by gear type and area and (2) determining impacts of gear on habitat.

Based on the current status of the model and the time frame for EFH designation, the SSC cautions there may not be sufficient time for an adequate SSC review and/or response by the model development team before the June Council meeting. Further, since the date and location of the review have not yet been scheduled, but must take place no later than May, the SSC cautions that it may not be possible for the groundfish and economic subcommittees to meet on such short notice. The SSC also notes that extensive data limitations (e.g., no coastwide data on distribution and intensity of fixed gear or recreational fishing) may preclude the use of the model to determine gear impacts on habitat. Rather, the SSC recommends that the model development team consider what questions the current version of the tool can answer, and, if necessary, develop an alternative strategy for evaluating fishing impacts on EFH and that the latter be available in sufficient time for SSC review.

PFMC
04/06/04

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON
ON GROUNDFISH ESSENTIAL FISH HABITAT ENVIRONMENTAL IMPACT
STATEMENT ANALYTICAL MODEL

The Groundfish Advisory Subpanel (GAP) attended the briefing on the essential fish habitat (EFH) analytical model conducted by Mr. Steve Copps of the NMFS Northwest Region staff and then discussed both the model and the time frame for future action on an EFH environmental impact statement (EIS).

The GAP is aware of court imposed deadlines for producing a final EIS and developing regulations in regard to EFH. The GAP agrees that additional knowledge of groundfish habitat can provide a good baseline for future conservation and management decisions. The GAP also recognizes the effort made to develop a database using fishermen's knowledge

Nevertheless, the GAP has serious concerns about some of the data - or lack thereof - in the model. While the intent is to update the model as new data are available, the GAP sees no way, at present, the model can take into account changes in fish habitat resulting from changes in the water column, including such things as water temperature and currents. Finally, the GAP is concerned an incomplete or inaccurate model will again lead to changes in regulations. The fisheries are already suffering from decisions made on incomplete or inaccurate data; use of a less than adequate model will only exacerbate the problem.

Finally, the GAP notes that while NMFS is putting extensive effort into producing a habitat model for use in management, other elements of NOAA are using different models in conjunction with making decisions on marine protected areas in national marine sanctuaries. There appears to be no coordination of these modeling efforts. The GAP urges the Council to make clear to NOAA that a single, coordinated model should be used for all purposes.

PFMC
04/06/04

HABITAT COMMITTEE COMMENTS ON GROUNDFISH ESSENTIAL FISH HABITAT ENVIRONMENTAL IMPACT STATEMENT ANALYTICAL MODEL

The Habitat Committee (HC), jointly with the Groundfish Advisory Subpanel and Groundfish Management Team, heard a status report on the Groundfish Essential Fish Habitat (EFH) Environmental Impact Statement (EIS) modeling effort. The presentation was given by Mr. Steve Copps (NMFS), Mr. Graeme Parkes (MRAG Americas), and Ms. Allison Bailey (TerraLogic GIS). This update emphasized the EFH designation component of the model. The impacts component is still under development.

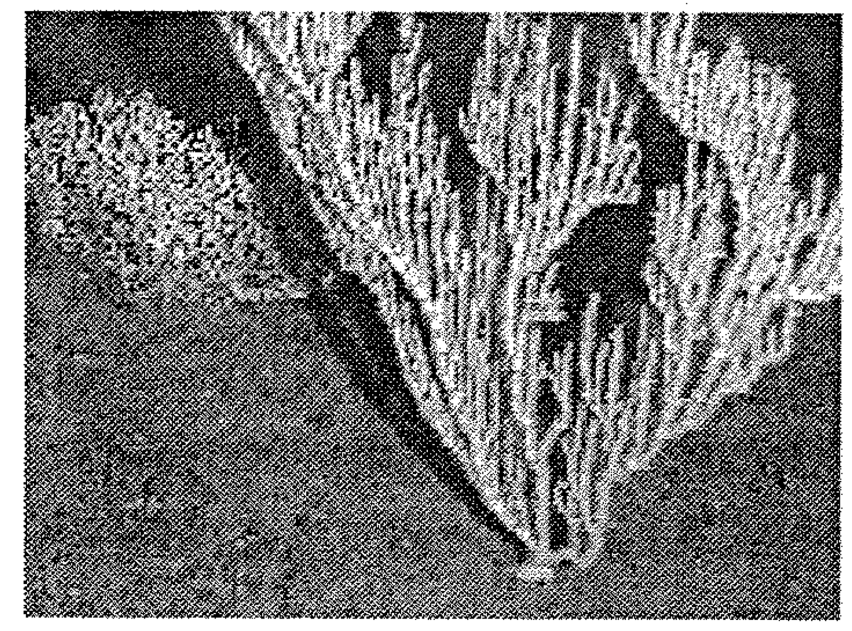
The HC would like to commend the EFH Team on their efforts to compile and synthesize the extraordinary amount of data to characterize the distribution of fish stocks relative to habitat types. We believe this tool is a significant step forward in assisting the Council in identifying EFH, recommend the Council endorse this modeling effort, and recommend the Council move to the next step of assessing impacts. The inclusion of information on nearshore, bay, and estuarine environments (e.g., kelp beds, eelgrass beds) strengthens the GIS database, and will be critical in consultations. As information on nearshore and estuarine habitat utilization, especially by juvenile life stages, becomes available in the future, it can be incorporated to strengthen the model.

We recommend the EFH Team provide a measure of the data quality on the maps, so policy makers can weigh their decisions while considering various levels of uncertainty.

The HC believes this project provides a useful, long-term tool for dealing with other groundfish management issues – for example, bycatch monitoring, estimating impacts of time and area closures, and locating marine reserves. We recommend NMFS fund this project to its completion, and the Council and NMFS support efforts to make it useful for addressing other management issues.

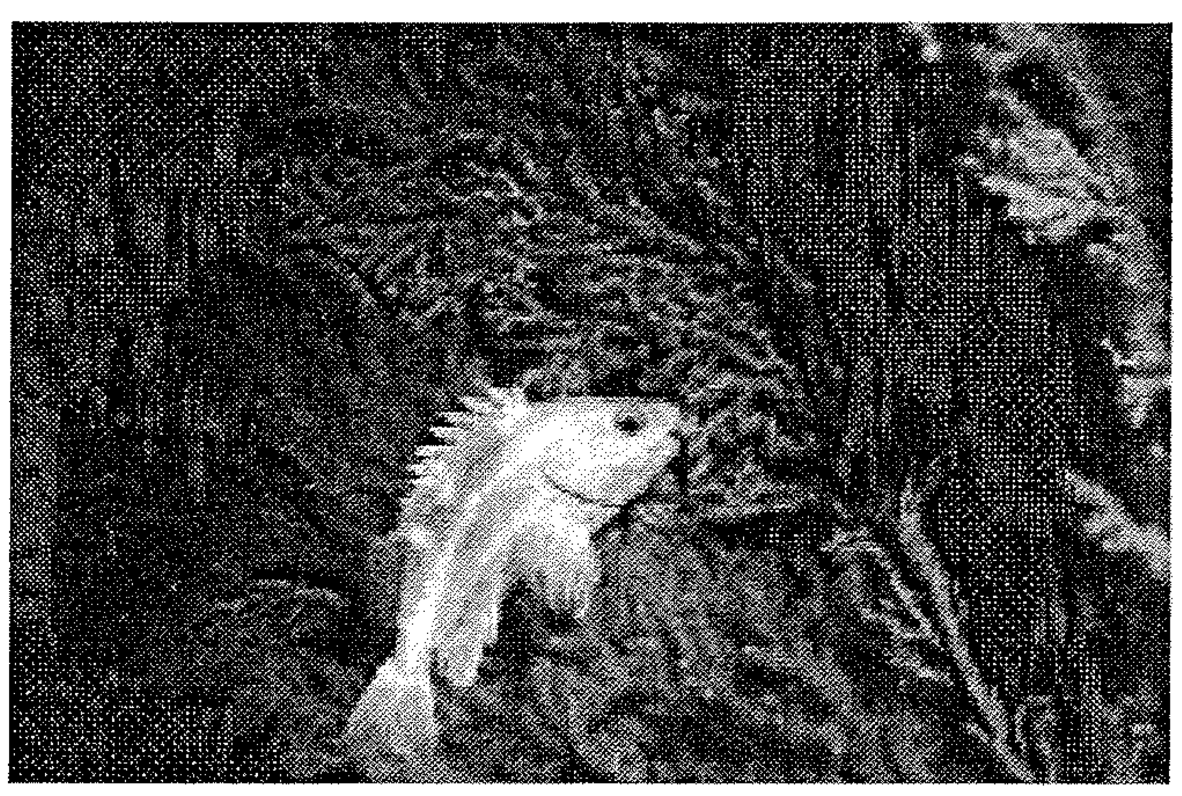
PFMC
04/06/04

Scientists' Statement on Protecting the World's Deep-sea Coral and Sponge Ecosystems



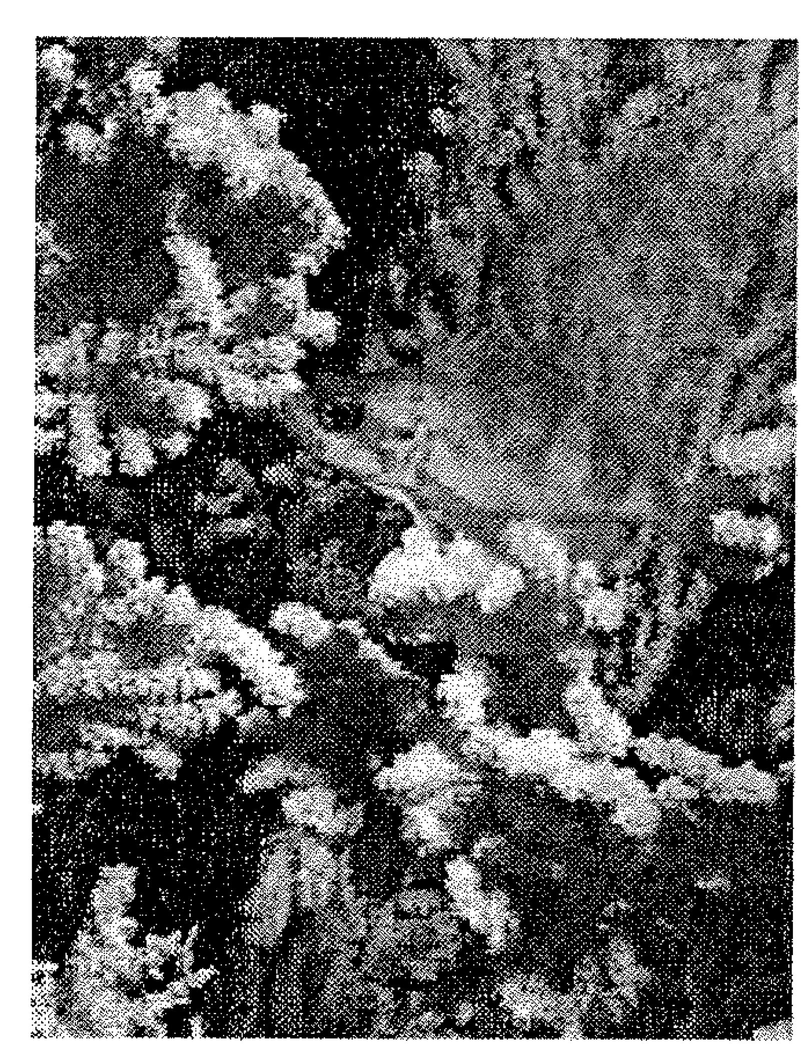
As marine scientists and conservation biologists, we are profoundly concerned that human activities, particularly bottom trawling, are causing unprecedented damage to the deep-sea coral and sponge communities on continental plateaus and slopes, and on seamounts and mid-ocean ridges.

Shallow-water coral reefs are sometimes called "the rainforests of the sea" for their extraordinary biological diversity, perhaps the highest anywhere on Earth. However, until quite recently, few people - even marine scientists - knew that the majority of coral species live in colder, darker depths, or that some of these form coral reefs and forests similar to those of shallow waters in appearance, species richness and importance to fisheries. Lophelia coral reefs in cold waters of the Northeast Atlantic have over 1,300 species of invertebrates, and over 850 species of macro- and megafauna were recently found on seamounts in the Tasman and Coral Seas, as many as in a shallow-water coral reef. Because seamounts are essentially undersea islands, many seamount species are endemics - species that occur nowhere else - and are therefore exceptionally vulnerable to extinction. Moreover, marine scientists have observed large numbers of commercially important but increasingly uncommon groupers and redfish among the sheltering structures of deep-sea coral reefs. Finally, because of their longevity, some deep-sea corals can serve as archives of past climate conditions that are important to understanding global climate change. In short, based on current knowledge, deep-sea coral and sponge communities appear to be as important to the biodiversity of the oceans and the sustainability of fisheries as their analogues in shallow tropical seas.



In recent years scientists have discovered deep-sea corals and/or coral reefs in Japan, Tasmania, New Zealand, Alaska, California, Nova Scotia, Maine, North Carolina, Florida, Colombia, Brazil, Norway, Sweden, UK, Ireland and Mauritania. Because research submarines and remotely operated vehicles suitable for studying the deep sea are few and expensive to operate, scientific investigation of these remarkable communities is in its very early stages. But it is increasingly clear that deep-sea corals usually inhabit places where natural disturbance is rare, and where growth and reproduction appear to be exceedingly slow. Deep-sea corals and sponges may live for centuries, making them and the myriad species that depend on them extremely slow to recover from disturbance.

Unfortunately, just as scientists have begun to understand the diversity, importance and vulnerability of deep-sea coral forests and reefs, humans have developed technologies that profoundly disturb them. There is reason for concern about deep-sea oil and gas development, deep-sea mining and global warming, but, at present, the greatest human threat to coral and sponge communities is commercial fishing, especially bottom trawling. Trawlers are vessels that drag large, heavily weighted nets across the seafloor to catch fishes and shrimps. Scientific studies around the world have shown that trawling is devastating to corals and sponges. As trawlers become more technologically sophisticated, and as fishes disappear from shallower areas, trawling is increasingly occurring at depths exceeding 1,000 meters.



It is not too late to save most of the world's deep-sea coral and sponge ecosystems. We commend nations including Australia, New Zealand, Canada and Norway, which have already taken initial steps towards protecting some coral and sponge ecosystems under their jurisdiction. We urge the United Nations and appropriate international bodies to establish a moratorium on bottom trawling on the High Seas. Similarly, we urge individual nations and states to ban bottom trawling to protect deep-sea ecosystems wherever coral forests and reefs are known to occur within their Exclusive Economic Zones. We urge them to prohibit roller and rockhopper trawls and any similar technologies that allow fishermen to trawl on the rough bottoms where deep-sea coral and sponge communities are most likely to occur. We urge them to support research and mapping of vulnerable deep-sea coral and sponge communities. And we urge them to establish effective, representative networks of marine protected areas that include deep-sea coral and sponge communities.

The following have signed the Scientists' Statement on Protecting the World's Deep-sea Coral and Sponge Ecosystems.

Affiliations are for identification only, and do not imply endorsement by the signers' institutions.

Tony Koslow, Ph.D., CSIRO Marine Research, Western Australia, Australia
André Freiwald, Prof. Dr., Institute of Paleontology, Erlangen, Germany
Edward O. Wilson, Ph.D., Harvard University, Massachusetts, USA
Sylvia A. Earle, Ph.D., Conservation International, California, USA
Norman Myers, Ph.D., University of Oxford, Oxford, UK
Michael Soulé, Ph.D., University of California-Santa Cruz, California, USA
Robert Paine, Ph.D., University of Washington, Washington state, USA
Daniel Pauly, Ph.D., University of British Columbia, British Columbia, Canada
Rainer Froese, Ph.D., Institute of Marine Research, Kiel, Germany
Jarl-Ove Strömberg, Professor, Kristineberg Marine Biological Station, Fiskebäckskil, Sweden
D. James Baker, Ph.D., Academy of Natural Sciences of Philadelphia, Pennsylvania, USA
George Branch, Ph.D., University of Cape Town, Rondebosch, South Africa
Callum Roberts, Ph.D., University of York, York, UK
Hjalmar Thiel, Prof. Dr., University of Hamburg, Hamburg, Germany
Stephen Hall, Ph.D., Australian Institute of Marine Science, Queensland, Australia
Jeremy Jackson, Ph.D., University of California San Diego, California, USA
Bill Ballantine, Ph.D., University of Auckland, Auckland, New Zealand
George H. Leonard, Ph.D., Monterey Bay Aquarium, California, USA
Vera Alexander, Ph.D., University of Alaska Fairbanks, Alaska, USA
James Barry, Ph.D., Monterey Bay Aquarium Research Institute, California, USA
Hugh Possingham, D.Phil., The University of Queensland, Brisbane, Australia
Terence Done, Ph.D., Australian Institute of Marine Science, Queensland, Australia
Phil Alderslade, Ph.D., Museum & Art Gallery of the Northern Territory, Darwin, Australia
Marta Estrada, Ph.D., Institut de Ciencies del Mar, Catalunya, Spain
Peter Raven, Ph.D., Missouri Botanical Garden, Missouri, USA
John K. Reed, M.Sc., Harbor Branch Oceanographic Institution, Florida, USA
Karen Stocks, Ph.D., University of California San Diego, California, USA
Graeme Kelleher, B.E., WCPA, Canberra, Australia
Verena Tunnicliffe, Ph.D., University of Victoria, British Columbia, Canada
Michael Risk, Ph.D., McMaster University, Ontario, Canada
David W. Inouye, Ph.D., University of Maryland, Maryland, USA
Nick Polunin, Ph.D., Newcastle University School of Marine Science & Technology, Newcastle upon Tyne, UK
P. Dee Boersma, Ph.D., University of Washington, Washington state, USA
Boris Worm, Ph.D., Institute for Marine Science, Kiel, Germany
Peter Auster, Ph.D., University of Connecticut, Connecticut, USA
Ransom Myers, Ph.D., Dalhousie University, Nova Scotia, Canada
Anson H. Hines, Ph.D., Smithsonian Environmental Research Center, Maryland, USA
Sandra Brooke, Ph.D., Oregon Institute of Marine Biology, OR, USA
Lisa Levin, Ph.D., Scripps Institution of Oceanography, California, USA
Rodrigo Bustamante, Ph.D., Charles Darwin Foundation, Galapagos Islands, Ecuador
Gert Wörheide, Prof. Dr., GZG Geobiology, Göttingen, Germany
J. Frederick Grassle, Ph.D., Rutgers University, New Jersey, USA
John Gray, Ph.D., University of Oslo, Oslo, Norway
Jason Hall-Spencer, Ph.D., University of Plymouth, Plymouth, UK
George Somero, Ph.D., Hopkins Marine Station of Stanford University, California, USA
Richard Bromley, Ph.D., University of Copenhagen, Copenhagen, Denmark
Giovanni Bearzi, Ph.D., Tethys Research Institute, Milano, Italy
Manfred Krautter, Prof. Dr., Universität Stuttgart, Stuttgart, Germany

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Currently, **over ~~900~~** 1136 **scientists** have signed this statement. For a complete listing, please go to http://www.savecorals.com

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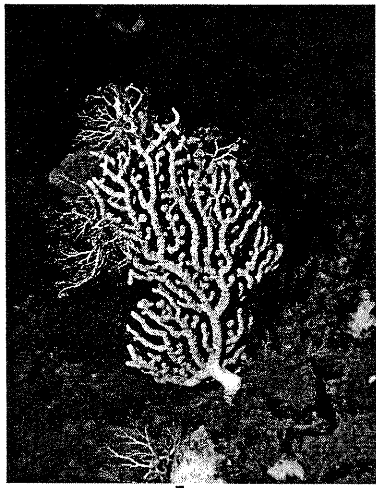
Photo's courtesy NOAA + Victoria O'Connell, AK Dept. of Fish + Game



OCEANA

Protecting the Pacific

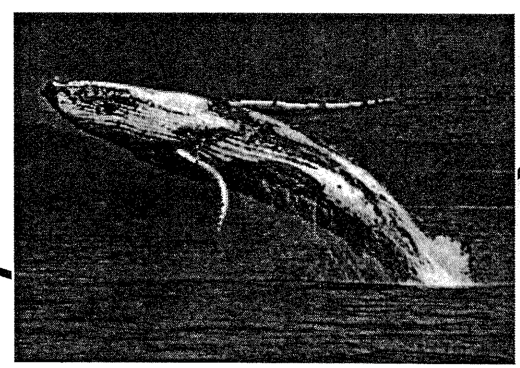


Exhibit C.6.e
Supplemental PowerPoint Comment
April 2004

Why we're here

Congress, in its wisdom, through the Sustainable Fisheries Act mandated that America maintain viable fisheries while protecting habitat.

- Sustainable Fisheries Act requires EFH be protected (1996)
- NOAA failed to take action
- NOAA noncompliance resulted in Court Order requiring Environmental Impact Statements for FMP's (2000)

Bubblegum coral courtesy NMFS

Essential Fish Habitat

(waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity)
16 U.S.C. 1802(10)

Each Fishery Management Plan must:

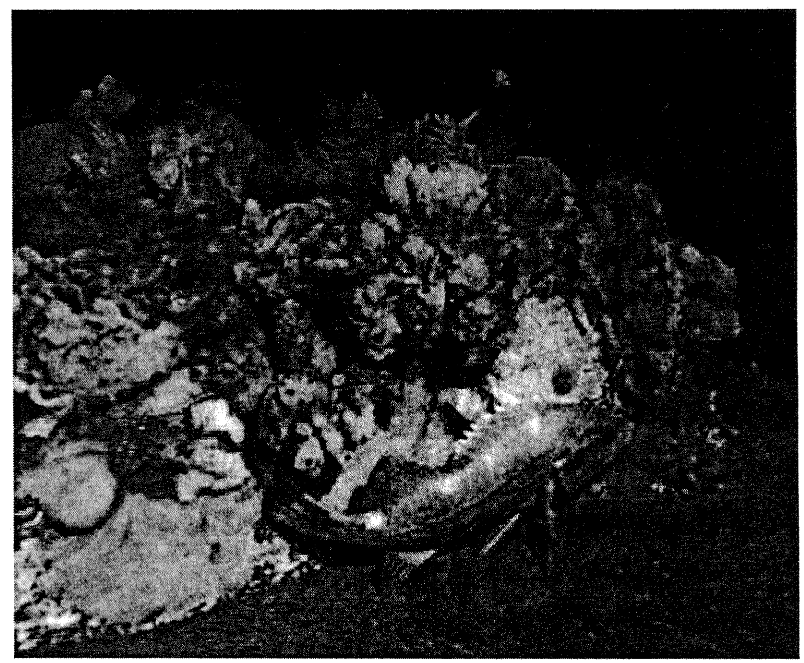
- Describe and identify EFH
- Minimize to the extent practicable adverse effects on EFH caused by fishing
- Identify other actions to encourage the conservation and enhancement of such habitat.
16 U.S.C. 1863(a)(7)

courtesy NMFS

Why are corals important?

Health of our Oceans depends on the biodiversity of ocean ecosystems.

- shelter
- protection from strong currents
- protection from predators
- nurseries for juveniles
- feeding areas
- spawning areas
- resting areas
- breeding areas



Rockfish and corals, courtesy NMFS

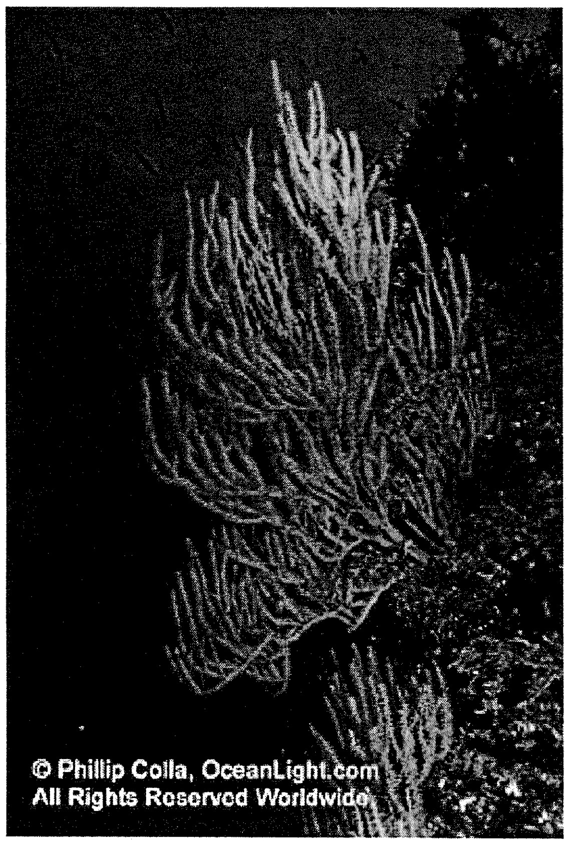
Coral and Sponge Abundance

- NMFS RACEBASE shelf and slope trawl surveys
- Summarized to 0.1 degree blocks
- Abundance of coral and sponge normalized by weight relative to effort

International Scientist letter

February 2004

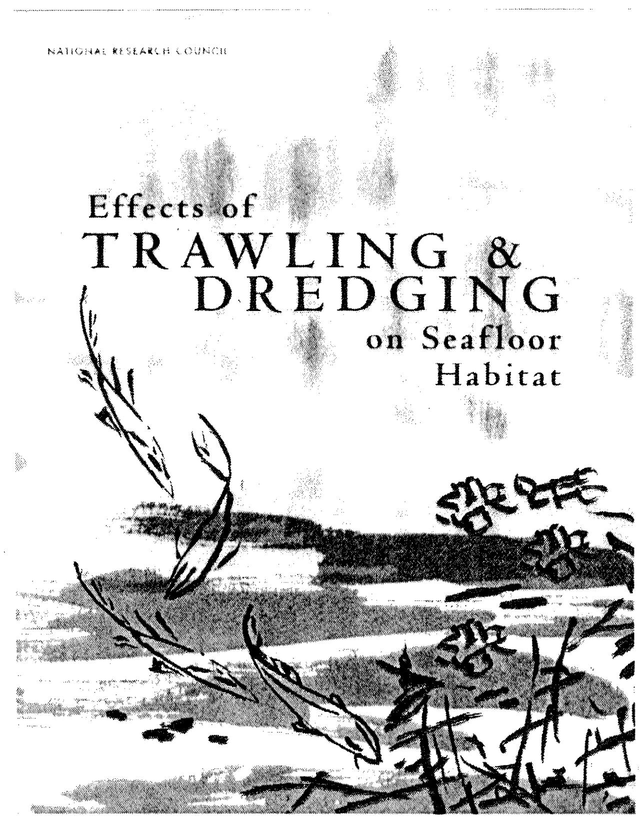
More than 1100 Scientists from around the world recently signed a statement on Protecting the World's Deep-sea Coral and Sponge Ecosystems



"In short, based on current knowledge, deep-sea coral and sponge communities appear to be as important to the biodiversity of the oceans and the sustainability of fisheries as their analogues in shallow tropical seas."

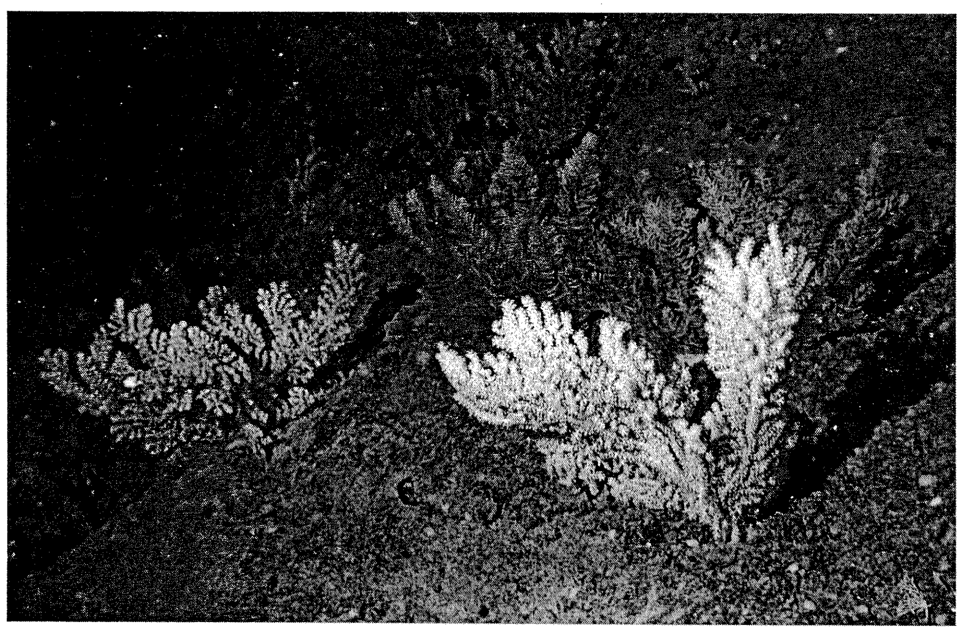
National Academy of Science Report
Trawling effects on the seafloor
National Research Council 2002

- If disturbance from trawling exceeds the resiliency threshold, then irrevocable long-term ecological effects will occur.
- If resilience is exceeded, system may flip to an alternative state.
- Trawling and dredging change the physical habitat and biological structure of ecosystems.
- Bottom trawling reduces the complexity, productivity, and biodiversity of benthic habitats most severely in areas of coral and sponge.



Model is progressing, but needs more…

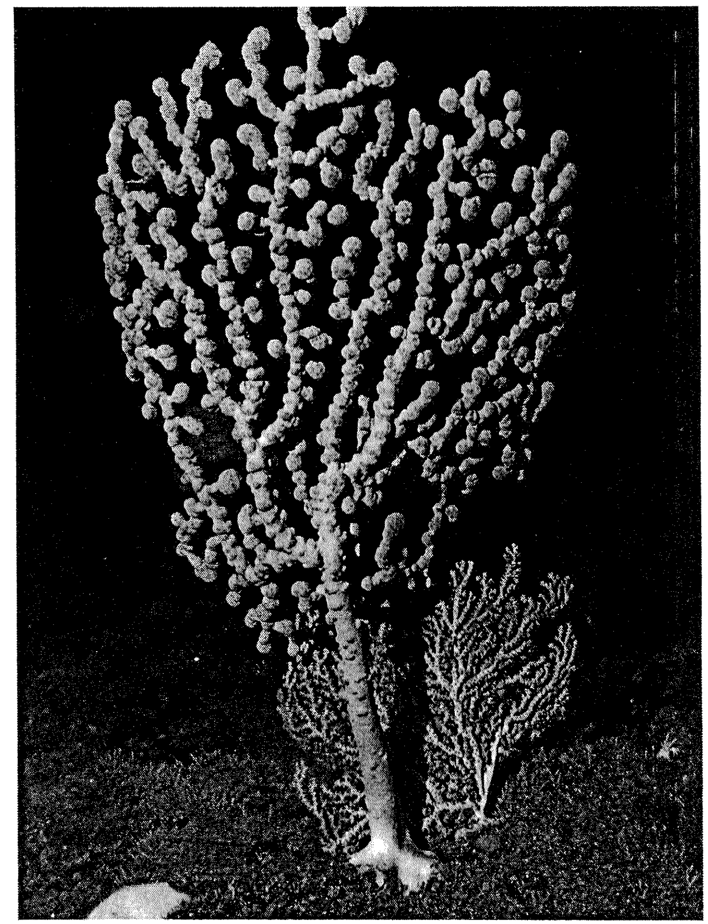
- Fishermen port surveys should include:
  - habitat
  - where they don't or can't fish
  - where they recommend protections



Courtesy MBARI

Model is progressing, but needs more…

- Biogenics must include corals, sponges, and other living seafloor habitat
  - Comments on suitability of surveys for coral and sponge presence/absence were misrepresented.
  - We support the SSC's recommendations that "additional effort to identify areas with biogenic structure, including especially the structure-forming invertebrates" be made. (SSC Comments at 4.)
  - Surveys are OK for fish, but not for corals?



Bubblegum corals, courtesy MBARI

Model is progressing, but needs more…

Adverse Impacts Analysis

NOAA regulations require that each FMP contain an evaluation of the potential adverse effects of fishing on EFH designated under the FMP. NOAA regulations define **adverse effect** to include any impact that reduces **quality and/or quantity** of EFH.

Such effects may include: direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

We are concerned that the modeling efforts to date to not address all of these factors, and are not designed to facilitate decisionmaker consideration of these factors.

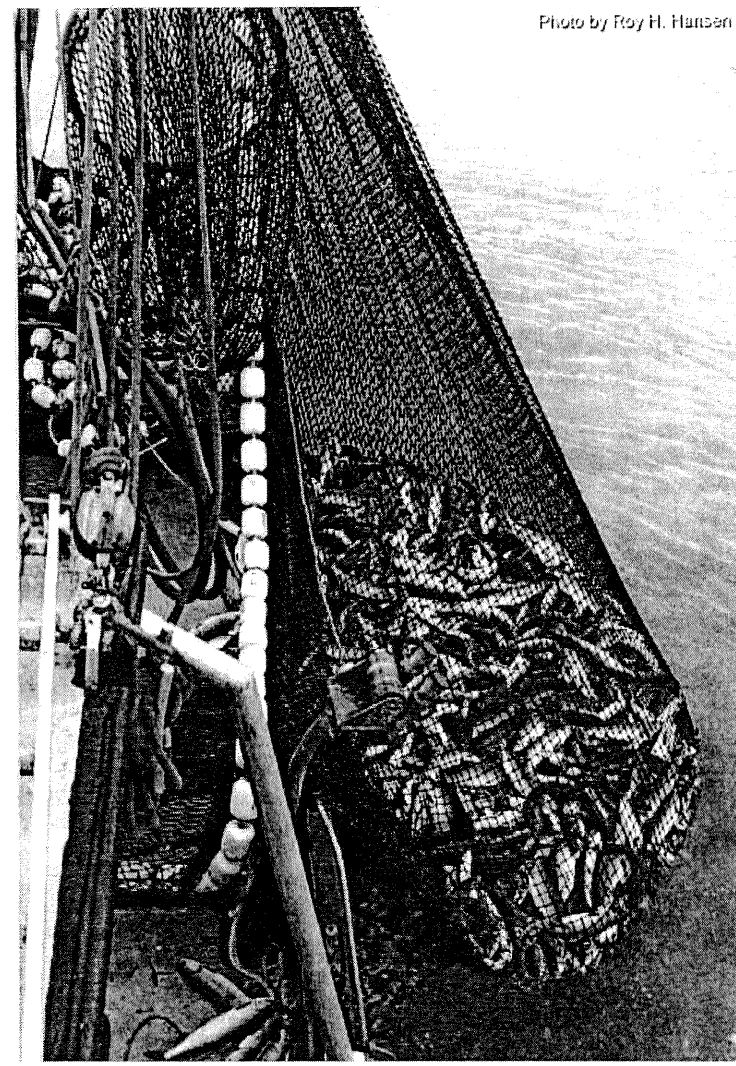
Our requests of the Council

- Corals, sponges, and other living seafloor substrates be included in model
- Conservation plaintiff representation on EIS Oversight Committee to develop EFH EIS Alternatives

Juvenile sharpchin in red tree coral, courtesy Victoria O'Connell, ADF&G

Sustainability

Goal: Develop fishery management plans that provide opportunities to catch fish without destroying habitat or the ecosystem.



OCEANA

Dedicated to protecting and restoring the world's oceans through policy advocacy, science, law and public education.

STATUS OF GROUNDFISH FISHERIES AND INSEASON ADJUSTMENTS

Situation: The Council set optimum yield (OY) levels and various management measures for the 2004 groundfish management season, with the understanding these management measures will likely need to be adjusted periodically through the year in order to attain, but not exceed, the OYs. Under this agendum, the Council will receive updates on appropriate groundfish fisheries and consider adopting inseason adjustments.

The Groundfish Management Team (GMT) will present information on the status of ongoing fisheries, and any need for management measure adjustments.

On Tuesday, April 6, under agendum C.4, the Council is scheduled to receive recommendations on new observer data and bycatch modeling methods from the Northwest Fisheries Science Center (NWFSC), the Scientific and Statistical Committee (SSC), the GMT, the Groundfish Advisory Subpanel and the public. Preliminary results from the West Coast Groundfish Observer Program (WCGOP) and proposed bycatch modeling methodologies for the limited entry trawl fishery and the limited entry fixed gear sablefish fishery were reviewed by the SSC at the March meeting in Tacoma, Washington. Since the March meeting, NWFSC staff considered the SSC recommendations and incorporated changes to the bycatch models as appropriate. The Council will decide how to best implement the new models for inseason adjustments in 2004 under this agendum (C.7) and fishery management in 2005 - 2006 (agendums C.8, C.10, and C.15).

Tier limit adjustments, and potentially other measures, in the limited entry fixed gear sablefish fishery and review of limited entry trawl regulations based on data from the WCGOP are expected inseason adjustment topics. The Council received considerable public testimony from the limited entry fixed gear sector at the March meeting. Other potential topics under this agendum include trip limit adjustments in response to the Pacific Groundfish Limited Entry Trawl Buyback Program and consideration of California recreational fishery proposals.

The Council is to consider advice from advisory bodies and the public on the status of ongoing fisheries and recommended inseason adjustments and adopt changes as necessary.

Council Action:

1. **Consider information on the status of ongoing fisheries.**
2. **Consider and adopt inseason adjustments as necessary.**

Reference Materials:

1. Exhibit C.7.d, Public Comment.

Agenda Order:

a. Agendum Overview — Mike Burner
b. Report of the Groundfish Management Team — Michele Robinson
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Consider Inseason Adjustments in the 2004 Groundfish Fishery

PFMC
03/19/04

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON STATUS OF 2004 FISHERIES AND INSEASON ADJUSTMENTS

As mentioned in Exhibit C.3.a., Supplemental GMT Report, the GMT received an update on the National Marine Fisheries Service observer data for trawl and limited entry fixed gear fisheries targeting sablefish, and catch projection models for canary rockfish in California recreational fisheries. The GMT also updated the bycatch scorecard to reflect the changes in trawl, limited entry fixed gear, open access, the inseason action taken in March relative to widow rockfish in the whiting fishery and lingcod in the California recreational fishery, Oregon recreational catch projections based on 2003 catch data, Washington recreational canary catch projections based on 2003 catches, and California recreational catch projections for canary and lingcod based on using the adjusted 2003 catch model. In reviewing the updated catch projections, the GMT has identified management issues and developed alternatives for inseason adjustments for the Council's consideration and focused its recommendations to be in line with the Council guidance provided on inseason adjustments (Attachment 1).

LIMITED ENTRY TRAWL

With regard to the trawl fishery, modeling projections for 2004 apply the updated observer data combined with a reduction in effort as a result of the trawl buyback program. The GMT recommends the Council adopt the alternative in Attachment 2 as part of inseason action for the trawl fishery. Under this alternative, the estimated impacts are 10.1 mt of canary rockfish and 104.7 mt of lingcod.

In addition, the GMT recommends the Council adopt the following inseason measures for limited entry trawl:

North of 40°10'

- Move the deep trawl RCA boundary from 200 fms to 150 fms in Periods 3 through 6
- Increase minor slope rockfish trip limits to:

  8,000 lbs/2 mo. in Periods 3 through 6

South of 40°10' to U.S./Mexico border

- Increase chilipepper rockfish trip limits with large footrope only to:

  12,000 lbs/2 mo. in Periods 3 and 4
  8,000 lbs/2 mo. in Periods 5 and 6

South of
~~Between~~ 40°10' and 38°

- Increase minor slope rockfish and splitnose to:

  50,000 lbs/2 mo. minor slope + 50,000 lbs/2 mo. splitnose in Periods 3 through 6

These additional limited entry trawl alternatives are expected to have increased impacts to bocaccio rockfish, darkblotched, and POP; however, the GMT believes these impacts can be accommodated within the current amounts available in the bycatch scorecard. The GMT will provide the Council with an updated scorecard with the results of inseason action by the end of this week.

LIMITED ENTRY FIXED GEAR

An analysis of bycatch and discard for the fixed gear fisheries is contained in Attachment 3. Based on this analysis, the GMT recommends that the non-trawl RCA boundaries remain unchanged for 2004 (100 fms N. of 40°10' and 150 fms S. of 40°10'). The GMT also recommends the following inseason adjustments for limited entry fixed gear:

- Increase the sablefish tier limits in the primary sablefish fishery to:

  Tier 1 - 69,600 lbs
  Tier 2 - 31,600 lbs
  Tier 3 - 18,100 lbs

South of
Between 40°10' ~~and 38°~~

- Increase minor slope rockfish and splitnose to be consistent with the trawl limits:

  50,000 lbs/2 mo. minor slope + 50,000 lbs/2 mo. splitnose in Periods 3 through 6

The GMT is not recommending any other changes to limited entry fixed gear trip limits, and is not recommending any changes to the open access trip limits.

To evaluate the increases in both the limited entry trawl and fixed gear trip limits for minor slope rockfish, splitnose, and chilipepper, the GMT strongly encourages the NMFS Observer Program to collect observer data on those fisheries in an effort to collect much-needed bycatch information. These observer data (collected through August) can then be available for management in April 2005 and could result in providing continued higher trip limits in 2005.

CALIFORNIA RECREATIONAL

The GMT reviewed 2002 and 2003 canary rockfish catch data from the California recreational fisheries, and two different models for projecting 2004 catches based on those data. The catches in 2003 were very high, especially in Wave 4 (July-Aug); it is thought that a portion of the catch in Wave 4 was the result of the fishery having been closed for the previous 8 months, creating a "derby" style fishery. One model creates an adjusted 2003 dataset by using the effort from Wave 5 (Sept-Oct) in 2003 to adjust catches for all waves in 2003 to those expected under a fishery with a similar structure to the 2002 season. This results in a reduced catch in Wave 4 to account for the "derby" response and added projected catches for the closed periods. The second model uses the adjusted 2003 catches and averages those with the 2002 catch data.

The application of an averaged 2002 and adjusted 2003 dataset would be to account for annual catch variability in the California recreational fishery, whereas application of the adjusted 2003 catch data alone would serve to be the most precautionary approach should the high effort levels estimated for 2003 be repeated in 2004.

The GMT recommends using the model with the adjusted 2003 catches only to project 2004 catches. This results in a catch estimate for the 2004 California recreational fishery of 17.49 mt. The catches modeled in September 2003 for the 2004 season projected a catch of 8.1 mt. Based on the Council guidance provided, the GMT recommends the following inseason management action to reduce the canary impacts in the California recreational fishery:

	INSEASON ACTION	CANARY impact		LINGCOD savings*	
		Adjusted 03	Avg 02-03	per option(s)	cumulative
1	set depth at <20 fm wave 5-6 40°10' to Pt. Conception	17.49	11.76	0	0
2	Add 30 fm closure May-Dec N. of 40°10'	14.74	10.03	8.1	8.1
2	set depth at <40 fm waves 3-6 S. of Pt. Conception	14.57		0.28	8.38
3	Add may-july closure from 40°10' to Pt. Lopez (36°?)	10.60	7.01	39.65	48.03
4	Add July closure from Pt. Lopez to Pt. Conception	9.98			
5	Add Nov-Dec closure from 40°10' to Pt. Lopez (36°?)	**9.32**	**6.68**	28.9	**76.93**

* Same under both models

OTHER ISSUES

The GMT had a considerable amount of discussion relative to the Council's intent to set aside a "buffer" for lingcod with the March inseason action to provide for uncertainty in the California recreational catch projections. The GMT would appreciate Council guidance on this issue as well as whether "buffers" should be specified in the scorecard as amounts held in reserve for precautionary purposes. The GMT recommends that a discussion of the use of "buffers" also include whether the intent is to hold the "buffer" in reserve for all fishing sectors, or whether they are sector-specific.

<u>GMT Recommendations</u>

1. Adopt the GMT recommended inseason action for the trawl fishery.
2. Adopt the increased sablefish tier limits for the primary sablefish fishery and the recommended trip limit increases for minor slope rockfish and splitnose S. of 40°10'.
3. Adopt a combination of alternatives for inseason management to reduce the canary impacts in the California recreational fishery.
4. Provide guidance on the use of "buffers" for overfished species.

Attachment 1

Based on Council Guidance, GMT Estimated Impacts with Inseason Action

4/6/04 14:02

Fishery	Bocaccio a/	Canary	Cowcod	Dkbl	Lingcod	POP	Widow	Yelloweye
Limited Entry Groundfish								
Trawl- Non-whiting	45.0	10.1	0.5	73.5	104.7	90.7	2.5	0.3
Fixed Gear	13.4	0.9	0.1	0.8	20.0	0.3	0.5	2.5
Whiting								
At-sea whiting motherships		0.9		1.4	0.3	1.7	59.7	0.0
At-sea whiting cat-proc		1.3		7.6	0.4	10.1	84.6	0.4
Shoreside whiting		0.4		0.5	0.7	0.4	29.9	0.0
Tribal whiting		4.7		0.0	0.5	1.5	37.1	0.0
Open Access								
Groundfish directed	10.6	1.0	0.1	0.2	70.0	0.1		0.6
CA Halibut	0.1			0.0	2.0	0.0		
CA Gillnet b/	0.5			0.0		0.0	0.0	
CA Sheephead b/				0.0		0.0	0.0	0.0
CPS- wetfish b/	0.3							
CPS- squid c/								
Dungeness crab b/	0.0		0.0	0.0		0.0		
HMS b/		0.0	0.0	0.0				
Pacific Halibut b/	0.0		0.0	0.0		0.0	0.0	0.5
Pink shrimp	0.1	0.5	0.0	0.0	0.5	0.0	0.1	0.1
Ridgeback prawn	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmon troll	0.2	1.6	0.0	0.0	0.3	0.0	0.0	0.2
Sea Cucumber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spot Prawn (trap)								
Tribal								
Midwater Trawl		2.3		0.0	0.1	0.0	40.0	0.0
Bottom Trawl		0.5		0.0	9.0	0.0	0.0	0.0
Troll		0.5		0.0	1.0	0.0		0.0
Fixed gear		0.3		0.0	15.0	0.0	0.0	2.3
Recreational Groundfish								
WA		1.72			65.0			3.5
OR		6.77			109.7		1.4	3.2
CA	62.8	9.32	1.8		287.6		1.4	1.4
Research: Based on 2 most recent NMFS trawl shelf and slope surveys, the IPHC halibut survey, and LOAs with expanded estimates for south of Pt. Conception.								
	2.0	1.0		1.6	3.0	3.0	1.5	1.1
Non-EFP Total	135.1	43.8	2.5	85.6	689.8	107.8	258.7	16.2
EFPs e/								
CA: NS FF trawl	10.0	0.5	0.5		20.0			0.5
OR: DTS f/		0.1		6.0		18.0		0.1
WA: AT trawl		1.5		3.0	4.5	8.5	5.5	0.5
WA: dogfish LL		0.1		0.5	2.0	0.5	0.5	1.0
WA: pollock g/		0.1					1.5	0.1
EFP Subtotal	10.0	2.3	0.5	9.5	26.5	27.0	7.5	2.2
TOTAL	145.1	46.1	3.0	95.1	716.3	134.8	266.2	18.4
2004 OY	250	47.3	4.8	240	735	444	284	22
DIFFERENCE	**104.9**	**1.2**	**1.8**	**144.9**	**18.7**	**309.2**	**17.8**	**3.6**
Percent of OY	58.0%	97.5%	62.5%	39.6%	97.5%	30.4%	93.7%	83.5%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available						

CA Rec Lingcod Savings
76.9

a/ South of 40°10' N. lat.
b/ Mortality estimates are not hard numbers; based on the GMT's best professional judgement.
c/ Bycatch amounts by species unavailable, but bocaccio occurred in 0.1% of all port samples and other rockfish in another 0.1% of all port samples (and squid fisheries usually land their whole catch). In 2001, out of 84,000 mt total landings 1 mt was groundfish. This suggests that total bocaccio was caught in trace amounts.
d/ These estimates have not been revised pending GMT review of the estimation methodology.
e/ Values are proposed EFP bycatch caps, not estimates of total mortality. The EFP is terminated inseason if the cap is projected to be attained early.
f/ The darkblotched rockfish and Pacific ocean perch caps are not defined yet for this EFP but are expected to be lower than the placeholders in this scorecard.
g/ Whiting impacts are deducted from the shoreside sector only.

Attachment 2

GMT preferred option for May revisions to **Limited Entry Trawl** trip limits

Trip limits

AREA	PERIOD	RCA BOUNDARIES inline	RCA BOUNDARIES outline	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	OtherFlat	Slope Rock
				TARGET SPECIES BI-MONTHLY LIMITS							
N. of 40°10'	1	75	150	9,300	15,000	3,100	67,500	No Limit	No Limit	100,000	4,000
	2	60	200	9,300	15,000	3,100	67,500	150,000	100,000	100,000	4,000
	3	60	150	16,000	18,000	4,500	32,000	150,000	100,000	100,000	8,000
	4	75	150	16,000	18,000	4,500	32,000	150,000	100,000	100,000	8,000
	5	75	150	16,000	18,000	4,500	32,000	150,000	100,000	100,000	8,000
	6	75	150	11,000	18,000	4,500	50,000	No Limit	No Limit	100,000	8,000
if small footrope used	1	75	150	2,000	1,000	1,000	10,000	4,000	10,000	30,000	
	2	60	200	2,000	1,000	1,000	10,000	4,000	10,000	30,000	
	3	60	150	10,000	1,000	3,000	27,000	11,000	30,000	80,000	
	4	75	150	10,000	1,000	3,000	27,000	11,000	30,000	80,000	
	5	75	150	10,000	1,000	3,000	27,000	11,000	30,000	80,000	
	6	75	150	5,000	1,000	1,000	18,000	8,000	20,000	70,000	
38°-40°10'	1	75	150	11,200	15,000	3,000	39,000	No Limit	No Limit	100,000	10,000
	2	75	150	11,200	15,000	3,000	39,000	10,000	20,000	100,000	10,000
	3	100	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	4	100	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	5	75	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	6	75	150	14,500	18,000	4,500	49,000	No Limit	No Limit	120,000	50,000
S. of 38°	1	75	150	11,200	15,000	3,000	39,000	No Limit	No Limit	100,000	40,000
	2	75	150	11,200	15,000	3,000	39,000	10,000	20,000	100,000	40,000
	3	100	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	4	100	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	5	75	150	14,500	18,000	4,500	49,000	10,000	20,000	120,000	50,000
	6	75	150	14,500	18,000	4,500	49,000	No Limit	No Limit	120,000	50,000

Bycatch	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
North of 40°10'	68.7	9.2	90.7	2.4	60.8	0.1	0.0	0.0
South of 40°10'	36.0	0.8	0.0	0.1	12.7	0.2	45.0	0.5
Total	104.7	10.1	90.7	2.5	73.5	0.3	45.0	0.5

Target species catch	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	OtherFlat	Slope Rock
North of 40°10'	2,446	522	589	4,666	1,724	2,155	3,859	360
South of 40°10'	620	256	260	1,969	211	237	2,247	400
Total	3,065	778	848	6,634	1,936	2,392	6,106	760

Attachment 3

GMT Analysis of Fixed Gear Bycatch and Discard

	Seaward boundary of the RCA at 150 fm (South of 40°10')				Seaward boundary of the RCA at 100 fm (North of 40°10')				
	Coastwide summary	Gear rates and bycatch		Combined bycatch	Coastwide summary	Gear rates and bycatch		Combined bycatch	Coastwide bycatch
		Longline	Pot			Longline	Pot		
Total catch allocated (mt)	**2,755**				**2,755**				
Observed sablefish discard rate	18.49%	19.24%	17.82%		15.6%	14.12%	18.01%		
Discard mortality percentage of landed mt + discarded mt	**4.3%**	**4.5%**	**4.2%**		**3.6%**	**3.2%**	**4.2%**		
Assumed discard mortality (mt)	120				98				
Landed catch target (mt)	**2,636**				**2,657**				
Amount allocated to:									
DTL (mt)	395				399				
Primary fishery (mt)	**2,240**				**2,258**				
Primary fishery tier limits (lb)									
Tier 1	69,067				69,624				
Tier 2	31,394				31,647				
Tier 3	17,940				18,084				
Percent of total catch, by area	10.5%				89.5%				
Percent of area catch, by gear		90%	10%			60%	40%		
Estimated distribution of total catch, by area	289.29	260.36	28.93		2,465.82	1,479.49	986.33		
Bycatch ratios [2]									
Lingcod		0.391%	0.159%			0.400%	0.151%		
Widow rockfish		0.001%	0.000%			0.001%	0.000%		
Canary rockfish		0.041%	0.000%			0.042%	0.000%		
Yelloweye rockfish		0.087%	0.000%			0.089%	0.000%		
Bocaccio rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Cowcod rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Pacific ocean perch		0.017%	0.000%			0.017%	0.000%		
Darkblotched rockfish		0.041%	0.009%			0.041%	0.009%		
Projected bycatch impacts (mt)									
Lingcod		1.0	0.0	**1.1**		5.9	1.5	7.4	**8.5**
Widow rockfish		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Canary rockfish		0.1	0.0	**0.1**		0.6	0.0	0.6	**0.7**
Yelloweye rockfish		0.2	0.0	**0.2**		1.3	0.0	1.3	**1.5**
Bocaccio rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Cowcod rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Pacific ocean perch		0.0	0.0	**0.0**		0.3	0.0	0.3	**0.3**
Darkblotched rockfish		0.1	0.0	**0.1**		0.6	0.1	0.7	**0.8**

[1] As in previous years, the rate of mortality for discarded sablefish in the fixed-gear fishery is assumed to be 20%.
[2] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.
[3] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.2.
[4] Please note that the observer data on which these rates are based include no observations from south of Ft. Bragg, CA, so these are likely underestimates of true bycatch.

6

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON INSEASON ADJUSTMENTS

The GMT has a correction to the inseason discussion from Tuesday (as adopted from Exhibit C.7.b., Supplemental GMT Report). The GMT recommended that, in order to achieve the canary rockfish savings in the California recreational fishery, that a closure be implemented south of Pt. Conception deeper than 40 fms (current depth closure is at > 60 fms) in Waves 3-6 (May-Dec). Subsequent to the Council's decision, it was brought to our attention that a depth management line at 40 fms has not been developed and specified in the 2004 specifications EIS; therefore, that line is not available for inseason management.

The GMT is requesting that the Council revisit its inseason decision to implement a 30-fm closure south of Pt. Conception in Wave 5 (Sept-Oct) only. This action would not result in increased impacts to canary rockfish (i.e., the impacts would remain at 9.32 mt); however, we have recalculated the anticipated lingcod savings from this action. This action would result in a lingcod savings of 77.9 mt (as compared to the previous estimate of 76.9 mt) because the depth closure is more restrictive (from 40 fms to 30 fms).

The GMT has updated the bycatch scorecard (attached) based on the inseason action that the Council took on Tuesday combined with our recommended action under this agenda item. The trawl non-whiting values were updated for bocaccio, darkblotched, and POP based on the trawl trip limit changes for chilipepper, minor slope rockfish, and splitnose. The California recreational value was calculated as follows:

Previous Scorecard Amount:	287.6
+ 59.2 mt Error Margin:	346.8
- 77.9 mt Lingcod Savings:	268.9

The GMT notes that the 59.2 mt error margin still remains in the California recreational catch projection to account for uncertainty and unquantifiable mortalities.

This results in a difference of 37.4 mt of lingcod remaining in the overall scorecard.

<u>GMT Recommendation:</u>

1. Adopt a 30-fm depth closure for south of Pt. Conception in Wave 5 (Sept-Oct) only for 2004, in place of the 40 fms closure previously adopted for Waves 3-6.

Table 1. Estimated mortality (mt) of overfished West Coast groundfish species by fishery in 2004 based on April 2004 Council actions.

4/8/04 12:01

Fishery	Bocaccio a/	Canary	Cowcod	Dkbl	Lingcod	POP	Widow	Yelloweye
Limited Entry Groundfish								
Trawl- Non-whiting	51.0	10.1	0.5	73.5	104.7	90.7	2.5	0.3
Fixed Gear	13.4	0.9	0.1	0.8	20.0	0.3	0.5	2.5
Whiting								
At-sea whiting motherships		0.9		1.4	0.3	1.7	59.7	0.0
At-sea whiting cat-proc		1.3		7.6	0.4	10.1	84.6	0.4
Shoreside whiting		0.4		0.5	0.7	0.4	29.9	0.0
Tribal whiting		4.7		0.0	0.5	1.5	37.1	0.0
Open Access								
Groundfish directed	10.6	1.0	0.1	0.2	70.0	0.1		0.6
CA Halibut	0.1			0.0	2.0	0.0		
CA Gillnet b/	0.5			0.0		0.0	0.0	
CA Sheephead b/				0.0		0.0	0.0	0.0
CPS- wetfish b/	0.3							
CPS- squid c/								
Dungeness crab b/	0.0		0.0	0.0		0.0		
HMS b/		0.0	0.0	0.0				
Pacific Halibut b/	0.0		0.0	0.0		0.0	0.0	0.5
Pink shrimp	0.1	0.5	0.0	0.0	0.5	0.0	0.1	0.1
Ridgeback prawn	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmon troll	0.2	1.6	0.0	0.0	0.3	0.0	0.0	0.2
Sea Cucumber	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spot Prawn (trap)								
Tribal								
Midwater Trawl		2.3		0.0	0.1	0.0	40.0	0.0
Bottom Trawl		0.5		0.0	9.0	0.0	0.0	0.0
Troll		0.5		0.0	1.0	0.0		0.0
Fixed gear		0.3		0.0	15.0	0.0	0.0	2.3
Recreational Groundfish								
WA d/		1.7			65.0			3.5
OR		6.8			109.7		1.4	3.2
CA e/	62.8	9.3	1.8		268.9		1.4	1.4
Research: Based on 2 most recent NMFS trawl shelf and slope surveys, the IPHC halibut survey, and LOAs with expanded estimates for south of Pt. Conception.								
	2.0	1.0		1.6	3.0	3.0	1.5	1.1
Non-EFP Total	141.1	43.8	2.5	85.6	671.1	107.8	258.7	16.2
EFPs f/								
CA: NS FF trawl	10.0	0.5	0.5		20.0			0.5
OR: DTS g/		0.1		6.0		18.0		0.1
WA: AT trawl		1.5		3.0	4.5	8.5	5.5	0.5
WA: dogfish LL		0.1		0.5	2.0	0.5	0.5	1.0
WA: pollock		0.1					1.5	0.1
EFP Subtotal	10.0	2.3	0.5	9.5	26.5	27.0	7.5	2.2
TOTAL	151.1	46.1	3.0	95.1	697.6	134.8	266.2	18.4
2004 OY	250	47.3	4.8	240	735	444	284	22
Difference	98.9	1.2	1.8	144.9	37.4	309.2	17.8	3.6
Percent of OY	60.4%	97.5%	62.5%	39.6%	94.9%	30.4%	93.7%	83.5%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available data sources.						

a/ South of 40°10' N. lat.

b/ Mortality estimates are not hard numbers; based on the GMT's best professional judgement.

c/ Bycatch amounts by species unavailable, but bocaccio occurred in 0.1% of all port samples and other rockfish in another 0.1% of all port samples (and squid fisheries usually land their whole catch). In 2001, out of 84,000 mt total landings 1 mt was groundfish. This suggests that total bocaccio was caught in trace amounts.

d/ Estimates for yelloweye have not been updated.

e/ Estimates for bocaccio, cowcod, widow, and yelloweye have not been updated.

f/ Values are proposed EFP bycatch caps, not estimates of total mortality. The EFP is terminated inseason if the cap is projected to be attained early.

g/ The darkblotched rockfish and Pacific ocean perch caps are not defined yet for this EFP but are expected to be lower than the placeholders in this scorecard.

Exhibit C.7.c
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON
STATUS OF 2004 GROUNDFISH FISHERIES AND INSEASON ADJUSTMENTS

The Groundfish Advisory Subpanel (GAP) met several times with the Groundfish Management Team (GMT) to discuss inseason adjustments to the groundfish fishery and followed the guidance on inseason adjustments provided by the Council.

In regard to limited entry trawl, the GAP recommends the option which is being presented by the GMT. This option will allow increases in harvest for Dover sole/thornyhead/sablefish trawl-caught sablefish complex (DTS) fisheries in both the north and south, with continuation of differential trip limits using large and small footrope trawls. An increase in the trip limits shallower than the Rockfish Conservation Area (RCA) in the north is essential, as nearshore boats can only access Dover sole and flatfish species during the summer months. This option will also provide greater opportunities for access to slope rockfish and chilipepper in the south, which to date have been constrained over fears of bocaccio and darkblotched impacts. Additional analysis of landing and observer data demonstrates that this issue is not as great a concern as originally modeled, especially given changes in fleet structure in the south following the groundfish buyback.

In regard to limited entry fixed gear, the GAP supports the sablefish tier limits proposed by the GMT which were developed on the basis of the fixed gear observer data presented to the Council, which shows lower discard rates than previously assumed. The GAP also supports the increase in fixed gear slope rockfish and splitnose limits proposed by the GMT, which follows past policy of trying to align fixed gear limits with trawl limits.

In regard to California recreational fisheries, the GAP recognizes that existing landings data - as wildly inaccurate as it may be - provides the only basis for determining changes in recreational measures. The GAP hopes new data collection programs will come on line soon, perhaps in enough time to modify some of the severe closures the recreational fishery will have to face.

The California members of the GMT worked with a GAP subcommittee to develop changes in management options which are designed to constrain the fishery within available amounts of canary rockfish and lingcod. The option that meets the Council guidance on canary rockfish impacts will result in closures in the recreational fishery along most of the California coast for the months of May, June, July, November, and December, as well as an additional depth restriction on the southern California coast in October. The GAP supports this option as the best alternative available at this time.

Finally, the GAP would like to thank the GMT for their efforts to provide options to and conduct modeling runs for the GAP. We are all working under difficult constraints of time, fish, and data and have tried to do the best we can to provide reasonable recommendations for conservation and management.

PFMC
04/06/04

Exhibit C.7.d
Public Comment
April 2004

------- Original Message --------
Subject: Coast Depth Restrictions 3/17
Date: Wed, 17 Mar 2004 06:52:31 -0800
From: Tony Blore <Tony@arrowac-merco.com>
To: <pfmc.comments@noaa.gov>

> R Anthony Blore
> Arrowac Fisheries Inc.
> > March 17, 2004
> > > Pacific Fishery Management Council
> 7700 NE Ambassador Place, Suite 200
> Portland, Or 97220-1384

> Re: Public Comment
> Groundfish Management
> Inseason Adjustments
> > COAST DEPTH RESTRICTIONS

> > Dear Council Members,
> > Arrowac Fisheries was in continual contact with Brian Culver, NMFS, and Michelle Robinson during the end of 2003 and the beginning of 2004 about both the depth restrictions off the Coast and the new VMS requirements that went into effect in 2004. Throughout those conversations Arrowac Fisheries was told that fishing off Washington Coast would return to status quo with a depth restriction of 100 fathoms to protect rockfish. It has now come to the attention of Arrowac Fisheries that this depth management fisheries approach may result in the fishing depth restriction being moved to 150 fathoms perhaps as early as June.
> This depth restriction will be financially devastating to Arrowac Fisheries Inc, the employee's of Arrowac Fisheries, and the fishermen who derive their livelihood from the longline fishery off the coast of Washington. It appears the tradeoff for this devastation of the local economy would be to enable the council to find additional rockfish bi-catch biomass to be allocated to another user group in another State and perhaps result in additional blackcod harvest potential for another user group in another state under the management of the PMFC.
> Arrowac Fisheries depends heavily on the dogfish harvest that takes place off the Washington Coast. Moving the depth restriction to 150 fathoms would virtually eliminate the harvest of dogfish by set line fishermen resulting in economic hardship to Arrowac Fisheries, a reduction of workforce and work hours for Arrowac employees, and economic hardship for local fishermen.
> Arrowac Fisheries also depends on the set line blackcod fishery that takes place off the Washington Coast. With a depth restriction of 150 fathoms taking place in June an additional negative economic hardship would be experienced by Arrowac and it's employees. Most likely Arrowac would see a reduction in blackcod pounds delivered with those pounds generating less dollar return and reduced work hours based on reduced volume for Arrowac Employees.
> With respect to the blackcod fishery of the Washington Coast the real negative economic impact would be born by the set line fishermen. Moving the depth restriction to 150 fathoms would result in the harvest of small blackcod, generating an average revenue of about a dollar

less per pound for the fisherman's catch. Bob Alverson knows what has happened to the blackcod small fish market in recent months. With more small fish hitting the market the result will be a continual decline in the value of small blackcod.
> Moving the depth restriction to 150 fathoms will result in exactly the opposite harvest results of what the PFMC is trying to achieve. All coast blackcod fishermen know that the large blackcod appear to be moving shallower earlier each year. Moving the depth restriction to 150 fathoms will result in the local fleet attempting to take their quota in April and May. Now a Derby atmosphere will be takin> g place off the coast with both tribal and non tribal fishers engaged on the grounds. Excessive gear loss will take place, fighting will take place amongst fishers, excessive bi-catch will take place, and selective fishing to try to maximize larger size fish will also take place. This is the type of fishing that has been so wasteful in the past, it's the type of fishing the PFMC has virtually eliminated, and it will be the > way fishing is forced to take place if the 150 fathom line is put into place.
> In addition the wasteful fishing practices will continue through the summer with larger vessels and larger quotas that will engage in the fishery after completing their Alaska fisheries. Now more gear will be required to harvest the quota if these vessels are forced outside 150 fathoms and with more fishing gear being deployed, increased bi-catch will take place. Some feel this depth restriction would force boats south to fish. Arrowac Fisheries does not feel this is the case. Last year we saw the 100 fathom depth restriction force vessels that normal fish in Oregon move to Washington waters in search of fish. As stated earlier the larger blackcod are moving shallower each year and like the Washington Coast the same thing is happening on the Oregon Coast. Moving the depth restrictions to 150 fathoms will result in the exact opposite harvest results of what the PFMC is trying to achieve.
> I am sorry that Arrowac Fisheries is not able to attend the ongoing meeting to address this serious issue in person. We were not aware that the depth restriction for set line was even being considered to be moved to 150 fathoms until yesterday. Please address our views and statements carefully. All of them are factual in substance.
> Thank you,
> Arrowac Fisheries Inc,
> R. Anthony Blore,
> > > Vice President Production, Bellingham Plant Manager

Exhibit C.7.d
Supplemental Public Comment 2
April 2004

RECEIVED
MAR 23 2004
PFMC

March 19, 2004

John E. Law
3964 Kendall Street
San Diego, CA. 92109
(858) 414-9731

To: Pacific Fishery Management Council Members.

Thank you for taking the time to read my comments prior to your April council meeting.

I am an open access groundfish fisherman. My vessel "Wild West" is a 23 foot open skiff. Currently I am fishing for shelf rockfish with rod & reel and slope rockfish with rod & reel and set lines. In addition, I have a deeper nearshore rockfish permit that is required by California. I no longer possess a nearshore fishery permit. California requires a nearshore permit to take nearshore rockfish, but would not accept any portion of my nearly 10,000 LBS. of rockfish landings under the category of "rockfish unspecified" as proof of participation.

I have done my best to keep up with the changing rules and regulations and I have tried my best to keep a good attitude, all with the hope that I will someday be able to catch enough rockfish to provide a living for myself and my family.

When the current season for shelf rockfish opened on March 1st, I was excited about the idea of returning to some of my favorite fishing areas, but unhappy with the 500LBS. for two months quota. Because I am a licensed fish receiver, I had pre-sold my catch to a Chinese restaurant for $2.50 LB. Instead of rushing out and trying to catch everything in one day, I caught what I needed and returned to the dock. The first day I was out five hours for 140LBS. The second day, three hours for 196 LBS. The third day, three hours for 153 LBS. I fished less than one full day in a three week period. My catch consisted of 100% shelf rockfish with zero bocaccio. Every fish was a vermilion rockfish, with the exception of three flag rockfish, three speckled rockfish, and one greenspotted rockfish. There was zero by-catch and zero waste. My experience and equipment had allowed me to target only the desired fish, without interacting with any fish that need protection.

Unfortunately, there is a very bad side to all of this. The closures have created a gold rush mentality among some fisherman. Because of the high prices now paid, new fisherman are gearing up to "get my 500 LBS." Fishermen know that they can put out very little effort and make a quick $1000. A recent example of this is easily confirmed because a NMFS observer was onboard the trip. With little knowledge of the fishery and a desire to show the observer that the shelf rockfish were plentiful, he fished in 45 fathoms near Pt. Loma, California. The trip resulted in 110 LBS. of vermilion rockfish, but 33 LBS. of copper and brown rockfish were discarded because he did not have a deeper nearshore permit! Because I have genuine concern for the health of the fishery, I will not make any attempt to fish inside of 60 fathoms for any type of rockfish, now that my shelf rockfish quota has been filled for the March – April period. If I did what this fisherman did I could go to the same area and keep 33 LBS. of deeper nearshore and discard 110 LBS. of shelf. With a 500 LBS. per month quota on deeper nearshore, this would be a terrible waste. Of course I could fish shallower, but then I would have to discard the nearshore rockfish because I do not have a permit. Obviously, the point that I am making is that as written, the rules allow for too much by-catch potential.

I am asking the council to consider the following ideas.

1) Adopt an immediate measure to stop new participants from catching shelf rockfish.

2) Implement a limited entry shelf rockfish permit.

3) Convince California to eliminate the deeper nearshore permit in the southern district and allow those fisherman with access to shelf rockfish to take all rockfish species including nearshore. This would end by-catch.

4) Allow participants with a shelf rockfish permit to keep any cow cod taken for personal home use. As stocks improve, the chances of encountering cow cod in the coastal areas will increase, and discarding these fish is a waste.

I have tried to keep my comments simple and to the point. I am supportive of the effort to rebuild rockfish stocks. I also believe that there is a way to allow those fisherman who have displayed an established interest in the fishery to continue to catch rockfish.

Sincerely,

John E. Law

John E. Law

PREFERRED ALTERNATIVE HARVEST LEVELS FOR 2005-06 FISHERIES

Situation: The groundfish fishery management plan (FMP) requires the Council to establish reference points for each major species or species complex: an acceptable biological catch (ABC), a total catch optimum yield (OY), and an overfishing threshold. Additionally, OYs for some species are allocated between the open access, limited entry, tribal, and recreational fisheries. The Council adopted a preliminary range of groundfish harvest levels (OYs) for consideration and analysis at the November 2003 meeting. However, the Groundfish Management Team (GMT) recommends a new range of lingcod and cabezon harvest levels for 2005-06 based on the revised assessments adopted at the March 2004 Council meeting (Exhibit C.8.b, Attachment 1). These harvest levels will determine the types of management measures available for Council consideration in 2005 and 2006. The Council is tasked with adopting recommendations for preferred 2005-06 groundfish harvest levels at this meeting.

Note that the choice of a preferred harvest level for bocaccio, cowcod, widow rockfish, and yelloweye rockfish needs to be considered in terms of the long term rebuilding alternatives that are part of the Council decision under agendum C.12. The Council action to adopt preferred harvest levels under the present agendum (C.8) should indicate that the preferred harvest levels for the four overfished species will be as determined in agendum C.12 on Thursday.

The canary rockfish OY varies dependent on commercial and recreational catch sharing due to differences in size selectivity in these fisheries and may be the single most constraining groundfish stock in 2004. The Council may want to defer choosing a final canary rockfish OY until final adoption of management measures in June.

Council Action:

1. **Adopt preferred alternative harvest levels (ABCs and OYs) for 2005-06 management (including the specification that the levels for the four overfished species in Amendment 16-3 are to be as determined in agendum C.12).**

References:

1. Exhibit C.8.b, Attachment 1: Groundfish Management Team Recommendations for the Range of 2005-06 Harvest Levels.

Agenda Order:

a. Agendum Overview — John DeVore
b. GMT Report on the Range of Acceptable Biological Catch (ABC) and Optimum Yield (OY) — Michele Robinson
c. Recommendations of the States, Tribes, and Federal Agencies
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action:** Adopt Preferred Alternative Harvest Levels (ABCs and OYs) for 2005-06 Management

PFMC
03/22/04

Exhibit C.8.b
Attachment 1
April 2004

GROUNDFISH MANAGEMENT TEAM RECOMMENDATIONS FOR THE RANGE OF 2005-06 HARVEST LEVELS

The Groundfish Management Team (GMT) considered the results of recently revised assessments for lingcod and cabezon, new cabezon harvest projections, and the range of rebuilding alternatives for bocaccio, cowcod, widow rockfish, and yelloweye rockfish to recommend a revised list of 2005 and 2006 ABCs and OYs for these species. The GMT attempted to capture the full range of harvest levels available using the revised lingcod and cabezon assessments as well as the full range of harvests specified in the Amendment 16-3 DEIS for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. Tables 1 and 2 of this report present the revised alternative ABCs and OYs for these six species and Table 3 presents the cabezon harvest projections provided by Dr. Andre Punt. Tables 1 and 2 present alternative harvest levels that are identical to those adopted for analysis by the Council in November 2003 with the following revisions:

Lingcod

The GMT referred to Table 6 on page 15 of the Addendum to the "Assessment of Lingcod for the Pacific Fishery Management Council in 2003" (presented in the March 2004 briefing book) and segregated lingcod ABCs and OYs north and south of the Columbia-Eureka INPFC management line. The range of lingcod OYs was based as follows: P_{MAX} = 90% under the Low OY alternative, P_{MAX} = 70% under the Medium OY alternative, and P_{MAX} = 60% under the High OY alternative.

Cabezon

The GMT referred to Table 3 in this attachment, which provides cabezon harvest level projections based on the SSC-recommended model from the revised assessment, and ranged OYs as follows: the Low OY alternative assumes an $F_{50\%}$ harvest rate and a 60-20 precautionary adjustment (this is the precautionary adjustment that CDFG uses for nearshore species management), the Medium OY alternative assumes an $F_{45\%}$ harvest rate and a 60-20 precautionary adjustment, and the High OY alternative assumes an $F_{45\%}$ harvest rate and a 40-10 precautionary adjustment.

Bocaccio

The GMT referred to tables presented in the Amendment 16-3 DEIS to range bocaccio ABCs and OYs as follows: the ABC/OY under the Low OY alternative assumed the STARb2 model with P_{MAX} = 90%, the ABC/OY under the Medium OY alternative assumed the STATc model with P_{MAX} = 70%, and the ABC/OY under the High OY alternative assumed the STARb1 model with P_{MAX} = 60%.

Cowcod

The GMT referred to tables presented in the Amendment 16-3 DEIS to range cowcod ABCs and OYs as follows: P_{MAX} under the Low OY alternative is 60% and P_{MAX} under the High OY alternative is 55%.

Widow Rockfish

The GMT referred to tables presented in the Amendment 16-3 DEIS to range widow rockfish ABCs and OYs as follows: the ABC/OY under the Low OY alternative assumed model 7 with P_{MAX} = 90%, the ABC/OY under the Medium OY alternative assumed model 8 with P_{MAX} = 60%, and the ABC/OY under the High OY alternative assumed model 9 with P_{MAX} = 60%.

Yelloweye Rockfish

The GMT referred to tables presented in the Amendment 16-3 DEIS to range yelloweye rockfish OYs as follows: P_{MAX} under the Low OY alternative is 90%, P_{MAX} under the Medium OY alternative is 70%, and P_{MAX} under the High OY alternative is 60%.

TABLE 1. Groundfish Management Team-recommended alternatives for acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for **2005**. (Overfished stocks in CAPS).

Stock	2004 ABCs/OYs		2005 ABC and OY Alternatives							
			Low OY		Med OY		High OY		Council OY a/	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD - coastwide	1,385	735	2,922	2,467	2,922	2,588	2,922	2,636		
Columbia and US-Vanc. areas			1,874	1,874	1,874	1,874	1,874	1,874		
Eureka, Monterey, and Conception areas			1,048	594	1,048	714	1,048	762		
Pacific Cod	3,200	3,200	3,200	1,600			3,200	3,200		
PACIFIC WHITING (Coastwide)	514,441	250,000	Decision deferred until March 2005							
Sablefish (Coastwide)	8,487	7,786	8,368	6,500	8,368	7,761	8,368	8,335	8,368	7,761
North of Conception	8,185	7,510		6,270		7,486		8,040		7,486
Conception area	302	276		230		275		295		275
PACIFIC OCEAN PERCH	980	444			966	447			966	447
Shortbelly Rockfish	13,900	13,900			13,900	13,900			13,900	13,900
WIDOW ROCKFISH	3,460	284	2,833	0	3,218	285	3,668	505		
CANARY ROCKFISH b/	256	47	270	43	270	48	270	48	270	48
Chilipepper Rockfish	2,700	2,000			2,700	2,000			2,700	2,000
BOCACCIO	400	250	447	135	566	308	745	713		
Splitnose Rockfish	615	461			615	461			615	461
Yellowtail Rockfish	4,320	4,320			3,896	3,896			3,896	3,896
Shortspine Thornyhead	1,030	983			1,055	999			1,055	999
Longspine Thornyhead	2,461	2,461			2,461	2,461			2,461	2,461
S. of Pt. Conception	390	195			390	195			390	195
COWCOD (S. Concep)	5	2.4	5	2.1			5	2.4		
N. Concep & Monterey	19	2.4	19	2.1			19	2.4		
DARKBLOTCHED	240	240			269	269			269	269
YELLOWEYE	53	22	54	24	54	27	54	28		
Nearshore Species										
Black WA	540	540			540	540			540	540
Black OR-CA	775	775			753	753			753	753
Minor Rockfish North	3,680	2,250			3,680	2,250			3,680	2,250
Remaining Rockfish North	1,612	1,216			1,612	1,216			1,612	1,216
Bocaccio	318	239			318	239			318	239
Chilipepper - Eureka	32	32			32	32			32	32
Redstripe	576	432			576	432			576	432
Sharpchin	307	230			307	230			307	230
Silvergrey	38	29			38	29			38	29
Splitnose	242	182			242	182			242	182
Yellowmouth	99	74			99	74			99	74
Other Rockfish North	2,068	1,034			2,068	1,034			2,068	1,034
Minor Rockfish South	3,412	1,968			3,412	1,968			3,412	1,968
Remaining Rockfish South	854	689			854	689			854	689
Bank	350	263			350	263			350	263
Blackgill	343	306			343	306			343	306
Sharpchin	45	34			45	34			45	34
Yellowtail	116	87			116	87			116	87
Other Rockfish South	2,558	1,279			2,558	1,279			2,558	1,279
Cabezon (off CA only)	Managed under "Other Fish"		88	44	103	51	103	91		
Dover Sole	8,510	7,440			8,510	7,440			8,510	7,440
English Sole	3,100	3,100			3,100	3,100			3,100	3,100
Petrale Sole	2,762	2,762			2,762	2,762			2,762	2,762
Arrowtooth Flounder	5,800	5,800			5,800	5,800			5,800	5,800
Other Flatfish	7,700	7,700	7,700	3,850			12,000	12,000		
Other Fish	14,700	14,700	15,000	7,500			15,000	15,000		

a/ Council OY is the Council's preferred harvest alternative for 2005.

b/ The canary rockfish ABC and OY are based on the Council's adopted rebuilding strategy that has a rebuilding target year of 2074, a specified harvest control rule (F = 0.220), and comports to a P_{MAX} (probability of successful rebuilding within the maximum allowable time period) of 60%. The OY varies by the commercial:recreational catch share due to the fact that the recreational fishery takes smaller fish and therefore has a greater "per ton" impact than the commercial fishery.

TABLE 2. Groundfish Management Team-recommended alternatives for acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for **2006**. (Overfished stocks in CAPS).

Stock	2004 ABCs/OYs		2006 ABC and OY Alternatives							
			Low OY		**Med OY**		**High OY**		**Council OY a/**	
	ABC	**OY**	**ABC**	**OY**	**ABC**	**OY**	**ABC**	**OY**	**ABC**	**OY**
LINGCOD - coastwide	1,385	735	2,716	2,299	2,716	2,414	2,716	2,459		
Columbia and US-Vanc. Areas			1,694	1,694	1,694	1,694	1,694	1,694		
Eureka, Monterey, and Conception areas			1,021	605	1,021	719	1,021	764		
Pacific Cod	3,200	3,200	3,200	1,600			3,200	3,200		
PACIFIC WHITING (Coastwide)	514,441	250,000	Decision deferred until March 2006							
Sablefish (Coastwide)	8,487	7,786	8,175	6,500	8,175	7,634	8,175	8,149	8,175	7,634
North of Conception	8,185	7,510		6,270		7,363		7,860		7,363
Conception area	302	276		230		271		289		271
PACIFIC OCEAN PERCH	980	444			934	447			934	447
Shortbelly Rockfish	13,900	13,900			13,900	13,900			13,900	13,900
WIDOW ROCKFISH	3,460	284	2,670	0	3,059	289	3,510	513		
CANARY ROCKFISH b/	256	47	279	45	279	51	279	51	279	51
Chilipepper Rockfish	2,700	2,000			2,700	2,000			2,700	2,000
BOCACCIO	400	250	443	140	549	309	733	704		
Splitnose Rockfish	615	461			615	461			615	461
Yellowtail Rockfish	4,320	4,320			3,681	3,681			3,681	3,681
Shortspine Thornyhead	1,030	983			1,077	1,018			1,077	1,018
Longspine Thornyhead	2,461	2,461			2,461	2,461			2,461	2,461
S. of Pt. Conception	390	195			390	195			390	195
COWCOD (S. Concep)	5	2.4	5	2.1			5	2.4		
N. Concep & Monterey	19	2.4	19	2.1			19	2.4		
DARKBLOTCHED	240	240			294	294			294	294
YELLOWEYE	53	22	55	25	55	28	55	29		
Nearshore Species										
Black WA	540	540			540	540			540	540
Black OR-CA	775	775			736	736			736	736
Minor Rockfish North	3,680	2,250			3,680	2,250			3,680	2,250
Remaining Rockfish North	1,612	1,216			1,612	1,216			1,612	1,216
Bocaccio	318	239			318	239			318	239
Chilipepper - Eureka	32	32			32	32			32	32
Redstripe	576	432			576	432			576	432
Sharpchin	307	230			307	230			307	230
Silvergrey	38	29			38	29			38	29
Splitnose	242	182			242	182			242	182
Yellowmouth	99	74			99	74			99	74
Other Rockfish North	2,068	1,034			2,068	1,034			2,068	1,034
Minor Rockfish South	3,412	1,968			3,412	1,968			3,412	1,968
Remaining Rockfish South	854	689			854	689			854	689
Bank	350	263			350	263			350	263
Blackgill	343	306			343	306			343	306
Sharpchin	45	34			45	34			45	34
Yellowtail	116	87			116	87			116	87
Other Rockfish South	2,558	1,279			2,558	1,279			2,558	1,279
Cabezon (off CA only)	Managed under "Other Fish"		94	63	108	72	108	107		
Dover Sole	8,510	7,440			8,510	7,440			8,510	7,440
English Sole	3,100	3,100			3,100	3,100			3,100	3,100
Petrale Sole	2,762	2,762			2,762	2,762			2,762	2,762
Arrowtooth Flounder	5,800	5,800			5,800	5,800			5,800	5,800
Other Flatfish	7,700	7,700	7,700	3,850			12,000	12,000		
Other Fish	14,700	14,700	15,000	7,500			15,000	15,000		

a/ Council OY is the Council's preferred harvest alternative for 2006.

b/ The canary rockfish ABC and OY are based on the Council's adopted rebuilding strategy that has a rebuilding target year of 2074, a specified harvest control rule (F = 0.220), and comports to a P_{MAX} (probability of successful rebuilding within the maximum allowable time period) of 60%. The OY varies by the commercial:recreational catch share due to the fact that the recreational fishery takes smaller fish and therefore has a greater "per ton" impact than the commercial fishery.

Table 3. Median harvest levels corresponding to three control rules for the "new catch & 1947-present CPUE index" analysis. Results are shown for two F_{MSY} proxies ($F_{50\%}$ and $F_{45\%}$).

Year	F_{MSY} proxy – $F_{50\%}$			F_{MSY} proxy – $F_{45\%}$		
	40-10	60-20	ABC	40-10	60-20	ABC
2004	62	26	82	74	31	99
2005	80	44	88	91	51	103
2006	97	63	94	107	72	108
2007	100	74	97	110	83	109
2008	100	81	97	107	88	108
2009	101	87	98	106	93	107
2010	102	95	99	107	100	107
2011	104	102	101	108	106	107
2012	106	110	103	111	112	107
2013	108	116	104	110	117	106
2014	109	122	105	110	121	105
2015	111	126	106	110	124	105
2016	112	133	107	110	128	104
2017	114	141	109	114	133	104
2018	115	147	111	114	136	104
2019	116	149	112	113	138	104
2020	118	151	112	114	143	102
2021	120	154	114	115	145	102
2022	122	157	114	117	148	101
2023	124	160	117	118	153	101

GROUNDFISH MANAGEMENT TEAM RECOMMENDATIONS FOR THE RANGE OF 2005-06 HARVEST LEVELS

The Groundfish Management Team (GMT) considered the results of recently revised assessments for lingcod and cabezon, new cabezon harvest projections, and the range of rebuilding alternatives for bocaccio, cowcod, widow rockfish, and yelloweye rockfish to recommend a revised list of 2005 and 2006 ABCs and OYs for these species. The GMT attempted to capture the full range of harvest levels available using the revised lingcod and cabezon assessments as well as the full range of harvests specified in the Amendment 16-3 DEIS for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. Revised Tables 1 and 2 of this report present the revised alternative ABCs and OYs for these six species and Table 3 in Exhibit C.8.b, Attachment 1 presents the cabezon harvest projections provided by Dr. Andre Punt. Revised Tables 1 and 2 present alternative harvest levels that are identical to those adopted for analysis by the Council in November 2003 with the following revisions:

Lingcod

The GMT referred to Table 6 on page 15 of the Addendum to the "Assessment of Lingcod for the Pacific Fishery Management Council in 2003" (presented in the March 2004 briefing book) and segregated lingcod ABCs and OYs north and south of the Columbia-Eureka INPFC management line. The range of lingcod OYs was based as follows: the ABC under the Low OY alternative is based on the new assessment adopted by the Council in March. The OY under the Low OY alternative is based on the harvest control rules (F=0.0531 in the north and south) adopted under Amendment 16-2 but applied to the exploitable biomasses projected for 2005 and 2006; P_{MAX} = 70% under the Medium OY alternative; and P_{MAX} = 60% under the High OY alternative.

Cabezon

The GMT referred to Table 3 in Exhibit C.8.b, Attachment 1, which provides cabezon harvest level projections based on the SSC-recommended model from the revised assessment, and ranged OYs as follows: the Low OY alternative assumes an $F_{50\%}$ harvest rate and a 60-20 precautionary adjustment (this is the precautionary adjustment that CDFG uses for nearshore species management); the Medium OY alternative assumes an $F_{45\%}$ harvest rate and a 60-20 precautionary adjustment with a constant catch averaged for 2005-07; and the High OY alternative assumes an $F_{45\%}$ harvest rate and a 40-10 precautionary adjustment.

Bocaccio

The GMT referred to tables presented in the Amendment 16-3 DEIS to range bocaccio ABCs and OYs as follows: the ABC/OY under the Low OY alternative assumed the STARb2 model with P_{MAX} = 90%, the ABC/OY under the Medium OY alternative assumed the STATc model with P_{MAX} = 70%, and the ABC/OY under the High OY alternative assumed the STARb1 model with P_{MAX} = 60%.

Cowcod

The GMT referred to tables presented in the Amendment 16-3 DEIS to range cowcod ABCs and OYs as follows: P_{MAX} under the Low OY alternative is 60% and P_{MAX} under the High OY alternative is 55%.

Widow Rockfish

The GMT referred to tables presented in the Amendment 16-3 DEIS to range widow rockfish ABCs and OYs as follows: the ABC/OY under the Low OY alternative assumed model 7 with P_{MAX} = 90%, the ABC/OY under the Medium OY alternative assumed model 8 with P_{MAX} = 60%, and the ABC/OY under the High OY alternative assumed model 9 with P_{MAX} = 60%.

Yelloweye Rockfish

The GMT referred to tables presented in the Amendment 16-3 DEIS to range yelloweye rockfish OYs as follows: P_{MAX} under the Low OY alternative is 90%, P_{MAX} under the Medium OY alternative is 70%, and P_{MAX} under the High OY alternative is 60%.

Canary Rockfish

The GMT recommends final harvest specifications for canary rockfish be deferred until June when management measures are decided since the OY depends on the commercial:recreational catch share.

Precautionary Adjustments for Pacific Cod, Other Flatfish, and Other Fish

The Council policy we have been operating under for some years regarding unassessed stocks and stocks with data-poor assessments, which is not limited to rockfish, has been to take a precautionary approach. Specifically, for unassessed stocks, the Council has adjusted OYs to 50% of the historical average catch levels. For stocks with data-poor assessments, the Council has applied a 25% reduction to the assessment value. The GMT notes that this has been done for most of the stocks that fall into these categories; however, the GMT recently discovered the precautionary adjustment has not been made to Pacific cod and species in the other flatfish and other fish categories. Therefore, the GMT recommends the OYs for Pacific cod, other flatfish, and other fish be reduced by 50%.

The ABCs for the Other Flatfish category have been based on landings from an earlier period. Recent review of landings data back to 1981 have led the GMT to question the derivation of the 7,700 mt ABC which has been in place since at least 1991. The GMT will require additional time to fully review this issue before it is prepared to recommend ABC and OY amounts for 2005-06. For the present motion we recommend the Council modify the lower end of the ABC range from 7,700 mt to 4,400 mt, and adjust the low OY from 3,850 mt to 2,200 mt. The GMT will finalize evaluation of this issue by the close of its May meeting, and will develop analysis of management measures appropriate for the revised range of OYs.

Amendment 16-2 Species

The harvests projected for canary rockfish, lingcod, darkblotched rockfish, and Pacific ocean perch are based on the rebuilding plans adopted under Amendment 16-2 (see discussion above). The target rebuilding year and harvest control rules for these species remain as adopted.

Amendment 16-3 Species

The GMT recommends the preferred harvest specifications for bocaccio, cowcod, widow rockfish, and yelloweye rockfish be made under agendum C.12 when rebuilding plans for these species are adopted.

Species With Status Quo Harvest Levels

The following species do not have updated assessments with 2005-06 projections and are recommended to be managed under status quo harvest levels: longspine thornyhead, petrale sole, chilipepper rockfish and splitnose rockfish.

Dover Sole

The Dover sole OY has been updated based on projections from the 2001 assessment. The GMT will determine the projected ABC before the June Council meeting.

Pacific Whiting

The Pacific whiting ABC (=OY) under the Medium OY alternative was based on projections from the recent assessment. The OY under the Low OY alternative was based on half the projected ABC and the OY under the High OY alternative was double the projected ABC. This is to explore widow rockfish bycatch implications.

REVISED TABLE 1. Groundfish Management Team-recommended alternatives for acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for **2005**. (Overfished stocks in CAPS).

Stock	2004 ABCs/OYs		2005 ABC and OY Alternatives							
			Low OY		Med OY		High OY		Council OY a/	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD - coastwide	1,385	735	2,922	918	2,922	2,588	2,922	2,636		
Columbia and US-Vanc. areas			1,874	574	1,874	1,874	1,874	1,874		
Eureka, Monterey, and Conception areas			1,048	344	1,048	714	1,048	762		
Pacific Cod	3,200	3,200	3,200	1,600			3,200	3,200		
PACIFIC WHITING (Coastwide)	514,441	250,000	181,287	181,287	362,573	362,573	725,146	725,146		
Sablefish (Coastwide)	8,487	7,786	8,368	6,500	8,368	7,761	8,368	8,335	8,368	7,761
North of Conception	8,185	7,510		6,270		7,486		8,040		7,486
Conception area	302	276		230		275		295		275
PACIFIC OCEAN PERCH	980	444			966	447			966	447
Shortbelly Rockfish	13,900	13,900			13,900	13,900			13,900	13,900
WIDOW ROCKFISH	3,460	284	2,833	0	3,218	285	3,668	505		
CANARY ROCKFISH b/	256	47	270	43	270	48	270	48	270	48
Chilipepper Rockfish	2,700	2,000			2,700	2,000			2,700	2,000
BOCACCIO	400	250	447	135	566	308	745	713		
Splitnose Rockfish	615	461			615	461			615	461
Yellowtail Rockfish	4,320	4,320			3,896	3,896			3,896	3,896
Shortspine Thornyhead	1,030	983			1,055	999			1,055	999
Longspine Thornyhead	2,461	2,461			2,461	2,461			2,461	2,461
S. of Pt. Conception	390	195			390	195			390	195
COWCOD (S. Concep)	5	2.4	5	2.1			5	2.4		
N. Concep & Monterey	19	2.4	19	2.1			19	2.4		
DARKBLOTCHED	240	240			269	269			269	269
YELLOWEYE	53	22	54	24	54	27	54	28		
Nearshore Species										
Black WA	540	540			540	540			540	540
Black OR-CA	775	775			753	753			753	753
Minor Rockfish North	3,680	2,250			3,680	2,250			3,680	2,250
Nearshore		122				122				122
Shelf		968				968				968
Slope		1,160				1,160				1,160
Remaining Rockfish North	1,612	1,216			1,612	1,216			1,612	1,216
Bocaccio	318	239			318	239			318	239
Chilipepper - Eureka	32	32			32	32			32	32
Redstripe	576	432			576	432			576	432
Sharpchin	307	230			307	230			307	230
Silvergrey	38	29			38	29			38	29
Splitnose	242	182			242	182			242	182
Yellowmouth	99	74			99	74			99	74
Other Rockfish North	2,068	1,034			2,068	1,034			2,068	1,034
Minor Rockfish South	3,412	1,968			3,412	1,968			3,412	1,968
Nearshore		615				615				615
Shelf		714				714				714
Slope		639				639				639
Remaining Rockfish South	854	689			854	689			854	689
Bank	350	263			350	263			350	263
Blackgill	343	306			343	306			343	306
Sharpchin	45	34			45	34			45	34
Yellowtail	116	87			116	87			116	87
Other Rockfish South	2,558	1,279			2,558	1,279			2,558	1,279
Cabezon (off CA only)	Managed under "Other Fish"		88	44	103	69	103	91		
Dover Sole	8,510	7,440			8510 c/	7476				
English Sole	3,100	3,100			3,100	3,100			3,100	3,100
Petrale Sole	2,762	2,762			2,762	2,762			2,762	2,762
Arrowtooth Flounder	5,800	5,800			5,800	5,800			5,800	5,800
Other Flatfish	7,700	7,700	4,400	2,200			12,000	12,000		
Other Fish d/	14,700	14,700	14,700	7,350			14,700	14,700		

a/ Council OY is the Council's preferred harvest alternative for 2005.

b/ The canary rockfish ABC and OY are based on the Council's adopted rebuilding strategy that has a rebuilding target year of 2074, a specified harvest control rule (F = 0.220), and comports to a P_{MAX} (probability of successful rebuilding within the maximum allowable time period) of 60%. The OY varies by the commercial:recreational catch share due to the fact that the recreational fishery takes smaller fish and therefore has a greater "per ton" impact than the commercial fishery.

c/ The projected ABC for Dover sole is not currently available but will be estimated by the GMT before the June Council meeting

d/ The cabezon harvest specifications will be subtracted from the Other Fish complex by INPFC area.

REVISED TABLE 2. Groundfish Management Team-recommended alternatives for acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for **2006**. (Overfished stocks in CAPS).

Stock	2004 ABCs/OYs		2006 ABC and OY Alternatives							
			Low OY		Med OY		High OY		Council OY a/	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD - coastwide	1,385	735	2,716	940	2,716	2,414	2,716	2,459		
Columbia and US-Vanc. Areas			1,694	574	1,694	1,694	1,694	1,694		
Eureka, Monterey, and Conception areas			1,021	366	1,021	719	1,021	764		
Pacific Cod	3,200	3,200	3,200	1,600			3,200	3,200		
PACIFIC WHITING (Coastwide)	514,441	250,000	114,297	114,297	228,593	228,593	457,186	457,186		
Sablefish (Coastwide)	8,487	7,786	8,175	6,500	8,175	7,634	8,175	8,149	8,175	7,634
North of Conception	8,185	7,510		6,270		7,363		7,860		7,363
Conception area	302	276		230		271		289		271
PACIFIC OCEAN PERCH	980	444			934	447			934	447
Shortbelly Rockfish	13,900	13,900			13,900	13,900			13,900	13,900
WIDOW ROCKFISH	3,460	284	2,670	0	3,059	289	3,510	513		
CANARY ROCKFISH b/	256	47	279	45	279	51	279	51	279	51
Chilipepper Rockfish	2,700	2,000			2,700	2,000			2,700	2,000
BOCACCIO	400	250	443	140	549	309	733	704		
Splitnose Rockfish	615	461			615	461			615	461
Yellowtail Rockfish	4,320	4,320			3,681	3,681			3,681	3,681
Shortspine Thornyhead	1,030	983			1,077	1,018			1,077	1,018
Longspine Thornyhead	2,461	2,461			2,461	2,461			2,461	2,461
S. of Pt. Conception	390	195			390	195			390	195
COWCOD (S. Concep)	5	2.4	5	2.1			5	2.4		
N. Concep & Monterey	19	2.4	19	2.1			19	2.4		
DARKBLOTCHED	240	240			294	294			294	294
YELLOWEYE	53	22	55	25	55	28	55	29		
Nearshore Species										
Black WA	540	540			540	540			540	540
Black OR-CA	775	775			736	736			736	736
Minor Rockfish North	3,680	2,250			3,680	2,250			3,680	2,250
Nearshore		122				122				122
Shelf		968				968				968
Slope		1,160				1,160				1,160
Remaining Rockfish North	1,612	1,216			1,612	1,216			1,612	1,216
Bocaccio	318	239			318	239			318	239
Chilipepper - Eureka	32	32			32	32			32	32
Redstripe	576	432			576	432			576	432
Sharpchin	307	230			307	230			307	230
Silvergrey	38	29			38	29			38	29
Splitnose	242	182			242	182			242	182
Yellowmouth	99	74			99	74			99	74
Other Rockfish North	2,068	1,034			2,068	1,034			2,068	1,034
Minor Rockfish South	3,412	1,968			3,412	1,968			3,412	1,968
Nearshore		615				615				615
Shelf		714				714				714
Slope		639				639				639
Remaining Rockfish South	854	689			854	689			854	689
Bank	350	263			350	263			350	263
Blackgill	343	306			343	306			343	306
Sharpchin	45	34			45	34			45	34
Yellowtail	116	87			116	87			116	87
Other Rockfish South	2,558	1,279			2,558	1,279			2,558	1,279
Cabezon (off CA only)	Managed under "Other Fish"		94	63	108	69	108	107		
Dover Sole	8,510	7,440			8510 c/	7,564				
English Sole	3,100	3,100			3,100	3,100			3,100	3,100
Petrale Sole	2,762	2,762			2,762	2,762			2,762	2,762
Arrowtooth Flounder	5,800	5,800			5,800	5,800			5,800	5,800
Other Flatfish	7,700	7,700	4,400	2,200			12,000	12,000		
Other Fish d/	14,700	14,700	14,700	7,350			14,700	14,700		

a/ Council OY is the Council's preferred harvest alternative for 2006.

b/ The canary rockfish ABC and OY are based on the Council's adopted rebuilding strategy that has a rebuilding target year of 2074, a specified harvest control rule (F = 0.220), and comports to a P_{MAX} (probability of successful rebuilding within the maximum allowable time period) of 60%. The OY varies by the commercial:recreational catch share due to the fact that the recreational fishery takes smaller fish and therefore has a greater "per ton" impact than the commercial fishery.

c/ The projected ABC for Dover sole is not currently available but will be estimated by the GMT before the June Council meeting

d/ The cabezon harvest specifications will be subtracted from the Other Fish complex by INPFC area.

Exhibit C.8.c
Supplemental Tribal Recommendations
April 2004

Mr. Chairman,

For the 2005-2006 management period, the tribes have the following recommendation on preferred harvest levels. Based on the decision by the authors of the latest stock assessment for lingcod to use two separate models to reflect the differences between stocks in the Columbia area north and the Eureka area south, the tribes recommend adopting separate OYs for those respective areas. The tribes believe that it is important to manage stocks based on regional differences where appropriate and that the latest lingcod stock assessment reflects such differences.

Exhibit C.8.d
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON PREFERRED ALTERNATIVE HARVEST LEVELS FOR 2005-2006 FISHERIES

The Groundfish Advisory Subpanel (GAP) reviewed the proposed harvest levels for the 2005-2006 fisheries as shown on tables 1 and 2 of exhibit C.8.b. In general, the GAP agrees with the Council preferred options, with the following exceptions:

Lingcod - given the recent stock assessments that show lingcod rebuilt in the north and close to rebuilt in the south, the GAP recommends the high acceptable biological catch (ABC)/optimum yield (OY) level.

Pacific cod - this is a highly fecund species with a varying stock size that represents a fringe population within the Council's area of jurisdiction. Harvest occurs only when cod and markets are available. The "precautionary" OY reduction proposed is unnecessary and will prevent utilization of this species. The GAP recommends the high ABC/OY level.

Sablefish - a majority of the GAP recommends the medium ABC/OY level. A minority of the GAP recommends the high ABC/OY level.

Widow rockfish, bocaccio, cowcod, yelloweye rockfish - the GAP recommended ABC/OY levels consistent with GAP recommendations on rebuilding models under agenda item C.12; since it is the GAP's understanding the Council will defer action on ABC/OY level choices until rebuilding models are approved, the GAP will discuss its recommendations for these species under that agenda item.

Cabezon (California) - the GAP recommends the high ABC/OY level, as this corresponds to management under the Council's 40/10 control policy. Since this is a federally managed fish, federal - rather than state - rules should apply.

Other flatfish, other fish - in both cases, the GAP recommended the high ABC/OY. The species in these categories are generally non-target catch except in some specialized circumstances. Some of these species are being considered for stock assessment and appropriate ABC/OY levels can be set at that time. In the case of flatfish especially, there are no indications of stock problems and the species in question are generally fast growing. Artificially imposing a "precautionary" OY reduction of 50% will only serve to unnecessarily constrain fisheries that are already severely affected by reductions needed to meet established rebuilding targets. The GAP sees no reason to make drastic cuts in OY levels for these species groups.

Finally, as a general comment, the GAP has previously expressed concern that ABC/OY levels are being based on stock assessment projections that assume stock size reduction through fishing mortality, even when little or no fishing is occurring. The GAP recognizes that - for legal reasons - the Council can't change stock assessments once adopted. However, the GAP urges that as part of the Terms of Reference for stock assessments and STAR Panel reports, the uncertainty of future projections based on an assumed level of fishing mortality be clearly stipulated, as was recently done with the Pacific whiting STAR Panel report. We believe that the Council should have the ability - based on appropriate scientific input - to revise projected ABC/OY levels if fishing mortality assumptions are incorrect.

Exhibit C.8.d
Supplemental SSC Report
April 2004

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PREFERRED ALTERNATIVE HARVEST LEVELS FOR 2005-2006 FISHERIES

The Scientific and Statistical Committee (SSC) reviewed the "Groundfish Management Team Recommendations for the Range of 2005-2006 Harvest Levels." The SSC discussion centered primarily on lingcod and cabezon, because revised assessment results are available for these two species. The GMT appears to have developed harvest ranges for these species that are consistent with the revised assessment results.

Regarding lingcod, the SSC again discussed the potential merit of separate northern and southern area management. Separate area management can help to avoid local area depletion when one geographic portion of a stock is less productive than another. This appears to be the case with lingcod, where data indicate the southern portion of the stock is less productive than the northern portion of the stock. The SSC notes the GMT proposal for splitting the sport fishery harvest guideline between the two areas has merit in this regard, especially when one considers the current allocation is approximately 70:30 (sport:commercial) in the south. Splitting the commercial harvest guideline between the two areas could also be potentially beneficial. The SSC notes the GMT proposes to use trawl survey data to modify the management area split from that presented in the assessment (the Eureka/Columbia International North Pacific Fishery Commission border) to the California/Oregon state border. This approach seems reasonable given the available data.

With respect to cabezon, the SSC notes the 2004 catch used in the projections (26 mt) is likely to be an underestimate of the true 2004 catch based on the California optimum yield (OY) of 88 mt. This underestimated catch causes the projected 2005-2006 harvest levels to be overestimated, particularly for the 60-20 option. The SSC recommends that in the future, rebuilding analyses should incorporate the most recent available data for developing catch projections.

The SSC observed that Table 1 (Exhibit C.8.b) indicates that for Pacific Cod, Other Flatfish, and Other Fish, the low OY option represents 50% of the established ABC. This adjustment is consistent with past council options for species groups where quantitative assessments were not available.

PFMC
04/06/04

REVIEW OF EXEMPTED FISHING PERMIT ACTIVITIES FOR 2003 AND INITIAL CONCEPTS FOR 2005-06

Situation: Exempted fishing permits (EFPs) provide a process for testing novel fishing gears and strategies to substantiate methods for prosecuting sustainable and risk-averse fishing opportunities.

Progress updates from past and ongoing EFPs may help the Council in their consideration of fishing strategies and opportunities for next year's fishery. State representatives who sponsored recent and ongoing EFPs will brief the Council on significant results from those EFPs. This agendum also provides the opportunity for Council, state, and agency representatives to discuss concepts for EFPs in 2005 and 2006. These discussions could serve to refine and coordinate contemplated EFPs prior to adoption of 2005-2006 management measure alternatives under the next agendum and final 2005-2006 management measures at the June Council meeting. Final approval of 2005 EFP applications will occur at the November Council meeting.

The cost of conducting EFPs is the loss of some available harvest for directed full fleet fisheries. Therefore, the costs and benefits of allocating available harvest to EFPs and directed fisheries needs to be considered coincidentally. Harvest set asides for proposed EFPs in 2005 and 2006 will be adopted along with 2005-06 management measure alternatives under agendum C.10.

Council Action:

1. **Consider EFP Results from 2003 and Concepts for 2005-06.**
2. **Provide Guidance on Development of EFPs for 2005-06.**

Reference Materials:

1. Exhibit C.9.b, WDFW Report.

Agenda Order:

a. Agendum Overview — Mike Burner
b. Recommendations of the States, Tribes and Federal Agencies
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Provide Guidance on Development of EFPs for 2005-06.

PFMC
03/19/04

CALIFORNIA DEPARTMENT OF FISH AND GAME PRELIMINARY REPORT SUMMARY ON 2003 EXEMPTED FISHERY PERMIT (EFP) TO TEST SELECTIVE SHELF FLATFISH TRAWL GEAR

General Provisions:
100% observer coverage (either state observers or NMFS observers)
State/vessel owner contracts
State/processor contract
Access to Trawl RCA to 100 fm
Required conversion of flatfish trawl configuration to "pineapple trawl design" used in Oregon
Full rockfish retention
Provisions for 6 vessels to participate
Bycatch caps for overfished species (for 6 vessels; individual vessel limit in parenthesis):

- canary: 1000 lb cap (100 lbs/ mo/vessel)
- bocaccio: 1000 lb cap (100 lbs/mo/vessel)
- yelloweye: 1000 lb cap (100lbs/mo/vessel)
- cowcod: 250 lb cap (50 lbs/mo/vessel)
- lingcod: 20 mt cap

EFP Results:
September 2003 – October 2003
1 vessel (out of 6); Princeton Port and San Francisco Processor
Gear: Scottish Seine
Total number of trips: 11
Total number of hauls: 37
Total catch:

Species	Total Catch (lbs)	Bycatch Rate
Shelf flatfish (target)	72,860	N/A
Canary rockfish	0	0
Bocaccio	5.5	0.00008
Yelloweye rockfish	0	0
Cowcod	0.6	0.00001
Lingcod	131.1	0.00180

Conclusion: 2003 EFP results suggest low bycatch rates by modified Scottish seine gear targeting flatfish; test should be conducted with modified Shelf Flatfish Trawl Gear (project to resume in 2004, September to November).

Exhibit C.9.b
Supplemental ODFW Report
April 2004

OREGON DEPARTMENT OF FISH AND WILDLIFE REPORT ON REVIEW OF EXEMPTED FISHING PERMIT ACTIVITIES FOR 2003 AND INITIAL CONCEPTS FOR 2005-2006

For The April 2004 Pacific Fishery Management Council Meeting

The selective flatfish trawl has been proven effective at reducing bycatch of canary and many other rockfish. However, it is clearly not effective at reducing the bycatch of darkblotched and other "bottom tending" rockfish, that currently need protection or may need protection in the future. There are other types of fish stocks taken off California, Oregon and Washington that, like rockfish, will likely prove to be less resilient to fishing than many flatfish stocks. Skate populations, for example, have proven to be easily overfished in other regions of the world. To help address some of these current and potential future bycatch issues, ODFW hopes to be able to complete additional trawl gear research in 2005-06 aimed at testing additional trawl modifications that may be able to more completely separate flatfish from other fish, based on size, shape or behavior.

This EFP will differ from most previous EFP's, in that research will be conducted under charter to the state of Oregon, with vessel operations under direct control of the principal investigators. Similar research in previous years has been conducted under a "letter of acknowledgment" (an LOA) from NOAA Fisheries. We have been advised though, that this type of research is more appropriately done under an EFP. The planning for this research, including identifying funding, is just beginning, however, we have identified the projected catch of overfished species needed to conduct this research. For 2005 work, we need 0.4t of canary rockfish, 0.15t of yelloweye rockfish, 2.5t of Pacific hake, 0.2t of Pacific ocean perch, 0.5t of darkblotched rockfish, 6.5t of lingcod (although these will all be released if alive) and a trace level (<0.1t) for bocaccio and cowcod. For 2006 research, which we anticipate will move once again out to the continental slope, we need 5.0t of Pacific hake, 3.0t of Pacific ocean perch, 3.0t of darkblotched rockfish, 0.4t of lingcod and trace level catches of canary rockfish, yelloweye rockfish, bocaccio and cowcod.

March 31, 2004
For More Information: Contact Steve Parker or Bob Hannah
503-867-4741

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
REPORT ON PROPOSED EXEMPTED FISHING PERMITS (EFPs) FOR 2005 AND 2006

The Washington Department of Fish and Wildlife (WDFW) is proposing to include the provisions of our Arrowtooth Flounder Trawl EFP into the federal regulations for 2005 and 2006. These provisions include mandatory observer coverage (using state-sponsored monitors), bycatch caps for overfished species, and rockfish retention. This proposal would allow fishers to access portions of the trawl rockfish conservation area (RCA), provided those provisions were met. (Note: A full description of this proposal is contained in Exhibit C.10.a., Attachment 2.) The portions of the RCA that could be accessed with this proposal have lower rockfish encounter rates, and would be specified by latitude/longitude as part of the regulations.

As a result of discussions with National Marine Fisheries Service (NMFS), it is our understanding that these provisions may need additional analysis beyond what can be accommodated in the 2005-06 specifications EIS. As such, if the Council approves the WDFW proposal, then NMFS may have to file a regulatory amendment to move the proposed arrowtooth trawl fishery into federal regulations through a separate process. It is unclear whether the regulatory amendment process would be finalized in time for the arrowtooth trawl fishery to begin in May 2005. Recognizing that the arrowtooth flounder fishery is extremely important to Washington trawl fishers and local processors, WDFW received guidance from NMFS to have a "placeholder" for an Arrowtooth Trawl EFP for 2005.

Based on this guidance, WDFW is proposing the following EFPs for 2005, in priority order, with the associated bycatch caps (in mt):

	Canary	Darkbl	Lingcod*	POP	Widow	Yelloweye
Arrowtooth Trawl	2.5	3.0	4.5	18.0	5.5	0.5
Longline Dogfish	0.1	0.5	2.0	8.5	0.5	1.0
Midwater Pollock	0.1	---	---	---	1.5	0.1

(* Cap would accommodate current trip limits)

The longline dogfish EFP has been conducted in 2003 and 2004. The EFP requirements include qualifying criteria that would have allowed three vessels to participate each year, however, only one vessel has indicated an interest. It is our intention to continue this EFP for one more year (2005) and remove the qualifying criteria to provide an opportunity for additional participation. If the results of the experiment continue to be positive, we would like to explore allowing this fishery in 2006 through the use of "hotspot" management.

The pollock EFP was introduced last year, but was not successful. It was conducted during an earlier time period (May) when pollock were not easily targeted. In 2004, the EFP will run in late summer and we would propose the same time period for 2005. It is our intent to use the data collected in the EFP to provide a pollock fishery in 2006, either through federal regulations (if pollock are added to the fishery management plan) or through state regulations, as appropriate.

Therefore, WDFW is not proposing any EFPs for the 2006 fishing year.

Exhibit C.9.b.
WDFW Report
April 2004

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
REPORT ON 2003 EXEMPTED FISHERIES (EFPs)

General Provisions for All WDFW EFPs:

- 100% observer coverage (either state-sponsored monitors or NMFS observers)
- Full rockfish retention
- Bycatch caps for overfished species
- State/vessel owner contracts
- State/processor contracts

Longline Dogfish EFP:

- March-June
- 1 vessel (out of 3); Bellingham processor
- Bycatch caps for yelloweye (2.0 mt) and canary rockfish (0.5 mt)
- Results
    - Yelloweye catch = 124 lbs
    - Canary catch = 31 lbs
    - Dogfish catch = 192,300 lbs
- Preliminary draft report in June 2004; final report available in September 2004

Arrowtooth Flounder Trawl EFP:

- May-August
- 6 vessels; Bellingham and Blaine
- Bycatch cap for canary rockfish (3.0 mt)
- Results
    - Canary catch = 2.0 mt
    - Arrowtooth catch = 2,631,100 lbs
    - Petrale catch = 361,800 lbs
    - Total ex-vessel revenue = $635,750 (Above limits = $506,900)
    - Total state revenue using FEAM model = $2.2 million
- Preliminary draft report in briefing book; final report available in April 2004

Pollock Midwater Trawl EFP:

- April-June (3 trips in May)
- 1 vessel (out of 3); Westport processor
- Bycatch caps for canary (0.5 mt) and widow rockfish (3.0 mt), and whiting (5000 mt)
- Results
    - Canary catch = 0; Widow catch = 5 lbs; Whiting catch = 49 mt
    - Pollock = 235,600 lbs
    - Terminated EFP early; whiting was ~ 33% of catch (in 2002, was < 10%)
    - Target pollock more cleanly in July-September (2004 EFP during this time period)

Exhibit C.9.c
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON REVIEW OF EXEMPTED FISHING PERMIT ACTIVITIES FOR 2003 AND INITIAL CONCEPTS FOR 2005-2006

The Groundfish Advisory Subpanel (GAP) reviewed the list of exempted fishing permits (EFPs) that were conducted in 2004 and briefly discussed potential EFPs for 2005-2006. The GAP has no recommendations at this time for changes in existing EFPs or for new EFPs beyond those that are being considered.

PFMC
04/07/04

Exhibit C.10
Situation Summary
April 2004

INITIAL REFINEMENT OF MANAGEMENT MEASURE ALTERNATIVES FOR 2005-06 FISHERIES

Situation: Management measures adopted during the Council process are designed to implement new and existing rebuilding programs, achieve bycatch reduction mandates, keep total catch within the proposed harvest levels, and achieve optimum benefits to the various user groups and fishing communities.

In the last five years, the Council has implemented a substantial restructuring of the groundfish fishery that includes gear restrictions, seasons, dramatically lower harvest levels consistent with previously-approved rebuilding programs for overfished species, and depth-based restrictions that shift the fishery out of the areas where the most depleted groundfish species reside. The management implications of new groundfish stock assessments and rebuilding analyses, as well as the overharvest of some species in recent years may require consideration of different management measures than implemented in 2004.

The Ad Hoc Allocation Committee (Committee) is scheduled to meet on March 24 and 25 (Exhibit C.2.b, Supplemental Ad Hoc Allocation Committee Report) to begin formulating recommended management and allocation alternatives that are responsive to new assessments and rebuilding analyses. Additionally, the Groundfish Management Team, Groundfish Advisory Subpanel, and interested public are expected to provide recommendations and alternatives for 2005-2006 management.

The Council should develop a range of specific management options at this meeting to help focus public attention on the extent of changes that may be necessary and to provide the basis for adopting final 2005-2006 management measures at the June Council meeting. Any allocation alternatives or specifications consistent with proposed management measures that will be considered for adoption by the Council need to be identified at this Council meeting. A preliminary draft 2005-2006 Management Specifications Environmental Impact Statement (EIS) will be prepared by late May, for pubic review and final Council consideration at the June Council meeting. It will be important that the Council and its advisors carefully deliberate the potential effectiveness of alternative management measures to stay within the alternative harvest levels adopted under agendum C.8. Otherwise, the quality of the 2005-2006 Management Specifications EIS may be compromised if alternatives are not properly structured and analyzed with as much scientific rigor as possible.

To achieve these goals, the Council is scheduled to deliberate 2005-2006 management measure alternatives in three steps this week. Initial refinement of management measures occurs under this agendum, followed by a GMT and GAP check-in on Thursday under agendum C.14, and a final decision on the range of alternatives on Friday under agendum C.15.

Council Action:

1. **Propose initial 2005-06 management measure alternatives for further refinement under agenda items C.14 and C.15.**
2. **Establish EFP set-asides.**

References:

1. Exhibit C.10.a, Attachment 1: Background information relative to state management of nearshore commercial and recreational groundfish fisheries.
2. Exhibit C.10.a, Attachment 2: Background information relative to converting Exempted Fishing Permits into regulations.

Agenda Order:

a. Agendum Overview — John DeVore
b. GMT Recommendations — Michele Robinson
c. Recommendations of the States, Tribes, and Federal Agencies
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. Council Recommendations to Refine Proposed 2005-06 Management Measure Alternatives for Public Review and Establish EFP Set-Asides

PFMC
03/22/04

Exhibit C.10.a
Attachment 1
April 2004

Background information relative to state management of nearshore commercial and recreational groundfish fisheries

Washington State Response to Achieving Quota, OY, and/or Harvest Guideline

The Washington State Legislature has granted the Washington Fish and Wildlife Commission the authority to adopt emergency regulations under the Revised Code of Washington (RCW) 77.04.090. The Fish and Wildlife Commission has delegated the authority to adopt emergency regulations to the Director of the Washington Department of Fish and Wildlife. Emergency regulations may be considered for various reasons, including the achievement of quotas, optimum yields, harvest limits or harvest guidelines, and to conform with federal regulations. The parameters for approving emergency regulations are not specified in the authority language. Emergency regulations can be adopted, filed, and in effect within 24 hours of being drafted.

Once adopted, emergency regulations are in effect for 120 days. During this time, if the regulation needs to remain in place for a longer duration, then the Department can consider adopting a permanent rule. Depending on the nature of the rule, it may have to go through the Fish and Wildlife Commission approval process. Once the permanent rule process has been initiated, a second emergency regulation can be filed to extend the time period. For example, an emergency regulation filed on March 1 that must remain in effect for the calendar year would expire on June 28. Provided that a permanent rule process has been initiated, a subsequent emergency regulation can be filed on June 29 that would remain in effect through October 26, in order to accommodate the time needed for the permanent rule process to be finalized.

Washington Administrative Code (WAC) 220-28-010 strengthens the ability to enforce emergency regulations, by stating, "It shall be unlawful to take, fish for or possess food fish or shellfish taken contrary to the provisions of any special season or emergency closed period prescribed in this chapter." A note at the end of the rule language also clarifies, "The department of fish and wildlife frequently adopts emergency rules of limited duration that relate to seasons, closures, gear, and other special matters concerning the industry...."

Once filed, copies of the emergency regulation are faxed to all Department regional offices and enforcement staff. The Department also uses its Outreach and Education program to inform the public of emergency regulations. Typically, a Fishing Rule Change notice is distributed to local media and the Department's sportfishing hotlines are updated within 24 hours of the rule adoption.

Washington Recreational Total Boat Catch by Species and Year - Ocean Areas Only (metric tons)
(Estimates for 2002 and 2003 include released catch. Lingcod discard mortality at 5% - others at 100%)
(Average weight for released fish is assumed to be equal to average weight of fish retained)

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002 1/**	**2003 1/**
Black Rockfish	229	180	222	150	143	171	176	176
Blue Rockfish	1	1	2	2	1	0	0	0
Bocaccio	0	0	0	0	0	1	1	0
Cabezon	3	1	4	2	3	3	6	5
Canary Rockfish	**3**	**4**	**12**	**5**	**3**	**2**	**2**	**2**
China Rockfish	1	0	1	1	1	1	1	1
Copper Rockfish	0	0	0	1	1	1	1	1
Kelp Greenling	1	0	0	1	1	1	2	1
Lingcod	**52**	**49**	**27**	**34**	**28**	**32**	**41**	**52**
Pacific Cod	0	0	1	0	0	0	5	13
Quillback Rockfish	0	0	2	2	2	0	2	1
Yelloweye Rockfish	**3**	**5**	**14**	**18**	**10**	**14**	**3**	**4**
Yellowtail Rockfish	4	6	29	6	8	4	2	7

1/ Catches currently in RecFIN reflect total mortality for all released fish, including lingcod

Washington Ocean Recreational Angler Trips (1,000s) By Boat Type
(Includes all target trip types)

Year	Private	Charter	Total
1996	52	51	103
1997	55	50	105
1998	37	44	81
1999	52	49	101
2000	52	49	101
2001	35	33	68
2002	75	58	133
2003	90	68	158

Table 1. California recreational catch estimates (MT) for nearshore rockfish and California scorpionfish by management regions from 1983-99. The catch estimates (a+b1) are derived from MRFSS; no survey data for 1990-1993. Draft CDFG v.1.

North Coast Region[1]

Species	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997	1998	1999
Black RF	98.4	217.6	248.5	193.2	93.3	130.8	128.0	174.4	100.4	83.9	81.1	51.5	67.7	71.3
Blue RF	11.9	13.9	5.6	4.2	6.0	14.3	10.5	21.3	5.5	4.6	3.1	3.5	5.3	3.0
Total	**110.3**	**231.4**	**254.1**	**197.4**	**99.2**	**145.1**	**138.5**	**195.6**	**106.0**	**88.6**	**84.2**	**55.0**	**72.9**	**74.4**
Black-and-Yellow RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brown RF	0.2	0.5	0.4	0.5	0.4	0.6	0.3	0.7	0.1	0.0	0.1	0.1	0.0	0.1
Calico RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
China RF	1.5	1.8	3.9	3.3	4.6	3.9	2.9	4.4	4.4	2.4	2.1	0.6	1.2	2.2
Copper RF	8.0	10.1	14.0	7.5	7.0	5.4	4.7	9.1	5.1	2.1	2.4	1.5	1.0	1.1
Gopher RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Grass RF	0.1	0.2	0.8	0.5	1.8	2.5	0.1	0.6	0.1	0.4	0.2	0.3	0.2	0.2
Kelp RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olive RF	0.7	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.3	0.1	0.2
Quillback RF	17.1	6.3	7.9	5.8	3.9	1.2	6.3	16.2	1.4	1.2	2.6	2.2	1.5	3.7
Treefish	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0
Scorpionfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**27.6**	**19.1**	**27.2**	**17.8**	**17.8**	**13.7**	**14.5**	**31.1**	**11.4**	**6.2**	**7.7**	**5.1**	**4.1**	**7.5**

Central Coast Region[2]

Species	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997	1998	1999
Black RF	121.5	182.5	193.5	204.6	118.3	152.1	102.0	109.4	110.1	74.0	72.7	39.2	49.0	90.6
Blue RF	649.3	455.3	256.1	120.5	253.0	292.8	234.5	439.3	158.3	98.1	160.8	292.6	244.1	195.6
Total	**770.8**	**637.9**	**449.5**	**325.1**	**371.3**	**444.9**	**336.5**	**548.7**	**268.3**	**172.1**	**233.5**	**331.8**	**293.1**	**286.2**
Black-and-Yellow RF	4.7	7.1	12.9	8.7	6.6	11.2	10.1	20.6	13.3	8.7	4.2	3.7	5.9	5.0
Brown RF	81.1	101.3	119.0	107.5	82.4	216.4	83.0	63.4	14.0	26.6	33.2	46.3	40.1	55.9
Calico RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
China RF	10.1	10.1	19.1	28.7	42.1	25.7	23.0	21.4	22.1	19.4	16.2	6.6	6.2	13.2
Copper RF	94.3	92.2	115.1	102.4	75.7	66.5	61.9	62.1	39.6	19.5	27.8	33.0	15.4	20.1
Gopher RF	9.7	32.7	27.1	25.4	14.5	17.6	22.7	102.6	77.5	34.1	34.9	35.2	38.0	43.5
Grass RF	1.8	3.8	8.6	9.3	32.5	21.8	4.8	15.4	5.6	5.5	7.2	6.0	4.4	2.1
Kelp RF	5.9	13.3	14.2	12.4	4.3	3.5	12.9	14.2	13.1	19.7	5.7	9.9	3.3	5.9
Olive RF	175.5	64.5	27.3	45.3	1.0	23.1	29.9	71.5	29.6	28.9	34.9	68.3	51.6	38.7
Quillback RF	22.9	4.1	4.3	7.4	1.6	0.7	3.3	19.6	2.7	1.8	1.0	1.2	1.2	1.7
Treefish	0.0	0.0	0.2	0.0	0.1	0.7	0.2	0.1	0.8	0.0	0.1	0.1	0.2	0.3
Scorpionfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	**406.1**	**329.1**	**347.6**	**347.1**	**261.0**	**387.3**	**251.9**	**390.7**	**218.2**	**164.1**	**165.1**	**210.2**	**166.3**	**186.4**

South Coast Region[3]

	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997	1998	1999
Black RF	0.2	31.6	40.1	20.0	8.4	0.7	3.5	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Blue RF	226.6	137.2	143.4	153.5	134.0	75.2	60.2	1.3	15.6	5.1	35.2	0.1	13.7	12.2
Total	**226.9**	**168.8**	**183.6**	**173.5**	**142.5**	**75.8**	**63.7**	**1.3**	**15.8**	**5.1**	**35.2**	**0.1**	**13.7**	**12.4**
Black-and-Yellow RF	10.6	21.1	19.0	5.8	1.7	1.2	1.2	0.3	0.0	0.7	0.2	0.0	0.0	0.4
Brown RF	43.3	74.2	88.6	96.5	80.8	70.0	56.2	4.0	14.6	13.4	14.6	11.4	3.3	8.9
Calico RF	0.2	0.2	0.8	0.8	0.1	0.9	0.5	0.5	1.8	1.2	0.4	0.4	0.3	0.5
China RF	5.6	3.7	4.9	10.1	6.9	4.7	7.5	0.1	0.0	0.0	0.0	0.0	0.0	0.3
Copper RF	114.1	128.5	163.5	141.8	12.5	72.9	68.1	16.2	55.2	18.5	61.2	6.3	26.6	49.6
Gopher RF	68.6	98.4	105.8	142.5	101.5	54.5	38.8	1.6	2.9	0.4	4.8	2.7	2.4	9.9
Grass RF	23.0	9.7	93.8	31.1	12.1	20.0	8.7	1.2	5.8	1.6	1.1	2.1	4.1	1.2
Kelp RF	27.8	29.9	20.1	15.8	8.2	7.2	4.1	7.7	14.7	2.2	6.5	2.7	1.6	2.1
Olive RF	111.4	135.4	111.8	77.5	65.2	30.8	21.7	13.2	19.5	5.3	7.8	1.7	4.9	5.0
Quillback RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treefish	10.5	11.8	15.9	17.7	3.8	6.1	10.8	14.4	12.5	17.9	21.3	5.5	9.6	16.0
Scorpionfish	70.5	85.5	69.5	75.0	53.2	217.4	267.1	75.6	121.3	101.8	166.6	103.9	82.9	139.6
Total	**415.2**	**513.0**	**624.3**	**539.5**	**292.8**	**268.3**	**217.6**	**59.2**	**126.9**	**61.2**	**117.9**	**32.7**	**52.8**	**93.9**

[1]-CA/OR border to Cape Mendocino; [2]-Cape Mendocino to Point Conception; [3]-Point Conception to US/MEX border.

Table 2. California recreational catch estimates (MT) for nearshore rockfish and California scorpionfish from 1983-1999. The catch estimates are derived from MRFSS (a+b1); no survey data for 1990-1993. Draft CDFG v1.

Species	Region	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996	1997	1998	1999
Black RF	North	98.4	217.6	248.5	193.2	93.3	130.8	128.0	174.4	100.4	83.9	81.1	51.5	67.7	71.3
	Central	121.5	182.5	193.5	204.6	118.3	152.1	102.0	109.4	110.1	74.0	72.7	39.2	49.0	90.6
	South	0.2	31.6	40.1	20.0	8.4	0.7	3.5	0.0	0.2	0.0	0.0	0.0	0.0	0.2
	STATE	220.1	431.7	482.1	417.8	220.0	283.5	233.5	283.8	210.7	157.9	153.8	90.7	116.7	162.1
Blue RF	North	11.9	13.9	5.6	4.2	6.0	14.3	10.5	21.3	5.5	4.6	3.1	3.5	5.3	3.0
	Central	649.3	455.3	256.1	120.5	253.0	292.8	234.5	439.3	158.3	98.1	160.8	292.6	244.1	195.6
	South	226.6	137.2	143.4	153.5	134.0	75.2	60.2	1.3	15.6	5.1	35.2	0.1	13.7	12.2
	STATE	887.9	606.4	405.1	278.2	393.0	382.3	305.2	461.9	179.4	107.8	199.1	296.2	263.1	210.8
Black-and-Yellow RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	4.7	7.1	12.9	8.7	6.6	11.2	10.1	20.6	13.3	8.7	4.2	3.7	5.9	5.0
	South	10.6	21.1	19.0	5.8	1.7	1.2	1.2	0.3	0.0	0.7	0.2	0.0	0.0	0.4
	STATE	15.4	28.2	31.9	14.5	8.4	12.5	11.3	20.9	13.3	9.5	4.5	3.7	5.9	5.3
Brown RF	North	0.2	0.5	0.4	0.5	0.4	0.6	0.3	0.7	0.1	0.0	0.1	0.1	0.0	0.1
	Central	81.1	101.3	119.0	107.5	82.4	216.4	83.0	63.4	14.0	26.6	33.2	46.3	40.1	55.9
	South	43.3	74.2	88.6	96.5	80.8	70.0	56.2	4.0	14.6	13.4	14.6	11.4	3.3	8.9
	STATE	124.6	176.0	207.9	204.5	163.6	287.0	139.6	68.1	28.7	40.1	47.9	57.8	43.4	64.9
Calico RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	South	0.2	0.2	0.8	0.8	0.1	0.9	0.5	0.5	1.8	1.2	0.4	0.4	0.3	0.5
	STATE	0.2	0.2	0.8	0.8	0.1	0.9	0.5	0.5	1.8	1.2	0.4	0.4	0.3	0.5
China RF	North	1.5	1.8	3.9	3.3	4.6	3.9	2.9	4.4	4.4	2.4	2.1	0.6	1.2	2.2
	Central	10.1	10.1	19.1	28.7	42.1	25.7	23.0	21.4	22.1	19.4	16.2	6.6	6.2	13.2
	South	5.6	3.7	4.9	10.1	6.9	4.7	7.5	0.1	0.0	0.0	0.0	0.0	0.0	0.3
	STATE	17.2	15.6	27.8	42.0	53.6	34.3	33.4	25.9	26.5	21.8	18.3	7.3	7.4	15.6
Copper RF	North	8.0	10.1	14.0	7.5	7.0	5.4	4.7	9.1	5.1	2.1	2.4	1.5	1.0	1.1
	Central	94.3	92.2	115.1	102.4	75.7	66.5	61.9	62.1	39.6	19.5	27.8	33.0	15.4	20.1
	South	114.1	128.5	163.5	141.8	12.5	72.9	68.1	16.2	55.2	18.5	61.2	6.3	26.6	49.6
	STATE	216.4	230.8	292.5	251.6	95.2	144.7	134.8	87.4	99.8	40.1	91.4	40.8	42.9	70.7
Gopher RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
	Central	9.7	32.7	27.1	25.4	14.5	17.6	22.7	102.6	77.5	34.1	34.9	35.2	38.0	43.5
	South	68.6	98.4	105.8	142.5	101.5	54.5	38.8	1.6	2.9	0.4	4.8	2.7	2.4	9.9
	STATE	78.3	131.2	132.9	168.0	116.1	72.2	61.5	104.3	80.4	34.6	39.8	37.9	40.4	53.5
Grass RF	North	0.1	0.2	0.8	0.5	1.8	2.5	0.1	0.6	0.1	0.4	0.2	0.3	0.2	0.2
	Central	1.8	3.8	8.6	9.3	32.5	21.8	4.8	15.4	5.6	5.5	7.2	6.0	4.4	2.1
	South	23.0	9.7	93.8	31.1	12.1	20.0	8.7	1.2	5.8	1.6	1.1	2.1	4.1	1.2
	STATE	25.0	13.8	103.1	41.0	46.5	44.3	13.6	17.2	11.6	7.5	8.5	8.5	8.7	3.5
Kelp RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	5.9	13.3	14.2	12.4	4.3	3.5	12.9	14.2	13.1	19.7	5.7	9.9	3.3	5.9
	South	27.8	29.9	20.1	15.8	8.2	7.2	4.1	7.7	14.7	2.2	6.5	2.7	1.6	2.1
	STATE	33.7	43.2	34.3	28.2	12.5	10.7	16.9	21.8	27.8	21.8	12.2	12.5	4.9	8.1
Olive RF	North	0.7	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.3	0.1	0.2
	Central	175.5	64.5	27.3	45.3	1.0	23.1	29.9	71.5	29.6	28.9	34.9	68.3	51.6	38.7
	South	111.4	105.4	111.8	77.5	65.2	30.8	21.7	13.2	19.5	5.3	7.8	1.7	4.9	5.0
	STATE	287.6	170.0	139.2	123.0	66.2	54.0	51.6	84.8	49.1	34.2	42.8	70.2	56.6	44.0
Quillback RF	North	17.1	6.3	7.9	5.8	3.9	1.2	6.3	16.2	1.4	1.2	2.6	2.2	1.5	3.7
	Central	22.9	4.1	4.3	7.4	1.6	0.7	3.3	19.6	2.7	1.8	1.0	1.2	1.2	1.7
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	STATE	40.0	10.4	12.3	13.2	5.5	1.8	9.7	35.8	4.0	3.0	3.6	3.3	2.7	5.3
Treefish	North	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0
	Central	0.0	0.0	0.2	0.0	0.1	0.7	0.2	0.1	0.8	0.0	0.1	0.1	0.2	0.3
	South	10.5	11.8	15.9	17.7	3.8	6.1	10.8	14.4	12.5	17.9	21.3	5.5	9.6	16.0
	STATE	10.5	11.8	16.4	17.7	3.9	6.8	11.1	14.5	13.6	17.9	21.4	5.6	9.9	16.3
CA Scorpionfish	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	South	70.5	85.5	69.5	75.0	53.2	217.4	267.1	75.6	121.3	101.8	166.6	103.9	82.9	139.6
	STATE	70.5	85.5	69.5	75.0	53.2	217.4	267.1	75.6	121.3	101.8	166.6	103.9	82.9	139.6

Table 3. California commercial catch estimates (MT) for nearshore rockfish and California scorpionfish from 1983-1999. The catch estimates are derived from CalCom expansion data. Draft CDFG v1.

Species	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
North Coast Region																	
Black RF	254.4	43.0	288.0	4.7	80.4	65.7	124.2	122.4	138.8	244.4	117.2	110.9	160.9	87.1	100.8	59.2	44.5
Blue RF	25.8	0.1	21.8	0.0	0.0	0.0	0.1	1.8	1.6	102.2	59.8	27.3	11.0	28.2	35.1	21.8	14.1
Total	**280.2**	**43.0**	**309.8**	**4.7**	**80.4**	**65.7**	**124.3**	**124.2**	**140.5**	**346.6**	**177.0**	**138.2**	**171.9**	**115.3**	**135.9**	**81.1**	**58.6**
Black-and-Yellow RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brown RF	0.4	0.0	0.5	4.9	0.0	1.5	18.0	4.0	0.2	0.2	0.6	0.1	0.2	0.2	0.7	1.6	0.9
China RF	0.0	0.0	0.0	0.0	0.0	0.3	0.2	2.5	0.7	2.8	0.8	1.6	4.6	3.8	3.7	2.3	2.2
Copper RF	7.3	0.6	0.1	0.0	0.1	0.5	5.0	17.1	8.8	9.5	3.0	3.3	15.1	8.4	10.9	4.3	7.2
Gopher RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Grass RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	2.1	0.3
Kelp RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Olive RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Quillback RF	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	38.0	2.8	3.7	1.5	4.7	3.5	5.6	2.0	4.9
Treefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scorpionfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0
Total	**7.6**	**0.7**	**0.6**	**4.9**	**0.1**	**2.3**	**23.2**	**24.4**	**48.3**	**15.5**	**8.1**	**6.6**	**24.6**	**16.1**	**22.6**	**12.3**	**15.8**
Central Coast Region																	
Black RF	32.8	11.4	81.0	16.8	8.0	9.1	7.7	11.9	5.7	17.0	27.6	24.6	8.2	31.1	27.3	26.7	8.7
Blue RF	30.2	12.8	152.6	15.9	8.2	7.8	31.4	26.7	35.2	79.3	74.8	42.0	23.7	15.9	28.6	26.0	21.7
Total	**63.0**	**24.1**	**233.6**	**32.7**	**16.2**	**16.9**	**39.1**	**38.6**	**40.9**	**96.3**	**102.5**	**66.6**	**32.0**	**47.0**	**55.9**	**52.7**	**30.4**
Black-and-Yellow RF	0.0	7.2	7.9	25.4	34.2	55.7	2.8	3.0	4.4	3.2	3.6	6.7	29.2	38.1	24.1	25.8	23.5
Brown RF	21.1	51.9	6.4	45.0	13.5	34.9	57.9	47.7	62.8	56.1	66.6	22.7	19.5	40.5	68.8	53.5	56.4
Calico RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
China RF	7.2	9.6	3.0	2.5	6.0	8.5	6.3	6.2	10.1	21.0	15.5	32.0	24.1	15.0	29.9	11.0	6.0
Copper RF	44.9	25.1	23.3	10.2	12.5	17.0	27.9	25.0	42.1	59.6	66.1	27.1	26.6	42.5	34.2	23.4	12.6
Gopher RF	26.8	7.4	0.3	0.1	0.0	0.0	42.7	43.8	64.4	75.0	65.8	40.2	57.2	51.8	41.7	35.9	34.9
Grass RF	0.0	0.4	0.4	1.3	1.7	2.8	0.1	0.1	1.9	5.7	9.6	22.3	34.0	32.0	25.4	33.6	22.3
Kelp RF	0.0	1.3	1.5	4.6	6.2	10.2	0.7	0.7	0.9	1.1	9.0	6.2	6.6	6.3	3.7	3.1	1.8
Olive RF	31.0	0.1	0.0	1.6	7.0	5.8	1.5	14.2	77.0	10.7	9.6	21.0	3.6	20.3	1.4	4.8	3.1
Quillback RF	0.0	0.1	0.0	0.1	0.1	0.3	1.8	1.5	11.2	3.1	1.0	18.8	4.6	8.2	14.7	9.8	3.5
Treefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.3	0.9	0.6	0.1	0.6
Scorpionfish	0.0	0.2	0.8	0.3	0.1	0.1	0.5	0.3	0.0	0.1	0.2	1.0	0.0	0.0	5.7	0.0	0.0
Total	**131.1**	**103.3**	**43.8**	**91.1**	**81.4**	**135.3**	**142.2**	**142.5**	**275.0**	**235.6**	**247.5**	**198.2**	**205.6**	**255.5**	**250.1**	**201.2**	**164.8**
South Coast Region																	
Black RF	0.9	2.6	2.4	2.2	0.0	5.9	0.0	0.4	0.2	0.6	0.4	0.0	0.3	0.0	0.0	0.2	0.0
Blue RF	0.4	0.6	0.6	2.8	0.3	1.9	1.5	1.2	0.6	27.9	24.0	6.7	14.2	2.6	2.3	0.6	0.2
Total	**1.3**	**3.3**	**3.0**	**5.0**	**0.3**	**7.8**	**1.5**	**1.6**	**0.8**	**28.5**	**24.3**	**6.7**	**14.4**	**2.7**	**2.3**	**0.8**	**0.2**
Black-and-Yellow RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.5	0.2	0.4	0.0	0.0	0.5	0.0
Brown RF	6.6	8.6	0.9	0.2	0.0	1.3	0.0	0.2	0.0	0.2	0.2	0.1	0.4	0.9	0.2	0.1	0.8
Calico RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
China RF	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	1.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
Copper RF	3.1	2.7	2.9	3.8	3.4	5.1	3.7	2.7	8.4	3.3	3.5	7.2	30.5	34.5	35.3	27.5	12.6
Gopher RF	2.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	4.1	12.2	5.1	4.8	3.6	3.0	4.3
Grass RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	12.2	17.0	10.4	5.4	6.3	4.1
Kelp RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1
Olive RF	4.1	5.6	5.8	23.2	6.0	0.2	5.1	0.8	0.1	21.3	17.0	4.8	37.4	8.2	6.6	0.8	6.8
Quillback RF	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treefish	0.0	0.0	0.0	0.0	0.4	0.0	0.8	0.0	0.3	0.8	0.7	0.2	0.4	0.0	0.9	0.1	0.4
Scorpionfish	14.4	11.2	15.4	6.9	12.9	15.6	19.5	40.0	28.8	35.0	26.5	50.2	41.1	34.7	37.7	51.1	39.3
Total	**30.6**	**28.2**	**25.1**	**34.2**	**22.7**	**22.1**	**29.1**	**43.8**	**39.1**	**66.4**	**53.1**	**87.4**	**132.5**	**93.7**	**89.8**	**89.4**	**69.1**

Table 4. California commercial catch estimates (MT) for nearshore rockfish and California scorpionfish from 1983-1999. The catch estimates are derived from CalCom expansion data. Draft CDFG v1.

Species	Region	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Black RF	North	254.4	43.0	288.0	4.7	80.4	65.7	124.2	122.4	138.8	244.4	117.2	110.9	160.9	87.1	100.8	59.2	44.5
	Central	32.8	11.4	81.0	16.8	8.0	9.1	7.7	11.9	5.7	17.0	27.6	24.6	8.2	31.1	27.3	26.7	8.7
	South	0.9	2.6	2.4	2.2	0.0	5.9	0.0	0.4	0.2	0.6	0.4	0.0	0.3	0.0	0.0	0.2	0.0
	STATE	288.1	56.9	371.5	23.7	88.4	80.7	131.9	134.7	144.7	262.0	145.1	135.6	169.4	118.2	128.1	86.1	53.2
Blue RF	North	25.8	0.1	21.8	0.0	0.0	0.0	0.1	1.8	1.6	102.2	59.8	27.3	11.0	28.2	35.1	21.8	14.1
	Central	30.2	12.8	152.6	15.9	8.2	7.8	31.4	26.7	35.2	79.3	74.8	42.0	23.7	15.9	28.6	26.0	21.7
	South	0.4	0.6	0.6	2.8	0.3	1.9	1.5	1.2	0.6	27.9	24.0	6.7	14.2	2.6	2.3	0.6	0.2
	STATE	56.4	13.5	175.0	18.7	8.5	9.8	33.0	29.7	37.4	209.4	158.6	75.9	48.9	46.8	66.0	48.5	35.9
Black-and-yellow RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	7.2	7.9	25.4	34.2	55.7	2.8	3.0	4.4	3.2	3.6	6.7	29.2	38.1	24.1	25.8	23.5
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.5	0.2	0.4	0.0	0.0	0.5	0.0
	STATE	0.0	7.2	7.9	25.4	34.2	55.7	2.8	3.0	4.4	3.9	4.2	6.8	29.6	38.1	24.1	26.4	23.5
Brown RF	North	0.4	0.0	0.5	4.9	0.0	1.5	18.0	4.0	0.2	0.2	0.6	0.1	0.2	0.2	0.7	1.6	0.9
	Central	21.1	51.9	6.4	45.0	13.5	34.9	57.9	47.7	62.8	56.1	66.6	22.7	19.5	40.5	68.8	53.5	56.4
	South	6.6	8.6	0.9	0.2	0.0	1.3	0.0	0.2	0.0	0.2	0.2	0.1	0.4	0.9	0.2	0.1	0.8
	STATE	28.0	60.5	7.8	50.1	13.5	37.7	75.9	51.9	63.1	56.5	67.3	23.0	20.1	41.6	69.7	55.3	58.0
Calico RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
	STATE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
China RF	North	0.0	0.0	0.0	0.0	0.0	0.3	0.2	2.5	0.7	2.8	0.8	1.6	4.6	3.8	3.7	2.3	2.2
	Central	7.2	9.6	3.0	2.5	6.0	8.5	6.3	6.2	10.1	21.0	15.5	32.0	24.1	15.0	29.9	11.0	6.0
	South	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	1.4	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.2
	STATE	7.2	9.6	3.0	2.6	6.0	8.8	6.5	8.8	12.2	23.8	16.3	33.8	28.7	18.8	33.6	13.3	8.4
Copper RF	North	7.3	0.6	0.1	0.0	0.1	0.5	5.0	17.1	8.8	9.5	3.0	3.3	15.1	8.4	10.9	4.3	7.2
	Central	44.9	25.1	23.3	10.2	12.5	17.0	27.9	25.0	42.1	59.6	66.1	27.1	26.6	42.5	34.2	23.4	12.6
	South	3.1	2.7	2.9	3.8	3.4	5.1	3.7	2.7	8.4	3.3	3.5	7.2	30.5	34.5	35.3	27.5	12.6
	STATE	55.3	28.3	26.2	14.0	16.0	22.6	36.6	44.8	59.3	72.4	72.5	37.5	72.1	85.4	80.4	55.2	32.4
Gopher RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
	Central	26.8	7.4	0.3	0.1	0.0	0.0	42.7	43.8	64.4	75.0	65.8	40.2	57.2	51.8	41.7	35.9	34.9
	South	2.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	4.1	12.2	5.1	4.8	3.6	3.0	4.3
	STATE	29.2	7.6	0.4	0.1	0.0	0.0	42.7	43.8	64.4	80.1	69.9	52.4	62.3	56.6	45.9	38.9	39.2
Grass RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	2.1	0.3
	Central	0.0	0.4	0.4	1.3	1.7	2.8	0.1	0.1	1.9	5.7	9.6	22.3	34.0	32.0	25.4	33.6	22.3
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	12.2	17.0	10.4	5.4	6.3	4.1
	STATE	0.0	0.4	0.4	1.3	1.7	2.8	0.1	0.1	1.9	5.8	10.3	34.5	51.0	42.5	31.6	42.0	26.7
Kelp RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	1.3	1.5	4.6	6.2	10.2	0.7	0.7	0.9	1.1	9.0	6.2	6.6	6.3	3.7	3.1	1.8
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1
	STATE	0.0	1.3	1.5	4.6	6.2	10.2	0.7	0.7	1.5	1.1	9.0	6.3	6.8	6.4	3.8	3.1	1.9
Olive RF	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3
	Central	31.0	0.1	0.0	1.6	7.0	5.8	1.5	14.2	77.0	10.7	9.6	21.0	3.6	20.3	1.4	4.8	3.1
	South	4.1	5.6	5.8	23.2	6.0	0.2	5.1	0.8	0.1	21.3	17.0	4.8	37.4	8.2	6.6	0.8	6.8
	STATE	35.1	5.7	5.8	24.8	13.0	6.0	6.6	15.0	77.1	32.1	26.6	25.8	41.0	28.5	8.0	5.5	10.2
Quillback RF	North	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	38.0	2.8	3.7	1.5	4.7	3.5	5.6	2.0	4.9
	Central	0.0	0.1	0.0	0.1	0.1	0.3	1.8	1.5	11.2	3.1	1.0	18.8	4.6	8.2	14.7	9.8	3.5
	South	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	STATE	0.0	0.2	0.0	0.1	0.1	0.3	1.8	1.5	49.2	5.9	4.7	20.3	9.3	11.7	20.3	11.9	8.4
Treefish	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Central	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.3	0.9	0.6	0.1	0.6
	South	0.0	0.0	0.0	0.0	0.4	0.0	0.8	0.0	0.3	0.8	0.7	0.2	0.4	0.0	0.9	0.1	0.4
	STATE	0.0	0.0	0.0	0.0	0.4	0.0	0.8	0.0	0.3	0.8	1.0	0.3	0.7	1.0	1.5	0.3	1.0
CA Scorpionfish	North	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0
	Central	0.0	0.2	0.8	0.3	0.1	0.1	0.5	0.3	0.0	0.1	0.2	1.0	0.0	0.0	5.7	0.0	0.0
	South	14.4	11.2	15.4	6.9	12.9	15.6	19.5	40.0	28.8	35.0	26.5	50.2	41.1	34.7	37.7	51.1	39.3
	STATE	14.4	11.4	16.2	7.2	13.0	15.6	20.1	41.1	28.8	35.0	26.8	51.2	41.1	34.7	43.5	51.1	39.4

Table 5. California recreational catch estimates (MT) for nearshore rockfish and California scorpionfish by MRFSS management regions from 2000-2003. The catch estimates (a+b1) are derived from MRFSS. CDFG draft v.1.

Northern California[1]

Species	2000	2001	2002	2003
Black RF	129.4	248.2	146.5	656.3
Blue RF	150.7	115.6	148.8	220.3
Total	**280.1**	**363.8**	**295.3**	**876.6**
Black-and-Yellow RF	8.3	7.0	7.1	10.1
Brown RF	51.2	104.8	55.5	136.2
Calico RF	0.1	0.0	0.0	0.0
China RF	18.4	16.4	16.0	17.9
Copper RF	24.2	17.2	12.6	20.6
Gopher RF	58.4	101.3	76.4	99.4
Grass RF	1.9	11.5	4.7	6.7
Kelp RF	4.1	1.9	12.1	14.6
Olive RF	53.8	42.6	127.9	32.1
Quillback RF	6.8	3.6	1.2	11.9
Treefish	0.8	1.6	1.1	0.8
CA Scorpionfish	0.0	0.0	0.0	0.0
Total	**228.0**	**307.9**	**314.5**	**350.3**

South California[2]

Species	2000	2001	2002	2003
Black RF	0.0	0.1	0.0	0.0
Blue RF	2.1	1.1	2.5	9.1
Total	**2.1**	**1.2**	**2.5**	**9.1**
Black-and-Yellow RF	0.2	0.2	0.3	0.0
Brown RF	7.9	10.5	11.2	13.7
Calico RF	0.1	0.0	0.0	0.0
China RF	0.0	0.0	0.0	0.0
Copper RF	22.4	16.8	10.1	16.4
Gopher RF	4.0	3.1	1.8	2.5
Grass RF	0.9	3.4	4.9	3.5
Kelp RF	3.0	6.2	9.3	7.9
Olive RF	0.5	11.2	14.7	11.2
Quillback RF	0.0	0.0	0.0	0.0
Treefish	3.7	8.9	5.2	4.9
CA Scorpionfish	89.5	113.5	102.2	87.5
Total	**42.8**	**60.2**	**57.5**	**60.1**

1-CA/OR border to Point Conception; 2-Point Conception to US/MEX border.

Table 6. California recreational catch estimates (MT) for nearshore rockfish and California California scorpionfish by MRFSS management regions from 2000-2003. The catch estimate (a+b1) are derived from MRFSS. CDFG draft v.1.

Species	Region	2000	2001	2002	2003
Black Rockfish	Northern California[1]	129.4	248.2	146.5	656.3
	South[2]	0.0	0.1	0.0	0.0
	STATE	129.4	248.3	146.5	656.3
Blue Rockfish	Northern California	150.7	115.6	148.8	220.3
	South	2.1	1.1	2.5	9.1
	STATE	152.8	116.7	151.3	229.4
Black and Blue	**Northern California**	**280.1**	**363.8**	**295.3**	**876.6**
	South	**2.1**	**1.2**	**2.5**	**9.1**
	STATE	**282.2**	**365.0**	**297.8**	**885.8**
Black-and-Yellow Rockfish	Northern California	8.3	7.0	7.1	10.1
	South	0.2	0.2	0.3	0.0
	STATE	8.5	7.1	7.4	10.1
Brown Rockfish	Northern California	51.2	104.8	55.5	136.2
	South	7.9	10.5	11.2	13.7
	STATE	59.2	115.2	66.6	149.9
Calico Rockfish	Northern California	0.1	0.0	0.0	0.0
	South	0.1	0.0	0.0	0.0
	STATE	0.2	0.0	0.0	0.0
China Rockfish	Northern California	18.4	16.4	16.0	17.9
	South	0.0	0.0	0.0	0.0
	STATE	18.4	16.4	16.0	17.9
Copper Rockfish	Northern California	24.2	17.2	12.6	20.6
	South	22.4	16.8	10.1	16.4
	STATE	46.7	34.0	22.7	37.0
Gopher Rockfish	Northern California	58.4	101.3	76.4	99.4
	South	4.0	3.1	1.8	2.5
	STATE	62.4	104.3	78.2	101.8
Grass Rockfish	Northern California	1.9	11.5	4.7	6.7
	South	0.9	3.4	4.9	3.5
	STATE	2.8	15.0	9.6	10.2
Kelp Rockfish	Northern California	4.1	1.9	12.1	14.6
	South	3.0	6.2	9.3	7.9
	STATE	7.1	8.1	21.4	22.5
Olive Rockfish	Northern California	53.8	42.6	127.9	32.1
	South	0.5	11.2	14.7	11.2
	STATE	54.3	53.8	142.6	43.3
Quillback Rockfish	Northern California	6.8	3.6	1.2	11.9
	South	0.0	0.0	0.0	0.0
	STATE	6.8	3.6	1.2	11.9
Treefish	Northern California	0.8	1.6	1.1	0.8
	South	3.7	8.9	5.2	4.9
	STATE	4.5	10.5	6.2	5.7
CA Scorpionfish	Northern California	0.0	0.0	0.0	0.0
	South	89.5	113.5	102.2	87.5
	STATE	89.5	113.5	102.2	87.5

1-CA/OR border to Point Conception; 2-Point Conception to US/MEX border.

Table 7. California commercial catch estimates (MT) for nearshore rockfish and California scorpionfish from 2000-2003. The catch estimates are derived from CalCom expansion data. CDFG Draft V.1.

Northern California[1]

Species	2000	2001	2002	2003
Black RF	46.1	99.8	94.5	57.6
Blue RF	12.8	16.2	15.2	7.5
Total	**58.9**	**115.9**	**109.7**	**65.2**
Black-and-Yellow Rockfish	18.9	10.6	9.9	7.6
Brown RF	40.9	30.3	23.2	19.9
China RF	2.6	1.6	2.3	0.6
Copper RF	6.1	10.1	9.7	2.4
Gopher RF	4.3	4.7	2.6	1.2
Grass RF	33.3	40.9	31.7	13.0
Kelp RF	15.5	12.1	9.5	10.0
Olive RF	1.1	0.9	1.0	1.0
Quillback RF	3.6	9.6	4.7	2.5
Treefish	3.5	3.2	0.7	0.1
CA Scorpionfish	0.7	1.1	1.0	0.6
Total	**130.5**	**125.0**	**96.4**	**58.8**

Southern California[2]

Species	2000	2001	2002	2003
Black RF	0.3	0.0	0.0	0.0
Blue RF	0.2	0.1	0.4	0.2
Total	**0.5**	**0.2**	**0.4**	**0.2**
Black-and-Yellow Rockfish	0.0	0.1	0.1	0.1
Brown RF	0.4	0.3	0.6	0.2
Calico RF	0.0	0.0	0.0	0.0
China RF	0.0	0.0	0.0	0.0
Copper RF	4.7	3.6	4.2	0.5
Gopher RF	3.1	2.3	1.0	0.3
Grass RF	12.2	10.6	7.1	3.4
Kelp RF	0.1	0.2	0.1	0.2
Olive RF	0.7	0.4	0.2	0.0
Quillback RF	0.0	0.0	0.0	0.0
Treefish	1.0	0.6	0.2	0.2
CA Scorpionfish	18.7	19.9	13.5	5.3
Total	**40.8**	**38.0**	**27.1**	**10.2**

1-CA/OR border to Point Conception; 2-Point Conception to US/MEX border.

Exhibit C.10.a
Attachment 2
April 2004

Background information relative to converting Exempted Fishing Permits into regulations

Using an Exempted Fishing Permit for a Large-scale Test of a Selective Flatfish Trawl in the Continental Shelf Flatfish Fishery

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Abstract

The Oregon Department of Fish and Wildlife and the Northwest Fisheries Science Center of NOAA conducted an Exempted Fishing Permit fishery test of a new selective flatfish trawl to estimate bycatch rates in the continental shelf flatfish fishery. Eight vessels participated, with observer coverage from May through October 2003. The trawl performed well and reductions in bycatch observed were consistent with the effects previously demonstrated in the controlled experiments. We recommend that a flatfish target fishery using this trawl be developed for use on the continental shelf off the west coast as a mechanism to reduce bycatch of some critical rockfish species.

Introduction

From 2000 through 2002, the Oregon Department of Fish and Wildlife (ODFW), working cooperatively with Oregon State University and the National Marine Fisheries Service, developed and tested a modified flatfish trawl, comparing its performance to a typical west coast sole trawl using an alternate haul sampling design (King et al. 2004). This experiment showed reductions in bycatch for several overfished species of 34 – 97%, despite the selective flatfish trawl being a larger trawl and having increased catches of flatfish.

Currently a large portion of the continental shelf, known as the rockfish conservation Area or RCA, is closed to groundfish trawling to limit the bycatch of several overfished species, notably canary rockfish *Sebastes pinniger*, yelloweye rockfish *S. ruberrimus*, and widow rockfish *S. entomelas* (PFMC, 2002). The depth range of the groundfish trawl RCA varies seasonally, but during the summer shelf flatfish fishery, it is approximately 137 – 366 m (PFMC, 2002). Although this area contains a large amount of high relief rockfish habitat, it also contains a vast amount of highly productive flatfish habitat, and is the primary location of several exploited flatfish species during their movement onto the shelf during summer months (*e.g.* Petrale sole *Eopsetta jordani*, Dover sole *Microstomus pacificus*) (Hagerman 1952, Ketchen and Forrester 1966). Access to these flatfish stocks is therefore restricted due to the lack of selectivity of conventional bottom trawl gear. Because the selective flatfish trawl showed such significant reductions in bycatch of overfished rockfish species, its implementation as a management tool has the potential to re-open some portion of the traditional shelf flatfish fishery and assist the Pacific Fishery Management Council in achieving the goals set forth in the federal fishery management plan for west coast groundfish, such as to maximize the value of the groundfish resource while preventing overfishing (PFMC, 2003).

The original alternate haul experiment using the selective flatfish trawl (King et al. 2004) was conducted off the central coast of Oregon, and tows were made primarily in rockfish habitat to most quickly learn about the bycatch reduction potential of the new trawl, given the patchy distribution of rockfish. Therefore, the experimental design, although good for measuring bycatch reduction, did not provide explicit information for managers to estimate bycatch rates for fishermen using the selective flatfish trawl in the traditional shelf flatfish fishery, where rockfish are not targeted. However to provide this information, the fishermen would need access to the closed RCA. To allow monitored access to the RCA, the ODFW and the Northwest Fisheries Science Center of NOAA

(NWFSC) developed an Exempted Fishing Permit (EFP) fishery to document the effectiveness of this type of trawl in the shelf flatfish fishery.

Given the large amount of comparative haul data presented in King et al. (2004), the performance of the selective flatfish trawl design was not in question. The EFP fishery documented the bycatch rates for species of concern with fishermen conducting normal flatfish fishing operations along different areas of the west coast both inside and outside of the RCA. The results could then be compared to the research data, and the West Coast Observer Program (WCOP) estimates of bycatch rates as descriptors of a potential fishery. The EFP therefore, was a feasibility test to determine if the idea tested in the research experiment could be scaled up to a fishery level and be useful for management.

In addition, because different vessels require nets of different sizes and other specifications, we developed measurable net design criteria, which 1) allowed fishermen to modify or build nets for their vessels that still have the functional components of the selective flatfish trawl, and 2) were objective and able to be enforced by federal and state enforcement agencies both in port and at sea. The ultimate objective of the EFP fishery was to generate information on how bycatch of overfished species might be reduced by introduction of the selective flatfish trawl to the nearshore component of the west coast groundfish trawl fishery.

Methods

The selective flatfish trawl is technically a legal fishing gear. Therefore, the EFP was essentially designed to allow two normally illegal actions to take place.

1) To permit fishing to take place within the RCA
2) To permit fishermen to land modified fishing-period limits to provide a financial incentive to construct a selective flatfish trawl, and configure and test the new gear.

Net Design

Trawl nets employed in the EFP fishery were required to meet design specifications similar to the original selective flatfish trawl (King et al. 2004). Some vessel owners modified an existing trawl to fit our criteria, while several owners had new trawls built to match the selective flatfish trawl design but scaled it to the appropriate size for their vessel. The design criteria were that the net must have a headrope at least 30% longer than the footrope, that the expected rise of the net could not exceed 1.5 m, that the headrope must not have any floats along the center 50% of its length, and that it must be a two-seam trawl. Otherwise, the trawl had to be a legal small-footrope trawl as defined in federal regulations.

EFP Design

Although allowing the two illegal actions required the EFP, many more restrictions were needed to ensure that catches of overfished species were not exceeded either by an individual vessel or by the project as a whole, and to allow data collected during the fishery to be stratified and analyzed effectively. A single EFP was issued to the state of Oregon and vessel behavior was regulated through state-vessel contracts.

Scope

The project was designed to span the entire shelf flatfish fishing season, including the two-month limit periods of May – June, July – August, and September – October, 2003. Although the project was administered by the state of Oregon, geographic coverage was maximized by selecting three vessels from Charleston, OR, two from Newport, OR, and three from Astoria, OR (Table 1). The number of vessels was constrained to eight because of the limited number of federal fishery observers available and because of the limited amount of canary rockfish mortality that could be incurred while conducting the project.

Table 1. Characteristics of the eight vessels and their selective flatfish trawls selected to participate in the selective flatfish trawl EFP, 2003.

Vessel name	Vessel length (m)	Port	Headrope length (m)	Footrope length (m)	Expected headrope height (m)
Columbian Star	15.8	Astoria	22.5	17.1	1.2
Searcher I	13.7	Charleston	27.7	21.3	1.5
Miss Linda	23.1	Charleston	40.3	31.2	1.4
Amak	21.3	Coos Bay	29.4	21.2	1.4
Prospector	17.7	Newport	34.9	24.8	1.3
Aja	22.2	Newport	40.3	30.8	1.5
Cygnet II	15.2	Warrenton	22.5	17.1	1.2
Home Brew	16.5	Warrenton	22.5	17.1	1.2

Fifty vessels were solicited by mail, based on their recent landing history of shelf flatfish. Each interested vessel owner submitted a net plan based on the defining criteria we supplied. We received 15 applications from interested fishermen (7 Astoria, 3 Newport, and 5 Charleston). We chose vessels by port, from those that submitted net plans closest in design to the original selective flatfish trawl. If necessary, we worked with the fishermen to modify their net plans to result in an acceptable configuration. The eight designs chosen had a range of sizes and footrope lengths (Table 1).

The three vessels chosen in Astoria were smaller vessels that fished in the shallow-water flatfish fishery and did not have the ability to fish seaward of the RCA. To try to collect more information on the fishing practices of these vessels, the project allowed vessels to choose an option where they must restrict their fishing from shore to 183 m as a single fishing area (shallow-water only option), versus fishing either shoreward, inside or seaward of the RCA on a given trip (mixed-shelf option). For the latter option, access to the RCA was limited to east of the 275-m management line (150 fm). The three Astoria vessels chose the shallow-water only option. The other five vessels were required to constrain all their tows on a given trip to within one of the three fishing zones (shoreward of RCA, in the RCA, or seaward of RCA).

All the rules of the EFP were detailed in signed state-vessel agreements. Additional processing rules and allowance for processors to have otherwise illegal amounts of some species in possession due to the EFP were detailed and enforced through state-processor agreements.

Observers
The NWFSC provided federal observers to cover all the vessel's trips during the EFP period. If a vessel requested an observer but one was not available, the vessel was allowed to go fishing, but only outside the RCA. However, because of limited observer availability and concern for data quality, a 100% observer requirement was instituted in mid-August for the remainder of the project. Observers counted and weighed the catch of all rockfishes by species (*Sebastes* genus only), and also conducted normal observer sampling of discarded fish so that total catch could be reconstructed. Only data from observed trips was used for bycatch analysis.

Bycatch Caps
Minimizing mortality of overfished species was paramount for this EFP, especially for canary rockfish, because any large catches could have severe impacts on other fisheries operating coast wide. Therefore, we developed catch projections and overall catch caps for several overfished species (Table 2). If the total catch for any one of the overfished species was exceeded, then the EFP would terminate and all access by the vessels to the RCA would be eliminated. As an additional protection, each vessel also had individual monthly bycatch caps for selected species (Table 2). If a vessel exceeded its cap during the month, as determined by the observer and corresponding landing weights, the vessel was not allowed to fish in the EFP for the remainder of the month. If this occurred twice, the vessel would be removed from the EFP permanently to constrain bycatch for the remaining vessels.

Table 2. Vessel and program catch caps for overfished species in the selective flatfish trawl EFP, 2003. Estimated catch was derived from experimental trawl data from King et al. (2004). Sole catches are in addition to normal fishery landing limits. NA = Not Applicable

Species	Estimated monthly vessel catch plus 10% (kg)	Total program catch cap (mt)	Vessel bycatch cap per month (kg)*
Canary rockfish	42	4.0	154
Widow rockfish	NA	9.9	154
Yelloweye rockfish	18	1.2	104
Darkblotched rockfish *S. crameri*	33	2.1	227
Dover sole	3,175	203	NA
Petrale sole	680	44	NA
Pacific ocean perch *S. alutus*	NA	<0.5	NA
Bocaccio *S. paucispinus*	NA	NA	NA
Cowcod *S. levis*	NA	NA	NA
Lingcod *Ophiodon elongatus*	500	13.0	NA
Pacific hake *Merluccius productus*	500	NA	NA

* Vessel caps are total weight of listed species captured per calendar month.

Catch Documentation

Each vessel was required to retain all rockfishes (genus *Sebastes*) to collect information on what would be landed with this trawl under a full retention fishery. All dead lingcod *Ophiodon elongatus* were also retained and landed with no penalty to the vessel. Vessels operated under modified trip limits to provide a modest financial incentive to participate in the project and to cover costs such as building a new trawl and accommodating an observer (Table 3). Any species required to be retained over normal landing limits was processed as normal and the proceeds forwarded to the state as a legal overage. Vessels were responsible to remain under trip limits for species not under full retention. At-sea observers determined total catch of rockfishes. Landing tickets were used to determine the species composition and weights of all other species. Landing tickets were monitored monthly and logbooks were collected periodically to monitor fishing distribution, catch and bycatch levels.

Table 3. Period landing limits allowed under the EFP detailed by fishing strategy option. Species not listed were either not limited or limits were the same as normal landing limits. Limits are two-month cumulative limits unless noted.

Species / complex	Mixed-shelf flatfish	Shallow-water flatfish
Sablefish	10,000 lbs	7,000 lbs
Longspine thornyheads	14,000 lbs	NA
Shortspine thornyheads	2,800 lbs	2,400 lbs
Dover Sole	39,000 lbs, not more than 35,000 lbs in one month	30,000 lbs
Arrowtooth flounder	200,000 lbs	5,000 lbs
All other flatfish	103,000 lbs, not more than 33,000 lbs may be Petrale sole	75,000 lbs, not more than 25,000 lbs may be Petrale sole
Lingcod	800 lbs	800 lbs
Canary rockfish	300 lbs per month	300 lbs per month
Yellowtail rockfish	200 lbs per month	200 lbs per month
Minor Slope rockfish	1,800 lbs, no more than 200 lbs darkblotched rockfish per month	1,800 lbs, no more than 200 lbs darkblotched rockfish per month
Pacific ocean perch	1,000 lbs	NA
Minor shelf rockfish, widow	1,000 lbs per month, no more than 200 lbs yelloweye, and no more than 200 lbs widow rockfish	1,000 lbs per month, no more than 200 lbs yelloweye, and no more than 200 lbs widow rockfish
Minor nearshore rockfish	300 lbs per month	300 lbs per month

Bycatch rates were calculated using two different measurements. First, bycatch rates of overfished species were calculated as the weight (kg) of the bycatch species divided by the sum (kg) of all target species caught, matching the stratum from the WCOP (Flatfish target: 0-100 fm: for each trip limit period). The target species consisted of all marketable flatfishes except Pacific halibut (*e.g.* Petrale sole, Dover sole, English sole, and rex sole). Variance calculations for the catch ratios were provided by the WCOP for expanded observer data from 2001-2002 (NOAA, 2003) at the tow level. Variance estimates for research data were also calculated at the tow level, but EFP data was collected and analyzed at the trip level, with variance estimates for the catch ratios following Cochran (1977).

Second, the bycatch rates were calculated as the weight (kg) of each bycatch species divided by the sum (kg) of all groundfish species for each stratum. The term "Groundfish" includes all catch except overfished species (J. Hastie, NOAA, Personal Communication). For these data, the species included are listed in Appendix I. This denominator was used to match the methodology used by the PFMC to estimate bycatch rates from the federal WCOP.

Results

The EFP project resulted in 141 trips and 1,371 tows spanning the continental shelf along all of Oregon and Washington during the three landing limit periods (Figure 1). However, because federal observers were not always available to cover every EFP vessel when the vessel wanted to fish, 15 trips (10.6%) were not observed. Non-observed trips occurred infrequently and proportionally for all vessels (Table 4). These trips did not enter into the RCA, except for three tows from two trips (Figure 2), and the catch data was not included in further analysis because of the lack of discard information. Of the three non-observed tows in the RCA, two start positions were estimated via LORAN and depth information to be within 1 km of the edge of the RCA, and one (with Lat: Lon) to be inside the RCA by less than 300 m. Typically, vessels fished shallower than the 275-m boundary for mixed-shelf flatfish strategy vessels and always shallower than the 183-m boundary for shallow-water flatfish strategy vessels (Figure 3).

In addition to unobserved trips, 11 observed trips were made to fish seaward of the RCA, mostly to target longspine thornyheads. These trips were identified by plotting all tow start points and identifying tow locations west of the RCA (defined as 137 – 366 m lines by NOAA) using GIS. Because the target fishery was different than the shelf flatfish fishery, these trips were removed from the bycatch analysis, but are included in Appendix II, which details the total catch landed during the EFP. The eastern RCA boundary changed from 91 m to 137 m on July 1st. Trips that fished in the area between the 91-m and 137-m lines in May or June were analyzed as fishing in the RCA. Lastly, three trips were removed from analysis because the vessel fished both inside the RCA and west of the RCA on the same trip. Our analysis focused on estimating bycatch in the shelf flatfish fishery and comparing catch data with WCOP data, so trips that fished entirely in the RCA or east of the RCA were included. The resulting database used to calculate bycatch rates consisted of 112 trips and 1,125 tows, with 721 tows in the RCA, and 404 shallower than the RCA (Table 4).

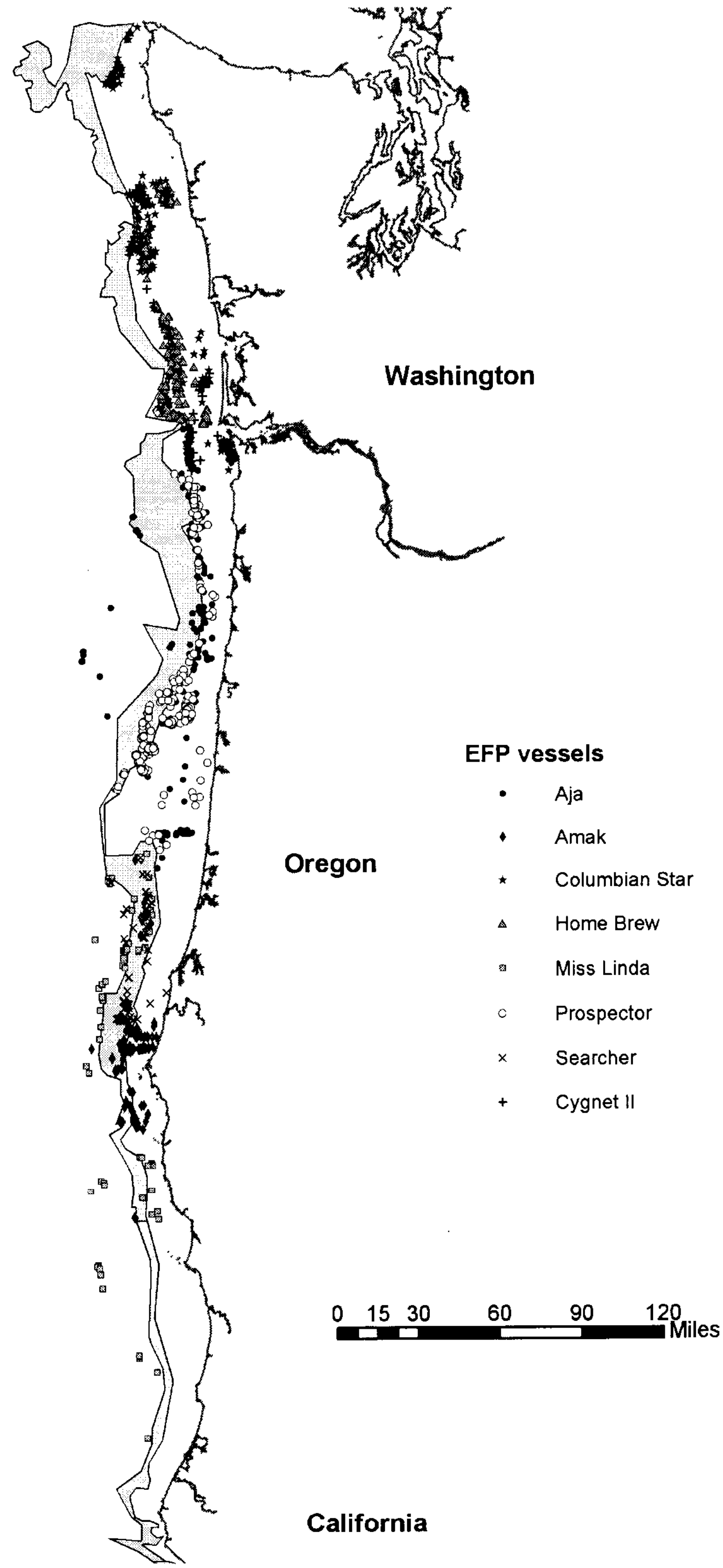

Figure 1. Tow locations for all tows conducted under the selective flatfish trawl EFP, 2003. Symbols are vessel specific. Polygon shows trawl RCA (137 - 366 m).

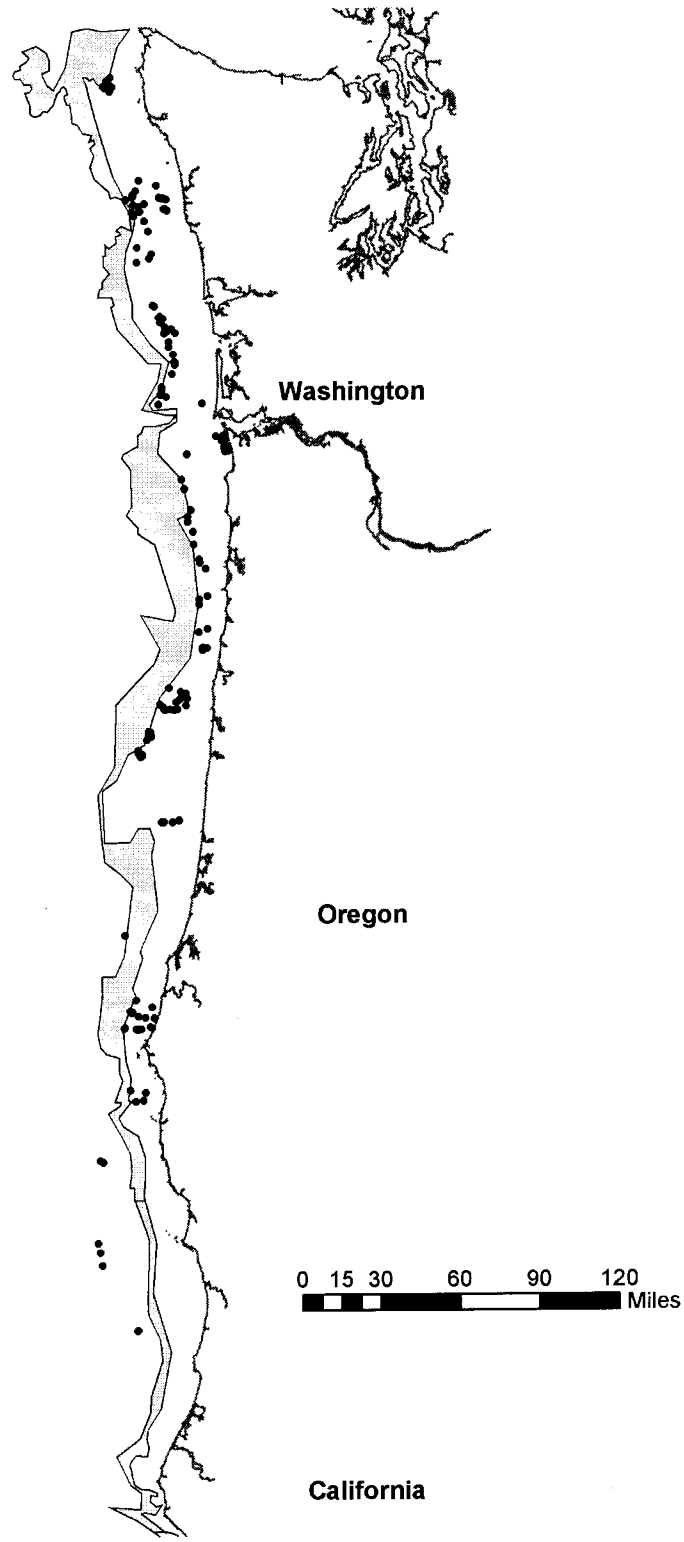

Figure 2. Tow locations for all unobserved trips in the selective flatfish trawl EFP fishery, 2003. Polygon shows trawl RCA (137 - 366 m).

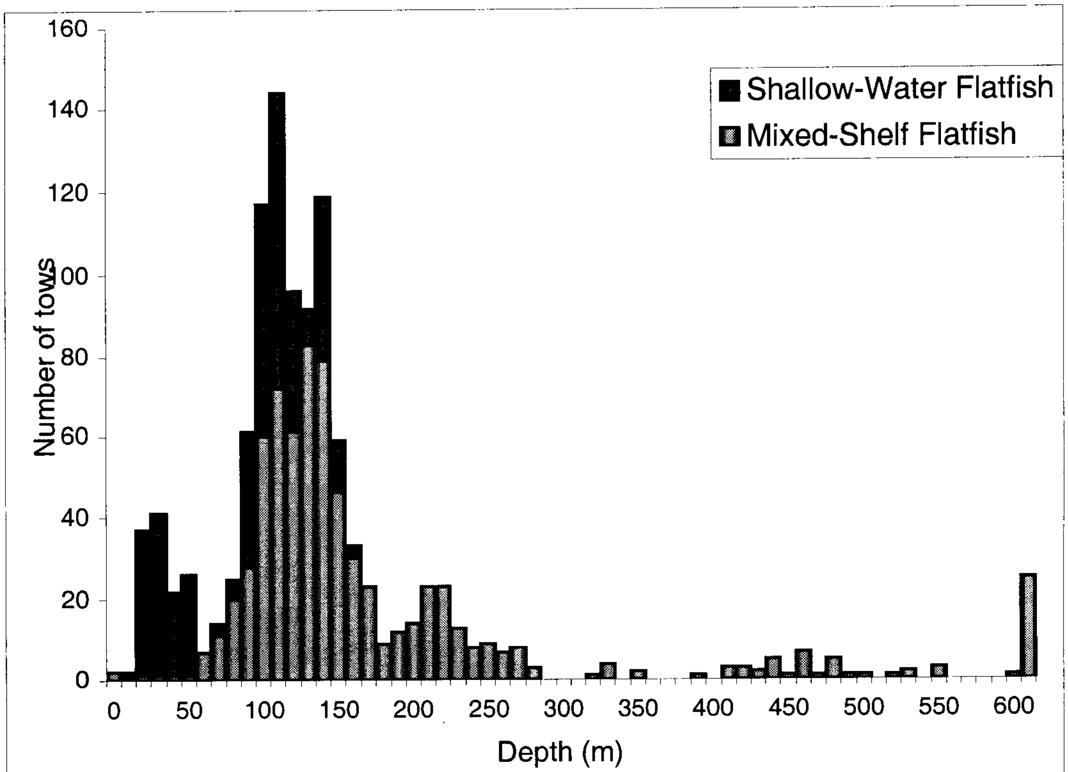

Figure 3. Distribution of all tow depths for vessels targeting mixed-shelf flatfish and shallow-water flatfish in the 2003 selective flatfish trawl EFP fishery.

Table 4. Frequency of unobserved trips and excluded trips for the eight vessels participating in the flatfish trawl EFP fishery, 2003.

Vessel	Number trips	Trips unobserved	Percent unobserved	Other trips excluded	Analyzed trips
Aja	21	2	9.5	3	16
Amak	21	2	9.5	2	17
Columbian Star	16	3	18.8	0	13
Cygnet II	16	2	12.5	0	14
Home Brew	16	1	6.3	0	15
Miss Linda	13	2	15.4	7	6
Prospector	19	2	10.5	0	17
Searcher I	17	1	5.9	2	14
Total	141	15	10.6	14	112

All eight vessels reported excellent net performance and were pleased with their high catch rates for flatfish and with the near complete elimination of Pacific hake using their selective flatfish trawl. Two vessels had some initial trouble tuning the net (*e.g.* net was digging), but following the addition of flotation along the wings, the nets fished well.

Species composition was very different between the mixed-shelf flatfish and the shallow-water flatfish strategies. Vessels had very large landing limits for "other flatfish" and were required to land all rockfish and dead lingcod (Table 3), so compositions for those species can be compared. Landings of Dover sole, Sablefish, and shortspine thornyheads were limited and are therefore similar among strategies. Percent of landed catch for each species shows that the shallow-water flatfish strategy trips caught many times nearshore flatfish species such as butter sole, starry flounder (200x), sand sole (10x), and curlfin sole (10x) (Figure 4). They landed three times the amount of yellowtail per trip because of the northern distribution of those trips, and outpaced the mixed-shelf flatfish strategy for other shelf species such as rex sole, sand dab, and English sole. The mixed-shelf flatfish strategy landed far more lingcod, Pacific ocean perch, and darkblotched rockfish, as expected. Surprisingly, although both strategies could fish out to 183 m, the shallow-water flatfish strategy landed less skates and Petrale sole, along with less canary rockfish and yelloweye rockfish.

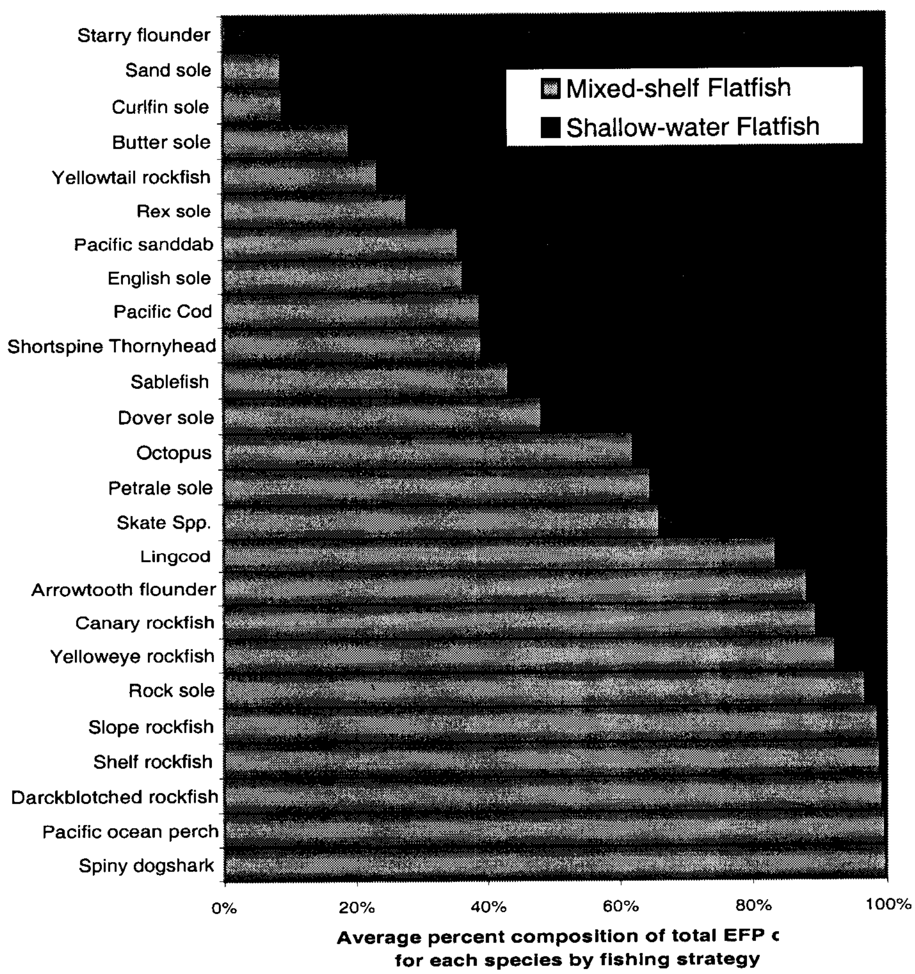

Figure 4. Comparison of catch for each species bewteen the mixed-shelf flatfish and shallow-water flatfish fishing strategies from the selective flatfish trawl EFP, 2003.

Bycatch for all rockfish species, and lingcod was low (Table 5). No bocaccio, widow rockfish, or Cowcod were captured at all. Catch of canary rockfish was well below the EFP cap of 4.0 mt. However, the monthly vessel-specific bycatch caps were exceeded; once by the Aja, and once by the Miss Linda. In both instances the darkblotched rockfish cap was exceeded, suggesting that the overall cap for this species was set too low (2.1 mt vs the 3.2 mt captured). Catches for all other overfished species were under the bycatch caps set in the EFP.

Table 5. Catches (kg) of all overfished rockfish and lingcod by vessel from the selective flatfish trawl EFP fishery, 2003.

	Charleston			Newport		Astoria			All
Species	Amak		Miss Linda	Aja	Prospector	Columbian Star	Cygnet II	Home Brew	Total
Bocaccio	0	0	0	0	0	0	0	0	0
Canary rockfish	108	234	35	174	185	16	5	29	786
Cowcod	0	0	0	0	0	0	0	0	0
Darkblotched rockfish	223	593	1,291	731	355	0	2	7	3,201
Pacific ocean perch	0	260	34	23	209	0	0	0	525
Widow rockfish	0	0	0	0	0	0	0	0	0
Yelloweye rockfish	2	9	0	22	3	2	0	0	39
Lingcod	1,680	737	428	5,119	2,973	495	539	397	12,368

Note: Although hake is overfished, it was not landed under the EFP so catch data is not available.

As with most bycatch data, the rates (kg / kg target) were variable among species, and among periods (Figure 4, Appendix III). For canary rockfish, bycatch estimates from the WCOP and control research tows (King et al. 2004) were similar, except where the research tows targeted rockfish habitat. Bycatch estimates for each EFP class were lower than WCOP or experimental research tows in all three periods. This same pattern was true for most species with the exceptions of darkblotched rockfish and Pacific ocean perch. Darkblotched rockfish were not found often in the 2001 WCOP data because the stratum was limited to 0 – 183 m. The EFP data and the research tows occurred at depths out to 275 m, reaching into darkblotched habitat. A similar pattern was observed for Pacific ocean perch, which also inhabit the deeper portion of the RCA. Widow rockfish and yelloweye rockfish were encountered very infrequently in all data sets, and the bycatch estimates are low but variable. Although fishing occurred south to 41°N, no bocaccio were captured. Lingcod are not excluded by the selective flatfish trawl (King et al. 2004), and for this species, rates were similar between the WCOP and the mixed-shelf flatfish strategy. Lingcod were encountered less frequently in the shallow-water flatfish strategy. Although hake was not retained, fishermen reported that hake catch was extremely low, supporting the results from research tows trawl.

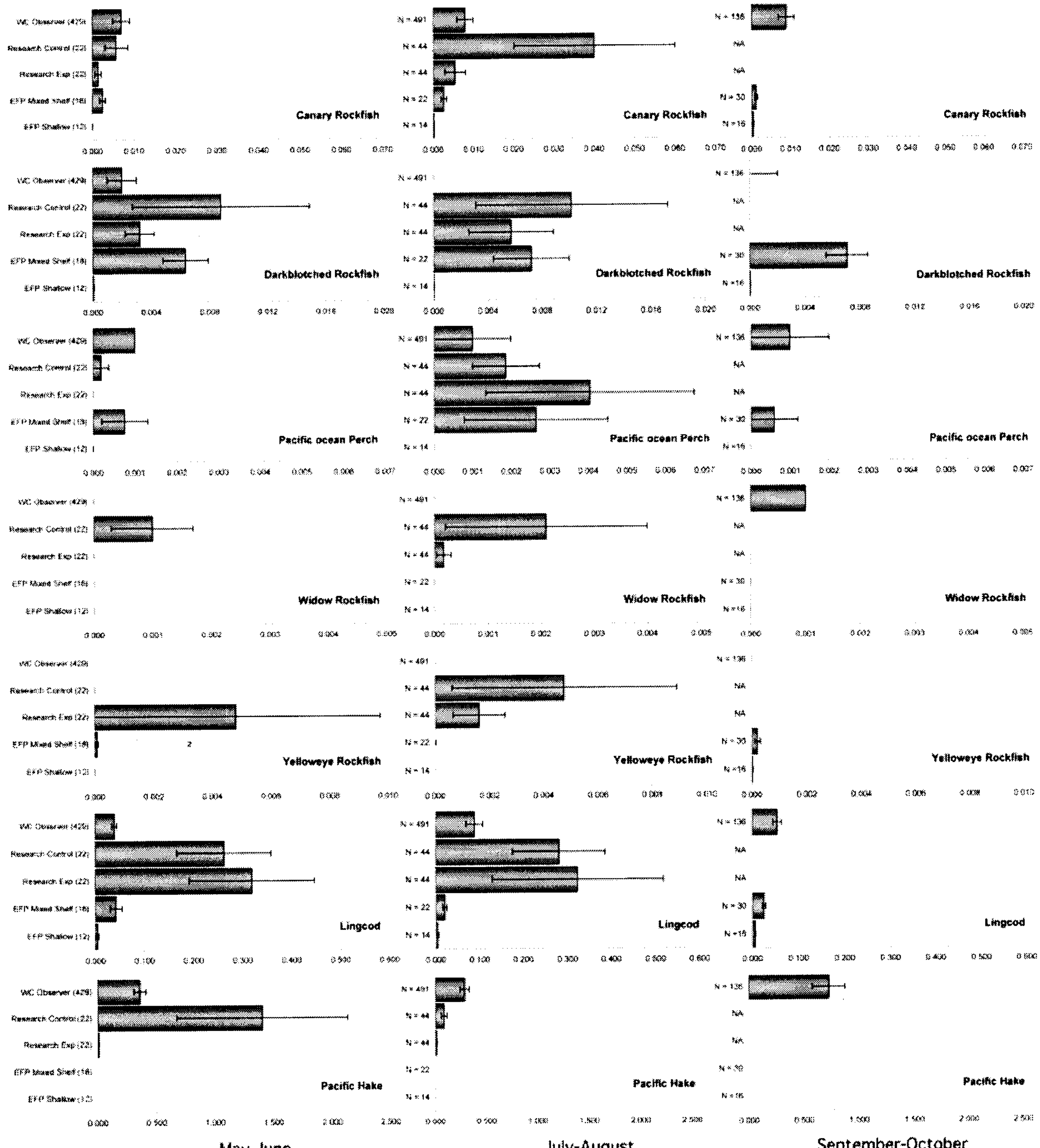

Figure 5. Comparison of bycatch ratios for seven species collected from the west coast observer program in 2001-2002, Research control and experimental tows from King et al. (2004), mixed-shelf flatfish target strategy EFP vessels, and shallow-water flatfish strategy EFP vessels in 2003. No research tows were done in September or October.

Discussion

The selective flatfish trawl design worked well in the normal shelf fishery. Bycatch rates for species expected to escape were low. The fishermen involved all had positive impressions of the net and said they would continue to fish it even outside the EFP program because 1) it caught flatfish well, 2) they did not have to sort hake on deck, and

3) bycatch rates were much lower and would eventually be incorporated into management through the normal federal WCOP. To our knowledge, there are now 11 selective flatfish trawls in use by the fleet, and two additionally modified trawls, built by Foulweather Trawl called "Pioneer Trawls," are in use in Alaska flatfish fisheries. In addition, the selective flatfish trawl design has been included as a bycatch reduction option for a New England bottom trawl fishery.

Trawl performance and bycatch estimates from the EFP agreed well with the conclusions from the controlled study of the selective flatfish trawl (King et al. 2004). As expected, bycatch in the fishery is lower than that from research tows targeting rockfish habitat. However, with EFP fishing alone, one cannot separate the effects of gear performance and fishing behavior, such as choice of fishing location. Although not quantified, we understand from discussions with the EFP fishermen that fishing behavior varied among vessels from avoiding areas with rockfish habitat, to occasionally targeting rockfish habitat to verify for themselves that the net avoided catching rockfishes. King et al. (2004) measured the gear effect directly. Any fishing behavior effect would also be present in the WCOP data, which are the data that bycatch projections are currently based upon and is not a bias specific to the EFP.

The total number of EFP tows is slightly more than the 2001-2002 WCOP total for the stratum (1,125 vs. 1,056 tows). Fishing took place under the EFP from below the California border (41°N) to the Canadian border (Figure 1), and matched the WCOP's "100 fm flatfish" stratum well in scope. Any bias in EFP data compared to the WCOP "100 fm" stratum would be due to EFP tows deeper than 183 m (100 fm) because five of the EFP vessels could fish in the RCA to 275 m. Surprisingly, this did not occur that often (Figure 1). Most fishing in the RCA occurred along the shallow, eastern edge, and varied seasonally (Figure 5), supporting the notion that vessels were targeting flatfish as specified in the state – vessel contracts. Fishermen followed the seasonal migration of Dover sole and Petrale sole into shallower waters during the summer and back into deeper waters in the fall. Differences in bycatch rates for a given species among periods was likely due to changes in the distribution of fishing effort. Differences between the research experimental trawl tows and the EFP mixed-shelf flatfish bycatch ratios are due to the targeting of rockfish habitat in the research tows (*e.g.* widow rockfish, lingcod). For species that avoid capture with the selective

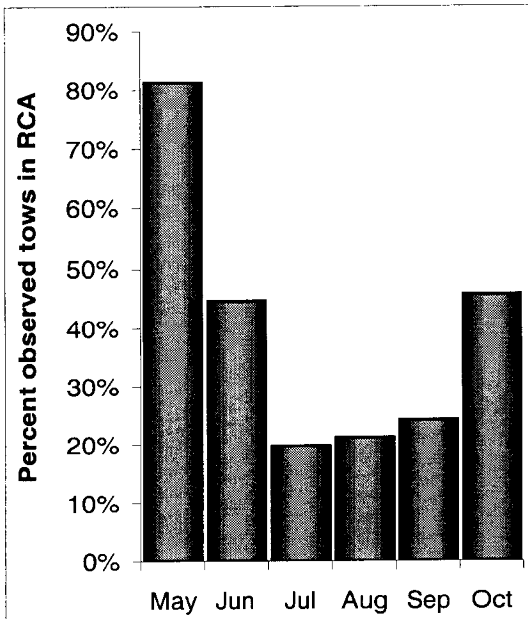

Figure 6. Distribution of fishing effort (tows) relative to the RCA during the selective flatfish trawl EFP, 2003.

flatfish trawl (*e.g.* canary, yelloweye rockfish, hake), the mixed-shelf flatfish strategy showed reductions in bycatch compared to the WCOP data. The reduction is not as dramatic as the reduction observed in King et al. (2004) because the research tows targeted rockfish habitat. However, reductions of more than 65% compared to WCOP rates could be realized by the fishery (Appendix III).

As an aid to implementing the use of this trawl in the fishery, ODFW and Oregon State Police developed objective criteria that could be used to define what characteristics a selective flatfish trawl would need to have in federal rule. These criteria, along with comparative drawings and an instructional video were prepared for enforcement personnel to be able to determine if the gear on a vessel was actually a selective flatfish trawl, and even be able to determine the type of trawl during setting or retrieving a net. This aspect was thought useful for coast guard personnel, or other at-sea enforcement for monitoring gear use.

Fishery Design

Because this trawl gear has different selectivities compared to traditional trawl gear for several important bycatch species, bycatch estimates for any fishery using this type of trawl should be specifically incorporated into the PFMC bycatch projection model. Given the research already conducted using this trawl (King et al. 2004), the number of tows involved in the EFP, and their geographic range, the bycatch rates presented here are the most appropriate rates to estimate future bycatch for fisheries using trawls with these defined characteristics.

As a bycatch reduction tool, we suggest that this trawl could be used in a continental shelf flatfish fishery. Although the final specifications must be developed and approved by the PFMC, we suggest a fishery with the following characteristics:

- The fishery should occur between 42°N latitude and the Canadian border. We have no data to address bocaccio bycatch rates with this trawl and consequently recommend additional controlled experiments in California to determine its effectiveness there.
- The fishery should require the use of a selective flatfish trawl as defined in federal regulations (as discussed above) and enforced by state and federal enforcement agents.
- The fishery could accommodate enhanced landing limits for Dover sole, Petrale sole, and other flatfish compared to the normal small footrope landing limits. The increase in flatfish catch should encourage switching to a more selective trawl gear, but not so large that flatfish landings increase dramatically and influence the market (Table 6). Trip limits for sablefish and shortspine thornyheads should remain at close to incidental levels to minimize discard of marketable fish but not lead to large effort shifts from the slope fishery.
- Until more data can be obtained from this trawl through normal WCOP coverage, we recommend using the most conservative rate generated using this trawl in the fishery, which was the mixed-shelf flatfish strategy segregated by trip limit period. By simply scaling the amount of flatfish catch in the fishery, the associated bycatch can be estimated using the recommended bycatch rates compared to rates from the 2001 –

Table 6. Comparison of trip limit structure (two-month periods, in pounds) for 2001 (the last year of RCA access), 2004, and proposed selective flatfish trawl for 2005, for May through October periods				
Species / complex	2001 Small footrope	2004 Small footrope	2004 Large footrope	2005 Selective trawl[a]
Dover sole	20,000	21,000	45,000	35,000
Arrowtooth flounder	15,000	6,000	150,000	50,000
Petrale sole	30,000	25,000	100,000	35,000
Other flatfish	*	35,000	100,000	60,000
Sablefish	11,000	5,000	8,700	7,000
Shortspine thornyhead	1,500	1,000	2,100	1,500
Longspine thornyhead	6,000	1,000	10,000	5,000

* Petrale and all other flatfish limits were combined in 2001.

[a] In lieu of small footrope trawl limits

2002 WCOP or the rates used by the PFMC (Figure 7). It should be noted that current PFMC model rates are slightly lower than WCOP rates from 2001-2002 because fishing is now restricted to outside the RCA (though the RCA changes seasonally). The difference in bycatch generated by the two rates can be viewed as a savings that could be applied to this fishery or other fisheries facing bycatch constraints, especially from canary rockfish and yelloweye rockfish.

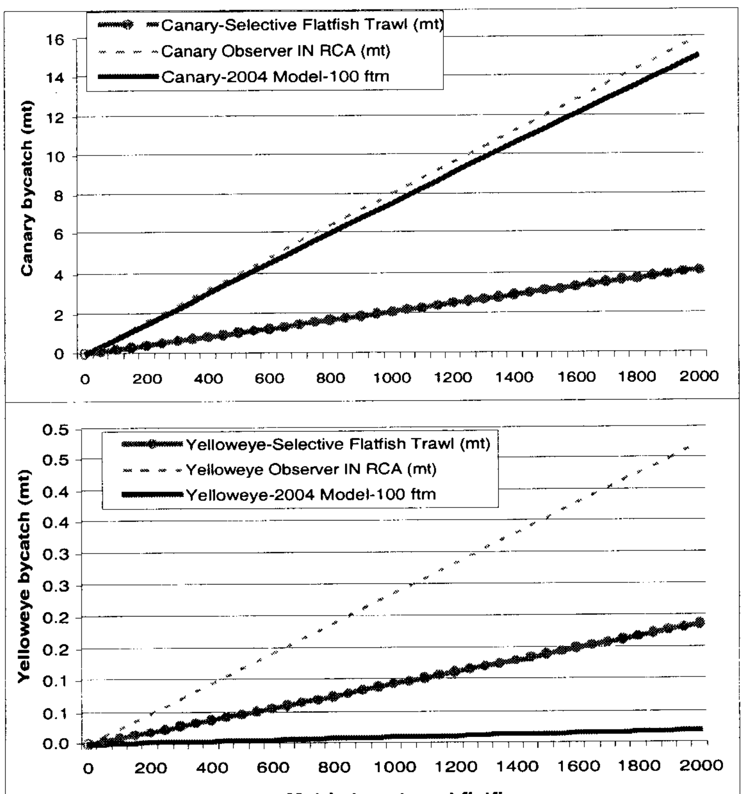

Figure 7. Comparison of canary rockfish and yelloweye rockfish bycatch estimates various levels of flatfish harvest using the selective flatfish trawl versus traditional t gear. Lines show catch using rates from the selective flatfish trawl (mixed-shelf fla strategy), 2001-2002 observer data with fishing in RCA, and 2004 PFMC bycatch rr for 100 ftm fishing limit.

- It is clear from EFP data, from the shelf experiment (King et al. 2004), and from new slope work done with this trawl (ODFW, Unpublished data), that the selective flatfish trawl does not avoid the capture of darkblotched rockfish. The RCA for traditional bottom trawls is in place to avoid capture of species of concern (mainly canary, yelloweye and darkblotched rockfish). The RCA for the selective flatfish trawl should be appropriate for its catch characteristics. Therefore, any fishery developed using this gear should not be allowed deeper than about 183 m (100 fm), the shallow end of the darkblotched rockfish distribution (Orr et al. 2000, Rogers et al. 2000). Flatfish target fishing with this trawl could be allowed out to 183 depending on the amount of available canary and yelloweye rockfish, which will be dependent on the number of vessels using the trawl. In this way, fishing with the selective flatfish trawl occurs outside the RCA by definition.
- The shelf flatfish fishery traditionally follows the movement of flatfish into shallower waters in the summer, and back into deeper waters in the fall. In the summer months, fishermen typically fish east of the RCA (< 137 m), as observed in the EFP when they could have fished in the RCA and didn't during the summer months (Figure 5). The periods when fishermen would need access to fish deeper than 137 m are spring and fall. Therefore we suggest allowing the selective flatfish trawl fishery to occur from May through October with a depth restriction of 0 – 183 m (100 fm). This depth zone also facilitates using an already established RCA boundary at 183 m. If bycatch needs to be reduced further, the fishery could be restricted to less than 137 m for July – September, but this makes the fishery unnecessarily complicated given the small additional bycatch savings.
- Participation in this fishery would not require 100% observer coverage, but should fall under the normal randomly-assigned observer program coverage to collect data, which should provide approximately 20% coverage in 2005. Because the trawl can be objectively defined and compliance can be easily enforced (both at sea and at the dock), use of the trawl can be documented and enforced through normal methods. The effectiveness of the trawl has been documented through a controlled experiment, and trawl performance in the fishery has already been measured.
- The fishery should be open to all limited entry trawl vessels as an alternate trawl gear by creating separate limits for large footrope, normal small footrope, and the small footrope selective flatfish trawl (SFT). These limits would work like current large and small footrope limits, where vessels may fish with any trawl type during a landing period, but their limits would be the most restrictive limits given the gear type actually used during the period: similar to the current rule for use of small footrope gear. Each fisherman would then operate normally and determine the best option on a trip limit period basis. Landing limit structure will influence this turnover and once fishing with a selective flatfish trawl, there should be no reason to return to normal small footrope trawl gear.

- As an alternative to have three gear types in the long run, it may be possible to replace small footrope trawl gear with the selective flatfish trawl. We note that the restrictive limits on small footrope trawl use have resulted in a 46% reduction in small footrope trips between 2001 and 2003 in Oregon and Washington (Table 7). With the large decrease in trips using small footrope gear and with the large bycatch reductions realized using this trawl, it may be feasible to require the use of the selective flatfish trawl for the small footrope fleet and phase out traditional small footrope gear all together. The higher flatfish limits would more than compensate for any trawl modifications (Table 6). This action is not necessary but would simplify management logistics by removing the need to move the RCA shoreward boundary several times each year to accommodate the summer fishery.

Table 7. Number of small footrope and large footrope landings between 2001 and 2003 in west coast ports, May – October periods. Numbers in parentheses are the percent of total trips in that season (ODFW, unpublished data).

Gear type	2001	2003	% Change
Small footrope			
Washington	336 (91%)	393 (86%)	-5%
Oregon	465 (52%)	225 (28%)	-46%
California	879 (79%)	391 (43%)	-45%
Large footrope			
Washington	32 (9%)	62 (14%)	57%
Oregon	427 (48%)	567 (72%)	67%
California	236 (21%)	509 (57%)	67%
Total trips	2,375	2,147	

- Because the number of vessels has been reduced through the vessel-buyback program, trip limits for shelf flatfish should increase at some point in 2004. The two interrelated pieces of information we lack to describe a selective flatfish trawl fishery for 2005 are 1) the trip limits for shelf flatfish in 2005 after adjustment for vessel reductions, and 2) how many vessels would participate in the program in 2005, effectively switching their bycatch rates from the model rates to the EFP recommended rates for each period. This latter number may be small since so few vessels made small footrope landings during May-October in 2003.

The higher flatfish limits and access to fishing grounds would provide an incentive to participate in the fishery, and also serve as a mechanism to move more selective flatfish trawls into other fisheries because it clearly has lower bycatch rates for many species of concern, and higher catch rates mostly for flatfishes. In a larger view, use of a selective flatfish trawl by many vessels is a positive step for bycatch reduction and should be encouraged.

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Appendix I. **List of all species considered "target" and "groundfish" when calculating bycatch rates.**

Target species	Groundfish species
English sole	Shelf rockfish:
Rock sole	Dusky rockfish
Petrale sole	Greenstriped rockfish
Dover sole	Harlequin rockfish
Rex sole	Puget Sound rockfish
Starry flounder	Pygmy rockfish
Butter sole	Redstripe rockfish
Sanddab	Rosethorn rockfish
Sand sole	Silvergray rockfish
Curlfin sole	Stripetail rockfish
Arrowtooth flounder	Slope rockfish:
Misc. flatfish	Aurora rockfish
	Redbanded rockfish
	Rougheye rockfish
	Sharpchin rockfish
	Shortraker rockfish
	Splitnose rockfish
	Yellowtail rockfish
	Shortspine thornyhead
	Longspine thornyhead
	Pacific cod
	Grenadier
	Sablefish
	Lingcod
	Spiny dogfish
	FMP shark
	Skate
	Green sturgeon
	English sole
	Rock sole
	Petrale sole
	Dover sole
	Rex sole
	Starry flounder
	Butter sole
	Sanddab
	Sand sole
	Curlfin sole
	Arrowtooth flounder
	Misc. flatfish
	Octopus

Appendix II. Detail of all landed catch (grouped by market category) during the Oregon selective flatfish trawl EFP 2003 by port (mt).

Species	Astoria	Newport	Coos Bay	Total
Arrowtooth flounder	3.873	37.145	21.808	62.825
Butter sole	0.081	0.000	0.000	0.081
Canary rockfish	0.048	0.359	0.376	0.783
Curlfin sole	0.297	0.032	0.019	0.347
Darkblotched rockfish	0.009	1.085	2.107	3.201
Dover sole	108.824	80.763	115.587	305.174
English sole	65.992	42.381	24.930	133.304
FMP shark	0.000	0.023	0.000	0.023
Green sturgeon	0.000	0.010	0.018	0.028
Grenadier	0.000	0.090	3.338	3.428
Lingcod	1.432	8.092	2.845	12.368
Longspine thornyhead	0.000	3.012	11.744	14.756
Misc. flatfish	3.230	0.000	0.059	3.289
Octopus	0.320	0.424	0.332	1.075
Pacific cod	23.172	19.063	2.910	45.145
Pacific ocean perch	0.000	0.231	0.293	0.525
Petrale sole	27.522	55.386	38.619	121.527
Rex sole	19.480	5.469	12.849	37.798
Rock sole	0.043	0.352	1.587	1.981
Sablefish	27.029	27.876	21.951	76.857
Sand sole	25.959	0.681	3.574	30.215
Sanddab	7.672	9.463	0.046	17.180
Shelf rockfish	0.024	3.488	2.470	5.981
Shortspine thornyhead	1.698	1.230	4.648	7.576
Skate	44.738	81.625	69.396	195.759
Slope rockfish	0.010	0.345	1.559	1.914
Spiny dogfish	0.000	1.264	0.011	1.275
Starry flounder	11.110	0.009	0.042	11.162
Yelloweye rockfish	0.002	0.025	0.011	0.039
Yellowtail rockfish	0.369	0.165	0.030	0.564

Appendix III. Overall bycatch rates for each overfished species captured in the selective flatfish trawl EFP, 2003. Bycatch rates are kg/kg groundfish, or kg/kg target species complex. Values are strategy ratios ± standard error.

Period	Strategy	Species	Bycatch per kg groundfish	SE	Bycatch per kg target	SE
May-June	Mixed-shelf flatfish	Canary rockfish	0.0036	0.0013	0.0024	0.0007
		Darkblotched rockfish	0.0095	0.0026	0.0064	0.0015
		Pacific ocean perch	0.0011	0.0009	0.0008	0.0006
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0001	0.0001	0.0001	0.0000
		Lingcod	0.0626	0.0176	0.0423	0.0123
May-June	Shallow-water flatfish	Canary rockfish	0.0001	0.0001	0.0000	0.0000
		Darkblotched rockfish	0.0001	0.0001	0.0000	0.0000
		Pacific ocean perch	0.0000	0.0000	0.0000	0.0000
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0000	0.0000	0.0000	0.0000
		Lingcod	0.0108	0.0063	0.0045	0.0032
July-August	Mixed-shelf flatfish	Canary rockfish	0.0060	0.0017	0.0027	0.0007
		Darkblotched rockfish	0.0160	0.0063	0.0072	0.0028
		Pacific ocean perch	0.0059	0.0040	0.0027	0.0019
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0000	0.0000	0.0000	0.0000
		Lingcod	0.0482	0.0138	0.0217	0.0043
July-August	Shallow-water flatfish	Canary rockfish	0.0004	0.0002	0.0001	0.0001
		Darkblotched rockfish	0.0001	0.0001	0.0000	0.0000
		Pacific ocean perch	0.0000	0.0000	0.0000	0.0000
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0000	0.0000	0.0000	0.0000
		Lingcod	0.0141	0.0067	0.0048	0.0022
September-October	Mixed-shelf flatfish	Canary rockfish	0.0021	0.0007	0.0012	0.0003
		Darkblotched rockfish	0.0130	0.0035	0.0070	0.0015
		Pacific ocean perch	0.0011	0.0011	0.0006	0.0006
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0004	0.0002	0.0002	0.0001
		Lingcod	0.0469	0.0076	0.0255	0.0037
September-October	Shallow-water flatfish	Canary rockfish	0.0015	0.0005	0.0004	0.0002
		Darkblotched rockfish	0.0001	0.0001	0.0000	0.0000
		Pacific ocean perch	0.0000	0.0000	0.0000	0.0000
		Widow rockfish	0.0000	0.0000	0.0000	0.0000
		Yelloweye rockfish	0.0001	0.0001	0.0000	0.0000
		Lingcod	0.0185	0.0048	0.0054	0.0013

Issues Related To Implementing A Selective Flatfish Trawl in the U.S. West Coast Shelf Trawl Fishery (raised by GMT)

1. Should 100% observer coverage be required for fishing within the trawl RCA?

Since the trawl has a proven and measured bycatch reduction effect (based on a randomized block, alternate haul experiment, King et al. 2004) for several rockfish species (particularly canary rockfish), 100% observer coverage is not needed to obtain the projected bycatch reduction when using this trawl in a fishery, either inside or outside the trawl RCA. Data from the EFP also show that the selective trawl can be objectively defined for enforcement purposes and that fishers can modify existing 2-seam trawls to turn them into selective flatfish trawls (Parker et al. 2004). The significant gear effect precludes a large behavioral component (*e.g.* choice of fishing location) in determining bycatch rate. Accordingly, normal observer coverage is indicated for this fishery.

Deployment of additional observers in any fishery should be based on individual fishery impacts, gear selectivities and bycatch coefficients of variation and should be used to improve region-wide bycatch estimates for all fisheries. The pink shrimp trawl fishery, for example, operates almost exclusively inside the RCA, but has only received minor levels of observer coverage, mostly because proven bycatch reduction devices are required.

2. Should a new selective flatfish trawl RCA be created?

The RCA boundaries currently vary from year to year and season to season, based on projected impacts on overfished rockfish species and the catch limits established for areas outside the RCA. Partial or full implementation of the selective flatfish trawl in areas shoreward of the RCA should result in changes in the current inside (shoreward) RCA boundaries because of lower projected rockfish catch. The Oregon EFP report (Parker et al. 2004) recommends a shoreward boundary be established for the RCA consistent with the catch characteristics of the selective flatfish trawl (100 fathoms), providing impact levels on overfished rockfish species can be kept low enough to meet other management objectives. Allowing unrestricted access to the RCA with the selective flatfish trawl has not been proposed due to anticipated impacts on darkblotched rockfish, which do not escape the selective trawl in significant numbers.

3. Does each alternative in Table 1 meet the management objectives?

All of the options, with the exception of status quo, can probably be configured to meet the management objectives. Status quo probably cannot meet the management objective of reducing bycatch to the extent possible, since this option would allow continued use of a higher bycatch gear in areas in which canary rockfish bycatch is constraining fisheries, even though a proven lower bycatch gear is available. Options which allow both the selective flatfish trawl and conventional small footrope trawls will not reduce bycatch rates as much as complete replacement with more selective gear, and in that sense fail to optimize harvest and minimize bycatch for some species. Also, options that do not allow fishing to occur out to 100 fathoms using the selective gear forgo harvest opportunities of some stocks without a significant bycatch impact.

4. Should full retention of rockfish be required with use of the selective flatfish trawl?

This is an issue that is not specific to the selective flatfish trawl, and may be more of an issue with conventional trawls that generate more rockfish bycatch. Full retention offers a benefit in that landing tickets can be used to estimate rockfish mortality, and some fish that otherwise might be discarded can be utilized. However, data from the EFP fishery showed that the few rockfishes landed under the full-retention rule were too small to be utilized and were simply ground upon landing, so there was little benefit in retaining rockfish in this shelf flatfish fishery. In fact, the perception of waste was increased because these fish were ground and discarded on shore. This aspect may be different in different fisheries or may vary with latitude for some species.

These benefits are offset by difficulties of enforcement (observer cost) and the possibility that in a small number of shallow tows, full retention could increase total rockfish mortality. In shallow shelf flatfish fisheries, some hauls are prosecuted at depths at which discarded rockfish would have a non-zero rate of survival, especially in sand sole and English sole tows, particularly with respect to incidental catch of black rockfish and yellowtail rockfish. These semi-pelagic species are more resilient to barotrauma effects and may survive at relatively high rates if discarded.

Full retention in fisheries such as the deepwater complex would prove more useful because rockfish bycatch can occur at higher rates, and the fish that are captured are more likely to be of marketable size and can be utilized. Full retention becomes part of a larger issue of observer coverage because observers would be required to ensure compliance. The concept of full rockfish retention needs to be developed further in terms of targeting fisheries with high rockfish bycatch of species that are usually of marketable size. These fisheries will also likely be prime candidates for higher levels of observer coverage to reduce the variance in bycatch rate estimates as discussed above.

5. What are the costs of the new trawl?

Costs for vessels participating in the selective flatfish trawl EFP ranged from $0 to modify an existing trawl up to about $8,000 for a brand new, large, complete selective flatfish trawl.

6. What are the benefits from implementing the new trawl?

Implementing the new trawl will allow increased yield from shelf flatfish stocks that are currently harvestable, but constrained by bycatch of canary rockfish. As canary rockfish stocks rebuild, lower canary rockfish bycatch rates in the shelf trawl fishery could enable more rapid increases in harvest levels in other fisheries currently constrained by canary rockfish bycatch, or relaxation in the depth or area restrictions for these fisheries. Use of this trawl also allows the escape of other species such as Pacific hake, which are typically discarded by bottom trawlers, and other species of rockfish (e.g. redstripe) that are sometimes captured in the shelf flatfish fishery.

7. Bycatch estimates with increased trip limits?

These depend on the actual limits selected and estimated participation in the shelf flatfish fishery under the increased limits (models needed reside with NMFS NWFSC staff). Appropriate bycatch rates are available from Parker et al. (2004) and can be estimated for various limits, but should be roughly 76% lower for canary rockfish than levels projected for similar limits taken with conventional trawls of similar size. Very large changes in trip limits are not recommended because they could greatly increase participation in this fishery. Trip limits should be adjusted to allow higher flatfish catch, recover costs of switching to a new trawl, and provide incentives for fishermen to use a more selective trawl gear.

8. How can EFP research and issues raised above be applied outside selective gear fisheries?

In some respects, the development of the selective flatfish trawl can serve as a potential model for the development of novel management measures and technology transfer of management measures into the fishing industry and into regulation. The concepts that were used in development and technology transfer for the selective flatfish trawl included the following.

1. Generating an idea - Development of scientific evidence that a novel management measure has some potential for helping to solve a management problem. For the selective flatfish trawl this involved mostly a literature review, but for other management measures it

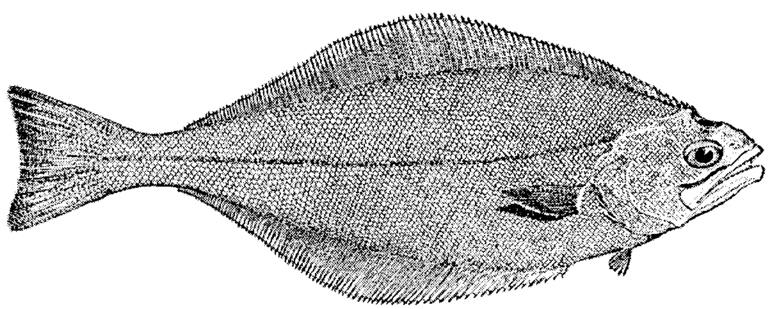
could be simulation modeling, testimony from industry or experience with a management approach in another region or fishery.

2. Initial testing - Initial testing of the novel management measure in a small-scale science-based experiment or Exempted Fishing Permit (EFP) fishery. For the selective flatfish trawl, this was accomplished via alternate haul, randomized block fishing experiments comparing conventional and selective flatfish trawls on the continental shelf and slope (e.g. King et al. 2004).
3. Fishery-scale testing - Testing of the management measure in an experiment on a larger geographic and time scale to allow the fishing industry to gain experience with the novel management measure. In this case, the 2003 EFP fishery filled that role.
4. Development of Draft Rule Language - The development of appropriate rule language to implement the novel management approach in consultation with enforcement officers.

Another way that the selective flatfish trawl research might be useful in another context could be to utilize the experimental results with this trawl in other fisheries. For example, if other fisheries have essentially the same bycatch issues (*e.g.* canary rockfish on the shelf), then the selective flatfish trawl would allow managers to reduce bycatch through a known gear effect, making it easier to create regulatory language to enforce a bycatch reduction mechanism.

Proposed Arrowtooth Flounder - Rockfish Conservation Area (AT-RCA) Trawl Fishing Program

Scoping Document



March 2004

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Intergovernmental Resource Management
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TABLE OF CONTENTS

List of Tables

Appendices

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE (WDFW) PROPOSED ARROWTOOTH FLOUNDER-ROCKFISH CONSERVATION AREA (AT-RCA) TRAWL FISHING PROGRAM

SCOPING DOCUMENT

1. BACKGROUND AND PURPOSE

Excluding Pacific whiting, the West Coast groundfish fishery stocks and harvests have been declining since the early 1990s. Since 1993, due to the increasingly severe harvest restrictions, landings of groundfish have fallen. Most of the decline has occurred in recent years with current levels of harvest being less than half of the harvests achieved in 1993. Over the last two decades, an unusually low level of recruitment into the fishery has occurred for many groundfish species.

Changes in the oceanic regime and an abnormally high number of El Nino events are likely to have contributed to the decline in the recruitment of several important long-lived rockfish species. These causes have exacerbated the difficulties in setting harvest quotas that attempted to counteract the decline in these stocks. This has a primary effect on the fishers and their crews, and secondary effects on port communities and fishery-related businesses, such as fish processors. The complex dynamics of managing the groundfish fisheries is further affected by the fact that recovery of these long-lived species will range from 10 years at the minimum to in excess of 50 years.

In recent years, the Pacific Fishery Management Council has been presented with new scientific information which suggests that productivity of West Coast groundfish is unusually low. As a result, more restrictive management measures have been adopted since 1998. During the 1983-1999 period, coastwide non-whiting landings have decreased 65 percent from 107,000 metric tons to 38,000 metric tons. In terms of revenue for the same period, non-whiting revenues have declined by 54 percent from $99.9 million to $46 million. The decline in abundance has been particularly severe for rockfish and flatfishes which account for about half of the non-whiting revenue.

Since 1998, the Pacific Council has initiated rebuilding plans for nine overfished groundfish species. Critical to these rebuilding plans and to the overall improvement of groundfish management is the need for more and better scientific data. There are 82 species covered under the West Coast Groundfish Fishery Management Plan, and at present, there is little or no data on a large number of these species. There is a need for comprehensive, timely and credible data for priority species to aid in the conservation and rebuilding efforts for these stocks.

In January 2000, the Secretary of Commerce declared a commercial fishery failure in the Pacific Coast groundfish fishery. In response to the request for disaster assistance, Congress appropriated $5 million in federal assistance to the affected states. Washington State received $1.5 million of the total appropriation, and a portion of those Disaster Relief funds ($300K) went to WDFW to implement its At-Sea Data Collection Program.

The AT-RCA program has been conducted under an Exempted Fishing Permit (EFP) for four years, as part of the WDFW At-Sea Data Collection Program. This project was initiated in 2001 to allow fishers access to healthier groundfish stocks while meeting the rebuilding targets of overfished stocks, and to collect bycatch data through an at-sea observer program. It was understood that the data collected in these programs would assist with future fishery management by producing valuable and accurate data on the amount, location and species composition of the bycatch of rockfish associated with these fisheries, rather than using calculated bycatch assumptions. It was also thought that these data would allow the Pacific Council to establish trip limits in the future that maximize fishing opportunities on healthy stocks while meeting conservation goals for depleted stocks.

Pacific Coast groundfish are managed by the Pacific Fishery Management Council under a federal fishery management plan (FMP). The management goals of the FMP are to:

1. Prevent overfishing by managing for appropriate harvest levels and prevent any net loss of the habitat of living marine resources.

2. Maximize the value of the groundfish resource as a whole.

3. 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.

In 2000, the Council adopted a Groundfish Fishery Strategic Plan. Strategic plan goals include:

- To adopt understandable, enforceable, and stable regulations that, to the greatest extent possible, meet the FMP's goals and objectives and the requirements of the Magnuson-Stevens Act.

- To establish an allowable level of catch that prevents overfishing while achieving optimum yield based on best available science.

- To quantify the amount and species of fish caught by the various gears in the groundfish fishery and account for total fishery-related removals.

The Groundfish Strategic Plan suggests that observer coverage be prioritized, perhaps focusing on collecting total mortality data for overfished groundfish stocks. As a secondary priority, the plan also states that an observer program should supplement the collection of data for stock assessments. Both of these objectives, along with the goals outlined above, are addressed with the proposed AT-RCA program.

The purpose of the AT-RCA program is to assist the Pacific Fishery Management Council in achieving the goals of the FMP by collecting bycatch data on overfished stocks (e.g., canary rockfish) to allow for informed management decisions, while maximizing safe harvest levels of healthier stocks (e.g., arrowtooth flounder).

Specifically, the objectives of the AT-RCA program are to:

- Use data collected from previous fisheries conducted under Exempted Fishing Permits to provide trawl fishers limited access to the federal trawl rockfish conservation area to target arrowtooth flounder.

- Continue to measure bycatch rates for canary and other rockfish associated with the arrowtooth flounder fishery through an at-sea observer program.

- Require the retention of all rockfish to acquire biological (age and sex) data for stock assessments through state shoreside sampling programs.

- Collect data that could be used to augment the National Marine Fisheries Service (NMFS) groundfish observer program.

- Encourage innovative ideas to develop and test selective gears.

While the AT-RCA program has been implemented through an EFP, NMFS has provided strong guidance that EFPs should have a termination date, and should not be used solely for the economic benefit of the participants. Again, from the initiation of the EFP, NMFS and the Council stressed the importance of using the data collected in these programs on a broader scale to assist with future fishery management. There was also support to apply these data to establish trip limits in the future that maximize fishing opportunities on healthy stocks while meeting conservation goals for depleted stocks.

The requirements of the AT-RCA program have been refined over time; in 2001 and 2002, the program primarily focused on the use of state-sponsored monitors onboard vessels to monitor bycatch, and collect discard data and biological samples. Beginning in 2003, WDFW required participating fishers to use an excluder device in an effort to minimize rockfish bycatch. There were no specific parameters identified; participating fishers were allowed to experiment with different excluder types. All of the participants used one of three types of excluders–these are defined and required as part of the 2004 EFP, and as part of the proposed AT-RCA program. Also for 2004, the participants will not have full access to the trawl rockfish conservation area (RCA), but are required to avoid areas of higher rockfish bycatch within the RCA. These closed areas have been defined through results from the first three years of the EFP, and are part of the provisions of the proposed AT-RCA program.

As the EFP has been refined over time, with more requirements each year, the participating fishers have been adamant in their belief that the majority of the bycatch reduction is a result of having an onboard monitor and hard bycatch caps for overfished rockfish, primarily canary. The presence on an onboard observer or state-sponsored monitor has caused the fishers to change their fishing behavior. They are actively avoiding areas with higher bycatch rates, experimenting with gear modifications to exclude rockfish, and taking a more precautionary approach to fishing practices in general, in order to stay within their bycatch caps while maximizing targeted catch.

WDFW believes that the AT-RCA program has been a success as an EFP and the data collected has been extremely valuable. Aside from the bycatch and biological data, the EFP has demonstrated that certain management tools, such as an at-sea monitoring program, bycatch caps for overfished rockfish, and mandatory rockfish retention, can be successfully implemented and also supported by fishers by providing economic incentives.

Since this management approach has been successfully demonstrated and refined over the four years of the program, there is little value in continuing the AT-RCA program as an EFP and much to be gained by moving the program into federal regulations. Because the EFP has been funded with state Disaster Relief monies, participation in the EFP has been limited to Washington-licensed trawl fishers; having the program defined in federal regulations would provide the opportunity to participate in the AT-RCA program to all West Coast trawl fishers.

2. ALTERNATIVES

Alternative 1. No action alternative (status quo). This alternative reflects no special provision for a conservation area approach to provide targeted trawl fishing opportunity for arrowtooth flounder, either through an EFP or federal regulations. Under this alternative, the EFP would be discontinued and arrowtooth fishers and processors would have to harvest and fill markets with arrowtooth that may be available outside the trawl RCA. It would result in no changes in management costs and no increase in costs for trawl fishers. For those participants in the Washington arrowtooth flounder EFP, there would be significant reductions in revenue. There would also be significant impacts to the facilities that process arrowtooth flounder and to their communities as a result of discontinuing the EFP. The vessels that fished under the EFP would likely fish seaward of the trawl RCA to access higher large footrope limits. As a result, there could be changes in fishing mortality of targeted stocks (arrowtooth flounder and petrale sole), bycatch of overfished rockfish and non-rockfish species, EFH impacts as a result of changing areas fished, and enforcement costs. The expected impacts of this alternative are compared with the expected impacts of Alternative 2 in the analysis of Alternative 2 below.

Alternative 2. Implement the provisions of the previous Washington Arrowtooth Flounder EFP into federal regulations. This alternative would integrate all of the provisions of the Washington arrowtooth flounder EFP into regulations pertaining to limited entry trawl permitted vessels fishing for groundfish within the EEZ. Specifically, this option would allow trawl fishers to access portions of the trawl RCA north of Destruction Island, WA, and have higher limits for arrowtooth flounder and petrale sole for the May-August time period. The provisions of this alternative include: implementation of a full rockfish retention program; 100% observer coverage (either by a state-sponsored monitor or a federal observer); fully funded by the permit holder; bycatch caps for overfished stocks; rockfish excluder requirements; and VMS declaration requirements. A full description of the regulatory provisions for this alternative are contained in Appendix A.

3. ANALYSIS

Management Costs - There is expected to be an increase in management costs as a result of modifying the VMS declaration system and administering the state-sponsored monitoring programs. The intent of this regulation would be to add a declaration code to the existing NMFS VMS declaration system. Fishers who would like to participate in the program would need to declare, through the VMS declaration system, on or before February 15 of each calendar year (i.e., must declare by February 15, 2005, in order to participate in May-August 2005). The estimated cost of adding the declaration code to the NMFS VMS declaration system is a one-time cost of $15,000.

Following receipt of the declaration notice, NMFS staff would provide Groundfish Management Team representatives with the list of participants. State agency representatives would then be responsible for contacting the vessel owners within their respective states, and securing contracts with those individuals for the program. The key elements of this contract include: the provisions of the AT-RCA program (observer coverage, bycatch caps, rockfish retention, area closures, and gear requirements), a payment schedule for the state-sponsored monitoring program, and a designated processing facility (to be completed by the vessel owner). The costs associated with this administrative task will vary, depending on the amount of vessels that declare and, subsequently, the number of contracts that will need to be prepared and issued; however, the estimated cost of this activity is expected to be minimal (< $200 per year).

Once the contracts have been secured with the participating vessels, the state agencies will meet with the representatives from the designated processing facilities that have been specified in the state/vessel contract, to review the provisions of the program as well as secure contracts with them. The key elements of this contract include: Provisions to comply with the rockfish retention provision--processing facilities receiving the fish will need to record the rockfish above trip limits, but required to be retained under this program, on a separate fish ticket–and the requirement to forfeit the value of those rockfish above limits to the state. The costs associated with this administrative task will vary, depending on the amount of processing facilities involved. The initial (first-year) estimated cost of this activity is expected to be about $500; however, this cost should be reduced in subsequent years (< $200 per year).

After the contracts are in place, the state agencies will follow their respective procedures for hiring temporary personnel as state-sponsored monitors. Once staff have been hired, additional time will need to be spent training the at-sea monitors consistent with the NMFS Observer Training Manual. Training activities will need to include: safety training; sampling methodology; rockfish and flatfish identification; equipment training; and familiarity with the provisions of the program (estimated training time is about ten days). The task of hiring and training the state-sponsored monitors is estimated to be about $3,000 per year.

Beyond training, there will be additional costs associated with supervising the monitors and overseeing the program. To the extent that these tasks can be absorbed with existing staff resources, these administrative costs for the duration of the four-month program are estimated to be about $5,000. If additional supervisory staff needs to be hired, the projected costs would be increased to about $12,000. The budget detail for the management cost estimates are contained in Appendix B.

Participant Costs and Revenue

Under Alternative 2, the participating permit holders would be liable for reimbursing the respective state agencies for the costs associated with the state-sponsored monitoring program. The estimated costs for the monitoring program will vary by state, but is estimated to be about $4,000 to $4,500 per month, or $16,000 to $18,000 for the full four-month program. Table 1. describes the average ex-vessel revenue above trip limits for the vessels participating in the Washington arrowtooth flounder EFP in 2002 and 2003. The reason the ex-vessel revenue increased in 2003 is a combination of an increase in effort (one significant vessel only participated for two months in 2002) and a decrease in trip limits for arrowtooth flounder and petrale sole in 2003 (small footrope limits).

Table 1. Average ex-vessel revenue above trip limits for the 2002 and 2003 Washington arrowtooth flounder EFPs.

	Arrowtooth	**Petrale**	**Total**
2002	$36,951	$6,881	$43,832
2003	$42,843	$45,268	$88,111

The trip limits which were in place for May-August for 2002 and 2003, and planned for 2004, are contained in Table 2. Table 3. uses the Fisheries Economic Assessment Model (FEAM) to project the impacts at the processor, vessel, local, and state levels for the value above trip limits in the 2002 and 2003 Washington arrowtooth flounder EFPs.

Table 2. Limited entry trawl trip limits for May-August north of 40°10'N latitude, 2002-2004.

	2002		**2003**		**2004**	
			Per 2 months		Per 2 months	
	Per trip	**Per mo.**	**Lg Foot**	**Sm Foot**	**Lg Foot**	**Sm Foot**
Arrowtooth	7,500	30,000	200,000	5,000	150,000	6,000
Petrale		15,000	30,000	10,000	100,000	25,000

Table 3. Projected impacts using FEAM model for the value above trip limits in the Washington arrowtooth flounder EFP in 2002 and 2003.

	2002			**2003**		
	Arrowtooth	**Petrale**	**Total**	**Arrowtooth**	**Petrale**	**Total**
Processor Impact	$687,287	$11,636	$698,922	$796,875	$76,544	$873,419
Vessel Impact	$368,918	$68,702	$437,620	$427,742	$451,954	$879,696
Total Impact	$1,056,205	$80,338	$1,136,542	$1,224,616	$528,497	$1,753,115
At Local Level	$940,022	$71,501	$1,011,523	$1,089,909	$470,363	$1,560,272
At State Level	$1,160,521	$88,272	$1,248,793	$1,345,566	$580,695	$1,926,261

There are many factors to consider in projecting vessel revenue for participants fishing under this program, including individual effort, individual costs, market limits, and knowledge of the fishery. However, using the average revenue derived from the Washington EFPs, the amount of revenue generated from having access to the trawl RCA and higher trip limits for arrowtooth and petrale outweighs the costs of the state-sponsored monitoring program. Average revenue in 2003 of $88,000 vs. estimated monitoring costs of $18,000 for a net gain of $70,000 (before costs for crew, fuel, ice, etc. are deducted).

Fishing Mortality of Targeted Stocks

Arrowtooth flounder move onto the shelf during the summer months (May-August) (Rickey 1995), so, under Alternative 1, it is unlikely that fishers using large footrope gear and fishing seaward of the trawl RCA during these months would fulfill the large footrope limits for arrowtooth flounder (200,000 lbs/2 mo. in 2003). Further, with the increase in size of the RCA in 2004 (moving from 100 fms to 60 fms for May-June, and from 100 fms to 75 fms in July-August), fishers using small footrope gear may also have difficulty achieving the small footrope limits shoreward of the RCA. Therefore, if Alternative 2 is adopted, there would be an expected increase in the fishing mortality of targeted stocks (arrowtooth flounder and petrale sole) as part of this program. However, this increased mortality probably would be similar to that experienced under the EFP given the average vessel landings of arrowtooth and petrale (within 93% for arrowtooth and 100% for petrale) that occurred with the 2003 limits for large footrope gear (Table 4.). To the extent that the projected catches of targeted stocks modeled preseason assumed that the large footrope limits would be achieved by some vessels, there may not be an increase in fishing mortality of targeted stocks beyond what was projected.

Table 4. Total and average vessel landings of targeted stocks above trip limits in the Washington arrowtooth flounder EFP in 2002 and 2003.

	2002		**2003**	
	Total	**Per Mo.**	**Total**	**Per Mo.**
Arrowtooth	369,509	92,377	428,427	107,107
Petrale	6,256	1,564	41,153	10,288

Community Impacts

There are two processing facilities that consistently participated in the Washington arrowtooth flounder EFP located in Bellingham and Blaine, Washington. Landings of arrowtooth flounder and petrale sole from non-EFP participating vessels to these facilities during the EFP period are minimal. As noted above, successfully catching arrowtooth flounder to fill available markets in the May-August period is likely dependent upon accessing the trawl RCA. If product were not available for these processing facilities to buy, significant reductions in employment and/or plant closures would result.

Bycatch

There is expected to be a full accounting of bycatch of rockfish (*Sebastes and Sebastelobus*) under this program with the 100% observer coverage and full rockfish retention requirements.

Estimates of bycatch of prohibited species will also be collected; however, estimates of non-rockfish bycatch (e.g., flatfish, lingcod) will not be collected. Under the definition of bycatch in the Magnuson-Stevens Act (i.e., discarded fish), rockfish bycatch will be reduced to zero. It is also significant to note that over the first three years of the program, less than one percent (by weight) of the rockfish that were required to be retained were unmarketable. Further, the full rockfish retention provisions of the program were strongly supported by participating processors and fishers. To the extent that rocky areas within the RCA would remain closed, and participating fishers will avoid areas of higher rockfish bycatch, this could likely result in a decrease of rockfish bycatch mortality. It is difficult to project how this program would affect bycatch of non-rockfish species because if Alternative 2 is not adopted, then most of the fishers would likely be fishing seaward of the RCA to access the higher large footrope limits; therefore, the amount of bycatch of non-rockfish species may not change. The species caught and discarded may vary, however, with higher amounts of flatfish within the RCA vs. higher amounts of Dover sole, shortspine and longspine thornyheads, and sablefish seaward of the RCA.

Enforcement
It is difficult to assess the impact to enforcement costs under Alternative 2. Fishers participating in the AT-RCA program would be shifting from the limited entry groundfish trawl fishery which would not represent an increase in overall fishing effort. There could be costs associated with an increase in the number of fishers that can access the trawl RCA. However, with 100% observer coverage under this program, and declaration requirements under the VMS system, enforcement costs might be reduced since landings of arrowtooth flounder and petrale would not need to be tracked against limits under Alternative 2.

Protected Species Interactions
There is not expected to be any increase in protected species interactions as a result of this action.

EFH Impacts
Because the proposed program is area-specific within the RCA and high rocky relief areas favored by rockfish will remain closed, this proposal is not expected to increase impacts to EFH for rockfish. Flat, muddy areas favored by flatfish, however, will be open to fishing and there may be an increase in impacts to those areas.

Data Requirements
There are no additional data requirements beyond what is currently required under state and federal law. Logbooks as required by state regulations must be maintained by the vessel operator, and trips taken under the program must be noted on the logbook sheets.

4. ALTERNATIVES CONSIDERED AND ELIMINATED

An alternative that implemented all of the provisions of Alternative 2 except for the 100% observer coverage requirement was considered. This option was eliminated because the participants in the Washington arrowtooth flounder EFP indicated that the program worked because of the observer coverage requirement. The state-sponsored monitors onboard the vessels helped ensure compliance with the bycatch caps. Having the monitors onboard resulted in positive changes in fishing behavior–skippers avoided known areas of higher abundances of rockfish, canary, in particular. Skippers also changed other fishing practices, such as experimenting with rockfish excluder devices, shortening tow time, and fishing in areas and during times of the day when canary rockfish are less available, in an effort to reduce rockfish catches. Requiring 100% observer coverage for this program, coupled with a hard bycatch cap for overfished rockfish species, helps ensure that vessels fishing in areas which are closed for rockfish conservation (RCA) do not exceed their projected rockfish catches, which could affect other West Coast fisheries that harvest groundfish. Further, data are not available to analyze what the projected impacts to overfished rockfish would be in the absence of observer coverage and bycatch caps as these provisions were required under the EFP and fishery independent data have not been collected.

5. REFERENCES CITED

Rickey, Martha H. 1995. Maturity, spawning, and seasonal movement of arrowtooth flounder, *Atheresthes stomias*, off Washington. Fishery Bulletin 93:127-138.

REGULATORY PROVISIONS FOR ALTERNATIVE 2.

1. FISHING PERIODS

A. The fishing activities described below would be permitted during the months of May, June, July, and August of each year.

2. REPORTING REQUIREMENTS

A. The operator of any vessel registered to a limited entry permit with a trawl endorsement must provide NMFS with a declaration report, as specified below, to identify the intent to fish within the trawl conservation area north of Destruction Island, as defined in the Federal Register.

B. Declaration reports will be submitted to NMFS through the current VMS declaration system.

C. Declaration reports must be received by February 15th of the year when fishing in the conservation area will occur. (For example, to fish for arrowtooth in the trawl conservation area in May 2005, a declaration report must be received by February 15, 2005.)

3. FISHING RESTRICTIONS

A. Discards

1. All fish caught during a tow under the AT-RCA program must be brought onboard the vessel.

2. All rockfish brought on board the vessel while fishing under the AT-RCA program must be retained onboard the fishing vessel and delivered to a designated processor.

B. Groundfish trip limits

1. The targeted species, arrowtooth flounder, is not subject to a monthly trip limit, but is constrained by the incidental catch of canary rockfish which will be applied as follows:

   a. Up to 250 lbs per month of canary rockfish may be landed per vessel in tows conducted under the AT-RCA program, which includes all tows within the federal trawl conservation area. If the vessel has already reached the current small footrope monthly limits for arrowtooth flounder and petrale sole as published in the Federal Register when the 250 lbs of canary rockfish are caught, the vessel cannot prosecute any additional targeted arrowtooth tows for the remainder of the month and cannot retain any additional arrowtooth flounder or petrale sole.

b. If a vessel has **not** already reached the current small footrope monthly limit for arrowtooth flounder as published in the Federal Register when the 250 lbs of canary rockfish are caught, the vessel may target arrowtooth flounder, and/or retain arrowtooth flounder until the small footrope monthly limit is reached. If the vessel has not already reached the current small footrope monthly limit for petrale sole as published in the Federal Register when the 250 lbs of canary rockfish are caught, the vessel may continue to retain petrale sole until the small footrope monthly limit is reached.

c. Once the monthly canary rockfish cap has been reached, the vessel cannot fish within the trawl RCA for the remainder of the calendar month.

d. An individual bycatch cap of 1,000 lbs. of canary rockfish will also apply to each vessel. Once this cap has been reached by an individual vessel in AT-RCA permitted tows, the vessel will not be allowed to continue to fish under the AT-RCA program.

e. All tows conducted within the federal trawl conservation area are considered AT-RCA permitted tows.

f. Petrale sole caught in a directed arrowtooth tow would not be subject to a monthly limit.Current groundfish trip limits for species other than arrowtooth flounder and petrale sole will apply to vessels operating under this program except that retention of rockfish over the limits will not be in violation of 50 CFR 660.323, so long as such overages are surrendered to the state in which the fish were landed.

g. No directed "arrowtooth flounder" tows may be made south of Destruction Island (47°40'30" N. lat.).

h. Specific descriptions of the designated areas within the trawl conservation area that would be open to fishing activities under the AT-RCA program are described in Attachment 1.

4. LANDINGS

A. The AT-RCA program is valid only for landings made a processing plants that have been specifically designated by the state. To ensure that the purposes of the AT-RCA program are implemented, the state is required to have a written agreement, signed by a representative of a processing plant, before that processing plant is accepted as a "designated processor." The state will provide instructions to each participating processing plant specifying the plant's role and responsibilities in relation to this program, including the process for forfeiting overages to the state.

B. The state must require that all fish caught during an AT-RCA permitted fishing trip, with the exception of spiny dogfish (*Squalus acanthias*) be offloaded at only one designated processing plant (i.e., the offloading of catch from one trip cannot be split between processing plants). Once offloading has commenced at a designated processing plant, all fish, except spiny dogfish, onboard the AT-RCA permitted vessel must be offloaded at that plant. Spiny dogfish may be offloaded at another designated plant, providing all of those taken during an individual fishing trip are offloaded at that plant.

5. GEAR RESTRICTIONS

A. The AT-RCA program is valid only for fishing with legal trawl gear, as currently defined in federal regulations.

B. While fishing under the AT-RCA program, an approved rockfish excluder must be used. Approved rockfish excluders are:

1. Diamond Opening - A diamond-shaped opening cut into the top of the body of the net with the rear of the opening 15 meshes forward of the point where the body of the net connects to the intermediate. Each leg of the diamond must be at least 36 inches in length and cut on the bar.

2. Triangle Opening - A triangle-shaped opening cut into the top of the body of the net with the point of the triangle toward the opening of the net and the base of the triangle 15 meshes forward of the point where the body of the net connects to the intermediate. The sides of the triangle must be at least 48 inches in length and cut on the bar. The base of the triangle must be at least 36 inches in length.

3. Large Mesh - Large mesh in the top of the net immediately behind the headrope consisting of meshes at least 10 inches in diameter (between the knots) . This large-mesh panel must be at least the equivalent of 15 meshes of 10-inch mesh (150 inches). This would include, for example, an opening at least 150 inches in length using only jib lines to connect the headrope to the body of the net.

C. Additionally, the fishing circle (widest circumference) of any net used under the AT-RCA program shall be limited to 450 meshes of 5 ½-inch mesh (between the knots), or the equivalent diameter if a different mesh size is used at the widest circumference of the net (for example, 354 meshes of 7-inch mesh).

D. Vessels fishing under the AT-RCA program would be allowed to have more than one type of legal trawl gear onboard the vessel; however large footrope trawl gear can only be used for directed arrowtooth tows on the continental slope where the depth, throughout the tow, is greater than 120 fathoms.

6. DATA REQUIREMENTS

A. Trawl Logs. Trawl logbooks as required by state law must be maintained by the vessel operator. "AT-RCA" shall be written on the log for each trip conducted under the AT-RCA program.

1. Estimated pounds of all retained species caught in each tow must be recorded in the logbooks.

2. Before setting the gear the vessel operators must record the intended target species in the logbook.

B. Other Reports. This program does not relieve the vessel operator from any other state or federal reporting requirements.

7. OBSERVER REQUIREMENTS

A. All vessels fishing under the AT-RCA program must carry a state-sponsored observer or a federal observer the state has agreed to use as a substitute to monitor fishing strategies and bycatch caps, collect data to estimate catch and incidental catch, and observe the retention of all rockfish. Necessary arrangements will be made by the state to ensure that an on board observer is carried on all AT-RCA program trips.

B. State-sponsored observers will remain onboard all of the vessel's trips for the two-month cumulative period in which AT-RCA program fishing occurs (even those trips not targeting arrowtooth flounder).

C. Vessels carrying observers under the AT-RCA program must abide by groundfish observer regulations at 50 CFR 660.360 (d) & (j).

D. All state-sponsored observers carried by vessels fishing under the AT-RCA program must have successfully completed an observer training course that prepares them for collecting data that is compatible with sampling protocols defined in the NMFS Pacific Coast groundfish observer manual.

E. NMFS Observer coverage requirements at 50 CFR 660.360 are independent of AT-RCA program observer requirements. Vessels that carry a state-sponsored observer may also be required to carry a NMFS observer. A state observer is not a substitute for a NMFS observer and a vessel carrying a state observer is not exempt from federal observer requirements.

F. The vessel operator must provide adequate departure and arrival notification to a designated state office including reasonable notice of unexpected changes in fishing plans, to allow for sampling of the catch at offloading and for deployment of at-sea observers.

8. PAYMENT OF OBSERVER FEES

1. AT-RCA program participants are liable for funding of state-sponsored observers for observation duties required under the AT-RCA program.

2. AT-RCA program participants are required to secure a written agreement with the state sponsoring the observers for the AT-RCA program. Written agreements would be valid

for the calendar year issued and will expire each year on August 31st.

3. The written agreement must be signed by the AT-RCA program participant and an official representative of the state and will include, but is not limited to, an agreement to abide by the regulations of the AT-RCA program, including funding for state-sponsored observers. The agreement will specify the applicable fees and a payment schedule for those fees (estimated to be approximately $4,000-4,500 per month).

4. Funding for state-sponsored observers must be received by the designated state office a minimum of 30 days prior to the beginning of the fishing period in which fishing under the AT-RCA program will occur. For example, funding for fishing in Period 3 (May-June) is due by April 1; funding for fishing in Period 4 (July-August) is due by June 1.

9. SANCTIONS

Failure of a vessel owner, operator, or the program participant to comply with the terms and conditions of the AT-RCA program, a notice issued under 50 CFR Part 660, Subpart G, any other applicable provision of 50 CFR Parts 600 and 660 Subpart G, the Magnuson-Stevens Act, or any other regulations promulgated thereunder, may be grounds for revocation, suspension, or modification of this program as well as civil or criminal penalties under the Magnuson-Stevens Act with respect to all persons and vessels conducting activities under the AT-RCA program.

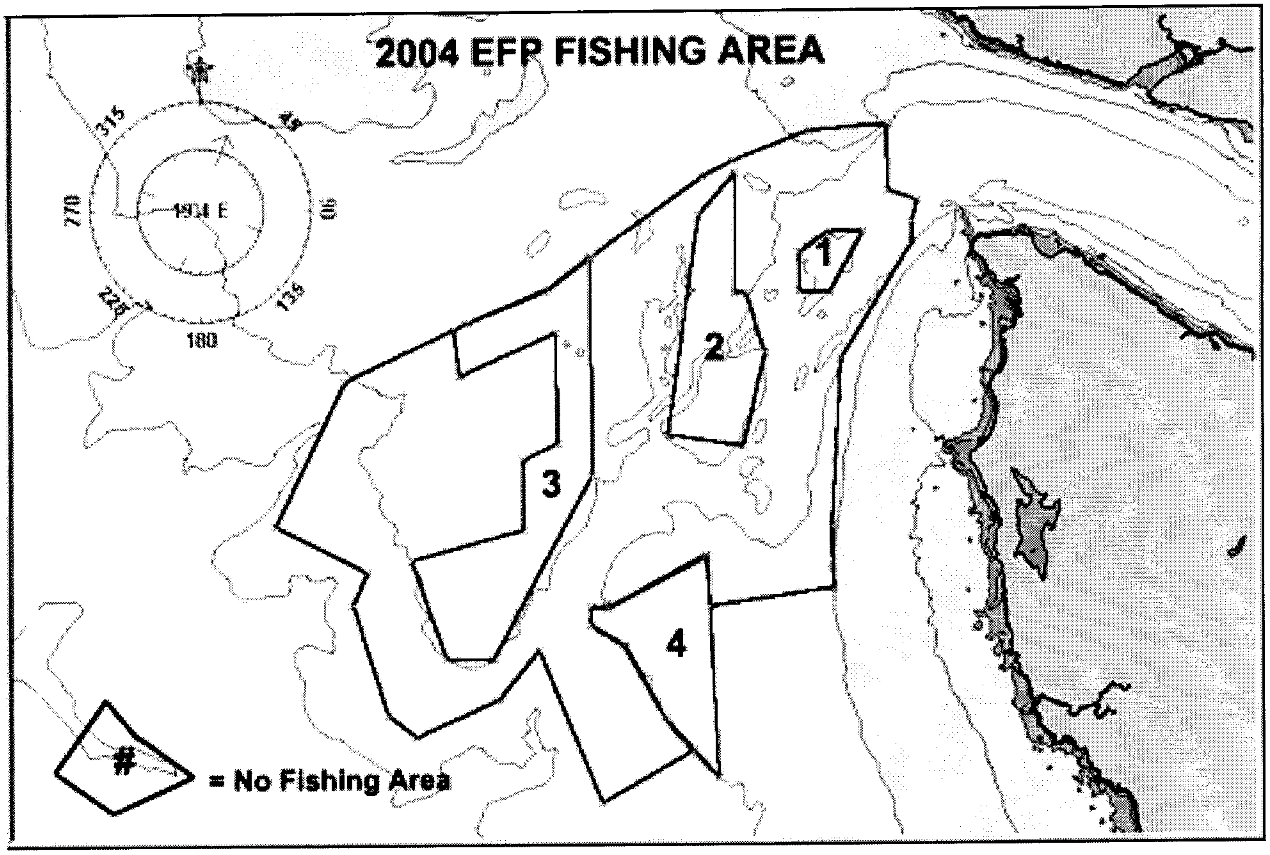
ATTACHMENT 1

Perimeter of 2004 Arrowtooth EFP Fishing Area

1	48	25.60 N	124	49.01 W
2	48	26.21 N	124	51.62 W
3	48	30.36 N	124	51.73 W
4	48	29.98 N	124	58.86 W
5	48	28.17 N	125	5.87 W
6	48	27.17 N	125	8.53 W
7	48	20.13 N	125	23.28 W
8	48	18.29 N	125	30.34 W
9	48	14.77 N	125	41.75 W
10	48	5.82 N	125	48.07 W
11	48	2.97 N	125	39.64 W
12	48	1.05 N	125	41.02 W
13	47	54.43 N	125	37.75 W
14	47	53.01 N	125	35.24 W
15	47	55.28 N	125	27.65 W
16	47	58.29 N	125	23.87 W
17	47	48.93 N	125	18.09 W
18	47	52.11 N	125	9.62 W
19	47	54.06 N	125	12.20 W
20	47	58.48 N	125	15.90 W
21	47	59.75 N	125	19.07 W
22	48	0.83 N	125	18.99 W
23	48	0.85 N	125	17.29 W
24	48	3.92 N	125	8.42 W
25	48	0.85 N	125	8.05 W
26	48	1.92 N	124	56.71 W
27	48	5.70 N	124	56.79 W
28	48	15.98 N	124	55.91 W
29	48	22.99 N	124	49.41 W
30	48	24.25 N	124	49.37 W
31	48	25.60 N	124	49.01 W

No Fishing Zones Within the Perimeter of the 2004 Arrowtooth EFP Area

ZONE 1					
	1	48	23.69 N	124	53.84 W
	2	48	23.64 N	124	57.00 W
	3	48	22.43 N	124	59.66 W
	4	48	20.06 N	124	59.66 W
	5	48	20.03 N	124	56.93 W
	6	48	23.69 N	124	53.84 W
ZONE 2					
	1	48	27.34 N	125	5.65 W
	2	48	24.78 N	125	9.07 W
	3	48	11.32 N	125	11.91 W
	4	48	10.69 N	125	4.93 W
	5	48	16.42 N	125	2.89 W
	6	48	19.96 N	125	4.60 W
	7	48	20.03 N	125	5.69 W
	8	48	27.34 N	125	5.65 W
ZONE 3					
	1	47	57.70 N	125	28.12 W
	2	47	57.85 N	125	32.48 W
	3	48	3.70 N	125	35.57 W
	4	48	5.55 N	125	25.36 W
	5	48	9.93 N	125	25.28 W
	6	48	10.86 N	125	22.05 W
	7	48	17.63 N	125	22.23 W
	8	48	15.01 N	125	31.17 W
	9	48	17.85 N	125	31.72 W
	10	48	20.25 N	125	22.92 W
	11	48	22.19 N	125	19.07 W
ZONE 4					
	1	48	3.90 N	125	8.27 W
	2	48	0.78 N	125	17.54 W
	3	48	0.87 N	125	19.07 W
	4	47	59.75 N	125	19.07 W
	5	47	58.53 N	125	15.98 W
	6	47	54.09 N	125	12.20 W
	7	47	50.44 N	125	7.22 W
	8	48	3.90 N	125	8.31 W


2004 EFP FISHING AREA
315
45
270
90
225
135
180
1
2
3
4
#
= No Fishing Area

MANAGEMENT COSTS FOR ALTERNATIVE 2.
BUDGET SUMMARY AND DETAIL

Tasks (Responsible Party)

A. Adding declaration code to NMFS VMS declaration system (NMFS)
B. Securing contracts with participating vessel owners (States)
C. Meeting and securing contracts with participating processors (States)
D. Hiring and training state-sponsored monitors (States)
E. Supervising monitors and overseeing program (States)

Costs

A. $15,000
B. < $200
C. $500 (first year); < $200 (subsequent years)
D. $3,000
E. $5,000 (existing staff resources); ~ $12,000 (new staff)

Budget Detail

A. Cost estimate provided from NMFS Northwest Region via e-mail (March 2, 2004)
B. State Biologist/Policy Coordinator - Salary and Benefits @ $4,500 per month (~$25.00 per hour) for < 8 hours
C. State Biologist/Policy Coordinator - Salary and Benefits @ $4,500 per month for 2.5 days
D. State Biologist/Policy Coordinator - Salary and Benefits @ $4,500 per month for 1 week ($1,000) + State Scientific Technician/Biologist - Salary and Benefits @ $3,000 per month for 3 weeks ($2,000)
E. State Scientific Technician/Biologist - Salary and Benefits @ $3,000 per month for 1.6 months (existing staff); or 4 months (new staff)

PACIFIC FISHERY MANAGEMENT COUNCIL SCHEDULE AND PROCESS FOR DEVELOPING 2005-2006 GROUNDFISH FISHERY SPECIFICATIONS AND MANAGEMENT MEASURES[1/]

October 14-17, 2003	The Groundfish Management Team (GMT) and Council staff meet in Seattle, Washington to review new stock assessments and rebuilding analyses and draft a recommended range of 2005-2006 groundfish harvest specifications and preliminary management measures.
November 3-7, 2003	The Council and advisory bodies meet in Del Mar, California to adopt: · The schedule and process for development of 2005-2006 groundfish fishery specifications and management measures. · A range of 2005-2006 harvest specifications and a preliminary range of management measures.
November 10, 2003-March 5, 2004	The Bycatch Model Work Group develops proposed methodologies to model bycatch in trawl and fixed gear fisheries based on data from the Observer Program.
January 14-16, 2004	The GMT and Council staff meet in La Jolla, California in a retreat format to discuss ways to improve GMT efficiency and develop a work plan to accomplish all the elements involved in the 2005-2006 groundfish fishery specifications and management measure process.
January 30, 2004	The Northwest Fisheries Science Center (NWFSC) releases the 2004 whiting stock assessment.
January 30, 2004	The NWFSC releases a report summarizing the second year of observer data and, if available, proposed methodologies to model bycatch in trawl and fixed gear fisheries (if available).
February 2-4, 2004	Whiting Stock Assessment Review (STAR) Panel meets in Seattle, Washington.
February 3-6, 2004	The GMT and Council staff meet in Portland, Oregon to review fishery impact assessment models, the updated observer data and, if available, modeling, discuss long-range management measures, discuss Recreational Fishery Information Network issues (with RecFIN staff), and other prioritized issues .
March 8-12, 2004	Council and advisory bodies meet at the Sheraton Tacoma Hotel in Tacoma, Washington. · The Bycatch Model Work Group briefs the GMT and Scientific and Statistical Committee (SSC) on proposed methodologies to model bycatch in trawl and fixed gear fisheries; SSC provides

1/ Including 2004 whiting fishery management specifications and management measures.

feedback as to any suggested improvements.
- The Council adopts whiting fishery specifications and management measures for 2004.
- The Council adopts cabezon and lingcod stock assessments for use in the 2005-2006 fishery specifications process.

March 15-
April 3, 2004

The Bycatch Model Work Group incorporates SSC-suggested improvements and finalizes models and methodologies for use in analyzing 2005-2006 groundfish specifications and management measures.

March 24-25

The Ad Hoc Allocation Committee meets in Portland, Oregon to discuss allocation alternatives for the 2005-2006 fishery.

April 5-9, 2004

The Council and advisory bodies meet at the Red Lion Hotel in Sacramento, California.
- The GMT analyzes the preliminary acceptable biological catches (ABCs), optimum yields (OYs), and management measures adopted at the November 2003 Council meeting and prepares a report presenting the results.
  - The GMT briefs the Groundfish Advisory Subpanel (GAP).
  - The states hold constituent meetings.
- The Council adopts:
  - Final ABC and OY levels.
  - Refined management measures for further analysis.

May 3-7, 2004

The GMT meets in Portland, Oregon to analyze the refined management measures adopted at the April Council meeting and prepares a report for public review and presentation at the June Council meeting.

May 21, 2004

Council staff release a report for public review with an analysis of the refined management measures:
- Document authoring complete by May 12, 2004.
- Document proofing and printing complete by May 19, 2004.
- Document distribution complete by May 21, 2004.

May 24-
June 11, 2004

State and tribal agencies hold constituent meetings to obtain input on final recommendations for final management measures.

June 14-18, 2004

The Council and advisory bodies meet at the Crowne Plaza Hotel in Foster City, California.
- The Council provides the GMT with a draft preferred alternative, which the GMT analyzes and briefs the GAP on the results.
- The Council takes final action on a preferred alternative for a complete set of 2005-2006 groundfish fishery specifications and management measures.

June 28-
July 2, 2004

The GMT meets in Portland, Oregon to complete all remaining analytical tasks necessary for the preparation of the *Draft Environmental Impact Statement (DEIS) for the Proposed 2005-2006 Groundfish Harvest Specifications and Management Measures.*

July 5- July 30, 2004	Council staff work with GMT members in drafting a complete DEIS document.
August 2-13, 2004	Council secretariate completes formatting, proofing, and printing of DEIS document.
August 16-20, 2004	GMT and NMFS regional staff review final DEIS draft and transmit to NMFS headquarters.
August 23- December 31, 2004	NMFS conducts internal Magnuson-Stevens Conservation and Management Act process, further National Environmental Policy Act processes, and notice and comment under Administrative Procedures Act.
January 1, 2005	The West Coast groundfish fishery begins under adopted specifications and management measures.

Oregon Recreational Total Boat Catch by Species and Year - Ocean Areas Only (metric tons)
(Estimates for 2001-03 include released catch. Lingcod discard mortality at 5% - others at 100%)
(Average weight for released fish is based on at-sea observations)

	1996	**1997**	**1998**	**1999**	**2000**	**2001 a/**	**2002 a/**	**2003 a/**
Black Rockfish	375	343	346	286	323	221	275	333
Blue Rockfish	32	65	65	39	38	26	16	25
Bocaccio	>1	>1	>1	>1	1	>1	>1	0
Cabezon	14	20	17	18	16	12	15	16
Canary Rockfish	**19**	**39**	**43**	**30**	**16**	**10**	**9**	**10**
China Rockfish	4	5	4	6	4	3	3	2
Copper Rockfish	2	4	4	5	4	2	4	3
Kelp Greenling	4	5	3	6	6	4	4	5
Lingcod	**81**	**108**	**69**	**86**	**51**	**61**	**76**	**101**
Pacific Cod	0	0	0	0	0	>1	>1	>1
Quillback Rockfish	2	4	5	5	3	3	4	4
Yelloweye Rockfish	**8**	**15**	**19**	**18**	**9**	**5**	**3**	**4**
Yellowtail Rockfish	20	30	35	21	17	16	19	15

a/ Landings from RecFIN and released impacts from ORBS

Oregon Ocean Recreational Angler Trips (1,000s) By Boat Type
(Includes all target trip types)

Year	Private	Charter	Total
1996	72	65	137
1997	70	67	137
1998	67	64	131
1999	78	62	140
2000	96	66	162
2001	140	70	211
2002	130	62	192
2003	159	62	221

Note: Increases in angler trips during 2001-2003 reflect increased salmon opportunity.

Tribal Proposals Regarding
Groundfish Fisheries for 2005 and 2006

Black Rockfish - The 2005 and 2006 tribal harvest guidelines will be set at 20,000 pounds for the management area between the US/Canada border and Cape Alava, and 10,000 pounds for the management area located between Destruction Island and Leadbetter Point. No tribal harvest restrictions are proposed for the management area between Cape Alava and Destruction Island.

Sablefish - The 2005 and 2006 tribal set asides for sablefish will be set at 10 percent of the Monterey through Vancouver area OY minus 3 % to account for expected discard mortality. Allocations among tribes and among gear types, if any, will be determined by the tribes.

Lingcod - For 2005 and 2006 the tribes propose an overall harvest guideline of between 50 and 100 mt for all tribal fisheries. Tribal fisheries will be restricted to 600 pound per day and 1,800 pound per week limits for all tribal fisheries except for the treaty troll fishery which would be limited to 1,000 pounds per day and 4,000 pounds per week. These limits may be adjusted inseason to stay within the overall harvest guideline.

For all other tribal groundfish fisheries the following trip limits will apply:

Thornyhead rockfish - Tribal fisheries will be restricted to a 300 pound per trip limit. This trip limit will be for short and longspine thornyheads combined.

Canary rockfish - Tribal fisheries will be restricted to a 300 pound per trip limit.

Other Minor Nearshore, Shelf and Slope Rockfish - Tribal fisheries will be restricted to a 300 pound per trip limit for each species group, or the limited entry trip limits if they are less restrictive than the 300 pound per trip limit.

Yelloweye Rockfish – The tribes will continue developing depth, area, and time restrictions in their directed Pacific halibut fishery to minimize impacts on yelloweye rockfish. Tribal fisheries will be restricted to 100 pounds per trip except during open competition fisheries for Pacific halibut.

Full Retention- The tribes will allow full retention of all rockfish species during open competition fisheries for Pacific halibut.

Tribal Proposals Regarding
Makah Trawl fisheries for 2005 and 2006

Pacific Whiting - For the 2005 and 2006 Pacific whiting fisheries, the tribal set aside will be as provided in the Makah Tribe's proposed allocation framework.

Midwater Trawl Fishery- Treaty midwater trawl fishermen will be restricted to a cumulative limit of yellowtail rockfish, based on the number of vessels participating, not to exceed 180,000 pounds per two month period for the entire fleet. Their landings of widow rockfish must not exceed 10% of the poundage of yellowtail rockfish landed in any given period. The tribe may adjust the cumulative limit for any two-month period to minimize the incidental catch of canary and widow rockfish, provided the average cumulative limit does not exceed 180,000 pounds for the fleet.

Bottom Trawl Fishery - Treaty fishermen using bottom trawl gear will be subject to the trip limits applicable to the limited entry fishery for Pacific cod, English sole, rex sole, arrowtooth flounder, and other flatfish. For petrale sole, fishermen would be restricted to 50,000 lbs/2 month period for the entire year. Because of the relatively small expected harvest, the trip limits for the tribal fishery will be those in place at the beginning of the season in the limited entry fishery and will not be adjusted downward, nor will time restrictions or closures be imposed, unless in-season catch statistics demonstrate that the tribes have taken ½ of the harvest in the tribal area. Fishermen will be restricted to PFMC approved trawl gear.

Pollock Test Fishery - The Makah Tribe will be examining the catch of pollock as part of their directed midwater whiting fishery in 2004. If successful targeting is achieved in 2004, the tribe would propose expanding to a directed fishery in 2005 concurrent with the setting of whiting harvest levels in March 2005. The tribe will coordinate the possible development of this fishery with NMFS, WDFW, and Canada's DFO.

Observer Program – The Makah tribe has an observer program in place to monitor and enforce the limits proposed above.

INTERNATIONAL PACIFIC HALIBUT COMMISSION

ESTABLISHED BY A CONVENTION BETWEEN CANADA

AND THE UNITED STATES OF AMERICA

DIRECTOR
BRUCE M. LEAMAN

P.O. BOX 95009
SEATTLE, WA 98145-2009

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(206) 634-1838

FAX:
(206) 632-2983

March 26, 2004

Dr. Don McIssac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 972220-1384

Re: Agenda item C.10

Dear Don:

The staff of the International Pacific Halibut Commission (IPHC) would like to offer its support for the adoption and use of selective flatfish trawls. These types of trawls have been designed to reduce the bycatch of certain rockfish species during flatfish fishing, but have also shown promising results in reducing halibut bycatch. Research by the Oregon Department of Fish and Wildlife on selective flatfish trawls has demonstrated significant reductions in bycatch of Pacific halibut: 29% lower on the shelf and 46% on the slope, while having only small impact on the target catch. Reductions in halibut bycatch will result in higher catch limits for treaty and no-treaty commercial halibut fishermen, and recreational halibut anglers. For these reasons, we encourage the Council to consider this type of trawl as it refines management measures for 2005 and beyond.

Thank you for this opportunity to comment.

Sincerely,

Bruce

Bruce M. Leaman
Executive Director

cc: IPHC Commissioners

ZIONTZ, CHESTNUT, VARNELL, BERLEY & SLONIM
ATTORNEYS AT LAW

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JAMES L. VARNELL
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BRIAN C. GRUBER

OF COUNSEL:
ALVIN J. ZIONTZ

2101 FOURTH AVENUE, SUITE 1230
SEATTLE, WASHINGTON 98121-2331
TELEPHONE 206-448-1230
FACSIMILE 206-448-0962

RECEIVED
APR - 2004
PFMC

Via Telefax and First Class Mail

April 1, 2004

Bob Lohn
Regional Administrator
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115-0070

Re: Treaty Indian Groundfish Fisheries in 2005 and 2006

Dear Mr. Lohn:

We have been asked to write to you on behalf of the Makah Indian Tribe. Pursuant to 50 C.F.R. § 660.324(d), the Tribe requests that provision be made for harvest of groundfish by Pacific coast treaty Indian tribes in 2005 and 2006 by continuing, with the exceptions noted below, the treaty regulations and allocations in effect in 2004, including the Makah allocation in the Pacific whiting fishery, with adjustments to reflect changes in Optimum Yields as determined by the Pacific Fishery Management Council and the National Marine Fisheries Service for 2005 and 2006.

The exceptions are as follows. First, in light of the anticipated increase in the Optimum Yield for lingcod, the Tribe requests an increase in lingcod trip limits in tribal longline and trawl fisheries to 600 pounds per vessel per day and 1,800 pounds per vessel per week, and an increase in lingcod trip limits in the tribal ocean troll fishery to 1,000 pounds per vessel per day and 4,000 pounds per vessel per week. Makah representatives will be prepared to address rockfish by-catch issues associated with these increases at the upcoming Council meeting.

Second, the Tribe requests an increase of 100 metric tons in the Harvest Guideline for the directed yellowtail rockfish harvest in the Makah trawl fishery. This reflects the increase in the Optimum Yield for yellowtail since the Harvest Guideline was set. Moreover, the Tribe has been able to harvest yellowtail rockfish with a lower incidental catch rate of widow and canary rockfish through time and area restrictions and other management measures, as verified by its onboard observer. Thus, even with this increase, the Tribe expects the same impacts on widow and canary rockfish as projected in the 2004 over-fished species scorecard.

Third, the Tribe requests an increase in petrale sole trip limits for the Makah trawl fishery to 50,000 pounds per vessel per two-month period. The Tribe believes this increase is reasonable since the fishery is not fully exploited and the tribal harvest will remain well below the non-treaty harvest.

Fourth, if there is a reduction in the Pacific cod Optimum Yield, which necessitates restrictions on the trawl fishery, the Tribe requests a set aside for the Makah trawl fishery, which would be managed by the Tribe. Makah representatives will be prepared to discuss an appropriate set aside level at the upcoming Council meeting.

The Tribe also requested that we advise you that it is exploring options for a pollock fishery. The Tribe will coordinate the possible development of the fishery with the National Marine Fisheries Service, the Washington Department of Fish and Wildlife, and the Canadian Department of Fisheries and Oceans.

Makah representatives will be available to discuss any questions you or your staff may have regarding these matters at the upcoming Council meeting.

Very truly yours,

ZIONTZ, CHESTNUT, VARNELL,
BERLEY & SLONIM

Marc Slonim

Marc D. Slonim

cc (via fax):

Bill Robinson
Eileen Cooney
Russ Svec
Steve Joner

Exhibit C.10.e
Supplemental Public Comment
April 2004

CITY OF FORKS

500 East Division Street • Forks, Washington 98331-8618

(360) 374-5412 • Fax: (360) 374-9430 • Web: www.forkswashington.org

RECEIVED
MAR 25 2004
PFMC

March 22, 2004

Mr. Donald Hanson, Chairman
Pacific Fishery Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220

RE: 2005-2006 Groundfish management

Dear Chairman Hanson and Council members,

My name is Dan Leinan and I represent the LaPush Area Recreation fisheries in the North of Falcon and PFMC process. Local citizens fish for groundfish and halibut in the Washington Area 3.

We are extremely concerned about the lack of regional management on weak groundfish stocks that govern our fisheries on healthier stocks. There is no fairness in allowing one state's excessive catch to preclude fishing in the other states. Groundfish fisheries are critically important to our coastal economy and tourism.

We urge you to adopt management measures for 2005-2006 that partition the coast into regions and assign the responsibility for management in these regions to the individual states.

Thank you for your help.

Sincerely yours,

R. Daniel Leinan
Clerk-Treasurer
City of Forks

cc: WDFW – Phil Anderson

Commissioners
FRANK UNFRED
DICK WATROUS
JIM STIEBRITZ

PORT OF ILWACO

P.O. Box 307
Ilwaco, Washington
98624

Mack Funk
Manager

Area Code 360
Phone 642-3143
FAX 642-3148
www.portofilwaco.com

RECEIVED
MAR 25 2004
PFMC

March 23, 2004

Mr. Donald Hanson
Pacific Fisheries Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220-1384

VIA FAX AND FIRST CLASS MAIL

Dear Mr. Hanson,

Our community has been severely impacted by the decline of the groundfish. We are very interested in the recovery of the endangered species, but we also know their are some species that are not endangered. We ask that you delegate the responsibility for managing the weak stocks in our waters to our state Department of Fish & Wildlife for 2005-2006. We think this is the best way to protect the weak stocks while allowing fishing on the more abundant species. The current system appears to favor other states over Washington.

Thank you for your consideration.

Sincerely,

Mack Funk

Mack Funk

Ilwaco Charter Association
P. O. Box 9
Ilwaco, WA 98624

RECEIVED
MAR 23 2004
PFMC

March 18, 2004

Mr. Donald Hanson, Chairman
Pacific Fishery Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220

Re: 2005-2006 Groundfish management

Dear Chairman Hanson and Council members,

My name is Butch Smith and I represent the Ilwaco Charter Association. My members fish for groundfish and halibut off both the Washington and Oregon coasts. We are extremely concerned about the lack of regional management on weak groundfish stocks that govern our fisheries on healthier stocks. There is no fairness in allowing one state's excessive catch to preclude fishing in other states. Groundfish fisheries are critically important for our coastal economies.

We urge you to adopt management measures for 2005-2006 that partition the coast into regions and assign the responsibility for management in these regions to the individual states.

Thank you for your help and effort.

Respectfully yours;

Butch Smith

Butch Smith
Ilwaco Charter Association

Cc: Phil Anderson

WESTPORT CHARTERBOAT ASSOCIATION
P. O. BOX 654 • WESTPORT, WASHINGTON 98595

RECEIVED
MAR 23 2004
PFMC

March 22, 2004

Mr. Donald Hanson, Chairman
Pacific Fishery Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220

Re: 2005-2006 Groundfish management

Dear Chairman Hanson and Council members,

I am writing to urge the Council to put into place a regional management system for certain groundfish species for 2005-2006 and beyond. The 30 vessel owner/operators that are members of our association depend upon groundfish and Halibut for a major part of their livelihood. We particularly depend upon Lingcod and Halibut. With the over fishing of Canary and Yelloweye rockfish we have been extremely careful to avoid these species while still being able to fish in deeper water where Lings and Halibut are found. We have been able to keep within the harvest/mortality expectations listed on the groundfish "scorecard" for the past few years.

We feel very threatened by California's inability to adequately manage its recreational groundfish fishery. Our fishery was over by the time that the entire coast was closed last fall but we feel we are very much at risk this season with California starting earlier than last year.

Although we recognize that the data used to calculate California recreational catches may be flawed, it is the only data available at this time. Washington and Oregon are able to use dockside sampling in-season and in real time. California does not appear to be able to calculate catches within a month or two of their occurring and the accuracy is very questionable.

Separating the management would not threaten California's ability to fish but it would allow us to control our own destiny and to receive the benefits of our own conservative management. We urge you to adopt regional management of Lingcod and rockfish for the 2005-2006 management cycle.

Respectfully yours,

Steve Westrick

Steve Westrick, President

Larry Swanson

From: Larry Swanson
Sent: Thursday, March 25, 2004 3:43 PM
To: 'Donals.McIsaac@noaa.gov'
Cc: 'mcedergreen@olynet.com'
Subject: 2005-2006 Ground fish management

March 25, 2004

RECEIVED
MAR 26 2004
PFMC

Mr. Donald Hanson, Chairman
Pacific Fishery Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220

Re: 2005-2006 Ground fish management

Chairman Hanson and Council members,

My name is Larry Swanson and I am writing this letter on behalf of Southwest Washington Anglers. Our members fish for ground fish and halibut from Depoe Bay, Or to Neah Bay, Wa. We are concerned that the current coast wide ground fish management basis could severely limit our regional fisheries. We see no fairness in allowing one states excessive catch to possibly significantly reduce another states fishery. These various fisheries are of extreme economic value to our small costal communities. We would urge you to develop management measures for 2005-2006 that would partition the ıst into regions and assign the responsibility of management of these regions to the states. Thanks for your help.

Sincerely,
Larry Swanson
Executive Board
Southwest Washington Anglers
1701 Broadway, box 246
Vancouver,WA 98663

Baronaire INC.
2515 KAUFFMAN AVENUE
VANCOUVER, WASHINGTON 98660
(503) 289-5569 • FAX (360) 695-6031
(360) 696-1604

RECEIVED
MAR 29 2004
PFMC

March 25, 2004

Mr. Dan Hanson
PFMC
7700 Ambassador Place
Suite 200
Portland, OR 97220

Chairman Hanson:

It has come to our attention that groundfish management has not addressed a serious issue concerning overfishing by one area impacting another area. We understand that this issue is to be addressed by the Council by June of this year.

To be short, and to the point. We believe that regional quotas, for groundfish, are necessary and should be implemented as soon as possible. We also believe that the individual states should be responsible for managing these regioanal quotas.

Thank you for your consideration of our views.

Sincerely,

Steve Watrous
President, Columbia Pacific Anglers
2515 Kauffman Ave
Vancouver, Wa 98660

PORT OF NEAH BAY

P.O. BOX 137 • NEAH BAY, WA 98357
TEL (360) 645-3015 • FAX (360) 645-3016
E-MAIL: portofneahbay@centurytel.net

RECEIVED
MAR 29 2004
PFMC

March 22, 2004

Mr. Donald Hanson, Chairman
Pacific Fishery Management Council
7700 Ambassador Place, Suite 200
Portland, OR 97220

Re: 2005-2006 Groundfish management

Dear Chairman Hanson and Council members:

My name is Robert Buckingham, Port Director for the Port of Neah Bay. I am writing today regarding management concerns for the recreational groundfish and halibut fisheries that originate from Neah Bay. The Port of Neah Bay has invested heavily in the newly constructed Makah Marina and additional upland facilities, that both support and are reliant on the recreational fisheries. A vibrant groundfish and halibut fishery are critically important to Neah Bay's economy, as it is to other coastal communities relying on recreational fishing to survive.

We are extremely concerned that the lack of regional management on weak groundfish stocks will have a devastating effect on our ability to continue fishing healthier stocks. There is absolutely no fairness in allowing one state's excessive catch to preclude fishing on otherwise healthy stocks of fish in the other states.

The Port of Neah Bay urges you to adopt management measures for 2005-2006 that partition the coast into regions and assign the responsibility for management in these regions to the individual states. Thank you for your help.

Respectfully yours,

Robert P. Buckingham
Port Director

cc: WDFW – Phil Anderson

STOCK ASSESSMENT PLANNING FOR 2007-08 MANAGEMENT

Situation: The Council has considered stock assessment planning for the 2007-2008 management period during the last two Council meetings. Dr. Elizabeth Clarke from the NMFS Northwest Fisheries Science Center (NWFSC) presented a detailed list of stocks for assessment as well as a tentative schedule of Stock Assessment Review (STAR) Panel meetings in March. The Council also received advice from the Scientific and Statistical Committee(SSC), Groundfish Advisory Subpanel (GAP), and Groundfish Management Team (GMT) regarding this list of stocks proposed for assessment and gave the following advice to the NWFSC:

- Don't assess the following underutilized stocks: arrowtooth flounder, chilipepper rockfish, yellowtail rockfish, bank rockfish, or shortbelly rockfish;
- Rank assessments as Low, Medium, or High priority;
- Allow flexibility to consider a full or updated assessment for yelloweye rockfish;
- Do a gopher rockfish assessment if there is adequate data;
- Do a kelp greenling assessment if there is adequate data;
- Consider doing a starry flounder assessment if there is enough data;
- Do a petrale sole assessment;
- Do a cabezon assessment based on the recommendation of the SSC;
- Advise which assessments can be full or update assessments;
- Advise as to the total number of full and update assessments that can be accommodated with workload constraints (the preliminary number was 22 or 23).

Dr. Clarke is expected to consider these recommendations and report back to the Council regarding the availability of data for those stocks the Council wanted to assessed in the upcoming cycle and answer any other questions the Council might have regarding the list of stocks for assessment and activities leading to final Council adoption in 2005. The Council task is to consider advice from Dr. Clarke, Council advisors, and the public before recommending a final plan for completing and reviewing stock assessments for use in 2007-2008.

Council Action:

1. **Adopt a final plan for completing and reviewing stock assessments for use in 2007-2008 groundfish fisheries.**

References:

None.

Agenda Order:

a. Agendum Overview — John DeVore
b. NMFS Report — Elizabeth Clarke
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Adopt Final Stock Assessment Plan

PFMC
03/22/04

STOCK ASSESSMENT PLANNING FOR 2007-2008 MANAGEMENT

April 2004
Northwest Fisheries Science Center

The following tables summarize the advice from the Northwest Fisheries Science Center regarding the priorities and schedules for workshops and stock assessments for 2007-2008 management of groundfish. Table 1 lists the stocks that are recommended for assessment, in order of priority, with the highest priority given to overfished stocks. The assessments are designated as likely for full or updated assessments. The availability of data for gopher, kelp greenling and starry flounder was reviewed and some experts believed that these assessments could be completed. Therefore, we recommend that these species be included for assessment. Three stocks that were considered for assessment, bank, splitnose and shortbelly, cannot be assessed given the current restraints on workload. We recommend these assessments be deferred to the next cycle.
Table 2 summarizes the workload for all agencies. The workload is near the capacity for all participants. Table 3 lists the STAR panels that must be conducted to review all assessments. Four full assessments will be reviewed at each STAR panel. In order to complete all four reviews efficiently, participation by authors in pre-assessment data and modeling workshops is essential. The proposed dates for the pre-assessment workshops as well as the recreational CPUE workshops are listed in Table 4. An additional STAR panel is recommended, based on discussion with the SSC, in the event that any contentious assessments need final review and resolution. This will make it more likely that the reviews of four assessments can be completed efficiently at one STAR panel.

the tables were provided as a powerpoint.

Table 1. Stock Assessments and Priorities

Agency	Status	Priority	Species
SWFSC	update	1	Boccacio
NWFSC	full	1	Canary
SWFSC	full	1	Cowcod
NWFSC	full	1	Darkblotched
WDFW	update	1	Lingcod
NWFSC	update	1	POP
SWFSC	update	1	Widow
WDFW	update	1	Yelloweye
NWFSC	update	1	Yellowtail
NWFSC	full	2	Blackgill
NWFSC	full	2	Cabezon
NWFSC	full	2	Dover sole
NWFSC	full	2	English Sole
NWFSC	full	2	Longspine Thornyhead
NWFSC	full	2	Pacific Hake
NWFSC	full	2	Petrale Sole
NWFSC	full	2	Sablefish
NWFSC	full	2	Shortspine Thornyhead
CDFG	full	3	California scorpionfish
SWFSC	full	3	Gopher
SWFSC	full	3	Kelp Greenling
SWFSC	full	3	Starry Flounder
SWFSC	full	3	Vermillion
~~NONE~~	~~full~~	~~3~~	~~Bank Rockfish~~
~~NONE~~	~~full~~	4	~~Shortbelly~~
~~NONE~~	~~full~~	4	~~Splitnose~~

Priorities: 1=overfished, 2=large landings 3=new species suggested by advisory groups 4= others

Table 2. Work Load

Agency	Full	Updates	Total
NWFSC	11	2	13
SWFSC	5	2	7
WDFW		2	2
CDFG	1		1
ODFW			0
Total			23

Table 3. STAR Panels

Panel	Possible Species	Time	Location
STAR Full Assessment Panel One	Pacific Hake	February	Seattle
STAR Full Assessment Panel Two	Sablefish, Dover, Shortspine Thornyhead, Longspine Thornyhead	May	Newport
STAR Full Assessment Panel Three	Petrale, English, Starry Flounder, Canary	May	Seattle
STAR Full Assessment Panel Four	California Scorpionfish,Cabezon, Gopher,Greenling	Late May	Santa Cruz
STAR Full Assessment Panel Five	Cowcod, Vermillion Blackgill, Darkblotched	June	La Jolla
STAR Update Panel One	Yellowtail, Bocaccio, Lingcod	August	Long Beach
STAR Update Panel Two	POP, Yelloweye, Widow	August	Seattle
WRAP UP STAR PANEL	As needed to finalize results from any problematic assessments	TBA	TBA

Table 4. 2004 Workshop Dates and Times

Topic	Date	Location
Recreational CPUE	June 29-30	Santa Cruz
Stock Assessment Data	July 26-30	Seattle
Stock Assessment Modeling Workshop	October 25-29	TBA

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENT PLANNING FOR 2007-2008 MANAGEMENT

Dr. Elizabeth Clarke presented a revised groundfish stock assessment schedule for 2005 to the SSC, which included changes to the previous list of species (March 2004, Exhibit E.3.b, Attachment 1, Table 1) resulting from recommendations by the Council's advisory bodies. The current proposal identifies a lead agency for 23 species, of which assessment authors have been identified for all but blackgill rockfish. A full assessment would be required for 17 species; six species would be updated assessments, one of which (yelloweye rockfish) would be carried forward as an update with provision to accommodate it as a full assessment, if so warranted.

A few of the proposed species have not been assessed previously, and the SSC notes that it will not be possible to determine whether sufficient data are available to support a full assessment for them until after the assessment work is started. If the available data were not adequate to carry out the planned assessment, a useful alternative outcome would likely be a comprehensive data summary, which would still require stock assessment review (STAR). New information provided by Dr. Clarke included useful criteria for prioritizing the species to be assessed, and the resulting classification of each species. The SSC requested the assessment list for the next assessment cycle be expanded to include those species that have been previously assessed, but are not scheduled for the current cycle, in order to provide a full assessment history of all stocks.

After discussing the stock assessment review workload associated with the proposed assessment schedule, it is apparent the existing STAR process and Terms of Reference cannot adequately accommodate the number of assessments without structural change. The planned update of the Terms of Reference by the SSC Groundfish Subcommittee will allow changes to be made that will match the new process and workload. Expanded roles for the data workshop and modeling workshop should help address some time consuming issues that were formerly examined during STAR panel meetings. Focused subgroups for species with similar data or modeling issues may benefit from additional follow-up workshops. However, the proposed workload of four species per STAR Panel is a considerable increase from the two (or three) species per panel approach that has previously served the review needs of the Council. This raises a concern that an effective review of four species may exceed allotted meeting time. In order to make efficient use of available review time, it may be necessary to require that STAT Teams provide results four to six weeks prior to the STAR meeting, so that some issues may be resolved through STAR/STAT interaction prior to the meeting, including requests for additional model runs. Despite these changes the level of review may be reduced under the proposed schedule.

The proposed schedule would require five full STAR panels and two update STAR panels. In addition, as a result of discussions with Dr. Clarke, the SSC recommends an 8th panel may be created to deal with any assessments where unresolved issues may remain at the conclusion of the regular STAR panel. This "mop-up" STAR panel would be composed of agency representatives and SSC Groundfish Subcommittee members, but not the outside or Center for

Independent Experts (CIE) reviewers. Revised Terms of Reference would specify conditions that would trigger the need for further review by the “mop-up” STAR panel.

Since the 2005 process will be a major change from the framework that has worked adequately in the past, the SSC recommends the SSC Groundfish Subcommittee carry out an evaluation at the conclusion. An account of how well the new process functioned would serve to identify any additional changes that might be needed for the next assessment cycle.

PFMC
04/07/04

Exhibit C.12
Situation Summary
April 2004

FMP AMENDMENT 16-3: REBUILDING PLANS FOR BOCACCIO, COWCOD, AND WIDOW AND YELLOWEYE ROCKFISH

Situation: The U.S. Secretary of Commerce has declared nine West Coast groundfish species overfished. In 2000, the Council adopted Groundfish fishery management plan (FMP) Amendment 12 to establish a framework for rebuilding overfished stocks pursuant to the 1996 Sustainable Fisheries Act. However, in August 2001 the Federal District Court for the Northern District of California remanded this amendment based on a successful legal challenge, ruling that the Council must formally adopt rebuilding plans as either FMP amendments or regulatory amendments, not as the policy documents the Council had adopted. Additionally, the court ruled the process of adopting the framework for rebuilding plans was inadequate under the National Environmental Policy Act (NEPA). In response, the Council developed Amendment 16-1, which establishes a legally-compliant framework for the adoption and implementation of rebuilding plans. This amendment was adopted by the Council at the September 2003 meeting and approved by NMFS on November 14, 2003. The Council developed Amendment 16-2, containing rebuilding plans for canary rockfish, darkblotched rockfish, lingcod, and Pacific ocean perch, concurrently with the framework, also adopting preferred alternatives at the September 2003 meeting. NMFS approved this amendment on January 30, 2004.

Amendment 16-3 contains rebuilding plans for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. The Council adopted a set of alternatives for evaluation in a Draft Environmental Impact Statement (DEIS) at the November 2003 meeting. Council staff have written the DEIS, which was released for the required 45-day public comment period in advance of this Council meeting. The DEIS does not contain the Council's preferred alternative. (If it does not yet exist, an agency may release a DEIS without identifying the preferred alternative, 40 CFR 1502.14(e).) NMFS is under a federal court order to sign a Record of Decision for this action by September 15, 2004. Given this time constraint and staff workload in the period between the April and June Council meetings, releasing the DEIS in advance of identifying a preferred alternative creates a more efficient process while not substantially diminishing the public's opportunity to comment on Council action.

The Council task at this meeting is to consider final adoption of preferred alternatives for the species rebuilding plans in Amendment 16-3. The action alternatives are arrayed according to common sets of rebuilding probabilities (P_{MAX} values), ranging from lows of 60% for bocaccio, widow rockfish, and yelloweye rockfish and 55% for cowcod under Action Alternative 1, to a high of 90% for the three aforementioned species and 60% for cowcod under Action Alternative 4. However, according to the rebuilding framework implemented under Amendment 16-1, the rebuilding plans need to adopt the target year (T_{TARGET}) and harvest control rule corresponding to the selected rebuilding probabilities. Based on the rebuilding plans, the Council would then manage groundfish stocks to rebuild by the target year; the rebuilding probabilities would likely change over time, but must remain above 50%. The DEIS contains a reasonable range of alternatives, but the Council may choose to combine targets for individual species from the different action alternatives to identify their preferred alternative. Council staff will prepare the final EIS (FEIS), including specification and analysis of preferred alternatives and responses to comments received, at the end of the 45-day public comment period.

Amendment 16-1 also requires that a specific standard be established for each rebuilding plan for determining when rebuilding progress has been adequate. The Council should consider tasking the Scientific and Statistical Committee (SSC) with developing a Terms of Reference for the standards and criteria for periodic review of rebuilding plans to determine adequacy of rebuilding progress as has been done for Amendment 16-2 rebuilding plans. Those Terms of Reference could include elements contained in the SSC's Terms of Reference for development of groundfish stock assessments. A revised Terms of Reference is currently scheduled to be available for Council consideration in November 2004.

Council Action:

1. **Adopt preferred alternatives for Amendment 16-3 species' rebuilding plans.**
2. **Consider tasking the SSC with developing a Terms of Reference for the standards and criteria for periodic review of rebuilding plans.**

Reference Materials:

1. Exhibit C.12.a, Attachment 1: Amendment 16-3 to the Pacific Coast Groundfish Fishery Management Plan; Rebuilding Plans For Bocaccio, Cowcod, Widow Rockfish and Yelloweye Rockfish; Draft Environmental Impact Statement Including Regulatory Impact Review and Initial Regulatory Flexibility Analysis.
2. Exhibit C.12.a, Attachment 2: Appendices to Amendment 16-3 Draft Environmental Impact Statement (***on CD***).

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Final Preferred Alternatives

PFMC
03/22/04

Exhibit C.12.a
Attachment 1
March 2004

AMENDMENT 16-3

TO THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

REBUILDING PLANS FOR

BOCACCIO, COWCOD, WIDOW ROCKFISH, AND YELLOWEYE ROCKFISH

DRAFT ENVIRONMENTAL IMPACT STATEMENT INCLUDING REGULATORY IMPACT REVIEW AND INITIAL REGULATORY FLEXIBILITY ANALYSIS

PREPARED BY
THE PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 200
PORTLAND, OR 97220
(503) 820-2280
WWW.PCOUNCIL.ORG

IN COOPERATION WITH THE

NATIONAL MARINE FISHERIES SERVICE
7600 SAND POINT WAY NE, BIN C15700
SEATTLE, WA 98115-0070
206-526-6150

MARCH 2004

This document is published by the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award Number NA03NMF4410101.

COVER SHEET
AMENDMENT 16-3 ENVIRONMENTAL IMPACT STATEMENT

Proposed Action: Implement legally-compliant rebuilding plans, consistent with the framework established in Amendment 16-1, that will set strategic rebuilding parameters to guide stock rebuilding for bocaccio (*Sebastes paucispinus*), cowcod (*S. levis*), widow rockfish (*S. entomelas*), and yelloweye rockfish (*S. ruberimus*). These rebuilding parameters stem from the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and National Standard 1 guidelines (50 CFR 600.310). The most important strategic rebuilding parameters are the time period within which the stock must be rebuilt to the target biomass capable of supporting maximum sustainable yield (MSY) and the harvest control rule that would constrain fishing mortality so that the stock can be rebuilt in that time period. Although the groundfish fishery management plan (FMP) states that new management measures intended to achieve these targets may be added to the FMP as part of rebuilding plans, only existing management measures are considered under the proposed action.

Type of Statement: DRAFT Environmental Impact Statement

For Further Information contact:

Mr. Robert Lohn
Regional Administrator
Telephone: (206) 526-6150

National Marine Fisheries Service Northwest Region
7600 Sand Point Way NE, BIN C15700
Seattle, WA 98115-0070

Dr. Donald O. McIsaac
Executive Director
Telephone: (503) 820-2280

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

Abstract:

The U.S. Secretary of Commerce (Secretary) has declared nine fish species managed under the Pacific Coast Groundfish Fishery Management Plan (FMP) to be overfished, based on criteria and procedures described in the Magnuson-Stevens Act (§304(e)), and overfishing criteria adopted by the Pacific Fishery Management Council (Council) under Amendment 11 to the FMP. The Magnuson-Stevens Act (§304(e)(3)) also requires councils to “prepare a fishery management plan, plan amendment, or proposed regulations” in order to prevent overfishing and implement a plan to rebuild the overfished stocks. The Council has chosen to adopt legally-compliant rebuilding plans for overfished groundfish through a series of FMP and/or regulatory amendments. Amendment 16-3 adopts rebuilding plans for four of the nine overfished species in order to rebuild these stocks to a size capable of supporting MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation, and according to the requirements of the Magnuson Stevens Act. The Act requires rebuilding plans to identify a time period, which “shall be as short as possible,” while accounting for various mitigating factors, such as the biology of the stock, ecological considerations, and the needs of fishing communities. This EIS evaluates alternatives with different strategic rebuilding parameters. These parameters include the harvest rate, the probability that the stock will rebuild in the maximum statutorily-permitted time period, and the median, or most likely, year in which the stock would be rebuilt to its target biomass for the given harvest rate. The use of the Mixed Stock Exception, identified in National

Standard 1 guidelines (50 CFR 600.310(d)(6)), is not considered for these four overfished stocks. (Under this exception overfishing could continue in cases where the overfished species co-occurs with other species that are the target of the fishery.) A range of management measures, implemented through the biennial harvest specification process, will be used to constrain total fishing mortality within levels identified by these parameters. The range of measures implemented in this fashion is not expected to differ in kind among the alternatives. New measures, different from the types of measures implemented through the biennial harvest specification process, are not considered at this time as part of the four rebuilding plans evaluated here. However, new management measures, consistent with stock rebuilding, could be part of some separate, future action.

Comments due by:

EXECUTIVE SUMMARY

ES.1.0 INTRODUCTION

ES.1.1 How This Amendment is Organized

This document provides background information about and analysis of changes to the Pacific Coast Groundfish Fishery Management Plan incorporated as Amendment 16-3. The actual changes, or amended parts of the plan, will appear in the final environmental impact statement as Appendix C. The Pacific Fishery Management Council prepared this document. The Council is one of eight regional Fishery Management Councils providing management recommendations to NMFS, which then implements these regulations through federal regulations as appropriate. The Pacific Fishery Management Council is responsible for fisheries occurring in federal waters off the U.S. West Coast. Each Council draws its membership from constituent states; in addition to Washington, Oregon, and California, Idaho is also a member of the Pacific Council because salmon, managed by the Council under a different fishery management plan, return to rivers in Idaho to spawn.

This document is the third in a series of amendments numbered Amendments 16-1, 16-2, and 16-3. Amendment 16-1, approved on November 14, 2003, establishes a framework for the adoption of rebuilding plans for overfished species. Amendment 16-2, approved on January 30, 2004, adopted rebuilding plans for darkblotched rockfish, Pacific ocean perch (POP), lingcod, and canary rockfish. This amendment adopts rebuilding plans for bocaccio, cowcod, yelloweye rockfish, and widow rockfish. Adopted plans are implemented through the framework contained in Amendment 16-1.

FMPs, and any amendments to them, must conform to the Magnuson-Stevens Act (MSA), the principal legislation governing fishery management within the Exclusive Economic Zone (EEZ), which extends from the outer boundary of the territorial sea to a distance of 200 nautical miles from shore. In addition to addressing MSA mandates, this document is an EIS, pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended. According to NEPA (Sec. 102(2)(C)), any "major federal action significantly affecting the quality of the human environment" must be evaluated in an EIS. Based on a preliminary determination by Council and NMFS staff, adopting these four rebuilding plans may have significant impacts. Therefore, rather than preparing an environmental assessment (EA), which provides "sufficient evidence and analysis for determining whether to prepare an environmental impact statement," NMFS and the Council have decided to proceed directly to preparation of an EIS. The document also contains information and analyses relevant to the Regulatory Flexibility Act (RFA) and EO 12866 (Regulatory Impact Review or RIR). These mandates require agencies to evaluate the economic impact of regulatory actions, especially on small entities.

Federal regulations (40 CFR 1502.9) require agencies to prepare and circulate a draft EIS (DEIS), which "must fulfill and satisfy to the fullest extent possible the requirements established for final statements in Section 102(2)(C) of the Act" (i.e., NEPA). Agency guidelines (NOAA Administrative Order 216-6. 5.01.b.1(i)) stipulate a minimum 45-day public comment period on the DEIS. At the end of this period a final EIS (FEIS) is prepared, responding to comments and revising the document accordingly. After the EIS is completed, a 30-day "cooling off" period ensues—with another opportunity for public comment—before the responsible official may sign a record of decision (ROD) and implement the proposed action. NMFS and the Council are under a court-mandated deadline of September 15, 2003, to sign the ROD for this EIS, signaling implementation of the rebuilding plans. In order to meet this deadline, in concert with the Council meeting schedule and other staff obligations, the DEIS for this action is being released in advance of the Council recommending a preferred alternative, which they plan to do on April 8, 2004, at their April meeting in Sacramento, California. It will be within the range of alternatives described and evaluated in this DEIS. After a 45-day public comment period, the Council will prepare the FEIS. In addition to responding to public comments, the FEIS will incorporate any additional analysis needed to fully evaluate the Council's preferred alternative. The FEIS must be released by early August 2004 to meet the court-mandated deadline.

Environmental impact analyses have four essential components: a description of the purpose and need for the proposed action, a set of alternatives that represent different ways of accomplishing the proposed action, a description of the human environment affected by the proposed action, and an evaluation of the predicted direct, indirect, and cumulative impacts of the alternatives.[1/] These elements allow the decisionmaker to look at different approaches to accomplishing a stated goal and understand the likely consequences of each choice, or alternative. EISs are commonly organized around four chapters covering each of these topics. This EIS is organized differently; Chapters 1 and 2 cover the purpose and need and describe the alternatives, but the next six chapters focus on parts of the human environment potentially affected by the proposed action. Each of these chapters describes both the baseline environment potentially affected by the proposed action and the predicted impacts of each of the alternatives. Appendices A and B provide additional supporting information. Appendix A is a comprehensive description of the affected environment and supports the descriptions included in Chapters 3 through 8. Appendix B reproduces tables first developed for Amendment 16-2 showing the catch of overfished species by different fleet segments and the co-occurrence of target species and overfished species.

ES.1.2 Purpose and Need

1.2.1 The Proposed Action

The proposed action is to implement legally-compliant rebuilding plans, consistent with the framework established in Amendment 16-1, that will set strategic rebuilding parameters to guide stock rebuilding for bocaccio (*Sebastes paucispinis*), cowcod (*S. crameri*), lingcod (*S. levis*), yelloweye rockfish (*S. ruberimus*), and widow rockfish (*S. entomelas*). These rebuilding parameters stem from the Magnuson-Stevens Act and National Standard 1 guidelines (50 CFR 600.310). The most important strategic rebuilding parameters are the time period within which the stock must be rebuilt to the target biomass capable of supporting MSY and the harvest control rule that would constrain fishing mortality so that the stock can be rebuilt in that time period. Amendment 16-1, addressing the process and standards for rebuilding plan adoption, states that new management measures intended to achieve these targets may be added to the FMP as part of rebuilding plans. However, no new management measures are proposed in Amendment 16-3 (evaluated in this EIS); instead, existing management measures implemented through the biennial management process will be used to constrain fishing to the targets identified in the rebuilding plans.

ES.1.2.2 Need (Problems for Resolution)

Rebuilding plans are mandated when the size of a stock or stock complex falls below a level described in the FMP as the minimum stock size threshold, or MSST, which is 25% of unfished biomass ($B_{25\%}$) for stocks managed under the groundfish FMP. Diminished stock size may be caused or exacerbated by fishing. Regardless of the cause of the decline, fishing mortality needs to be controlled to prevent further deterioration in the condition of the stock, and if the stock has been overfished, to allow it to rebuild.[2/] Amendment 11 to the groundfish FMP established the "status determination criteria" (including MSST) that are used to

1/ Federal regulations at 40 CFR 1502 detail the required contents of an EIS. Although there are several additional components, this list is of the core elements.

2/ But when environmental changes affect the long-term productive capacity of the stock, one or more components of the status determination criteria may be respecified and the need for a reduction in fishing mortality reevaluated (50 CFR Section 600.310).

determine whether overfishing is occurring and whether a stock has reached an overfished state. Rebuilding plans specify how an overfished stock will be rebuilt.

The proposed action is needed, because the four groundfish species addressed by this amendment (bocaccio, cowcod, yelloweye rockfish, and widow rockfish) are overfished. National Standard 1 in the Magnuson-Stevens Act requires conservation and management measures that prevent overfishing. Preventing overfishing also means returning stocks to a size capable of achieving MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation. In order to satisfy this mandate, legally compliant rebuilding plans must be adopted for stocks that have been declared overfished by the Secretary of Commerce.

ES.1.2.2 Purpose of the Proposed Action

The *purpose* of the proposed action is to rebuild bocaccio, cowcod, yelloweye rockfish, and widow rockfish stocks managed under the Pacific Coast Groundfish FMP to a size capable of supporting MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation, and according to the requirements of the MSA. The MSA states: "For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations... for such fishery shall... specify a time period for ending overfishing and rebuilding the fishery..." (Sec. 304(e)(4)). The MSA also states that this time period "shall be as short as possible," and usually may not exceed 10 years. However, in setting a time period for rebuilding the stock, fishery managers may take into account various mitigating factors, such as the biology of the stock and the needs of fishing communities, such that the time period may exceed 10 years. Rebuilding plans must also take into account variations and contingencies in ecological and environmental conditions that cause MSY biomass to vary over time, which affects the practicable time period for rebuilding the stock. (The next section further describes stock rebuilding requirements.)

ES.2.0 Description of the Alternatives

The alternatives will be structured around management targets for each of the four overfished species considered in the EIS. These targets are derived from National Standards Guidelines, which specify how rebuilding should occur (50 CFR600.310(e)). Rebuilding should bring stocks back to a population size that can support MSY (B_{MSY}). A rebuilding plan must specify a target year (T_{TARGET}) based on the time required for the stock to reach B_{MSY}. This target is bounded by a lower limit (T_{MIN}) defined as the time needed for rebuilding in the absence of fishing (i.e., fishing mortality rate [F] = 0). Rebuilding plans for stocks with a T_{MIN} less than 10 years must have a target less than or equal to 10 years. If, as is the case with all of the groundfish stocks considered in this amendment, the biology of a particular species dictates a T_{MIN} of 10 years or greater, then the maximum allowable rebuilding time, T_{MAX}, is the rebuilding time in the absence of fishing (T_{MIN}) plus "one mean generation time."

Because of the uncertainty surrounding stock assessments and future population trends (due, for example, to variable recruitment), the rebuilding period limits and the target need to be expressed probabilistically. At the policy level this makes the tradeoff between long-term risk and short-term costs explicit. Long-term risk is expressed in terms of the probability that the stock will rebuild in the maximum time period (T_{MAX}), given a specified level of harvest during the rebuilding period. If harvest limits are lowered, representing greater short-term costs, this probability (P_{MAX}) increases. Conversely, if a higher harvest rate is chosen, P_{MAX} decreases, representing greater long-term risk that the stock will fail to rebuild. The target year is derived from the same computation. For a given harvest rate, T_{TARGET} is the year in which there is a 50% probability the stock will be rebuilt. (In other words, it is equally likely the stock will have already been rebuilt by this year as it is that the stock will not be rebuilt until a later year.) If catches of an overfished species are prohibited, then T_{TARGET} will be equal to T_{MIN}, the minimum possible rebuilding time. (T_{MIN} is also calculated in a similar way: it is the year with a 50% rebuilding probability, but with the harvest rate set to zero.) Choosing a target year equal to T_{MAX} results in a P_{MAX} equal to 50% since the T_{TARGET} and T_{MAX} are equal.

National Standards Guidelines identify a "mixed-stock complex" exception to the definition of overfishing (50 CFR 600.310(d)(6)), which is applicable to some overfished groundfish species. Different fish assemblages—some with healthy stocks and some with overfished stocks—can co-occur in a mixed-stock complex, and thus, both can be caught simultaneously. An optimum yield (OY) harvest for the healthy stock can result in overfishing the depleted stock. The guidelines allow councils to authorize this type of overfishing in certain circumstances (50 CFR 600.315(d)(6)). However, the Council chose not to consider the mixed-stock exception in developing the alternatives evaluated in this EIS.

Given the framework described above, the alternatives represent different rebuilding strategies for each of the four overfished species, which can be described in terms of a harvest rate and the associated P_{MAX} and T_{TARGET} values. Five alternatives are proposed for evaluation in the Amendment 16-3 EIS; they are described below. Under each alternative range of values is presented for bocaccio based on three different stock assessment model outputs in the 2003 stock assessment and associated rebuilding analysis (MacCall 2003a; MacCall 2003b), approved for evaluation by the Council. These are models STATc, STARb1, and STARB2. The STARb1 and STARb2 models bracket uncertainty about stock status, based on data from California Cooperative Fishery Investigation (CalCOFI) larval fish surveys and a new recreational fishery CPUE index. The STATc model is a hybrid, incorporating data from all sources. Similarly, a range of values is presented for widow rockfish based on scenarios 7, 8, and 9 in the stock assessment and rebuilding analysis for that species (He *et al.* 2003a; He *et al.* 2003b). These model outputs vary due to ranging of the power coefficient for the midwater juvenile fish survey index.

ES.2.1 The No Action Alternative

An EIS must consider the alternative of no action. This represents the conditions that would apply if the proposed action or one of its alternatives is not implemented. Although the Council has been managing overfished groundfish species using interim rebuilding plans, comparing the rebuilding strategies to how overfished stocks would be managed according to the existing framework in the FMP is more informative. Under this framework a precautionary management strategy to rebuild stocks to B_{MSY} decreases the optimum yield (OY or target harvest level) from the ABC (acceptable biological catch) using the 40-10 adjustment. The 40-10 adjustment is a linear decrease in the OY from the ABC for spawning stock biomass levels between $B_{40\%}$ (40% of the unfished biomass, a proxy for B_{MSY}) and $B_{10\%}$, at which point the OY is adjusted to zero. This results in a straight line, representing the precautionary reduction, intersecting the x-axis at $B_{10\%}$ and the line representing the ABC-biomass relationship at $B_{40\%}$ (see Figure ES.1). Conversely, when the stock is rebuilt, or at $B_{40\%}$, the OY would be set equal to the ABC. The harvest control rule is, therefore, a variable harvest rate based on the stock's biomass relative to its initial, unfished biomass. The parameters used to describe rebuilding strategies can be computed for the harvest rates resulting from application of the 40-10 precautionary reduction, as shown below. In comparison to the other alternatives, the precautionary strategy can result in much lower OYs in the short term, if the overfished stock is at a low biomass level, but allow greater harvests at higher biomass levels, making full recovery less likely. The strategic rebuilding parameters and projected 2003 OY for each species under this alternative are presented in the following table.

Stock	Strategic Rebuilding Parameters		
	F rate (2005 OY)	P_{MAX}	T_{TARGET}
Bocaccio			
STATc (base model)	varies (7)	77.6%	2025
STARb1	varies (67)	90.4%	2019
STARb2	varies (0)	83.7%	2026
Cowcod	varies (0)	NA	NA
Widow Rockfish			
Model 8 (base model)	varies (1,359)	0%	>2102
Model 7	varies (1,016)	0%	>2102
Model 9	varies (1,799)	0%	>2102
Yelloweye Rockfish	27	0%	>2351

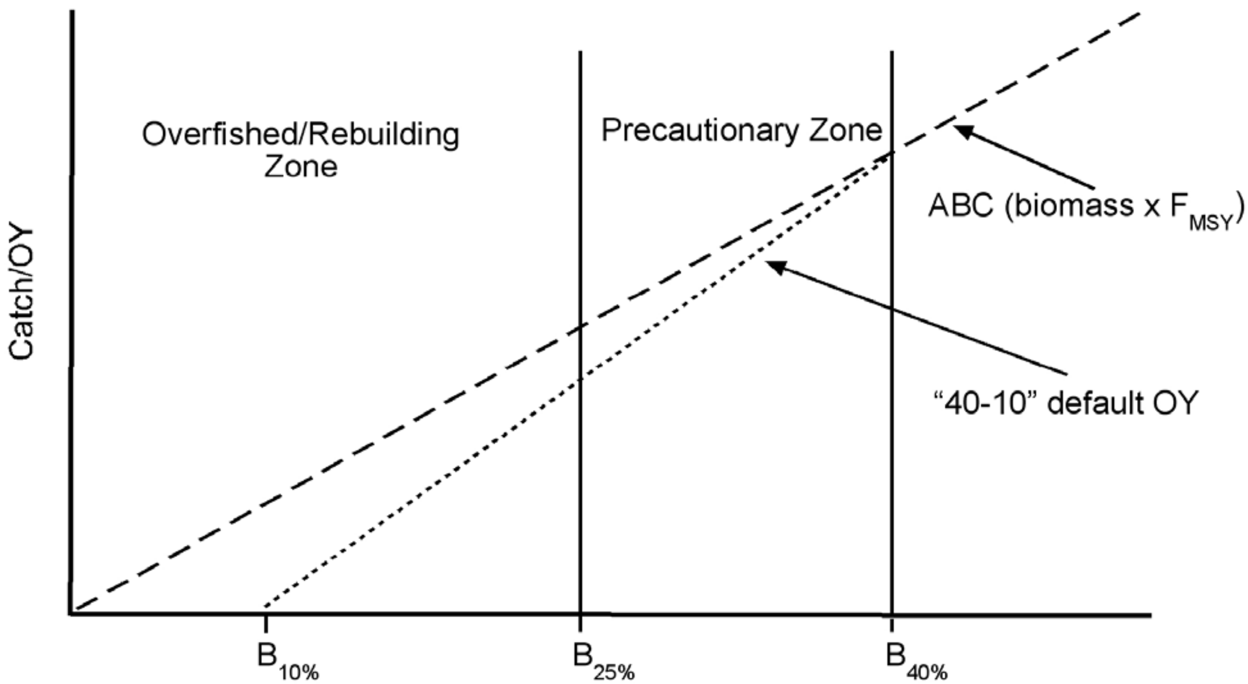

Figure ES.1. The 40-10 precautionary adjustment.

ES.2.2 Action Alternative 1

Action Alternative 1 generally specifies the most liberal, legally-compliant harvests considered by the Council for rebuilding these four species. While this action alternative may constrain fisheries less than the other alternatives considered, it does entail the highest risk of not rebuilding by T_{MAX}. Therefore, of the considered action alternatives, Action Alternative 1 has the lowest short term negative economic impacts to fisheries and fishing communities and the highest biological risk to these overfished stocks. The strategic rebuilding parameters and projected 2003 OY for each species under this alternative are presented in the following table.

Stock	Strategic Rebuilding Parameters		
	F rate (2005 OY)	P_{MAX}	T_{TARGET}
Bocaccio			
STATc (base model)	0.0165 (375 mt)	60%	2025
STARb1	0.0914 (713)	60%	2027
STARb2	0.0643 (304)	60%	2031
Cowcod	0.0100 (4.8 mt)	55%	2095
Widow Rockfish			
Model 8 (base model)	0.0615 (375 mt)	60%	2025
Model 7	0.0914 (713)	60%	2027
Model 9	0.0643 (304)	60%	2031
Yelloweye Rockfish	0.0167 (28 mt)	60%	2067

ES.2.3 Action Alternative 2

Action Alternative 2 is one of the two intermediate action alternatives considered by the Council in November 2003 for detailed analysis in this EIS. Short term negative socioeconomic impacts to fishermen and fishing-dependent communities are greater than those under Action Alternative 1, but less than those specified under the other action alternatives. Consequently the risk of not rebuilding by T_{MAX} is less than Action Alternative 1, but greater than the other action alternatives. The strategic rebuilding parameters and projected 2003 OY for each species under this alternative are presented in the following table.

Stock	Strategic Rebuilding Parameters		
	F rate (2005 OY)	P_{MAX}	T_{TARGET}
Bocaccio			
STATc (base model)	0.0498 (307 mt) 0.0801	70%	2023
STARb1	(633)	70%	2024
STARb2	0.0541 (259)	70%	2029
Cowcod	0.009 (4.2 mt)	60%	2090
Widow Rockfish			
Model 8 (base model)	0.0070 (213 mt)	60%	2035
Model 7	0.0041 (111)	60%	2035
Model 9	0.0122 (423)	60%	2031
Yelloweye Rockfish	0.0161 (27 mt)	60%	2062

ES.2.4 Action Alternative 3

Action Alternative 3 is one of the two intermediate action alternatives considered by the Council in November 2003 for detailed analysis in this EIS. Short term negative socioeconomic impacts to fishermen and fishing-dependent communities are greater than those under Action Alternative 1 or 2, but less than those specified under Action Alternative 4. Consequently the risk of not rebuilding by T_{MAX} is less than Action Alternative 1 or 2, but greater than Action Alternative 4. The strategic rebuilding parameters and projected 2003 OY for each species under this alternative are presented in the following table.

Stock	Strategic Rebuilding Parameters		
	F rate (2005 OY)	P_{MAX}	T_{TARGET}
Bocaccio			
STATc (base model)	0.0383 (240 mt)	80%	2020
STARb1	0.0670 (538)	80%	2022
STARb2	0.0430 (209)	80%	2027
Cowcod	0.009 (4.2 mt)	60%	2090
Widow Rockfish			
Model 8 (base model)	0.0040 (124 mt)	80%	2032
Model 7	0.0011 (30)	80%	2031
Model 9	0.0094 (327)	80%	2028
Yelloweye Rockfish	0.0153 (27 mt)	80%	2058

ES.2.5 Action Alternative 4

Action Alternative 4 generally specifies the most conservative, legally-compliant harvests considered by the Council for rebuilding these four species. While this action alternative may constrain fisheries more than the other alternatives considered, it does entail the lowest risk of not rebuilding by T_{MAX}. Therefore, of the considered action alternatives, Action Alternative 4 has the highest short term negative economic impacts to fisheries and fishing communities and the lowest biological risk to these overfished stocks. The strategic rebuilding parameters and projected 2003 OY for each species under this alternative are presented in the following table.

Stock	Strategic Rebuilding Parameters		
	F rate (2005 OY)	P_{MAX}	T_{TARGET}
Bocaccio			
STATc (base model)	0.0209 (134 mt)	90%	2018
STARb1	0.0496 (407)	90%	2020
STARb2	0.0271 (134)	90%	2025
Cowcod	0.009 (4.2 mt)	60%	2090
Widow Rockfish			
Model 8 (base model)	0.0001 (4 mt)	90%	2028
Model 7*	0 (0)	90%	2030
Model 9	0.0060 (209)	90%	2026
Yelloweye Rockfish	0.0142 (24 mt)	90%	2054

*There is only an 82.8% probability of rebuilding widow rockfish with a zero harvest under Model 7. $T_{TARGET} = T_{MIN}$ in this scenario.

ES. 2.6 Alternatives Considered But Eliminated From Further Detailed Analysis

Any alternatives with less than a 50% probability of rebuilding to B_{MSY} within T_{MAX} are not compliant with the MSA as interpreted in a 2000 Federal Court ruling (*Natural Resources Defense Council* v. *Daley, April 25, 2000, U.S. Court of Appeals for the District of Columbia Circuit*). Therefore, alternatives with a P_{MAX} less than 50% are not analyzed in this rebuilding plan.

The Council further limited the range of alternatives for detailed analysis at its November 2003 meeting. Those alternatives with a 50% probability of rebuilding to B_{MSY} within T_{MAX}, as well as those alternatives with a 0% fishing mortality rate, were rejected from detailed analysis.[3/] A 50% rebuilding probability was considered too risky a long term rebuilding strategy for any of these species, while the economic harm to West Coast fisheries and fishing communities resulting from a zero fishing strategy was considered too high a cost to pay to rebuild these stocks.

As noted above, councils may consider the mixed stock exception in multispecies fisheries where bycatch is unavoidable. However, the Council chose not to consider alternatives based on this provision.

Lastly, there is a limited range of cowcod alternatives for analysis. Cowcod was the first of the overfished West Coast groundfish stocks so declared after adoption of FMP Amendment 11, which was responsive to the mandates of the 1996 Sustainable Fisheries Act. Many of the tools used to analyze rebuilding effects, such as the Punt rebuilding program (Punt 2002), were not available when this stock was assessed and a rebuilding analysis was prepared. Coupled with the data limitations in the assessment, cowcod stock status is poorly estimated and the typical suite of rebuilding projections are unavailable. Consequently, there is no way, short of conducting a new assessment, to analyze alternatives with probabilities of rebuilding to B_{MSY} within T_{MAX} greater than 60%.

ES.3.0 Impacts of the Alternatives

Chapters 3 through 8 in this EIS evaluate impacts of the alternatives to different components of the human environment. In each chapter the baseline condition of the subject environmental component is described. (Appendix A provides more detailed descriptions of the affected environment for West Coast groundfish.) The projected impacts of the alternatives are then evaluated. These projected impacts are summarized in Table ES-1.

3/ One exception is the Action Alternative 4 for widow rockfish under the assumption that Model 7 represents the true state of nature. This scenario specifies a zero harvest and harvest rate with an estimated 82.8% probability of rebuilding by T_{MAX}.

TABLE ES-1. Impact Summary. (Page 1 of 3)

	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Marine Ecosystems and Essential Fish Habitat	Short term decrease in impacts. In the long term impacts are indistinguishable between the alternatives.	Short term term effects unlikely to differ from No Action due to mitigation such as EFH EIS, closed areas. In the long term impacts are indistinguishable between the alternatives.	Short term effects unlikely to differ from No Action due to mitigation such as EFH EIS, closed areas. In the long term impacts are indistinguishable between the alternatives.	Short term effects unlikely to differ from No Action due to mitigation such as EFH EIS, closed areas. In the long term impacts are indistinguishable between the alternatives.	Lowest level of short term impacts. EFH EIS, closed areas also apply. Slowest increase in impacts. In the long term impacts are indistinguishable between the alternatives.
Protected Species	Possible short term increase in impacts on marine mammals and seabirds. In the long term impacts are indistinguishable between the alternatives.	Little or no short term increase in impacts on marine mammals and seabirds. In the long term impacts are indistinguishable between the alternatives.	Little or no increase short term in impacts on marine mammals and seabirds. In the long term impacts are indistinguishable between the alternatives.	No increase in impacts on marine mammals and seabirds. In the long term impacts are indistinguishable between the alternatives.	Possible short term reduction in impacts. In the long term impacts are indistinguishable between the alternatives.
Overfished Species in this EIS	Rebuilding only occurs for one of the four species (bocaccio).	First species rebuilt is bocaccio (2025). Rebuilding occurs for all four species by 2095.	First species rebuilt is bocaccio (2023). Rebuilding occurs for all four species by 2090.	First species rebuilt is bocaccio (2020). Rebuilding occurs for all four species by 2090.	First species rebuilt is bocaccio (2018). Rebuilding occurs for all four species by 2090.
Co-occurring Species	Constraints on shelf fisheries south of Cape Mendocino would reduce short term fishing mortalities for co-occurring species. In the long term impacts are indistinguishable between the alternatives.	Greatest short term impacts on co-occurring species. In the long term impacts are indistinguishable between the alternatives.	Lower mortality in short term of species caught incidentally in whiting trawl than Alternative 1. In the long term impacts are indistinguishable between the alternatives.	Lower mortality in short term of species caught incidentally in whiting trawl than Alternative 2. In the long term impacts are indistinguishable between the alternatives.	Lowest mortality in short term for co-occurring species. In the long term impacts are indistinguishable between the alternatives.
Public Sector and Management Regime	Very conservative and complex management regulations south of Cape Mendocino. Probably high survey costs.	Most liberal management regime. Least complex regulations. Potentially higher enforcement costs.	Similar to Alternative 1, but possibly higher management costs for whiting fishery.	Higher management and enforcement costs than Alternative 2.	Most constrained management regime. Probable closure of northern midwater and southern nearshore fisheries. Impacts to the public sector and the management regime greater than under Alternative 3.

TABLE ES-1. Impact Summary. (Page 2 of 3)

	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Commercial Vessels	Increased benefits for midwater trawl and whiting trawl fisheries, but not sustainable. Severely limited fisheries south of Cape Mendocino.	Maintains same general level and distribution of activity as in 2004. Allows highest level of activity among the alternatives in northern midwater trawl and whiting trawl fisheries, and in southern exempted trawl and fixed gear fisheries.	Maintains similar level of activity as in 2004. May constrain midwater trawl and whiting trawl more than in 2004.	Maintains similar level of activity as in 2004. Constrains midwater trawl and whiting trawl more than Alternative 2.	Lowest activity level for most commercial fisheries. Fisheries north and south of Cape Mendocino are very constrained. Virtual elimination of midwater trawl and whiting trawl in the short term.
Buyers and Processors	Increased benefits for whiting processors. Severely limited harvests from most fisheries south of Cape Mendocino	Maintains same general level and distribution of harvest as in 2004. Allows increased whiting harvest. May allow increased harvests from exempted trawl and fixed gear fisheries south of Cape Mendocino.	Maintains same general level and distribution of harvest as in 2004. Less favorable for whiting processors than Alternative 1. May allow some increase in exempted trawl and fixed gear harvests south of Cape Mendocino.	Maintains same general level and distribution of harvest as in 2004, but whiting harvest lower than Alternative 2.	Lowest harvests among the alternatives north and south of Cape Mendocino. Virtual elimination of whiting harvests in the short term.
Recreational Fishery	Virtual elimination of recreational groundfish fisheries south of Cape Mendocino.	Maintains at least the same level of activity as in 2004 north of Cape Mendocino. May allow increased activity south of Cape Mendocino.	Maintains the same level of activity as in 2004.	Maintains similar level of recreational fishing activity as in 2004. May constrain fisheries north of Cape Mendocino more than in 2004.	Much lower activity than in 2004 for recreational groundfish fisheries north and south of Cape Mendocino. May also constrain non-groundfish recreational fisheries.
Tribal Fishery	Most beneficial to tribal vessels midwater trawl and whiting trawl vessels.	Maintains at least the same level of tribal fishing activity as in 2004. Allows increased activity for tribal midwater trawl and whiting trawl.	May constrain tribal midwater trawl and whiting trawl fisheries more than in 2004.	Constrains tribal midwater trawl and whiting trawl fisheries more than Alternative 2.	Virtual elimination of the tribal midwater trawl and whiting fishery in the near term.

TABLE ES-1. Impact Summary. (Page 3 of 3)

	No Action	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Communities	Negatively impact fishing communities in southern and central California. May be the most favorable for harvesters and processors north of Cape Mendocino.	Maintains at least the same level of benefits to West Coast communities as in 2004. May allow increased benefits from whiting harvest and processing for communities north of Cape Mendocino. May allow increased benefits from exempted trawl and fixed gear for communities south of Cape Mendocino.	Generally maintains the level of benefits to West Coast communities as in 2004. May reduce benefits below 2004 level from whiting harvest and processing for communities north of Cape Mendocino.	Reduced level of benefits than in 2004, especially for communities north of Cape Mendocino.	Severely depress harvests north and south of Cape Mendocino. Virtual elimination of whiting harvests.
Nonconsumers and Nonusers	Rebuilding occurs only for bocaccio.	Slowest rebuilding. Lowest value to nonconsumers and non-users.	Second slowest rebuilding. Second lowest value to nonconsumers and non-users.	Second fastest rebuilding for all species. Second highest value to nonconsumers and non-users.	Fastest rebuilding for all species. Highest value to nonconsumers and non-users.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Page

1.0 INTRODUCTION

1.1 How This Amendment is Organized

This document provides background information about and analysis of changes to the Pacific Coast Groundfish Fishery Management Plan incorporated as Amendment 16-3. The actual changes, or amended parts of the plan, will appear in the final environmental impact statement as Appendix C. The Pacific Fishery Management Council prepared this document. The Council is one of eight regional Fishery Management Councils providing management recommendations to NMFS, which then implements these regulations through federal regulations as appropriate. The Pacific Fishery Management Council is responsible for fisheries occurring in federal waters off the U.S. West Coast (see Appendix A, Figure 1-6). Each Council draws its membership from constituent states; in addition to Washington, Oregon, and California, Idaho is also a member of the Pacific Council because salmon, managed by the Council under a different fishery management plan, return to rivers in Idaho to spawn.

This document is the third in a series of amendments numbered Amendments 16-1, 16-2, and 16-3. Amendment 16-1, approved on November 14, 2003, establishes a framework for the adoption of rebuilding plans for overfished species. Amendment 16-2, approved on January 30, 2004, adopted rebuilding plans for darkblotched rockfish, Pacific ocean perch (POP), lingcod, and canary rockfish. This amendment adopts rebuilding plans for bocaccio, cowcod, yelloweye rockfish, and widow rockfish. Adopted plans are implemented through the framework contained in Amendment 16-1.

FMPs, and any amendments to them, must conform to the Magnuson-Stevens Act (MSA), the principal legislation governing fishery management within the Exclusive Economic Zone (EEZ), which extends from the outer boundary of the territorial sea to a distance of 200 nautical miles from shore. In addition to addressing MSA mandates, this document is an EIS, pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended. According to NEPA (Sec. 102(2)(C)), any "major federal action significantly affecting the quality of the human environment" must be evaluated in an EIS. Based on a preliminary determination by Council and NMFS staff, adopting these four rebuilding plans may have significant impacts. Therefore, rather than preparing an environmental assessment (EA), which provides "sufficient evidence and analysis for determining whether to prepare an environmental impact statement," NMFS and the Council have decided to proceed directly to preparation of an EIS. The document also contains information and analyses relevant to the Regulatory Flexibility Act (RFA) and EO 12866 (Regulatory Impact Review or RIR). These mandates require agencies to evaluate the economic impact of regulatory actions, especially on small entities.

Federal regulations (40 CFR 1502.9) require agencies to prepare and circulate a draft EIS (DEIS), which "must fulfill and satisfy to the fullest extent possible the requirements established for final statements in Section 102(2)(C) of the Act" (i.e., NEPA). Agency guidelines (NOAA Administrative Order 216-6. 5.01.b.1(i)) stipulate a minimum 45-day public comment period on the DEIS. At the end of this period a final EIS (FEIS) is prepared, responding to comments and revising the document accordingly. After the EIS is completed, a 30-day "cooling off" period ensues—with another opportunity for public comment—before the responsible official may sign a record of decision (ROD) and implement the proposed action. NMFS and the Council are under a court-mandated deadline of September 15, 2003, to sign the ROD for this EIS, signaling implementation of the rebuilding plans. In order to meet this deadline, in concert with the Council meeting schedule and other staff obligations, the DEIS for this action is being released in advance of the Council recommending a preferred alternative, which they plan to do on April 8, 2004, at their April meeting in Sacramento, California. It will be within the range of alternatives described and evaluated in this DEIS. After a 45-day public comment period, the Council will prepare the FEIS. In addition to responding to public comments, the FEIS will incorporate any additional analysis needed to fully evaluate the Council's preferred alternative. The FEIS must be released by early August 2004 to meet the court-mandated deadline.

Environmental impact analyses have four essential components: a description of the purpose and need for the proposed action, a set of alternatives that represent different ways of accomplishing the proposed action, a description of the human environment affected by the proposed action, and an evaluation of the predicted direct, indirect, and cumulative impacts of the alternatives.[4/] These elements allow the decisionmaker to look at different approaches to accomplishing a stated goal and understand the likely consequences of each choice, or alternative. EISs are commonly organized around four chapters covering each of these topics. This EIS is organized differently; Chapters 1 and 2 cover the purpose and need and describe the alternatives, but the next six chapters focus on parts of the human environment potentially affected by the proposed action. Each of these chapters describes both the baseline environment potentially affected by the proposed action and the predicted impacts of each of the alternatives. Based on this structure, the document is organized in 14 chapters:

- The rest of this chapter, Chapter 1, discusses the reasons for changing the FMP. This description of purpose and need defines the scope of the subsequent analysis.

- Chapter 2 outlines different alternatives that have been considered to address the purpose and need. The Council will choose one of these alternatives as their preferred alternative, which is recommended to NMFS for adoption as a plan amendment.
-
- Chapter 3 describes **West Coast marine ecosystems and essential fish habitat (EFH)** potentially affected by the proposed action and discloses the predicted impacts of the alternatives on that segment of the human environment.

- Chapter 4 describes **protected species** potentially affected by the proposed action and discloses the predicted impacts of the alternatives on that segment of the human environment.

- Chapter 5 describes the **Amendment 16- 3 overfished species** affected by the proposed action and discloses the predicted impacts of the alternatives on that segment of the human environment.

- Chapter 6 describes **co-occurring fish species** affected by the proposed action and discloses the predicted impacts of the alternatives on that segment of the human environment.

- Chapter 7 describes the **public sector and fisheries management regime** and how the different alternatives would affect these institutions.

- Chapter 8 describes the **socioeconomic environment**, which includes commercial and recreational fisheries and coastal communities in the action area, and how they would be affected by the different alternatives.

- Chapter 9 addresses additional requirements of NEPA and implementing regulations, including the identification of any measures that will be implemented to mitigate significant impacts of the proposed action.

- Chapter 10 details how this amendment meets 10 National Standards set forth in the Magnuson-Stevens Act (§301(a)) and groundfish FMP goals and objectives.

4/ Federal regulations at 40 CFR 1502 detail the required contents of an EIS. Although there are several additional components, this list is of the core elements.

- Chapter 11 provides information on those laws and Executive Orders, in addition to the Magnuson-Stevens Act and NEPA, that an amendment must be consistent with, and how this amendment has satisfied those mandates.

- Chapters 12, 13, and 14 include required supporting information: the list of preparers, who received copies of the document, and the bibliography.

Appendices A and B provide additional supporting information. Appendix A is a comprehensive description of the affected environment and supports the descriptions included in Chapters 3 through 8. Appendix B reproduces tables first developed for Amendment 16-2 showing the catch of overfished species by different fleet segments and the co-occurrence of target species and overfished species.

1.2 Purpose and Need

1.2.1 The Proposed Action

The proposed action is to implement legally-compliant rebuilding plans, consistent with the framework established in Amendment 16-1, that will set strategic rebuilding parameters to guide stock rebuilding for bocaccio (*Sebastes paucispinis*), cowcod (*S. crameri*), lingcod (*S. levis*), yelloweye rockfish (*S. ruberimus*), and widow rockfish (*S. entomelas*). These rebuilding parameters stem from the Magnuson-Stevens Act and National Standard 1 guidelines (50 CFR 600.310). The most important strategic rebuilding parameters are the time period within which the stock must be rebuilt to the target biomass capable of supporting MSY and the harvest control rule that would constrain fishing mortality so that the stock can be rebuilt in that time period. Amendment 16-1, addressing the process and standards for rebuilding plan adoption, states that new management measures intended to achieve these targets may be added to the FMP as part of rebuilding plans. However, no new management measures are proposed in Amendment 16-3 (evaluated in this EIS); instead, existing management measures implemented through the biennial management process will be used to constrain fishing to the targets identified in the rebuilding plans.

1.2.2 Need (Problems for Resolution)

As of February 2002 the Secretary had declared nine groundfish stocks overfished. These are: bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), cowcod (*S. levis*), darkblotched rockfish (*S. crameri*), lingcod (*Ophiodon elongatus*), Pacific ocean perch (*S. alutus*), widow rockfish (*S. entomelas*), yelloweye rockfish (*S. ruberrimus*), and Pacific whiting (*Merluccius productus*).[5/] These declarations, stemming from Magnuson-Stevens Act requirements, are based on overfishing criteria adopted by the Council under Amendment 11 to the Pacific Coast Groundfish FMP. The Magnuson-Stevens Act (§304(e)(3)) also requires councils to “prepare a fishery management plan, plan amendment, or proposed regulations” in order to prevent overfishing and implement a plan to rebuild the overfished stocks. The Council developed Amendment 12 to specify an effective process for implementing rebuilding plans. This amendment was

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5/ The most recent whiting stock assessment (Helser *et al.* 2004), incorporating new data from the 2003 hydro-acoustic survey, estimates current biomass between 47% and 51% of unfished biomass; the stock is therefore not currently overfished. Furthermore, because the 1999 year class was larger than previously estimated, estimates of the 2001 biomass in the current stock assessment range from 27% to 33% of unfished biomass, indicating that the stock approached, but never fell below, the $B_{25\%}$ minimum stock size threshold (Whiting STAR Panel 2004). As of this writing it is unclear what procedural steps, if any, are necessary for NMFS to declare whiting not overfished, removing the requirement to prepare a rebuilding plan and manage the stock accordingly.

adopted by the Council in April 2000 and approved by NMFS on December 7, 2000. However, in Federal District Court the Natural Resources Defense Council challenged the legality of the provisions in Amendment 12 related to rebuilding plans,[6/] based on the Magnuson-Stevens Act and the NEPA. The Court found that the rebuilding plans created in accordance with Amendment 12 did not comply with the Magnuson-Stevens Act because the plans did not take the form of an FMP, FMP amendment, or regulation. Therefore, the Council must specify rebuilding plans as an FMP or regulatory amendment. (Development of a new FMP covering overfished groundfish species is not considered.) Amendment 16-1 establishes a legally-compliant framework for the adoption and implementation of rebuilding plans. This amendment adopts rebuilding plans for four overfished groundfish species, consistent with the framework.

Rebuilding plans are mandated when the size of a stock or stock complex falls below a level described in the FMP as the minimum stock size threshold, or MSST, which is 25% of unfished biomass ($B_{25\%}$) for stocks managed under the groundfish FMP. Diminished stock size may be caused or exacerbated by fishing. Regardless of the cause of the decline, fishing mortality needs to be controlled to prevent further deterioration in the condition of the stock, and if the stock has been overfished, to allow it to rebuild.[7/] Amendment 11 to the groundfish FMP established the "status determination criteria" (including MSST) that are used to determine whether overfishing is occurring and whether a stock has reached an overfished state. Rebuilding plans specify how an overfished stock will be rebuilt.

The proposed action is needed, because the four groundfish species addressed by this amendment (bocaccio, cowcod, yelloweye rockfish, and widow rockfish) are overfished. National Standard 1 in the Magnuson-Stevens Act requires conservation and management measures that prevent overfishing. Preventing overfishing also means returning stocks to a size capable of achieving MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation. In order to satisfy this mandate, legally compliant rebuilding plans must be adopted for stocks that have been declared overfished by the Secretary of Commerce.

1.2.2 Purpose of the Proposed Action

The *purpose* of the proposed action is to rebuild bocaccio, cowcod, yelloweye rockfish, and widow rockfish stocks managed under the Pacific Coast Groundfish FMP to a size capable of supporting MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation, and according to the requirements of the MSA. The MSA states: "For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations... for such fishery shall... specify a time period for ending overfishing and rebuilding the fishery..." (Sec. 304(e)(4)). The MSA also states that this time period "shall be as short as possible," and usually may not exceed 10 years. However, in setting a time period for rebuilding the stock, fishery managers may take into account various mitigating factors, such as the biology of the stock and the needs of fishing communities, such that the time period may exceed 10 years. Rebuilding plans must also take into account variations and contingencies in ecological and environmental conditions that cause MSY biomass to vary over time, which affects the practicable time period for rebuilding the stock. (The next section further describes stock rebuilding requirements.)

6/ The amendment also removed FMP provisions that allowed foreign fishing on groundfish stocks. This part of the amendment was not challenged, and these provisions of the FMP stand.

7/ But when environmental changes affect the long-term productive capacity of the stock, one or more components of the status determination criteria may be respecified and the need for a reduction in fishing mortality reevaluated (50 CFR Section 600.310).

1.3 Background

1.3.1 Requirements for Rebuilding Plans

National Standards Guidelines specify how rebuilding should occur and, in particular, establish constraints on Council action (50 CFR600.310(e)). Rebuilding should bring stocks back to a population size that can support MSY (B_{MSY}). A rebuilding plan must specify a target year (T_{TARGET}) based on the time required for the stock to reach B_{MSY}. This target is bounded by a lower limit (T_{MIN}) defined as the time needed for rebuilding in the absence of fishing (i.e., a zero fishing mortality rate, $F = 0$). Rebuilding plans for stocks with a T_{MIN} less than 10 years must have a target less than or equal to 10 years. If, as is the case with most of the groundfish stocks considered in this amendment, the biology of a particular species dictates a T_{MIN} of 10 years or greater, then the maximum allowable rebuilding time, T_{MAX}, is the rebuilding time in the absence of fishing (T_{MIN}) plus "one mean generation time." Mean generation time is a measure of the time required for a female to produce a reproductively-active female offspring (Pielou 1977; and especially Restrepo *et al.* 1998) calculated as the mean age of the net maternity function (product of survivorship and fecundity at age). The Magnuson-Stevens Act states the rebuilding time should be as short as possible, taking into account the status and biology of the overfished stocks and the needs of fishing communities (Sec. 304(e)(A)(i)). All four species considered in this amendment have minimum rebuilding times greater than 10years, so the target years considered in the alternatives are also greater than T_{MIN}.

Because of the uncertainty surrounding stock assessments and future population trends (due, for example, to variable recruitment), the rebuilding period limits and the target need to be expressed probabilistically. At the outset of the rebuilding period T_{TARGET} should be set, so there is at least a 50% probability of achieving B_{MSY} within the T_{MAX}.[8/] (Probabilities associated with T_{MIN}, T_{TARGET}, and T_{MAX} are discussed in Appendix A, Section 1.1.1.2.)

National Standards Guidelines identify a "mixed-stock complex" exception to the definition of overfishing (50 CFR 600.310(d)(6)), which is applicable to some overfished groundfish species. Different fish assemblages—some with healthy stocks and some with overfished stocks—can co-occur in a mixed-stock complex, and thus, both can be caught simultaneously. An OY harvest for the healthy stock can result in overfishing the depleted stock. The guidelines allow councils to authorize this type of overfishing if three conditions are met (50 CFR 600.315(d)(6)). First, an FMP (or plan amendment) must assess the overall benefits of such a policy in comparison to other measures, such as reducing the OY for the healthy stock. Second, councils must consider mitigating measures that reduce overfishing by, for example, modifying fishing strategy or gear configuration. The benefits of mitigation must be compared to those determined in the preceding assessment; the measures would only be implemented if they will result in greater benefits. Finally, permitted overfishing cannot result in eventual listing of the species (or evolutionarily significant unit, thereof) under the ESA. This mixed-stock exception is not considered in formulating rebuilding plans for the four species in this FMP amendment and EIS.

National Standard Guidelines also distinguish the activity of "overfishing" from the status of a stock characterized as "overfished." Overfishing is defined by the maximum fishing mortality threshold (MFMT); harvest mortality above this limit constitutes overfishing. A stock is considered overfished when its biomass falls below the MSST, which for stocks managed under the groundfish FMP, is defined as $B_{25\%}$ (25% of the unfished biomass). Thus, the MFMT refers to a fishing rate while the MSST refers to a stock size. Although

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8/ The use of a low bound 50% probability is not specified in regulations; it is the result of litigation (*Natural Resources Defense Council* v. *Daley, April 25, 2000, U.S. Court of Appeals for the District of Columbia Circuit*).

sometimes causing confusion, this distinction is an important one. It can be seen that any combination of these two features may apply to a stock. For example a stock above the MSST may experience overfishing (because the MFMT is being exceeded). Conversely, an overfished stock (biomass below the MSST) may not be experiencing overfishing. In fact, stock rebuilding characterizes this second condition where historical overfishing has caused the stock to become overfished. Although overfishing is no longer occurring, and the stock is rebuilding, the stock is considered overfished until it returns to the target biomass.

1.3.2 Stock Status of the Four Species Considered in this Amendment

1.3.2.1 Bocaccio Stock Status

There are two separate West Coast bocaccio populations. The southern stock exists south of Cape Mendocino and the northern stock north of 48° N latitude in northern Washington (off Cape Flattery). Although it is unclear whether this separation results in reproductively separate stocks, assessment scientists and managers have treated the two populations as independent stocks north and south of Cape Mendocino. The southern stock is considered overfished, the northern stock is not.

A 1996 assessment (Ralston *et al.* 1996) indicated the stock was in severe decline. NMFS formally declared the stock overfished in March 1999 after the groundfish FMP was amended to incorporate the tenets of the Sustainable Fisheries Act. MacCall et al. (1999) confirmed the overfished status of bocaccio and estimated spawning output of the southern stock to be 2.1% of its unfished biomass and 5.1% of the MSY level. The northern stock of bocaccio has not been assessed.

The last two assessments—in 2002 and 2003—have produced very different results. The 2002 stock assessment (MacCall and He 2002a) found a slight increase in relative abundance from previous assessments, to 4.8% of unfished biomass, potential productivity appeared lower than previously thought, making for a more pessimistic outlook. Bocaccio have highly variable recruitment; a relatively strong 1999 year class has played a big role in recent assessments. Data used in the 2002 assessment showed lower than expected revealed recruitment of the 1999 year class into the fishable population, leading scientists to conclude that stock rebuilding would not proceed as rapidly as previously thought. As a result, the Council established a 2003 OY of 20 mt. (This value was expressed as a ceiling, management measures implemented at the outset of 2003 aimed to keep actual harvest mortality below this level.) Even with this very low harvest level, the rebuilding analysis showed that the stock would not rebuild; however, the analysis showed a low probability of further stock decline with this level of fishing mortality.

In the assessment conducted the next year (MacCall 2003b) the 1999 year class appeared much more robustly in the data. When combined with a lower estimate of natural mortality, this assessment resulted in a much more optimistic outlook for bocaccio recovery, even with a substantial increase in harvest mortality. After vetting by a stock assessment review (STAR) panel, the assessment presented three different results. (See Section 1.1.1.1 in Appendix A for a description of the stock assessment review process.) The STAR Panel recommended the use of two assessment models as a means of bracketing uncertainty because of the differing recruitment information in two data sources: the triennial trawl survey conducted by NMFS and recreational CPUE data, which was computed differently than in previous assessments. Following the STAR Panel meeting, MacCall, the stock assessment author, presented a third "hybrid" model that incorporated the data from all of the indices. The Council's Scientific and Statistical Committee (SSC) recommended and the Council approved the use of this third modeling approach. This resulted in modest improvement in estimated stock size, but significantly affected the estimated productivity of the stock. These results had substantial effects on the rebuilding outlook for bocaccio. The current rebuilding analysis (MacCall 2003a), using the "hybrid" model, suggests the stock could rebuild to B_{MSY} within 25 years while sustaining an OY of approximately 300 metric tons in 2004 (see Table 2-1).

1.3.2.2 Cowcod Stock Status

While cowcod are not a major component of the groundfish fishery, they are highly desired by both recreational and commercial fishers because of their bright color and large size. The cowcod stock south of Cape Mendocino has experienced a long-term decline. Abundance indices decreased approximately tenfold between the 1960s and the 1990s, based on commercial passenger fishing vessel (CPFV) logs (Butler *et al.* 1999). Recreational and commercial catch also declined substantially from peaks in the 1970s and 1980s, respectively.

The cowcod stock in the Conception management area (off Southern California) was assessed in 1998 (Butler *et al.* 1999). Unfished spawning biomass (B_0) was estimated to be 3,370 mt, and 1998 spawning biomass was estimated at 7% of B_0, well below the 25% overfishing threshold. As a result, NMFS declared cowcod in the Conception and Monterey management areas overfished in January 2000. Large areas off southern California (the Cowcod Conservation Areas) have been closed to fishing for cowcod. The stock's low productivity and declined spawning biomass also necessitates an extended rebuilding period, estimated at 62 years with no fishing-related mortality (T_{MIN}) , to achieve a 1,350 mt B_{MSY} for the Conception management area.

There is relatively little information about the cowcod stock and there are major uncertainties in the one assessment that has been conducted. The assessment authors needed to make estimates of early landings based on more recent data and reported total landings of rockfish. Age and size composition of catches are poorly sampled, population structure is unknown, and the assessment was restricted to southern California waters.

A cowcod rebuilding review was completed in 2003 which validated the assumption that non-retention regulations and area closures have been effective in constraining cowcod fishing mortality (Butler *et al.* 2003). These results, although encouraging, are based on cowcod fishery-related removals from recreational charter vessel (CPFV) observations and angler reported discards. Non-retention regulations and limited observation data have increased the need for fishery independent population indices.

1.3.2.3 Widow Rockfish Stock Status

Williams, *et al*. (2000) assessed widow rockfish in 2000. The 2001 spawning output level (8,223 mt) was 23.6% of the unfished level (33,490 mt), based on that assessment and a revised rebuilding analysis (Punt and MacCall 2002) adopted by the Council in June 2001 and the stock was therefore declared overfished in 2001. The analysis estimated the minimum rebuilding time (T_{MIN}) was 22 years, and with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 38 years.

A new assessment for widow rockfish was completed in 2003 (He *et al.* 2003b). This assessment concluded that the widow rockfish stock size is 22.4% of the unfished biomass, but indicates that stock productivity is considerably lower than previously thought although data sparseness was a significant limitation (Conser *et al.* 2003; He *et al.* 2003b). Many of the strategic rebuilding parameters for widow rockfish did not change dramatically with the new rebuilding analysis (He *et al.* 2003a) (also see Table 2-3). The rebuilding period in the absence of fishing increased to 25 years and, with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 41 years. However, the harvest rate associated with these rebuilding trajectories has dropped significantly, in response to the new understanding of decreased stock productivity. The interim rebuilding OY for 2003 using the 2000 rebuilding analysis was 832 metric tons. Under the 2003 rebuilding analysis , the OY for 2004 is 284 mt using the base model.

1.3.2.4 Yelloweye Rockfish Stock Status

The first-ever yelloweye rockfish stock assessment was conducted in 2001 (Wallace 2002). The assessment concluded current yelloweye rockfish stock biomass is about 7% of unexploited biomass in Northern California and 13% of unexploited biomass in Oregon. The assessment revealed a thirty-year declining biomass trend in both areas with the last above-average recruitment occurring in the late 1980s. The stock was declared overfished in 2002 because its biomass was well below the minimum stock size threshold. At the same time, it was separated from the rockfish complexes in which it was previously listed. As with the other overfished stocks, yelloweye rockfish harvest is now tracked separately.

In June 2002 the SSC recommended that managers should conduct a new assessment incorporating Washington catch and age data. This recommendation was based on evidence the biomass distribution of yelloweye rockfish on the West Coast was centered in waters off Washington and that useable data from Washington were available. Based on that advice, the Council asked for a new assessment in the summer of 2002, in advance of a final decision on 2003 management measures. Methot, *et al.* (2002) did the assessment, which was reviewed by a STAR Panel in August 2002. The assessment result was much more optimistic than the one prepared by Wallace (2002), largely due to the incorporation of Washington fishery data. While the overfished status of the stock was confirmed (24% of unfished biomass), Methot, *et al.* (2002) provided evidence of higher stock productivity than originally assumed. The assessment also treated the stock as a coastwide assemblage.

1.3.3 Summary of the Current Management Regime

Draft rebuilding plans and rebuilding analyses have been used since 2000 to guide the Council in deciding annual management measures for overfished groundfish stocks. The four rebuilding plans adopted through Amendment 16-2 provided guidance in developing management measures for 2004. Consistent with the stock rebuilding framework in the groundfish FMP, the harvest control rule (or exploitation rate) for two of these stocks, darkblotched rockfish and Pacific ocean perch, were changed in order to rebuild these stocks by the target year with the same probability (P_{MAX}). With adoption and approval of Amendment 17, groundfish management is shifting two a two-year, or biennial, management cycle. The Council is currently developing harvest specifications and management measures for the first biennial management cycle, 2005-2006. These harvest specifications will be consistent with rebuilding plans in both Amendments 16-2 and 16-3 (this amendment). This process accounts for new information from stock assessments and rebuilding analyses, and legal constraints on harvests imposed by the need to rebuild overfished groundfish fisheries. Although the Council has respected these constraints in its decisions to date, NMFS has the authority to reject these decisions because, in the regulatory context, they only represent recommendations to the Secretary of Commerce.

The Council has typically chosen a risk-averse strategy when deciding on harvest levels for overfished stocks based on recommendations contained in rebuilding analyses and given by the Council's advisory bodies (see Appendix A, Table 2-2 and 2-3). Total mortality has been controlled by reducing trip and landing limits for co-occurring species in select target fisheries, gear restrictions (e.g., the small footrope specification for landing shelf rockfish), seasonal closures (e.g., the recreational groundfish fishery seasons adopted in California), and area closures (e.g., Groundfish Conservation Areas, which include the Cowcod Conservation Area, Rockfish Conservation Area, and Yelloweye Rockfish Conservation Area).

The actual bycatch (or discard) rate for overfished species, which may differ among the various groundfish fishery sectors, is a critical uncertainty that must be addressed if effective measures to control total mortality, and thus, achieve rebuilding objectives, are to be adopted. Limited data have been available on which to base these estimates. Therefore, bycatch and discard rate assumptions have been contentious and the focus of some recent legal challenges. However, NMFS implemented an observer program in August 2001, which allows direct observation of commercial bycatch. Bycatch data from this program were first used in 2003 to estimate total mortality of overfished species. As more data become available from a broader range of groundfish fisheries, they are being used to improve bycatch estimates. (Section 1.2.3 in Appendix A discusses bycatch modeling and the use of observer data.) This will promote more informed management decisions and allow managers to more effectively control total mortality of overfished groundfish stocks.

1.3.4 Summary of Litigation over Amendment 12

In January 2000, the Natural Resources Defense Council (NRDC), along with other conservation organizations, challenged the adequacy of Amendment 12 (*Natural Resources Defense Council* v. *Evans*) in Federal District Court. They claimed that rebuilding plans submitted pursuant to Amendment 12 were inadequate for two reasons. First, they did not take the form of fishery management plans, plan amendments, or regulations as required by the Magnuson-Stevens Act. Second, rebuilding plans could allow overfishing under the "mixed-stock exception." The NRDC argued that the overfished species provisions in the SFA demonstrate Congress's intent to eliminate this exception, so rebuilding plans should not entertain this exception. The Plaintiffs also argued that the EA accompanying Amendment 12 failed to consider a reasonable range of alternatives as required by NEPA. The Court found for the Plaintiffs on the claim that rebuilding measures must conform to the MSA-mandated format of a plan, plan amendment, or regulation and the NEPA-related claim of an inadequate range of alternatives. The Court decided that the second Magnuson-Stevens Act-related claim, on the validity of the mixed-stock exception, was not ripe for judicial review because the exception had not yet been applied to Pacific groundfish management. In response to its findings, the Court ordered NMFS to revise Amendment 12, so rebuilding plans accord with Magnuson-Stevens Act and NEPA requirements.

1.3.5 Development of Rebuilding Plan Adoption Strategy

Because of the litigation described above, in late 2001 work began on a new FMP amendment for the rebuilding plan adoption process that would be consistent with the Court's findings. The Council and NMFS published a Notice of Intent (NOI) to prepare an EIS on April 16, 2002 (67 FR 18576). According to this NOI, the EIS would evaluate two sets of alternatives: one set addressing the framework for rebuilding plan adoption (or the "process and standards") and a second set evaluating different rebuilding strategies that could be adopted as rebuilding plans for overfished species. (These strategies are described in terms of targets and limits, such as T_{TARGET}, T_{MIN}, T_{MAX}, harvest control rules satisfying a given target, and potential management measures to constrain fishing mortality to levels determined by the harvest control rule.) Based on internal discussion, Council staff decided in late 2002 that the process and standards alternatives should be analyzed in a separate environmental document and adopted as Amendment 16-1. Evaluated in an EA, Amendment 16-1 was approved by NMFS on November 14, 2003.

1.3.6 Relationship Between the Contents of Rebuilding Plans and the Contents of this EIS

FMP language, adopted as part of Amendment 16-1, specifies the contents of rebuilding plans. Although these components are part of this EIS, they are not presented as separate, concise documents. Rebuilding plans as such will appear in the first annual Stock Assessment and Fishery Evaluation (SAFE) document published after rebuilding plan adoption and approval by the Secretary. The components identified in the draft FMP language, and corresponding sections in this EIS, are summarize below.

1. A description of the biology and status of the overfished stock and fisheries affected by stock rebuilding measures.

   Chapter 5 describes the biology and status of the stocks in this Amendment; more in-depth discussion of overfished stocks may be found in Section 2.4.1 of Appendix A. Chapter 8 describes the fisheries affected by stock rebuilding measures; more in-depth discussion may be found in Chapter 6 of Appendix A.

2. A description of how rebuilding parameters for the overfished stock were determined (including any calculations that demonstrate the scientific validity of parameters).

   Rebuilding analyses for the overfished species describe how rebuilding parameters are calculated. These analyses are summarized in Chapter 5. The rebuilding analysis documents are available from the Council upon request.

3. Estimates of rebuilding parameters (B_0, B_{MSY}, T_{MIN}, T_{MAX}, and the probability of reaching target biomass by this date [P_{MAX}], and T_{TARGET}) at the time of rebuilding plan adoption.

   B_0, B_{MSY}, T_{MIN}, T_{MAX} are listed in Tables 2-2 and 2-3 in Appendix A. The values do not differ among the alternatives. Values for P_{MAX}, and T_{TARGET} under each alternative are listed in Chapter 2 of this EIS, Tables 2-1 through 2-4.

4. The process, and any applicable standards, that will be used during periodic review to evaluate progress in rebuilding the stock to the target biomass.

   FMP Section 4.5.3.5 lists three types of review standards. For the four rebuilding plans considered here the following review standard will be adopted as part of each rebuilding plan: "The Council, in consultation with the Scientific and Statistical Committee (SSC) and Groundfish Management Team (GMT), will determine on a case-by-case basis whether there has been a significant change in a parameter such that the chosen management target must be revised."

5. Any management measures the Council may wish to specifically describe in the FMP that facilitate stock rebuilding in the specified period. (These measures would be in addition to any existing measures typically implemented through annual or biennial management.)

   No new management measures will be adopted as part of these four rebuilding plans. Existing management measures that are part of the FMP framework are used to constrain total fishing mortality to levels consistent with rebuilding targets.

6. Any goals and objectives in addition to, or different from, those listed in the FMP.

   No additional goals and objectives are included in these rebuilding plans.

7. Potential or likely allocations among sectors.

   Section 8.3.1 discusses potential allocation among sectors.

8. For fisheries managed under international agreement, a discussion of how the rebuilding plan will reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

   None of the fisheries catching the overfished stocks considered in this amendment are currently managed under international agreement.

9. Any other information that may be useful to achieve the rebuilding plan's goals and objectives.

   Appendix A describes baseline conditions. This information may be used, as appropriate, when drafting rebuilding plans.

1.4 Scoping Summary

1.4.1 Background to Scoping

The National Environmental Policy Act requires the public and other agencies be involved in the decision-making process. "Scoping" is an important part of this process. Scoping is designed to provide interested citizens, government officials, and tribes an opportunity to help define the range of issues and alternatives that should be evaluated in the EIS. NEPA regulations stress that agencies should provide public notice of NEPA-related proceedings and hold public hearings whenever appropriate during EIS development (40 CFR 1506.6).

The scoping process is designed to ensure all significant issues are properly identified and fully addressed during the course of the EIS process. The main objectives of the scoping process are to provide stakeholders with a basic understanding of the proposed action, explain where to find additional information about the project, provide a framework for the public to ask questions, raise concerns, identify issues, recommend options other than those being considered by the agency conducting the scoping, and ensure those concerns are included within the scope of the EIS review process.

On September 12, 2003, NMFS and the Council published a notice of intent (NOI) in the *Federal Register* announcing their intent to prepare an EIS in accordance with NEPA for Amendment 16-3 to the groundfish FMP. This NOI:

- described a scoping meeting to be held on November 2, 2003;
- identified where additional information about the proposed project could be obtained;
- explained the roles of NMFS and the Council in the EIS and authorization processes;
- presented a brief summary of the history of rebuilding plans; and,
- described the alternatives being considered to date by NMFS and the Council for inclusion in the EIS.

Publication of the NOI announced the public and agency scoping comment period, which ended on November 10, 2003.

1.4.2 Council Scoping and Agency NEPA Scoping

The Council process, which is based on stakeholder involvement, encourages public participation and public comment on fishery management proposals during Council, subcommittee, and advisory body meetings. The advisory bodies involved in groundfish management include the GMT, with representation from state, federal, and tribal fishery scientists; and the Groundfish Advisory Subpanel (GAP), whose members are drawn from the commercial and recreational fishery, processing, and conservation sectors. The Ad Hoc Allocation Committee, a subpanel of the Council, provides advice on allocating harvest opportunity among the various fishery sectors. These opportunities all constitute the broadly defined Council scoping process, not all of which focuses on the scope and content of NEPA analysis. The Council reviewed a scoping document at their November 3-7, 2003, meeting and adopted for analysis the range of alternatives included in this EIS. Shortly after the DEIS becomes available in late March, the Council will identify their preferred alternative during their April 4-9 meeting in Sacramento, California. At that time the public will have the opportunity to make recommendations to the Council on which alternative they should select. A 45-day comment period, during which NMFS will accept written comments, will also begin at that time.

In addition, the Council hosted a public scoping meeting on November 2, 2003, at the Hilton Hotel in Del Mar, California specifically for the purpose of getting comments on the scope of the NEPA analyses for rebuilding plan related actions. Ten people attended. The meeting served two purposes: to listen to and record the public's comments about the proposed action and to respond to requests for background information. The Council also received two letters during the scoping period.

1.4.3 Summary of Scoping Comments Received by the Council

The 10 people attending the public scoping session and the two written comments break down into the following interest group categories:

Comment Source	Number
Government agency	1
Commercial fishing sector	1
Recreational fishing sector	5
Conservation organizations	3
Other	2
TOTAL	12

The number of times an issue is raised during the scoping process provides an indication of the issues that commentors are most concerned about. Scoping also helps agencies eliminate from detailed study issues that are not significant (40 CFR 1501.4(g)).

Table 1-1 summarizes and categorizes the scoping comments. The way in which this EIS addresses issues raised by the comments is discussed below according to the categories listed in Table 1-1.

Accountability: The comments raise the issue of how the Council and NMFS will ensure a rebuilding plan is effectively rebuilding an overfished species. First, periodic stock assessments and rebuilding analyses provide the scientific underpinning for evaluating stock rebuilding. According to the framework, strategic rebuilding parameters may be changed as part of the federal rulemaking process used to establish biennial management measures to ensure adequate process. Second, the MSA directs the Secretary of Commerce (through NMFS) to review rebuilding plans at least every two years to ensure adequate progress. In addition, through the framework adopted by Amendment 16-1, and as noted above, the Council will also review progress every two years based on standards being developed by the GMT and SSC. This issue has to do with the framework for adopting and reviewing rebuilding plans, not the rebuilding plans themselves, and is therefore outside the scope of this EIS.

Bycatch: The comments recommend measures to reduce bycatch and ask that bycatch rates be evaluated in this EIS. Adopting bycatch reduction measures is outside the scope of this EIS. NMFS released a bycatch mitigation draft programmatic EIS on February 20, 2004 (NMFS 2004b). The Council will identify their preferred alternative for this EIS at their April 2004 meeting. This EIS identifies practicable conservation and management measures to reduce bycatch and bycatch mortality. Thus, there is a parallel decision process for implementing bycatch reduction measures. The issue of bycatch accounting is discussed in Appendix A, Section 1.2.3. Bycatch in different groundfish fishery sectors is discussed in Appendix A, Section 6.4.1.

Closed areas and marine reserves: The comments focus on evaluating the utility and effects of the Rockfish Conservation Area (RCA), a coastwide closed area intended to keep vessels out of depths where overfished species bycatch is highest, and whether to make it a permanent marine reserve. The RCA is a management measure established through the annual (now biennial) management process. As new and better data become available, primarily through the groundfish observer program, the configuration of the RCA has been adjusted to allow fishing opportunity given the constraints of stock rebuilding. Such changes have been, and will continue to be, the subject of NEPA analysis associated with setting harvest specifications and management measures. Although changes to the RCA are not a component of rebuilding plans and are therefore outside the scope of this Amendment 16-3 EIS, the Council and NMFS are preparing an EIS to evaluate 2005-2006 specifications and measures.

Cumulative effects: This comment emphasizes the need to evaluate cumulative effects, which are incremental effects of the proposed action "when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions" (40 CFR 1508.7). Chapters 3 through 8 evaluate cumulative impacts on different components of the human environment.

Enforcement: This comment asks that the EIS analyze measures that aid in enforcement. Although enforcement measures are not part of the proposed action, as part of the analysis of impacts to the public sector, enforcement issues are discussed.

Habitat: These comments recommend analyzing the effect of fishing on important habitat and implementing habitat conservation measures as part of the proposed action. Chapter 3 evaluates the impacts of the alternatives on essential fish habitat (EFH). (Chapter 4 in Appendix A describes fishing and non-fishing impacts to EFH.) However, implementing habitat conservation measures is not considered as part of species rebuilding plans and is outside the scope of the proposed action. NMFS is currently preparing an EIS evaluating the designation of EFH and measures to minimize impacts to such habitat. This concurrent NEPA analysis, scheduled for completion in early 2006, will evaluate habitat conservation measures.

Harvest rates: These comments focus on how harvest rates might change based on increases in stock size. The framework implemented by Amendment 16-1 accounts for the possibility that the harvest rate, which as part of the harvest control rule is a strategic rebuilding parameter, may need to be changed. Such changes can be effected through the same federal rulemaking process used to establish biennial management measures and would be evaluated in the accompanying environmental impact analysis.

Historical factors: These comments recommend that the EIS discuss past management and fishing practices to determine what caused overfishing and discuss the harvest history in terms of bycatch levels. Commentors also recommend the evaluation of management measures necessary for rebuilding. In Appendix A, Section 1.2 discusses key management issues, including bycatch; Section 2.2 describes the history of exploitation and Section 6.4 describes bycatch in different fishery sectors. Chapters 5 and 8 in the main part of the EIS also discuss historical bycatch levels with an accounting by species.

Science and data: The commentor recommends discussing controversy surrounding stock assessment results. In Appendix A, Section 1.1.1.1 describes the stock assessment process while Section 1.2.1 describes some of the problems associated with scientific uncertainty. Controversy is also a factor in the decision to prepare an EIS rather than an EA.

Management measures: Commentor recommended including and evaluating management measures needed to rebuild stocks. As noted above, rebuilding plans establish targets for rebuilding and evaluating rebuilding progress. Management measures are developed and implemented through the biennial management cycle included in the FMP framework. This allows management measures to be regularly adjusted in response to changes in stock status. Harvest levels for overfished species are set according to the targets established in rebuilding plans; management measures are then crafted to keep total fishing mortality within these limits. Fishery monitoring is also an important part of this process, so that total mortality is accurately determined.

Amending the FMP to include new management measures specifically for the purposes of stock rebuilding is not considered as part of the proposed action because this would be a much less flexible approach; the FMP should provide a comprehensive framework for ongoing and responsive management rather than a detailed specification of management measures for every situation.

Mixed stock exception: This comment argues against the use of the mixed stock exception. The mixed stock exception has not been used by the Council and is not considered for the four species in this amendment.

Monitoring: These comments emphasize the importance of monitoring to effective stock rebuilding and recommend including a discussion of monitoring methods and measures in the EIS. Section 7.1.5 in this EIS discusses management data systems, including catch monitoring. In Appendix A, Section 1.2.3 also discusses current programs to monitor and estimate total fishing mortality. Effective monitoring is crucial to fisheries management, not just stock rebuilding alone. NMFS and the Council are always trying to improve and expand catch monitoring programs, as evidenced by the implementation of the groundfish observer program. As recreational fishing mortality becomes a significant component of total fishing mortality for some stocks, improvements in monitoring programs for these fisheries are being made. Although these efforts are going on in concert with the development and implementation of rebuilding plans, they are not considered a part of the rebuilding plans themselves. Rather, they represent a key component of the overall fishery management program.

Overages: The commentor recommends that when the harvest limit for a particular species is exceeded in a given year, the harvest limit in the succeeding year should be reduced to account for the excess mortality. The harvest level for a species or species group (optimum yield or OY) applies to a single year and both over or under harvests are not carried over in setting the next year's harvest level. If an OY is exceeded, NMFS and the Council evaluate why it happened and adjust management measures in future years accordingly. Periodic stock assessments account for past catches and serve as the basis for determining future harvest levels.

Recreational fishing: The comments emphasize the importance of rockfish, including overfished species, to recreational fishers. The impacts of different rebuilding plan alternatives on recreational fisheries are evaluated in Section 8.5.6 in this EIS.

Range of alternatives: These comments stress the need to evaluate a sufficiently broad range of alternatives and overfished species. Chapter 2 describes the alternatives. They are structured around different rebuilding probabilities (P_{MAX} values), which also indicate a range of associated target rebuilding years and harvest control rules. For all species, except cowcod, these cover a wide range of values from 60% to 90%. The P_{MAX} 50% value (the minimum permitted by legal precedent) and 100% have been eliminated from detailed consideration because they are not considered reasonable, either in terms of stock rebuilding (50%) or socioeconomic impacts (100%). Cowcod are not well-assessed, but available information indicates that this is a very unproductive stock and rebuilding plans based on either a 55% or 60% P_{MAX} are reasonable. It would have been preferable to evaluate rebuilding plans for all overfished species in a single impact analysis. However, dividing the adoption process into two amendments allowed better coordination with the availability of new stock assessments.

Social factors: The commentor asks that the EIS analyze different outcomes from a maximum harvest level to no harvest at all. As noted above, the range of alternatives covers a broad range of potential outcomes, although the extreme ends of the range—maximum harvest and no fishing—have been eliminated from detailed study because they are considered unreasonable. Alternatives incorporating rebuilding targets based on a 50% P_{MAX} (maximum allowed harvest) and a 100% P_{MAX} (little or no allowed harvest) were evaluated in Amendment 16-2, which adopted rebuilding plans for canary rockfish, darkblotched rockfish, Pacific ocean perch, and lingcod. It wound that the 100% P_{MAX} alternative would have significant socioeconomic impacts.

Although the 50% P_{MAX} was not found to have significant biological impacts, for the Amendment 16-3, the Council chose to consider only more risk-averse alternatives (60% P_{MAX} and above), anticipating that analysis would show moderate to severe socioeconomic impacts across the range of alternatives, balanced against the benefits of stock rebuilding.

Other general comments: These comments cover several issues, including recognizing other EISs in preparation of this EIS, evaluating different management policies, using the current management regime as the no action alternative, and adequately analyzing all issues related to overfishing. Although this EIS includes discussion and description of a full range of issues, as noted above, management measures are not part of the proposed action. As in Amendment 16-2, the no action alternative is based on the default harvest policy in the absence of interim or adopted rebuilding plans.

1.4.4 Criteria Used to Evaluate the Impacts of the Amendment 16-3 Proposed Action

Implementation of the rebuilding plans for four overfished species will be evaluated based on projected impacts to the components of the human environment listed below. For each of these components the criteria used for measuring direct, indirect, and cumulative impacts are described. These criteria were developed by Council and NMFS staff, based on scoping comments and Council and advisory body discussions.

Habitat and Protected Species

The combined and cumulative effects of implementing multiple rebuilding plans are considered. Impacts to habitat and protected species would correlate with the level and type of fishing activity. Increased fishing activity, particularly bottom trawling, would result in greater impacts to habitat in comparison to a decrease in fishing. Different protected species are affected by a variety of gear types. For example, ESA-listed salmon stocks are caught in midwater trawl fisheries targeting Pacific whiting. Although there are no data for West Coast fisheries, elsewhere, longline fisheries hook seabirds during gear deployment. As with habitat, alternatives that allow more fishing effort would result in greater impacts to protected species in comparison to alternatives that result in less fishing effort.

Overfished Species Stocks

Rebuilding analyses provide three metrics that can be used to compare the effect of the alternatives on the four overfished species stocks considered in this EIS. The analyses identify the probability of rebuilding in the maximum permissible time period and the median rebuilding year (or target year) for different harvest levels. The harvest level represents the direct impact. The associated probability of rebuilding in the maximum time period is a measure of the long-term risk that a particular harvest level will not achieve rebuilding. The median rebuilding year is the most likely year by which the stock will be rebuilt and is an indication of the tradeoff between harvests and how quickly the stock will rebuild. Harvest levels are inversely correlated with the rebuilding time and probability. The alternatives will be evaluated based on these metrics. Alternatives that restrict harvests more have less environmental impacts than alternatives that allow a higher harvest rate.

Co-occurring Species

Co-occurring species include other overfished groundfish stocks whose rebuilding plans are not implemented through this amendment and stocks that are not overfished. Certain overfished species act as constraining stocks in that the level of harvest needed to rebuild them is so low that harvest limits for co-occurring species cannot be reached. Direct and indirect impacts of the alternatives can be compared by considering each of the four overfished species' rebuilding plans separately. Alternatives that require lower harvest limits for the species in question would also limit harvest of co-occurring species, thereby resulting in less environmental impact while higher harvest limits would result in greater environmental impacts. Because of the constraining effect of rebuilding measures for a given overfished species, combined and cumulative effects also have to be considered. An evaluation of these effects considers the interaction between rebuilding measures for different overfished species. However, the same metric—fishing mortality to co-occurring species—can be used.

The Management Regime

Although not part of the proposed action, management measures will be implemented to ensure total fishing mortality remains at levels necessary to achieve targets incorporated into rebuilding plans. Generally, the range of management measures implemented through the biennial harvest specification process will be used, although new management measures could be identified in the FMP and implemented through future actions. The impacts of the alternatives are evaluated in terms of the types of management measures that may be used. More complicated, controversial, and difficult-to-enforce management measures would impose greater costs in comparison to less complex measures. Impacts to the management regime can also be evaluated in terms of the data needed to both support and evaluate potential management measures. Management measures that are more dependent on precise total catch monitoring will require a higher level of direct observation than is currently in place. Increasing observer coverage would entail more costs.

Commercial Fisheries

Commercial fishery impacts are compared in terms of changes in expected landings, and where possible, exvessel revenue. These socioeconomic impacts are inversely related to biological impacts. Alternatives that limit harvest more, and thereby reduce landings, also reduce exvessel revenue; while alternatives that allow higher harvest levels result in comparatively higher exvessel revenue.

Recreational Fisheries

Recreational fishery impacts are evaluated qualitatively based on the change in fishing opportunity as measured by the number of fishing trips that might occur under each alternative. These effects are compared for each overfished species in terms of the impact of rebuilding measures on recreational fishing. Because some species are not caught in recreational fisheries, rebuilding measures would have little effect. Other species, such as bocaccio, are frequently caught, and rebuilding measures would have a greater impact.

Tribal Fisheries

Tribal fishery impacts are qualitatively evaluated based on the degree of change in groundfish landings compared to historical landings. Some treaty fisheries have specific allocations reserved to them, and rebuilding measures could affect the allocations. As with all socioeconomic impacts, alternatives with a lower harvest limit are more likely to affect tribal allocations than those that allow a higher harvest limit.

Buyers, Processors, and Markets

Impacts on buyers and processors correlate closely with changes in landings and associated exvessel revenue. (Exvessel revenue is derived from purchases by this sector.) Alternatives can, thereby, be qualitatively evaluated in a similar fashion. Lower harvest limits would reduce the amount of fish that could be purchased relative to higher harvest limits. Impacts of the alternatives on markets, such as retail outlets and restaurants, can be qualitatively evaluated in terms of the substitutability of other fish products for those that might become unavailable (or become too expensive) as a result of harvest limits. Some groundfish products might be easily substituted, while others—such as live fish sales—may not be.

Fishing Communities

Fishing community impacts represent the aggregate of the socioeconomic impacts described above. Alternatives can be qualitatively evaluated by comparing the alternatives in terms of changes in personal income resulting from changes in groundfish landings. Given the range of these species and how vessels targeting them are distributed by port, there will be geographic differences in community impacts. This evaluation compares these differences, based on the different harvest limits set for different overfished groundfish species under alternative rebuilding plans.

TABLE 1-1. Summary of scoping comments received on Amendments 16-3. (Page 44 of 3)

	Number of comments
Accountability	
The Amendment 16-1 Process and Standards document defers to the individual rebuilding plans for determining adequacy of progress. We want to ensure that this document and 16-2 have mechanisms in them to ensure accountability.	1
If you have a strong recruitment year, it will be very tempting to increase allowable fishing mortality levels instead of banking that recruitment. But if you have a bad recruitment year, what happens in terms of pushing the rebuilding period out? Address these issues and include effective mechanisms for accountability in the rebuilding plans.	1
Bycatch	
Scientists and fishermen should work collaboratively to do research to develop better methods for bycatch reduction.	1
Analyze management measures that reduce bycatch (including bycatch of prey species) - for example, capacity reduction, time and area closures, no-take MPAs, trip or bag limits, mortality caps, and gear modifications.	2
Include a full, species-specific analysis of bycatch and evaluate as alternatives and consider for adoption in the rebuilding plan all potentially practicable bycatch reduction measures.	1
Closed Areas/Marine Reserves/Rockfish Conservation Areas	
As the stocks increase, the harvest increases will occur outside the RCA. Retention of overfished species caught in areas outside the RCA should be allowed in the future. This is the spillover effect in action. The fish inside the RCA will continue to be protected.	1
As the stocks increase, there is tradeoff in terms of management measures. Either the size of RCAs can be reduced or retention of overfished species should be allowed.	1
Analyze the effects of making the RCA a permanent marine protected area. Evaluate how you would approach management in this way.	1
Cumulative Effects	
Analysis of alternatives must include cumulative effects and past, present, and reasonably foreseeable future effects of activities on the environment.	1
Enforcement	
Analyze measures that aid in enforcement, such as vessel monitoring systems.	1
Habitat and Marine Reserves	
Considering habitat is especially important in rebuilding overfished species.	1
Analyze management measures that reduce the adverse impacts of fishing practices on important habitats (including habitat of prey species) - for example, capacity reduction, time and area closures, no-take MPAs, trip or bag limits, gear modifications, and prohibitions on fishing practices that adversely impact important habitats or prey species.	2
Fully analyze habitat needs and existing habitat impacts for each overfished species and consider the full range of alternatives for protecting and enhancing habitat for each species subject to rebuilding.	1
Harvest Rates	
In the past an F20% harvest rate was used, which was reviewed and worked well. But the unexpected shift in environmental regime combined with continued management at this rate caused overfishing problems.	1
How will rebuilding plans take into account that catch rates will increase as the stock increases?	1
There has to be a provision in the rebuilding plan that as an overfished stock gets above a certain level they can be caught and retained.	1

TABLE 1-1. Summary of scoping comments received on Amendments 16-3. (Page 45 of 3)

	Number of comments
Historical Factors	
The EIS should look at the history of how these stocks became overfished. Can we learn anything from the past to determine better ways to manage the fishery?	1
Analyze the extent to which current management systems (including the year-round fishery goal and use of small bimonthly trip limits) have contributed to the overfished status of each species, and consider alternatives that might help rebuild each species faster or more effectively.	1
Include a full analysis of the harvest history of each species, including the amount of fish that have been landed in previous years and the amount believed to have been discarded, and address the effectiveness of management measures in restricting fishing catch to the levels necessary to rebuild these overfished species on the appropriate timeline.	1
Science and Data	
The EIS should discuss and recognize the controversy surrounding stock assessment results.	1
Management Measures for Rebuilding	
Include management measures for achieving rebuilding targets and time periods in Amendment 16-3 and the EIS. Rebuilding plans consisting of a target and rebuilding strategy only fall short of an actual plan to return a species to an applicable management level.	1
Analyze management measures that ensure rebuilding targets are met (i.e. limiting fishing effort via capacity reduction, time and area closures, a network of no-take marine protected areas, trip or bag limits, and caps on total mortality) with accounting systems that ensure annual mortality levels necessary for rebuilding are not exceeded.	2
Analyze measures that account for total mortality and ensure successful rebuilding.	1
Mixed Stock Exception	
We object to the use of the mixed stock exception.	1
Monitoring	
There needs to be a strong monitoring component in the rebuilding plans. If the Council commits to rebuilding plans, they should also commit to making them work.	1
Analyze information sources necessary to track rebuilding progress and ensure annual mortality goals are achieved. If sources are lacking, identify essential data collection elements and methods, such as ways to accurately assess effort, monitor bycatch, identify fishing locations and identify important habitat. Include current efforts in addition to increased observer coverage, use of federal permits or licenses to better estimate effort, use of VMS or other technologies, etc.	1
Overages	
Explore options for proper accounting of annual mortality levels and ways to ensure that any overages are addressed in subsequent annual limits. For example, explore deduction of overage amounts in the subsequent year; percent reduction in annual mortality limits to account for past overages; and establishing firm rebuilding dates that are not revised with subsequent assessments.	2
Recreational Fishing	
In the scoping information document, the discussion of fishing communities is inaccurate in stating that there are alternatives to recreational groundfish. Because recreational fishers show a strong preference for a particular type of fish (e.g., groundfish vs. salmon), they will not necessarily switch if fishing opportunity on one type is eliminated. Also, there may be restrictions on other stocks that limit fishing. This affects both private and CPFV vessels.	1
There are people who "live and die by the rockfish" and will not be replaced. People focus on a particular group of fish by preference.	1

TABLE 1-1. Summary of scoping comments received on Amendments 16-3. (Page 46 of 3)

	Number of comments
Range of Alternatives	
Explore a full range of rebuilding time options with high probabilities of success. Include short and long-term economic and ecological implications.	1
Explore a full range of management measures necessary to ensure a high probability of successfully rebuilding depleted stocks within the rebuilding target time. Analyze measures that will rebuild depleted populations by limiting total mortality to levels consistent with rebuilding targets; that will minimize the incidental catch of a depleted species' prey species; and that will reduce fishing gear impacts on the marine environment - including past, present and reasonably foreseeable adverse impacts of fishing and non-fishing operations on habitat used by depleted species.	1
Include as many overfished groundfish species as possible in the EIS in order to take a holistic approach to rebuilding.	1
Social Factors	
Look at social values from a range of maximizing the amount of cheap fish extracted to not having any fishing and relying only on the non-consumptive value of the resource.	1
Other Comments/General	
Ideally the Council should develop a programmatic ecosystem EIS. In this EIS, the cumulative effects analysis brings in [or should bring in?] other factors in a similar way. Such an analysis would include evaluation of coastal impacts such as development and pollution. Definitely recognize outcomes of the bycatch PEIS and EFH EIS and how they might affect the outcome of rebuilding' species.	1
Discuss different management policies in the EIS. For example, evaluate full retention or how catches should be treated to reduce bycatch.	1
The current management regime should serve as the "no action" or "status quo" alternative.	1
The EIS must fully analyze all issues that are potentially relevant to the species' current overfished condition and to different available strategies for rebuilding the species.	1
Total Comments	**39**

2.0 REBUILDING PLAN ALTERNATIVES

Rebuilding alternatives for bocaccio, cowcod, widow rockfish, and yelloweye rockfish within MSA, FMP, and other legal constraints are analyzed in this EIS. The action alternatives were decided by the Council in November 2003 and are compared with a No Action Alternative. There are three rebuilding parameters judged to be strategic in rebuilding overfished groundfish species: T_{TARGET} (the median year when spawning biomass is projected to reach B_{MSY}), P_{MAX} (the probability of the stock attaining B_{MSY} in the maximum allowable time (T_{MAX})), and the harvest control rule (i.e., F or harvest rate). Estimates of these strategic rebuilding parameter estimates under each action alternative and under the No Action Alternative are derived in the most recent stock assessments and rebuilding analyses prepared for these species and presented in Tables 2-1 through 2-4. Relative risk and probability of rebuilding alternatives meeting rebuilding objectives is sensitive to our current state of knowledge and the harvest control rule (i.e., harvest rate) adopted as a rebuilding target and strategy. The harvest control rule varies between rebuilding alternatives analyzed in this rebuilding plan, the best available science in forming decisions, and our current state of knowledge does not.

Incorporating habitat-protective measures, such as marine protected areas or marine reserves, in the alternatives analyzed in this EIS was recommended by some during scoping for this EIS. Although protecting critical habitats from the potential negative impacts of fishing may be an effective means to rebuild these species, such measures were considered beyond the scope of this EIS which seeks to analyze the effects of alternative harvest levels on the affected West Coast physical, biological, and socioeconomic environments. However, area closures are considered in this EIS. Currently depth-based closures are in place to move the fishery off areas where these species primarily reside to reduce the total mortality of adult fish. Additionally, the Cowcod Conservation Area closure is the primary means to minimize fishing mortality for this depleted stock. The Council and NMFS are developing a policy for habitat-based management that may result in modification to existing closures or other management measures intended to protect habitat deemed important to groundfish production. At issue in the development of this policy is the integration of habitat-based management with the harvest control management strategies that have historically been the foundation for Council actions. NMFS is currently preparing an EIS evaluating programmatic measures designed to identify and describe West Coast groundfish EFH and minimize potential fishing impacts on West Coast groundfish EFH. According to the current schedule, NMFS will publish a draft EIS for this action in February 2005. Publication of the final EIS for this action is scheduled for December 2005, with implementation of any measures pursuant to the EIS occurring in 2006 (contact Mr. Steve Copps, NMFS, 206-526-6187).

Other management measures are also addressed in this EIS, but are not structured in the alternatives analyzed. Such measures include trip, landing, and bag limits; seasonal fishery closures; gear restrictions; and capacity reduction mechanisms. While all of these strategies may aid the rebuilding of overfished groundfish species, they are ancillary to the analysis of the effect of managing the total mortality of these species to alternative levels. Catch monitoring in West Coast groundfish fisheries has been uncertain at best, but is improving with the advent of the NMFS Groundfish Observer Program and the development of the California Recreational Fisheries Survey (CRFS). These nascent monitoring systems have not been in place long enough to use as a "litmus test" of the efficacy of management measures to control total mortality of groundfish species. Therefore, it is anticipated that effective management measures will be adopted in biennial notice and comment rulemaking. Such measures will be analyzed using the best available science. This EIS simply analyzes the alternative harvest levels consistent with the framework provisions adopted in FMP Amendment 16-1. Once rebuilding plans are adopted for overfished groundfish species, it is expected that management measures adopted in subsequent rulemaking will effectively limit harvest to the total mortality levels specified in the rebuilding plans.

2.1 No Action Alternative (40-10 Rule)

The choice of the *No Action* alternative for the four overfished groundfish species subject to rebuilding plans analyzed in this EIS was considered in terms of providing the most informative analysis of the consequences and tradeoffs of rebuilding these stocks and what rebuilding strategies are formalized in the FMP. Absent rebuilding plans for these species in the FMP, the precautionary management strategy to rebuild stocks to B_{MSY} (for the stocks analyzed in this EIS, the B_{MSY} proxy is 40% of initial, unfished biomass or $B_{40\%}$) in the FMP is to decrease the optimum yield (OY or target harvest level) from the acceptable biological catch (ABC) using the 40-10 adjustment. The 40-10 adjustment is a scaled decrease in the OY from the ABC as the spawning stock biomass varies downward from $B_{40\%}$, until at $B_{10\%}$, the OY is set to 0 (Appendix Figure 2-3). Conversely, when the stock is rebuilt, or at $B_{40\%}$, the OY would be set equal to the ABC. Therefore, the harvest control rule is a variable harvest rate based on the stock's biomass relative to its initial, unfished biomass. Since this is the only rebuilding strategy currently in the FMP, and Amendment 16 to the FMP is intended to incorporate a rebuilding framework and individual species' rebuilding plans into the FMP, the *No Action* alternative is structured using the 40-10 adjustment.

2.1.1 Bocaccio

The No Action Alternative for bocaccio specifies significantly lower harvest levels than any of the action alternatives in 2004-2006 with a zero harvest in 2004 under the STATc base model used in the rebuilding analysis (MacCall 2003a) (Table 2-1). This is a legally viable rebuilding alternative since the T_{TARGET} rebuilding year is estimated to occur prior to T_{MAX} with a rebuilding probability greater than 70% (P_{MAX} = 77.6% under the STATc model and higher under the competing STARb1 and STARb2 models). However, zeroing fishing mortality until stock abundance exceeds 10% of unfished biomass is extremely punitive to California shelf fisheries, especially given the ramping up of the harvest rate as the stock rebuilds. This rebuilding strategy would therefore lead to much greater instability in California fisheries relative to any of the action alternatives that specify alternative constant harvest rate strategies.

2.1.2 Cowcod

The No Action Alternative for cowcod specifies a zero fishing mortality strategy for the foreseeable future (Table 2-2) and perhaps considerably longer given the extremely poor recruitment estimated in the assessment (Butler *et al.* 1999) and rebuilding analysis (Butler and Barnes 2000). The input data for these cowcod analyses were too sparse to provide the same stochastic results and long-term projections to better understand whether the No Action Alternative is even legally viable (i.e., it is uncertain whether the stock could rebuild by 2099 (= T_{MAX}) with at least a 50% probability using the default 40-10 harvest control rule). However, it is reasonable to conclude that the No Action Alternative is similar to the action alternatives for cowcod in that minimal fishing mortalities are required to achieve rebuilding. In fact, the difference in harvest levels between all cowcod rebuilding alternatives is negligible and should be considered zero harvest strategies.

2.1.3 Widow Rockfish

The No Action Alternative for widow rockfish under Model 8 does specify some harvest in 2004-2006 since the stock's current level of depletion is greater than 10% of its unfished biomass. In fact, the No Action harvest level for widow rockfish is about four to five times greater than that under the most liberal action alternative (Table 2-3). There is a 0% probability of attaining B_{MSY} in the maximum time allowable (T_{MAX} = 2042) since the stock's spawning biomass does not reach the biomass target in the almost 100-year projection horizon in the most recent rebuilding analysis (He *et al.* 2003a). Therefore, the No Action Alternative for widow rockfish does not comport with legal rebuilding mandates. The same is true when considering either of the competing models (models 7 or 9) in the rebuilding analysis.

2.1.4 Yelloweye Rockfish

The No Action Alternative specifies slightly higher yelloweye rockfish harvests in 2004-2006 than the action alternatives (Table 2-4). However, there is a 0% probability of attaining B_{MSY} in the maximum time allowable (T_{MAX} = 2070) since the stock's spawning biomass does not reach the biomass target in an almost 350-year projection horizon (i.e., the stock fails to rebuild by 2351- the last year projected in available model runs). Therefore, the No Action Alternative for yelloweye rockfish does not comport with legal rebuilding mandates.

2.2 Action Alternative 1

Action Alternative 1 generally specifies the most liberal, legally-compliant harvests considered by the Council for rebuilding these four species. While this action alternative may constrain fisheries less than the other alternatives considered, it does entail the highest risk of not rebuilding by T_{MAX}. Therefore, of the considered action alternatives, Action Alternative 1 has the lowest short term negative economic impacts to fisheries and fishing communities and the highest biological risk to these overfished stocks.

2.2.1 Bocaccio (P_{MAX} = 60%)

Action Alternative 1 for bocaccio specifies a rebuilding strategy estimated to have a 60% probability of rebuilding by T_{MAX}. Annual harvest levels under the STATc base model from the most recent rebuilding analysis by MacCall (2003a) range from 373-376 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Helser *et al.* 2003) and the SSC to recommend consideration of the competing STARb1 and STARb2 models. The range of 2004-2006 harvests is therefore extended to 295-713 mt under this alternative (Table 2-1). The target rebuilding year (T_{TARGET}) for bocaccio under this alternative is 2025, 2027, or 2031 depending on whether the STATc, STARb1, or STARb2 model, respectively represents the true state of nature. Bocaccio harvest rates (F) specified under Action Alternative 1 are 0.0615, 0.0914, or 0.0643 under rebuilding models STATc, STARb1, or STARb2, respectively.

2.2.2 Cowcod (P_{MAX} = 55%)

Action Alternative 1 for cowcod specifies a rebuilding strategy estimated to have a 55% probability of rebuilding by T_{MAX}. Unlike other species rebuilding plans analyzed in this EIS that specify a constant harvest rate strategy, the cowcod rebuilding plan contemplates a constant annual harvest strategy. This action alternative specifies an annual harvest of 2.4 mt in the Conception INPFC area. The GMT recommended and the Council adopted the same harvest limit for the Monterey INPFC area. Therefore, this alternative specifies a 4.8 mt constant annual harvest limit for the Conception and Monterey INPFC areas combined (Table 2-2), which encompasses waters off California south of 40°30' N latitude. The estimated T_{TARGET} under this alternative is 2095.

2.2.3 Widow Rockfish (P_{MAX} = 60%)

Action Alternative 1 for widow rockfish specifies a rebuilding strategy estimated to have a 60% probability of rebuilding by T_{MAX}. Annual harvest levels under the base model 8 from the most recent rebuilding analysis by He et al. (2003a) range from 284-289 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Conser *et al.* 2003) and the SSC to recommend consideration of the competing models 7 and 9. The range of 2004-2006 harvests is therefore extended to 180-513 mt under this alternative (Table 2-3). The target rebuilding year (T_{TARGET}) for widow rockfish under this alternative is 2038, 2039, or 2034 depending on whether Model 8, 7, or 9, respectively represents the true state of nature. Widow rockfish harvest rates (F) specified under Action Alternative 1 are 0.0093, 0.0067, or 0.0146 under rebuilding models 8, 7, or 9, respectively.

2.2.4 Yelloweye Rockfish (P_{MAX} = 60%)

Action Alternative 1 for yelloweye rockfish specifies a rebuilding strategy estimated to have a 60% probability of rebuilding by T_{MAX}. Annual harvest levels specified under this alternative range from 27-29 mt during 2004-2006 (Table 2-4). The target rebuilding year (T_{TARGET}) for yelloweye rockfish under this alternative is 2067 and the harvest rate is 0.0167.

2.3 Action Alternative 2

Action Alternative 2 is one of the two intermediate action alternatives considered by the Council in November 2003 for detailed analysis in this EIS. Short term negative socioeconomic impacts to fishermen and fishing-dependent communities are greater than those under Action Alternative 1, but less than those specified under the other action alternatives. Consequently the risk of not rebuilding by T_{MAX} is less than Action Alternative 1, but greater than the other action alternatives.

2.3.1 Bocaccio (P_{MAX} = 70%)

Action Alternative 2 for bocaccio specifies a rebuilding strategy estimated to have a 70% probability of rebuilding by T_{MAX}. Annual harvest levels under the STATc base model from the most recent rebuilding analysis by MacCall (2003a) range from 306-309 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Helser *et al.* 2003) and the SSC to recommend consideration of the competing STARb1 and STARb2 models. The range of 2004-2006 harvests is therefore extended to 250-633 mt under this alternative (Table 2-1). The target rebuilding year (T_{TARGET}) for bocaccio under this alternative is 2023, 2024, or 2029 depending on whether the STATc, STARb1, or STARb2 model, respectively represents the true state of nature. Bocaccio harvest rates (F) specified under Action Alternative 2 are 0.0498, 0.0801, or 0.0541 under rebuilding models STATc, STARb1, or STARb2, respectively.

2.3.2 Cowcod (P_{MAX} = 60%)

Action Alternative 2 for cowcod specifies a rebuilding strategy estimated to have a 60% probability of rebuilding by T_{MAX}. Unlike other species' rebuilding plans analyzed in this EIS that specify a constant harvest rate strategy, the cowcod rebuilding plan contemplates a constant annual harvest strategy. This action alternative specifies an annual harvest of 2.1 mt in the Conception INPFC area. The GMT recommended and the Council adopted the same harvest limit for the Monterey INPFC area. Therefore, this alternative specifies a 4.2 mt constant annual harvest limit for the Conception and Monterey INPFC areas combined (Table 2-2), which encompasses waters off California south of 40°30' N latitude. The estimated T_{TARGET} under this alternative is 2090.

2.3.3 Widow Rockfish (P_{MAX} = 70%)

Action Alternative 2 for widow rockfish specifies a rebuilding strategy estimated to have a 70% probability of rebuilding by T_{MAX}. Annual harvest levels under the base model 8 from the most recent rebuilding analysis by He et al. (2003a) range from 212-216 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Conser *et al.* 2003) and the SSC to recommend consideration of the competing models 7 and 9. The range of 2004-2006 harvests is therefore extended to 111-430 mt under this alternative (Table 2-3). The target rebuilding year (T_{TARGET}) for widow rockfish under this alternative is 2035, 2035, or 2031 depending on whether Model 8, 7, or 9, respectively represents the true state of nature. Widow rockfish harvest rates (F) specified under Action Alternative 2 are 0.0070, 0.0041, or 0.0122 under rebuilding models 8, 7, or 9, respectively.

2.3.4 Yelloweye Rockfish (P_{MAX} = 70%)

Action Alternative 2 for yelloweye rockfish specifies a rebuilding strategy estimated to have a 70% probability of rebuilding by T_{MAX}. Annual harvest levels specified under this alternative range from 26-28 mt during 2004-2006 (Table 2-4). The target rebuilding year (T_{TARGET}) for yelloweye rockfish under this alternative is 2062 and the harvest rate is 0.0161.

2.4 Action Alternative 3

Action Alternative 3 is one of the two intermediate acton alternatives considered by the Council in November 2003 for detailed analysis in this EIS. Short term negative socioeconomic impacts to fishermen and fishing-dependent communities are greater than those under Action Alternative 1 or 2, but less than those specified under Action Alternative 4. Consequently the risk of not rebuilding by T_{MAX} is less than Action Alternative 1 or 2, but greater than Action Alternative 4.

2.4.1 Bocaccio (P_{MAX} = 80%)

Action Alternative 3 for bocaccio specifies a rebuilding strategy estimated to have an 80% probability of rebuilding by T_{MAX}. Annual harvest levels under the STATc base model from the most recent rebuilding analysis by MacCall (2003a) range from 237-242 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Helser *et al.* 2003) and the SSC to recommend consideration of the competing STARb1 and STARb2 models. The range of 2004-2006 harvests is therefore extended to 199-541 mt under this alternative (Table 2-1). The target rebuilding year (T_{TARGET}) for bocaccio under this alternative is 2020, 2022, or 2027 depending on whether the STATc, STARb1, or STARb2 model, respectively represents the true state of nature. Bocaccio harvest rates (F) specified under Action Alternative 3 are 0.0383, 0.0670, or 0.0430 under rebuilding models STATc, STARb1, or STARb2, respectively.

2.4.2 Cowcod (P_{MAX} = 60%)

The cowcod specifications under Action Alternative 3 are the same as under Action Alternatives 2 and 4.

2.4.3 Widow Rockfish (P_{MAX} = 80%)

Action Alternative 3 for widow rockfish specifies a rebuilding strategy estimated to have an 80% probability of rebuilding by T_{MAX}. Annual harvest levels under the base model 8 from the most recent rebuilding analysis by He et al. (2003a) range from 123-126 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Conser *et al.* 2003) and the SSC to recommend consideration of the competing models 7 and 9. The range of 2004-2006 harvests is therefore extended to 30-333 mt under this alternative (Table 2-3). The target rebuilding year (T_{TARGET}) for widow rockfish under this alternative is 2032, 2031, or 2028 depending on whether Model 8, 7, or 9, respectively represents the true state of nature. Widow rockfish harvest rates (F) specified under Action Alternative 3 are 0.0040, 0.0011, or 0.0094 under rebuilding models 8, 7, or 9, respectively.

2.4.4 Yelloweye Rockfish (P_{MAX} = 80%)

Action Alternative 3 for yelloweye rockfish specifies a rebuilding strategy estimated to have an 80% probability of rebuilding by T_{MAX}. Annual harvest levels specified under this alternative range from 25-27 mt during 2004-2006 (Table 2-4). The target rebuilding year (T_{TARGET}) for yelloweye rockfish under this alternative is 2058 and the harvest rate is 0.0153.

2.5 Action Alternative 4

Action Alternative 4 generally specifies the most conservative, legally-compliant harvests considered by the Council for rebuilding these four species. While this action alternative may constrain fisheries more than the other alternatives considered, it does entail the lowest risk of not rebuilding by T_{MAX}. Therefore, of the considered action alternatives, Action Alternative 4 has the highest short term negative economic impacts to fisheries and fishing communities and the lowest biological risk to these overfished stocks.

2.5.1 Bocaccio (P_{MAX} = 90%)

Action Alternative 4 for bocaccio specifies a rebuilding strategy estimated to have a 90% probability of rebuilding by T_{MAX}. Annual harvest levels under the STATc base model from the most recent rebuilding analysis by MacCall (2003a) range from 130-137 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Helser *et al.* 2003) and the SSC to recommend consideration of the competing STARb1 and STARb2 models. The range of 2004-2006 harvests is therefore extended to 127-414 mt under this alternative (Table 2-1). The target rebuilding year (T_{TARGET}) for bocaccio under this alternative is 2018, 2020, or 2025 depending on whether the STATc, STARb1, or STARb2 model, respectively represents the true state of nature. Bocaccio harvest rates (F) specified under Action Alternative 4 are 0.0209, 0.0496, or 0.0271 under rebuilding models STATc, STARb1, or STARb2, respectively.

2.5.2 Cowcod (P_{MAX} = 60%)

The cowcod specifications under Action Alternative 4 are the same as under Action Alternatives 2 and 3.

2.5.3 Widow Rockfish (P_{MAX} = 90%)

Action Alternative 4 for widow rockfish specifies a rebuilding strategy estimated to have a 90% probability of rebuilding by T_{MAX}. The annual harvest level under the base model 8 from the most recent rebuilding analysis by He et al. (2003a) is 4 mt during 2004-2006. However, major model uncertainties in the rebuilding analysis compelled the STAR Panel (Conser *et al.* 2003) and the SSC to recommend consideration of the competing models 7 and 9. The range of 2004-2006 harvests is therefore extended to 0-213 mt under this alternative (Table 2-3). The target rebuilding year (T_{TARGET}) for widow rockfish under this alternative is 2028, 2030, or 2026 depending on whether Model 8, 7, or 9, respectively represents the true state of nature. Widow rockfish harvest rates (F) specified under Action Alternative 4 are 0.0001, 0.0000, or 0.0060 under rebuilding models 8, 7, or 9, respectively.

2.5.4 Yelloweye Rockfish (P_{MAX} = 90%)

Action Alternative 4 for yelloweye rockfish specifies a rebuilding strategy estimated to have a 90% probability of rebuilding by T_{MAX}. Annual harvest levels specified under this alternative range from 23-25 mt during 2004-2006 (Table 2-4). The target rebuilding year (T_{TARGET}) for yelloweye rockfish under this alternative is 2054 and the harvest rate is 0.0142.

2.6 Action Alternative 5 (Council Preferred)

The Council will choose its preferred alternative for each species rebuilding plan at its April 5-9, 2004 meeting in Sacramento, California.

2.6.1 Bocaccio

2.6.2 Cowcod

2.6.3 Widow Rockfish

2.6.4 Yelloweye Rockfish

2.7 Alternatives Considered But Eliminated From Further Detailed Analysis

Any alternatives with less than a 50% probability of rebuilding to B_{MSY} within T_{MAX} are not compliant with the MSA as interpreted in a 2000 Federal Court ruling (*Natural Resources Defense Council* v. *Daley, April 25, 2000, U.S. Court of Appeals for the District of Columbia Circuit*). Such alternatives are not analyzed in this rebuilding plan.

The Council further limited the range of alternatives for detailed analysis at its November 2003 meeting. Those alternatives with a 50% probability of rebuilding to B_{MSY} within T_{MAX}, as well as those alternatives with a 0% fishing mortality rate, were rejected from detailed analysis.[9/] A 50% rebuilding probability was considered too risky a long term rebuilding strategy for any of these species, while the economic harm to West Coast fisheries and fishing communities resulting from a zero fishing strategy was considered too high a cost to pay to rebuild these stocks.

The Mixed Stock Exception is a provision in NSG 1 allowing an OY above the overfishing level as long as the harvest meets certain standards. Harvesting one species of a mixed-stock complex at its optimum level may result in the overfishing of another stock component in the complex. The Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.
(b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur.
(c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof, to require protection under the Endangered Species Act.

However, the Council chose not to consider a mixed stock exception alternative in this analysis when advised by the National Marine Fisheries Service that a mixed stock exception would not be supported for any of these species. Therefore, despite its legal availability, a mixed stock exception alternative is not further analyzed herein.

Lastly, there is a limited range of cowcod alternatives for analysis. Cowcod was the first of the overfished West Coast groundfish stocks so declared after adoption of FMP Amendment 11, which was responsive to the mandates of the 1996 Sustainable Fisheries Act. Many of the tools used to analyze rebuilding effects, such as the Punt rebuilding program (Punt 2002), were not available when this stock was assessed and a rebuilding analysis was prepared. Coupled with the data limitations in the assessment, cowcod stock status

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9/ One exception is the Action Alternative 4 for widow rockfish under the assumption that Model 7 represents the true state of nature. This scenario specifies a zero harvest and harvest rate with an estimated 82.8% probability of rebuilding by T_{MAX}.

is poorly estimated and the typical suite of rebuilding projections are unavailable. Consequently, there is no way, short of conducting a new assessment, to analyze alternatives with probabilities of rebuilding to B_{MSY} within T_{MAX} greater than 60%.

2.8 Summary of the Alternatives for Each of the Four Overfished Species

2.8.1 Bocaccio

There is a wide range of harvest levels and consequent effects between the bocaccio rebuilding alternatives. The OYs projected in the short term (2004-2006) range from 0-115 mt under the No Action Alternative, (which is a viable rebuilding strategy according to the National Standard Guidelines) depending on which model is judged to most closely resemble a true state of nature. A near-zero exploitation standard would significantly constrain commercial and recreational fisheries south of Cape Mendocino and would be akin to the actions taken in 2003 when most fisheries were closed in the 20-150 fm depth zone to manage for a 20 mt OY. In fact, the presence of a strong 1999 year class (MacCall 2003b) might constrain fisheries to a greater extent since that cohort is now recruited to fisheries and more likely to be incidentally caught. The range of short term harvests under the action alternatives is 130-713 mt annually with a difference of about 13 years in predicted rebuilding times depending on the rebuilding model (Table 2-1). While this range of harvests under the action alternatives has a proportional range of effects based on the scale of constraints imposed on fisheries to manage to these total catch OYs, actual constraints are likely to be based on other species' rebuilding plans, most notably canary rockfish. It is unlikely that the higher end of the harvest range could ever be attained in the near future as long as fisheries are constrained by the need to rebuild canary rockfish, cowcod, yelloweye rockfish, and other depleted groundfish species co-occurring with bocaccio. Such effects are more thoroughly evaluated in Chapters 5, 6, and 8 of this EIS.

2.8.2 Cowcod

There is a negligible difference in the harvest levels and subsequent effects of the No Action Alternative and the two action alternatives for rebuilding cowcod. All alternatives are essentially the same, prescribing zero or near-zero harvests and complete avoidance strategies. Realistically, the zero harvest under the No Action Alternative and the most liberal annual harvest level of 4.8 mt in the Conception and Monterey INPFC areas combined is functionally the same, given our abilities to detect such small impacts in the affected fisheries. Therefore, this analysis will not strive to differentiate effects of cowcod rebuilding alternatives, but will instead focus on biological effects of rebuilding and critique management strategies designed to avoid cowcod.

2.8.3 Widow Rockfish

There is significant uncertainty in widow rockfish rebuilding projections which confounds the decision on the most appropriate rebuilding strategy. The base model 8 in the assessment and the rebuilding analysis was considered the most plausible by the STAT Team, STAR Panel, and SSC. Accordingly, the Council interim harvest rate of 0.0093 set for 2004 fisheries estimates an OY of 284 mt with a 60% probability of rebuilding within T_{MAX} (Action Alternative 1, Table 2-3). The target rebuilding year under this strategy is 2038. However, a more risk-averse approach with higher rebuilding probabilities quickly diminishes rebuilding yields and disrupts current fisheries. For instance, Action Alternative 4 specifies a strategy with a P_{MAX} of 90% and a negligible harvest rate which projects near-zero rebuilding yields. The widow rockfish stock would rebuild ten years faster under this alternative relative to Action Alternative 1. Action alternatives 2 and 3 provide some yields of widow rockfish to accommodate incidental bycatch, with intermediate risk relative to action alternatives 2 and 3. The No Action Alternative is not viable for widow rockfish since it does not rebuild within the maximum allowable time specified in the National Standard Guidelines.

2.8.4 Yelloweye Rockfish

There is little difference in the No Action Alternative and the action alternatives to rebuild the coastwide yelloweye rockfish stock, at least in the short term (2004-2006) projections provided in Table 2-4. The 4-6 mt difference in harvest limits between the most liberal and most conservative alternatives analyzed is arguably not within the current data monitoring systems' capability to precisely differentiate (see Chapter 7). Additionally, the differential short term effects to the physical (habitat) and socioeconomic environments (fisheries and fishing communities) are negligible. Biological effects of the alternatives are more significant. The difference in predicted rebuilding times between the most liberal and most conservative action alternative is 13 years (Table 2-4). The No Action Alternative for rebuilding yelloweye rockfish is not legally viable given that the stock does not rebuild in the maximum allowable time (T_{MAX}) according to the National Standard Guidelines. This is due to the escalating harvest rate as biomass increases under the 40-10 rule.

TABLE 2-1. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with alternative rebuilding models for bocaccio under each analyzed rebuilding alternative.[a/] (Page 1 of 1)

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives				
	No Action	1	2	3	4
			STATc (base model)		
2004 OY (mt)[b/]	0	376	306	237	130
2005 OY (mt)	7	375	307	240	134
2006 OY (mt)	28	373	309	242	137
P_{MAX}	77.6%	60%	70%	80%	90%
T_{TARGET}	2025	2025	2023	2020	2018
F rate	NA	0.0615	0.0498	0.0383	0.0209
			STARb1		
2004 OY (mt)[b/]	13	710	625	526	392
2005 OY (mt)	67	713	633	538	407
2006 OY (mt)	115	704	630	541	414
P_{MAX}	90.4%	60%	70%	80%	90%
T_{TARGET}	2019	2027	2024	2022	2020
F rate	NA	0.0914	0.0801	0.0670	0.0496
			STARb2		
2004 OY (mt)[b/]	0	295	250	199	127
2005 OY (mt)	0	304	259	209	134
2006 OY (mt)	0	308	265	215	140
P_{MAX}	83.7%	60%	70%	80%	90%
T_{TARGET}	2026	2031	2029	2027	2025
F rate	NA	0.0643	0.0541	0.0430	0.0271

a/ Bocaccio harvest specifications and strategic rebuilding parameters are based on the most recent rebuilding analysis by MacCall (2003b).

b/ These 2004 OYs are projected from the most recent rebuilding analysis and are not necessarily the harvest specification decided by the Council for 2004. The Council chose a bocaccio OY of 250 mt for 2004 with no stated or inferred preference for which model represents the true state of nature. While the OY specification is 250 mt, the Council decided to target a harvest limit of 199 mt; the difference representing a buffer against catch estimation uncertainty.

TABLE 2-2. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with cowcod rebuilding alternatives.[a/] (Page 1 of 1)

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives		
	No Action	1	2, 3, & 4
2004 OY (mt)[b/]	0	4.8	4.2
2005 OY (mt)	0	4.8	4.2
2006 OY (mt)	0	4.8	4.2
P_{MAX}	NA	55%	60%
T_{TARGET}	NA	2095	2090
F rate	NA	0.0100	0.009

a/ Cowcod harvest specifications and strategic rebuilding alternatives are based on the most recent rebuilding analysis by Butler and Barnes (2000). The OYs in the rebuilding analysis are only for the Conception INPFC area. The GMT recommended the same OY for the Monterey INPFC area; therefore, the OYs depicted in the table are double those presented in the rebuilding analysis.

b/ These 2004 OYs are projected from the rebuilding analysis and are not necessarily the harvest specification decided by the Council for 2004. The Council chose a cowcod OY of 4.8 mt for the Conception and Monterey areas combined (i.e., Action Alternative 1) with no stated or inferred preference for a rebuilding alternative.

TABLE 2-3. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with alternative rebuilding models for widow rockfish under each analyzed rebuilding alternative. a/ (Page 1 of 1)

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives				
	No Action	1	2	3	4
			Model 8 (base model)		
2004 OY (mt)[b/]	1,439	284	212	123	4
2005 OY (mt)	1,359	285	213	124	4
2006 OY (mt)	1,317	289	216	126	4
P_{MAX}	0%	60%	70%	80%	90%
T_{TARGET}	NA (>2102)	2038	2035	2032	2028
F rate	NA	0.0093	0.0070	0.0040	0.0001
			Model 7		
2004 OY (mt)[b/]	1,088	180	111	30	0
2005 OY (mt)	1,016	180	111	30	0
2006 OY (mt)	974	181	111	30	0
P_{MAX}	0%	60%	70%	80%	90% [c/]
T_{TARGET}	NA (>2102)	2039	2035	2031	2030 [c/]
F rate	NA	0.0067	0.0041	0.0011	0
			Model 9		
2004 OY (mt)[b/]	1,888	501	418	323	206
2005 OY (mt)	1,799	505	423	327	209
2006 OY (mt)	1,755	513	430	333	213
P_{MAX}	0%	60%	70%	80%	90%
T_{TARGET}	NA (>2102)	2034	2031	2028	2026
F rate	NA	0.0146	0.0122	0.0094	0.0060

a/ Widow rockfish harvest specifications and strategic rebuilding alternatives are based on Model 8, the base model in the most recent stock assessment (He *et al.* 2003a) and rebuilding analysis (He *et al.* 2003b).

b/ These 2004 OYs are projected from the most recent rebuilding analysis and are not necessarily the harvest specification decided by the Council for 2004. The Council chose a widow rockfish OY of 284 mt for 2004 with no stated or inferred preference for which model represents the true state of nature.

c/ There is only an 82.8% probability of rebuilding widow rockfish with a zero harvest under Model 7. $T_{TARGET} = T_{MIN}$ in this scenario.

TABLE 2-4. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with yelloweye rockfish rebuilding alternatives.[a/] (Page 1 of 1)

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives				
	No Action	1	2	3	4
2004 OY (mt)[b/]	27	27	26	25	23
2005 OY (mt)	29	28	27	26	24
2006 OY (mt)	31	29	28	27	25
P_{MAX}	0%	60%	70%	80%	90%
T_{TARGET}	NA (>2351)	2067	2062	2058	2054
F rate	NA	0.0167	0.0161	0.0153	0.0142

a/ Yelloweye rockfish harvest specifications and strategic rebuilding alternatives are based on the most recent rebuilding analysis by Methot and Piner (2002b).

b/ These 2004 OYs are projected from the most recent rebuilding analysis and are not necessarily the harvest specification decided by the Council for 2004. The Council chose a yelloweye rockfish OY of 22 mt for 2004 with no stated or inferred preference for which model represents the true state of nature.

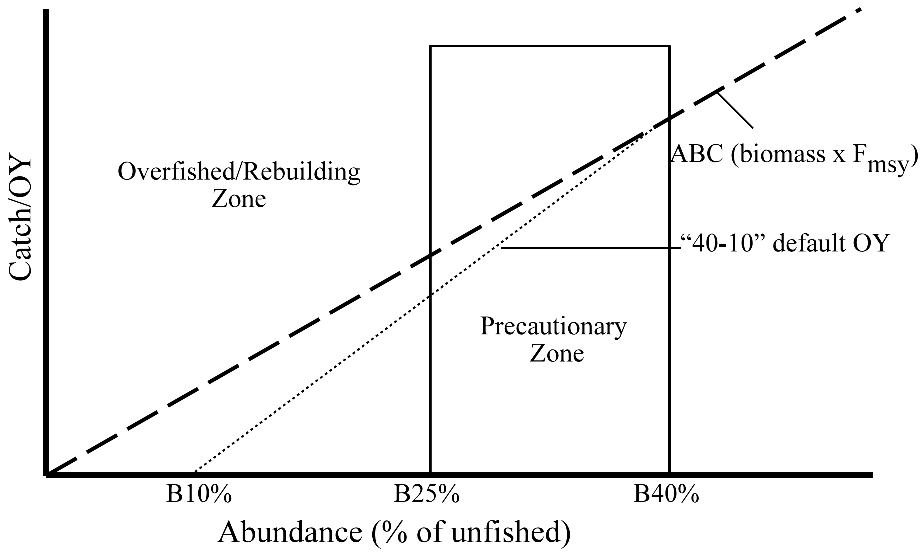

FIGURE 2-1. Relationship of the acceptable biological catch (ABC) of groundfish and the biomass-based reduction of the optimum yield (OY) for groundfish species managed under the Pacific Coast Groundfish Fishery Management Plan.

3.0 WEST COAST MARINE ECOSYSTEMS AND ESSENTIAL FISH HABITAT

3.1 Affected Environment: West Coast Marine Ecosystems

Appendix A, Section 2.3.1 describes the West Coast fishery ecosystem. Marine ecosystems are influenced by the characteristics of the water column and underlying substrate. Key factors in the water column include water depth and temperature, vertical mixing, and currents. Temperature and depth place physiological limits on the distribution of species. Depth and water turbidity determine light penetration, which is required for primary production by phytoplankton. Vertical and horizontal mixing bring nutrients into the photic zone, the upper layers where light penetrates, further influencing the level of primary production. Large-scale surface and subsurface current systems affect water temperature, nutrients, and the transport of planktonic life forms, including larval fish. Nearshore and continental shelf zones are the most productive areas because the relatively shallow depth allow light penetration throughout the water column and complete mixing. Nonetheless, commercially important groundfish species are also found on the continental slope, the zone marking the transition from the shallower shelf to the deep abyssal plain. Physical characteristics of the bottom affect ecosystems. Large coastal features—islands and embayments, for example—affect water circulation. Bottom topography is important to the distribution of benthic species. As implied by their name, many rockfish species prefer hard substrate; flatfish, including commercially important species like Dover sole, require sand or mud substrate.

Climate change is also an important influence on the productivity of marine ecosystems, which in turn has an important effect on fishery production. Scientists have become more aware of cyclical climate changes in recent years. Many people are aware of the El Niño-Southern Oscillation phenomenon; strong events have had noticeable effects across the Pacific and continental U.S. El Niño event also affect West Coast marine ecosystems. During such an event warm water moves up the West Coast, inhibiting the upwelling of cold nutrient-rich water. With less nutrients available in the photic zone primary production suffers, which also affects species higher up on the food chain, including many commercially important groundfish species. Scientists have also identified a much longer climate cycle, which they have dubbed the Pacific Decadal Oscillation, or PDO. This is a shift between periods of relatively warm sea surface temperatures off the West Coast and cooler water. During the warm phase, as with El Niño, fisheries production suffers. Scientists now realize that a warm phase began around 1976 and 1977, just at the time that domestic fisheries were expanding. As harvest rates increased dramatically, fish stocks were becoming less productive. By examining climate records scientists estimate that these cycles last for about 20 years, and there is evidence that West Coast waters recently entered a cooler phase, which should enhance productivity. This phenomenon is important when considering overfished species because stock productivity is a key factor in estimating how much fishing mortality a stock can sustain and still rebuild in the time period dictated by the rebuilding plan.

3.2 Affected Environment: Essential Fish Habitat

The MSA, as amended by the 1996 Sustainable Fisheries Act, requires NMFS and federal fishery councils to describe essential fish habitat (EFH) for the species they manage. They must also enumerate potential threats to EFH from both fishing and non-fishing activities. These descriptions are compiled as part of each FMP. NMFS completed this task for the West Coast in 1998. However, a subsequent court challenge at the national level has required NMFS and the fishery councils to go back and do a better job of identifying, characterizing, and proposing protection measures for EFH. NMFS Northwest Region is currently preparing a programmatic EIS to address this challenge. The completion date for this project is early 2006. Chapter 4 in Appendix A gives an overview of how EFH for the West Coast has been identified and characterized to date. That section of the appendix also details what is known about the effects of fishing and non-fishing activities on EFH.

Because EFH must be identified for each life stage of each species in the fishery management unit, when taken together groundfish EFH covers all marine and coastal waters in the West Coast EEZ. Currently seven composite characterizations of different types have EFH have been identified. These are broad classifications based on bottom type, topography, and water depth.

3.2.1 Bocaccio EFH

Bocaccio range from Krozoff and Kodiak Islands in the Gulf of Alaska to central Baja California, Mexico (Hart 1988). They are found in a wide variety of habitats, often on or near bottom features, but sometimes over muddy bottoms, both nearshore and offshore (Sakuma and Ralston 1995). Larvae and small juveniles are pelagic (Garrison and Miller 1982) and are commonly found in the upper 100 m of the water column, often far from shore (MBC 1987). Large juveniles and adults are semi-demersal and are most often found in shallow coastal waters over rocky bottoms associated with algae (Sakuma and Ralston 1995). Adults are commonly found in eelgrass beds, or congregated around floating kelp beds (Love *et al.* 1990; Sakuma and Ralston 1995). Young and adult bocaccio also occur around artificial structures, such as piers and oil platforms (MBC 1987). Although juveniles and adults are usually found around vertical relief, adult aggregations also occur over firm sand-mud bottoms (MBC 1987). Bocaccio move into shallow waters during their first year of life (Hart 1988), then move into deeper water with increased size and age (Garrison and Miller 1982).

Although bocaccio are found coastwide, only the stock in Southern California waters has been declared overfished.

3.2.2 Cowcod EFH

Cowcod are most abundant in waters off central and southern California. They range from 22-491 m in depth and are considered to be parademersal (transitional between a midwater pelagic and benthic species). Adults are commonly found at depths of 180 m to 235 m and juveniles are most often found in 30 m to 149 m of water (Love *et al.* 1990).

MacGregor (1986) found that larval cowcod are almost exclusively found in Southern California and may occur many miles offshore. Juveniles occur over sandy bottom areas, and solitary ones have been observed resting within a few centimeters of soft-bottom areas where gravel or other low relief was found (Allen 1982). Young of the year have been observed on fine sand and clay sediment as well as oil platform shell mounds and other complex bottom features at depths ranging from 22-122 fm (40-224 m). Adult cowcod are primarily found over high relief rocky areas (Allen 1982). They are generally solitary, but occasionally aggregate (Love *et al.* 1990). Solitary subadult cowcod have been found in association with large white sea anemones on outfall pipes in Santa Monica Bay (Allen 1982). Although cowcod are generally not migratory, they may move, to some extent, to follow food (Love 1991).

3.2.3 Widow Rockfish EFH

Widow rockfish range from Albatross Bank of Kodiak Island to Todos Santos Bay, Baja California, Mexico (Eschmeyer *et al.* 1983; Miller and Lea 1972a; NOAA 1990). They occur over hard bottoms along the continental shelf (NOAA 1990). This species prefers rocky banks, seamounts, ridges near canyons, headlands, and muddy bottoms near rocks. Large widow rockfish concentrations occur off headlands such as Cape Blanco, Cape Mendocino, Point Reyes, and Point Sur. Adults form dense, irregular, midwater and semi-demersal schools deeper than 100 m at night and disperse during the day (Eschmeyer *et al.* 1983; NOAA 1990; Wilkins 1986). All life stages are pelagic, but older juveniles and adults are often associated with the bottom (NOAA 1990). All life stages are fairly common from Washington to California (NOAA 1990).

Pelagic larvae and juveniles co-occur with yellowtail rockfish, chilipepper, shortbelly rockfish, and bocaccio larvae and juveniles off Central California (Reilly *et al.* 1992).

3.2.4 Yelloweye Rockfish EFH

Yelloweye rockfish range from the Aleutian Islands, Alaska, to northern Baja California, Mexico, and are common from Central California northward to the Gulf of Alaska (Eschmeyer *et al.* 1983; Hart 1988; Love 1991; Miller and Lea 1972b; O'Connell and Funk 1986). They occur in water 25 m to 550 m deep with 95% of survey catches occurring from 50 m to 400 m (Allen and Smith 1988). These fish are bottom dwelling, generally solitary, rocky reef fish, found either on or just over reefs (Eschmeyer *et al.* 1983; Love 1991; Miller and Lea 1972b; O'Connell and Funk 1986). Boulder areas in deep water (>180 m) are the most densely populated habitat type, and juveniles prefer shallow-zone broken-rock habitat (O'Connell and Carlile 1993). They also reportedly occur around steep cliffs and offshore pinnacles (Rosenthal *et al.* 1982). The presence of refuge spaces is an important factor affecting their occurrence (O'Connell and Carlile 1993).

3.3 Criteria Used to Evaluate Impacts

The proposed action only has indirect effects. (Indirect impacts occur at a different time or place than the proposed action.) The strategic parameters identified in the rebuilding plan will be used, in concert with stock assessments and rebuilding analyses, to determine harvest levels (OYs) for overfished species in advance of each biennial management cycle. For a given species, rebuilding by an earlier year and/or with a higher rebuilding probability (P_{MAX}) requires a lower fishing mortality rate, which translates into lower OYs. The alternatives will have differential impacts depending on these different harvest levels. Higher OYs for a given overfished species could lead to increased fishing effort by different fishery sectors. This effect can be magnified because the relatively low OYs required to rebuild overfished species constrain fishing opportunity on co-occurring healthy stocks. (Section 1.2.2 in Appendix A details this issue.) Increased fishing effort could lead to an increase in fishing-related impacts while a decrease in fishing effort would have the opposite effect. Thus, changes in fishing effort could be one way to evaluate the relative effects of the alternatives. However, there are limited data available on the distribution, intensity, and duration of fishing effort expended by various groundfish fishery sectors.[10/] Furthermore, different gear types have different kinds of impacts to habitat, although bottom trawl gear is likely to have the greatest impact because of its extensive contact with substrate. The effects of fishing gear on different types of habitat are not well understood either. For example, in high energy environments (e.g., strong wave action or currents) the relative effect of fishing gear may be modest compared to more stable, low energy environments. Currently, there is insufficient information to fully evaluate the effects of the proposed action on essential fish habitat.

Impacts of the proposed action at the ecosystem level are at least as difficult to predict. As already noted, rebuilding plans determine the harvest level (OY) for an overfished species as part of the biennial management process. This in turn determines the level of fishing and how many fish are removed from marine ecosystems. This may change the relative abundance of species at different trophic levels, affecting ecosystem structure and contributing to follow-on indirect and cumulative effects. However, the nature, intensity, and location of these effects are not well-understood, especially across the range of marine ecosystems potentially affected by changes in the abundance of harvested groundfish species.

10/ Fishing locations are reported in logbooks required for limited entry trawl vessels. Similar reporting is not required for other sectors catching groundfish. To date, a model has not been developed to predict the distribution and intensity of fishing effort for a given set of management measures. As part of the EFH EIS referenced below, NMFS is developing a model to predict impacts to EFH, which includes a component for predicting fishing effort distribution and intensity.

Given these limitations, rebuilding targets, which differ among the alternatives, are used as proxies for fishing effort as criteria to assess the relative effects of the alternatives on essential habitat and ecosystem function.

When an agency is evaluating reasonably foreseeable significant adverse effects, there is incomplete or unavailable information, and the costs of obtaining it are exorbitant or the means unknown, the agency must: (1) so state, (2) describe the importance of the unavailable information to the assessment, (3) summarize any existing scientific information, and (4) evaluate impacts based on generally accepted scientific principals (40 CFR Part 1502.22), which may accord with the best professional judgement of agency staff. NMFS acknowledges that the information necessary to fully evaluate impacts to the fishery ecosystem and essential fish habitat, as described in the preceding paragraph, cannot be reasonably obtained at this time, and impacts are generally unknown. Necessary information may become available at a future date. NMFS is preparing an EIS to comprehensively evaluate groundfish habitat and the effects of groundfish fishing on that habitat, in response to litigation (*American Oceans Campaign v. Daley et al.*, Civil Action No 99-982(GK)). This EIS is gathering more information about the effects of fishing in order to evaluate alternatives to minimize fishing effects on EFH to the extent practicable, as required by the Magnuson-Stevens Act. A predictive risk assessment model is being developed for this project, which will be used to develop alternatives for the designation and protection of EFH. In addition to any direct outcome of this EIS, such as establishing additional protection measures for EFH, it may be possible to adapt the assessment model to predict the effects of other actions, such as setting harvest specifications. The DEIS for this proposed action is scheduled for release in February 2005, and the EIS process will be completed (by signing of the ROD) in February 2006. The following evaluation is based on best professional judgement of NMFS staff.

3.4 Discussion of Direct and Indirect Impacts

Appendix A Chapter 4 describes adverse impacts of fishing gear to essential fish habitat (EFH), including ecosystem effects, in general terms. Ecosystem effects are, almost by definition, indirect. Overfishing has reduced some fish stocks to levels that are a small fraction of estimated unfished biomass and may affect trophic relationships: these species are less available both as prey and predators. Direct effects to habitat result from the deployment of fishing gear that damages benthic habitat. Habitat modification can also have indirect ecological effects because different species may be better adapted to the altered habitat, displacing other species. Bottom trawl footrope restrictions implemented by the Council make it difficult for fishers to access rock piles and other areas of complex topography (due to the risk of gear damage). This helps protect important, complex habitat and creates defacto refugia for species preferring that habitat type. Biodiversity impacts are directly and indirectly related to overfishing. Overfished species may become locally extinct in a part of their former range, and there is some risk of actual species extinction. It is unlikely such extinctions would be a direct result of overfishing, in the sense that all organisms were removed by fishing. However, the population could be reduced to such a low level that unfavorable environmental conditions or biological and behavioral constraints (inhibiting successful reproduction for example) could subsequently result in localized or species extinction. Given the current state of knowledge and available data, it is not possible to quantitatively evaluate the ecosystem, habitat, and biodiversity effects of the alternatives. Instead, the alternatives are evaluated qualitatively below.

The effects of fishery management practices on the physical environment typically include such things as fishing gear effects on the ocean floor, changes in water quality associated with vessel traffic, and fish processing discards as a result of fishing practices. There are no data to suggest that characteristics of the California Current System or topography of the coast change with fishery management or fishing practices. However, there is information to indicate fishery management and fishing practices may have an effect on EFH.

In general, potential bottom trawl fishing-related impacts to groundfish habitat take the form of lost or discarded fishing gear and direct disturbance of the seafloor from contact by trawl nets. While the effects of fishing on groundfish habitat have not been directly investigated, there is some research exploring how gear affects habitat. Auster and Langton (1999) reviewed a variety of studies reporting habitat effects due to fishing for a wide range of habitats and gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction of habitat complexity.

Bottom trawling gear is known to modify seafloor habitats by altering benthic habitat complexity and by removing or damaging infauna and sessile organisms (Freese *et al.* 1999; Friedlander *et al.* 1999). In a study on the shelf and slope off California, high-resolution sidescan-sonar images of the Eureka area revealed deep gouges on the seafloor believed to be caused by trawl doors (Friedlander *et al.* 1999). The effects of bottom trawling on a "hard bottom" (pebble, cobble, and boulder) seafloor was also investigated in the Gulf of Alaska, and results indicated a significant number of boulders were displaced and emergent epifauna were removed or damaged after a single pass with trawl gear. Casual observations during the Freese *et al.* (1999) study revealed that Sebastes species use cobble-boulder and epifaunal invertebrates for cover. When boulders are displaced they can still provide cover, but when piles of boulders are displaced it reduces the number and complexity of crevices (Freese *et al.* 1999).

Limited qualitative observations of fish traps, longlines, and gillnets dragged across the seafloor during set and retrieval showed results similar to mobile gear, such that some types of organisms living on the seabed were dislodged. Quantitative studies of acute and chronic effects of fixed gear on habitat have not been conducted (Auster and Langton 1999).

In addition to fishing activities, humans have many direct and indirect effects on groundfish habitat. While non-fishing human impacts have not been directly assessed on groundfish habitat, a study of flatfish in Puget Sound, Washington indicated that anthropogenic stressors included chemical contaminant exposure and alteration of nearshore nursery habitats (Johnson *et al.* 1998). The New England Fishery Management Council compiled a list of human-induced threats to fish habitat that may be used as a guide to factors affecting groundfish species off the West Coast. Oil, heavy metals, acid, chlorine, radioactive waste, herbicides and pesticides, sediments, greenhouse gases, and ozone loss are thought to be chemical factors that affect fish habitat. Biological threats can include the introduction of non-indigenous species, stimulation of nuisance and toxic algae, and the spread of disease. Human activities that may physically threaten fish habitat are dredging and disposal, mineral harvesting, vessel activity, shoreline alteration, and debris (Wilbur and Pentony 1999).

In the last few decades, marine debris has also been recognized as posing a risk to marine organisms via entanglement and ingestion. Seafloor debris was surveyed from Point Conception, California to the United States/Mexico international border at depths of 10 m to 200 m and anthropogenic debris occurred on approximately 14% of the mainland shelf. Of the debris sampled, discarded fishing gear had the largest spatial coverage, followed by plastic, metal, and other debris (e.g., shoe soles and automobile parts) (Moore and Allen 1999). Less is known about the quantity of marine debris off Washington and Oregon, but it may be at levels that could negatively affect marine organisms.

3.5 Discussion of Cumulative Impacts

Cumulative effects result primarily in changes in the productivity of ecosystem components, which itself may be a result in fishery-induced changes in ecosystem structure. These factors include:

<u>Climate variability.</u> Climate cycles affect population productivity. Since predictions about future productivity are based on past relationships, between stock size and recruitment for example, if underlying conditions change, these predictions may be inaccurate. Thus, if climate is not or cannot be accounted for when

modeling population dynamics, scientists may under or over predict population growth and sustainable fishery removals.

Ecosystem structure. Structural change becomes an effect itself (if resulting from fishery removals) that could interact cumulatively with the effects of the alternatives. Ultimately, it is the presence and differing abundances of species that constitutes ecosystem structure. The abundance of a given species is in turn the result of physiographic conditions (water temperature, relief, depth, etc.), processes external to an arbitrarily bounded system (e.g., fishing mortality) and interactions between system components (trophic relationships). Structure can change as a result of internal feedback. For example, scientists have posited "cultivation/depensation effects" that may lead to recruitment failure even though one would expect compensation to declines in biomass (MacCall 2002a; Walters and Kitchell 2001). (Compensatory response assumes that growth and survival are density dependent.)

Non-fishing impacts to habitat. These change physiographic conditions, which may produce changes in ecosystem structure. (Appendices to the groundfish FMP describes these effects.) Activities such as dredging, oil and gas exploitation, wastewater discharge, aquaculture and coastal development generally affect inshore habitats. With some notable exceptions (such as the live fish fishery in Southern California) most limited entry and directed open access fisheries do not occur in the inshore areas directly affected by these activities. However, according to EFH descriptions in the groundfish FMP, early life stages of some target species—such as Pacific cod, whiting, bocaccio and English sole—use estuarine habitat, so these stocks could be affected if nearshore non-fishing activities reduce productivity by damaging habitat.

Past and future fishing activity and related management actions. Excluding whiting, the highest groundfish landings were in 1982, primarily because of very large catches of widow rockfish. Landings were lower, although fairly stable through the 1980s but began to decline steeply beginning in the early 1990s. Non-whiting landings fell by 67% between 1992 and 2002 (See Appendix A Table 6-1a-c, which show historical landings by weight, and exvessel revenue in current and inflation-adjusted dollars.) Using landings as a proxy for changes in fishing effort, past effort was substantially higher than is likely to occur in the near future. This activity likely resulted in substantial impacts to EFH. The trawl vessel buyback program implemented in December 2003 retired about one third of the limited entry fleet. Although this may allow increases in landing limits and more fishing effort by the remaining vessels, the net effect is likely to be a reduction in total trawl effort. In the foreseeable future, the need to rebuild overfished groundfish stocks will likely constrain fishing effort to levels near or modestly above the level occurring at present. The distribution and intensity of fishing effort, and therefore impacts to EFH, could be affected by measures implemented pursuant to the EFH EIS mentioned above. Any such measures would likely come into effect in 2006.

3.5.1 Potential Unintended Consequences

Another way of looking at cumulative impacts is to identify the potential unintended consequences of the proposed action. The proposed action has an express purpose, as discussed in Chapter 1. However, when combined with other actions or external effects, the proposed action may have other effects. By definition, any description of unintended consequences must be speculative because they cannot be fully anticipated. But this discussion helps inform the public as to the potential range of effects stemming from the proposed action.

Recovery of overfished stocks may allow fishing effort to increase, potentially increasing habitat and ecosystem impacts. Obviously, these impacts would have to affect organisms other than groundfish species managed under the FMP; if habitat impacts affected the productivity of groundfish stocks this would hinder rebuilding of overfished species, or for non-overfished species, the harvest levels that could be sustained under the management framework. If this hindered stock rebuilding, under the management framework harvests would continue to be constrained, which would likely require limits on fishing effort, thus limiting fishing-related habitat impacts. Furthermore, separate actions, such as the EFH EIS mentioned above, are likely to further mitigate habitat impacts. Alternatively, constraints necessary to rebuild stocks could lead to shifts in fishing pattern or the gear types used. For example, expanding closed areas such as the RCA could concentrate fishing effort in productive areas outside the RCA, intensifying fishing-related impacts there.

3.6 Summary of Impacts

3.6.1 No Action Alternative

Only bocaccio is projected to rebuild under the No Action alternative. Widow rockfish and yelloweye rockfish are not projected to rebuild; there is insufficient information to determine the long-term prospects for cowcod, although the short-term OYs are consistent with rebuilding. Therefore, this alternative is only legally viable for bocaccio and possibly cowcod. Overfished bocaccio and cowcod stocks occur mainly south of Point Conception; changes in fishing effort related to stock rebuilding would therefore primarily affect habitat in those areas. Both are found in variety of habitats in continental shelf areas, although rocky areas are preferred adult habitat, especially for cowcod (see discussion above). The largest component of fishing mortality for both species is from recreational fisheries. Limited entry trawl, fixed gear, and directed open access (which is primarily fixed gear) account for most of the remaining fishing mortality for both species. In the open access sector, the exempted trawl fishery for California halibut accounts for a lot of the bocaccio bycatch. Under No Action the OYs for both species would be reduced to zero or near zero in the short term (see Tables 2-1 and 2-2). Management strategies for cowcod would likely not change since current OYs (and under the action alternatives) are already very low. The primary strategy is avoidance: using the Cowcod Conservation Area and Rockfish Conservation Area to exclude fishers from areas where this species most frequently occurs. Managing for the near-zero short-term OYs for bocaccio would likely require expanding the RCA in Southern California to push more commercial fishing effort into deeper, continental slope waters, and further curtailing or eliminating sport fishing opportunity. The short-term effect on habitat, in terms of fishing impacts, would be modest. Recreational fishing has negligible habitat impacts, so further curtailing it would have little effect. Habitat-related impacts from trawl fishing on the continental shelf could be reduced, although impacts in deep water could increase if effort shifted into this zone.

Bocaccio OYs are projected to increase fairly rapidly under No Action. The projected 2006 OY of 28.2 mt would exceed the very restrictive 2003 OY of 20 mt. By 2010 the OY would exceed the projected total fishing mortality for 2004. This suggests that management restrictions could be relaxed to allow more fishing opportunity in areas where bocaccio occurs. Other overfished species, such as canary rockfish and cowcod, would then act as constraints on the amount and distribution of fishing effort since these stocks have low projected OYs over the long term.[11/] Thus, over the long-term the distribution and intensity of fishing effort related to bocaccio rebuilding may not differ substantially from current conditions.

It is not possible to predict cumulative impacts to EFH and West Coast fishery ecosystems under No Action. Leaving aside for a moment the legality of this alternative, in that widow and yelloweye rockfish would not rebuild, this alternative would result in higher OYs over the long term, which could lead to an increase in fishing effort. However, if one assumes that the rebuilding targets adopted under Amendment 16-2 for the

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11/ The target year for canary rockfish is 2074 and projected OYs during rebuilding are below 200 mt. They are distributed coastwide, and are caught in many of the same fisheries that catch bocaccio in the Monterey and Conception management areas. Section 2.4.1.2 in Appendix A describes canary rockfish distribution, life history, and stock status.

four other overfished species remain in place, resulting OYs for those species would place an additional limit on fishing activity.

3.6.2 The Action Alternatives

The projected OYs for cowcod and yelloweye rockfish vary by a small amount under the action alternatives. There would thus be little practical difference in the kinds of management measures and resulting distribution and intensity of fishing effort resulting from the need to rebuild these two species. In addition, in the short term at least, these OYs are close enough to those now in place under interim rebuilding measures that the impacts are unlikely to differ from current levels.

Although there are three different stock assessment model results presented for bocaccio and widow rockfish under the alternatives, discussion here is confined to an evaluation using the base models. This evaluation is qualitative and primarily focuses on the relative impacts of the alternatives. The other models bracket uncertainty around the base models. Comparing alternatives using any one of the models would result in a similar arrangement of relative impacts.

Referring to Table 2-2, which shows short-term OYs for bocaccio under the alternatives, successively lower OYs would be implemented moving through the alternatives from Alternative 1 to Alternative 4. Alternatives 1 through 3 have short-term OYs substantially above the projected catch of bocaccio in 2004, which is 145.1 mt (see Table 5-12). The 2005 OY is just below this value while the 2006 OY is just above it. Alternatives 1-3, therefore, would not require any change from the current management regime specifically to address bocaccio rebuilding. Alternative 4 would require slight reductions. Depending on the allocation of bycatch allowances among different fisheries, this could have a modest effect on several different fisheries. As noted above, the largest share of estimated bocaccio harvest mortality occurs in the recreational fishery. They are also caught in limited entry trawl fisheries targeting bank and chilipepper rockfish south of Cape Mendocino (or 40º 10' N latitude). These bottom trawl fisheries have greater impacts to habitat than recreational fisheries. Estimated total catch of bocaccio in fixed gear fisheries in 2004, according to Table 5-12, is 24 mt (limited entry fixed gear and directed open access), or less then one-fifth of total estimated fishing mortality. These gear types have a modest impact on habitat.

Widow rockfish are mainly caught in the Pacific whiting fishery. (According to Table 5-12, 211 mt of widow rockfish will be caught in this fishery in 2004, almost four-fifths of the total widow rockfish fishing mortality projected for 2004.) The second large source of fishing mortality, according to Table 5-12, is the Tribal midwater fishery (which primarily targets yellowtail rockfish.) Trawl vessels use midwater nets, which do not make contact with the bottom. The impacts to physical habitat from changes in fishing effort in this sector are therefore negligible. According to the table, the limited entry fixed gear sector will catch an estimated 5 mt, about two percent of the 270 mt total projected fishing mortality for this species. Catches in other sectors (limited entry trawl, open access, recreational, research, and EFP fisheries) are much more modest, totaling 14 mt in 2004, according to these projections. If harvest restrictions are necessary, Council policy is to structure management measures so that limits are first applied to the whiting fishery before implementing measures to reduce incidental catch in non-whiting fisheries. Thus, rebuilding-related OY reductions would first affect the whiting fishery, and at very low levels would require restrictions in other fisheries. Projected OYs under Alternative 1 (see Table 2-3) are close to the 2004 OY (under the base model) since this accords to interim rebuilding targets currently in use. Alternatives 2 and 3 would require moderate to substantial reductions in the whiting fishery, but no additional limits on non-whiting fisheries under current Council policy. In the short term, adverse habitat impacts could occur from groundfish fisheries if vessels shift effort from the midwater whiting fishery to bottom trawling. Current management restrictions, primarily the RCA, would make it more likely that the increase in effort, and attendant impacts, would occur in the deepwater DTS fishery. Alternative 4 would require closing the whiting fishery and additional restrictions on other sectors, likely reducing overall effort. In the short term at least, Alternative 4 could reduce groundfish fishing related habitat impacts.

The action alternatives have mixed long-term and cumulative effects. All of the action alternatives are projected to rebuild these overfished stocks. This will have a beneficial effect to the degree that ecosystem structure and biodiversity, as measured by the relative abundance and distribution of species, returns to a state closer to natural conditions. Stock rebuilding will also increase fishing opportunity; although projected OYs for bocaccio and widow rockfish are insufficient to support a directed fishery, the constraints imposed by low OYs for these species on harvesting healthy stocks would be eased. However, rebuilding OYs for canary rockfish, which are caught incidentally in some of the same fisheries (particularly fixed gear and recreational), primarily off of Washington but extending south to Conception in small amounts, would than assume the constraining role. Habitat impacts may be mitigated by the EIS NMFS is currently developing to designate EFH and identify measures to reduce fishing-related impacts.

4.0 PROTECTED SPECIES

4.1 Affected Environment

Protected species fall under three overlapping categories, reflecting four mandates: the Endangered Species Act of 1973 (ESA), the Marine Mammal Protection Act of 1972 (MMPA), the Migratory Bird Treaty Act (MBTA), and EO 13186. Chapter 5 in Appendix A describes species which occur off the West Coast and are protected under these mandates.

The ESA protects species in danger of extinction throughout all or a significant part of their range and mandates the conservation of the ecosystems on which they depend. "Species" is defined by the Act to mean a species, a subspecies, or—for vertebrates only—a distinct population. Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is likely to become an endangered species within the foreseeable future throughout all, or a significant part, of its range. Bycatch of ESA-listed wild chinook salmon stocks by the whiting fishery is the most well-document impact of groundfish fisheries on protected species. Limits on chinook bycatch in the whiting fishery were established as result of the September 27, 1993, Biological Opinion issue pursuant to the ESA. This opinion established the bycatch rate of 0.05 chinook salmon/mt of whiting with an 11,000 fish threshold for the entire whiting fishery (at-sea and shore-base sectors combined). Re-initiation of the Biological Opinion is required if both the bycatch rate and bycatch limit are exceeded (NMFS 2003b). (Table 5-3 in Appendix A shows the incidental annual catch of chinook salmon for all sectors of the whiting fleet combined from 1991 to 2001.)

Other ESA-listed species that may interact with West Coast groundfish fisheries are sea turtles. Four of the six species found in U.S. waters have been sighted off the West Coast. These species include: Loggerhead *(Caretta caretta*), Green (*Chelonia mydas),* Leatherback (*Dermochelys coriacea*), and olive ridley (*Lepidochelys olivacea*). Little is known about the interactions between sea turtles and West Coast fisheries. Directed fishing for sea turtles in West Coast groundfish fisheries is prohibited because of their ESA listings; however, incidental take of sea turtles by longline or trawl gear may occur. (Green, leatherback, and olive ridely sea turtles are listed as endangered; loggerheads are listed as threatened.) The management and conservation of sea turtles is shared between NMFS and the U.S. Fish and Wildlife Service (FWS). Section 5.1.2 in Appendix A describes the range and occurrence of these species.

In addition to the ESA, the federal MMPA guides marine mammal species protection and conservation policy. Under the MMPA, on the West Coast NMFS is responsible for the management of cetaceans and pinnipeds, while the FWS manages sea otters. Stock assessment reports review new information every year for strategic stocks and every three years for non-strategic stocks. (Strategic stocks are those whose human-caused mortality and injury exceeds the potential biological removal [PBR].) Marine mammals, whose abundance falls below the optimum sustainable population (OSP), are listed as "depleted" according to the MMPA.

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA and ESA. NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. West Coast groundfish fisheries are in Category III, denoting a remote likelihood of, or no known, serious injuries or mortalities to marine mammals. Section 5.2.2 in Appendix A describes 25 marine mammal species known to occur of the West Coast. Of these, 16 may interact with groundfish fisheries. Three of these 16 species—the Guadalupe fur seal, Stellar sea lion and southern sea otter—are listed as threatened under the

ESA (see Table 5-4 in Appendix A).

The FWS is the primary federal agency responsible for seabird conservation and management. Four species found off the Pacific Coast are listed under the ESA. (See Table 5-5 in Appendix A.) In 2002, the FWS classified several seabird species that occur off the Pacific Coast as "Species of Conservation Concern." These species include: black-footed albatross (*Phoebastria nigripes*), ashy storm-petrel (*Oceanodroma homochroa*), gull-billed tern (*Sterna nilotica*), elegant tern (*Sterna elegans*), arctic tern (*Sterna paradisaea*), black skimmer (*Rynchops niger*), and Xantus's murrelet (*Synthliboramphus hypoleucus*).

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing, or possessing migratory birds is unlawful. In addition to the MBTA, an Executive Order, Responsibilities of Federal Agencies to Protect Migratory Birds, (EO 13186) directs federal agencies to negotiate Memoranda of Understanding with the U.S. Fish and Wildlife Service (FWS) that would obligate agencies to evaluate the impact on migratory birds as part of any NEPA process. The FWS and NMFS are working on a Memorandum of Understanding concerning seabirds.

In February 2001, NMFS adopted a National Plan of Action (NPOA) to Reduce the Incidental Take of Seabirds in Longline Fisheries. This NPOA contains guidelines that are applicable to relevant groundfish fisheries and would require seabird incidental catch mitigation if a significant problem is found to exist. As part of NPOA implementation, NMFS assessed the incidental take of seabirds in longline fisheries. During the first year of the West Coast Groundfish Observer Program (September 2001–October 2002), observers did not document any incidental seabird takes by in the limited entry groundfish longline fleet. (During the assessment period, approximately 30% of landings by the limited entry fixed gear fleet had observer coverage.) Appendix A describes 60 seabird species occurring off the West Coast. Three of these species—the short-tailed albatross, California brown pelican, and California least tern—are listed as endangered under the ESA. One species, the marbled murrelet, is listed as threatened.

4.2 Criteria Used to Evaluate Impacts

Presumably, effects on protected species correlate with changes in the level of fishing effort. Increased fishing effort could lead to an increase in interactions between fishing vessels and protected species while a decrease in fishing effort would have the opposite effect. Thus, changes in fishing effort could be one way to evaluate the relative effects of the alternatives. However, as discussed in Chapter 3 in connection with habitat and ecosystem impacts, there are limited data available on the distribution, intensity, and duration of fishing effort associated with the groundfish fisheries. Furthermore, different gear types would affect protected species differently, so the relative level of fishing effort by gear type would have to be accounted for. Even if such data were available, this distribution and intensity level of fishing effort would have to be correlated with the distribution of protected species. Finally, the effects of resulting interactions (aside from observed mortality) need to be better understood. Given these limitations, the different rebuilding plan targets in the alternatives, which will help to determine annual harvest levels, are used as proxies for fishing effort as criteria to assess the relative potential effects of the alternatives on protected species.

When an agency is evaluating reasonably foreseeable significant adverse effects, there is incomplete or unavailable information, and the costs of obtaining it are exorbitant or the means unknown, the agency must: (1) so state, (2) describe the importance of the unavailable information to the assessment, (3) summarize any existing scientific information, and (4) evaluate impacts based on generally accepted scientific principals (40 CFR Part 1502.22), which may accord with the best professional judgement of agency staff. NMFS acknowledges that the information necessary to fully evaluate impacts to protected species, as described in the preceding paragraph, cannot be reasonably obtained at this time. Necessary information may become available at a future date. Beginning in 2004 NMFS implemented a vessel monitoring system (VMS) program for limited entry groundfish vessels, which will gather information on the location of vessels. This information may become available to resource managers, allowing a better assessment of the distribution of fishing effort. NMFS is also preparing an EIS addressing the identification and protection of essential fish habitat. A predictive risk assessment model is being developed for this project, which includes a fishing effort component (see Chapter 3). When completed, it may be possible to adapt this model to predict likely protected species interactions. The West Coast Groundfish Observer Program is currently gathering data on interactions with protected species. As more data are gathered, the spatial and temporal distribution of interactions will be better understood.

Given the available information and the requirements of NEPA regulations, the remainder of this section describes the available scientific information on interactions, and based on the best professional judgement of agency staff, qualitatively assesses the predicted environmental impacts of the proposed action and alternatives on protected species.

4.3 Discussion of Direct and Indirect Impacts

The alternatives will have no direct impacts on fisheries. Increased fishing effort could result in an increase in interactions between groundfish fisheries and protected species. Adverse impacts of these interactions could include death due to capture by or entanglement in fishing gear, changes in the availability of prey species, and changes in behavior that reduce the fitness or reproductive capacity of a protected species. There is some information on gear-related mortality from fishery observers. There is insufficient information to determine what effect, if any, groundfish fisheries have on the availability of prey species and behavioral changes.

Incidental capture of ESA-listed wild salmon stocks is the best documented interaction between protected species and groundfish fisheries. The impacts of incidental catches in the whiting fishery are managed through the Biological Opinion mentioned above. Catch amounts and rates below the thresholds established in the BO indicate the impacts are minor. (See Section 5.1.1 in Appendix A for a discussion of these thresholds.) If they are consistently exceeded, consultations would be reinitiated and additional measures implemented to reduce impacts. Of the four species considered in this amendment, only widow rockfish are caught in significant numbers in the Pacific whiting fishery. In 2002, 135.6 mt of widow rockfish were caught (NMFS 2003a). A small amount of bocaccio, 190 kg, was also caught. If rebuilding measures for widow rockfish force steep reductions in the incidental catch of widow rockfish, changes in fleet activity could also reduce salmon bycatch, independent of any ongoing efforts on the part of the fleet to minimize salmon bycatch.

The groundfish bycatch mitigation draft programmatic EIS (DPEIS) (NMFS 2004b, pp. 4-147–4-160) describes impacts to sea turtles, marine mammals, and seabirds by West Coast groundfish fisheries.

Although incidental capture of sea turtles in various fisheries is a significant source of mortality (see cumulative effects, below), the area of operation and gear types used in West Coast groundfish fisheries make it unlikely that sea turtles are incidentally caught. Incidental catches have not been documented.

The groundfish bycatch mitigation DPEIS enumerates fishery-related mortality estimates for marine mammals on the West Coast. Most observed mortality has occurred in set net, gillnet and trammel net fisheries, which are not groundfish FMP fisheries. Table 4-1 lists marine mammal interactions observed during the first year of the West Coast Groundfish Observer Program. Lethal interactions occurred in both the trawl and longline fisheries, although the highest mortality was of California sea lions taken by trawl gear, with seven individuals. Trawlers also took two Stellar sea lions and an unidentified sea lion. One unidentified pinnipeds was taken by a longline vessel. (Seals and sea lions are pinnipeds.) Because marine mammals are diving animals and strong swimmers, they are more likely to be taken by trawl gear than longline gear. They are generally too large to be taken in traps (pots). (Sea otters, which are smaller animals, are an exception in this respect.) Other marine mammals noted as having been taken in West Coast groundfish fisheries are the harbor seal, sea otter, Dall's porpoise, white-sided dolphin, and short-beaked dolphin.

In the North Pacific, where seabird interactions are better documented, seabirds are most commonly incidentally-caught by longline vessels (USFWS 2003). This typically occurs during gear deployment. Seabirds like to forage for discarded offal and bait thrown overboard during fishing operations; they are then attracted to the baited hooks as the line is shot from the vessel. If they become hooked, they can be dragged under the water and drown. Some mortality may occur in trawl fisheries when seabirds may become entangled in cables running from the vessel to sonar gear attached to the net, causing them to drown (USFWS 2003). Similar impacts could occur in West Coast groundfish trawl fisheries. To date, the West Coast Groundfish Observer Program has documented few seabird deaths. Table 4-2 shows observations from the first year of the program, September 2001 to October 2002. Approximately 10% of the coastwide limited entry trawl landed weight and 30% of the limited entry fixed gear landed weight was observed during this period. As shown in the table, five seabirds were taken and nine non-lethal interactions were documented. All the mortality was observed on a trawl vessel, which is unusual. Interactions also occurred on vessels using rod-and-reel, pot, and longline gear. Of the overfished species considered in this amendment, yelloweye rockfish are most commonly caught in fixed gear fisheries and harvest restrictions have required management measures directed at these fisheries. More ambitious rebuilding targets for this species, requiring a reduction in the OY, could reduce fishing effort and potential seabird interaction in the fixed gear sector.

4.4 Discussion of Cumulative Impacts

The FEIS for the highly migratory species (HMS) FMP (PFMC 2003c) recently implemented by the Council discusses effects of those fisheries on the range of protected species discussed here, except for ESA-listed salmon. An EIS evaluating the Western Pacific region pelagic fisheries FMP (URS Corporation 2001) presents a comprehensive treatment of cumulative effects to many of the same categories of protected species. Sea turtle stocks affected by those fisheries are the same as potentially interact with West Coast groundfish fisheries. The many of the marine mammals and seabirds affected by Western Pacific pelagic fisheries are different than those occurring off the West Coast, but similar external factors would interact cumulatively with groundfish fisheries to affect protected species. These sources are used to describe cumulative impacts to protected species potentially interacting with groundfish fisheries.

4.4.1 Cumulative Impacts–ESA-listed Salmon

The EA for 2003 West Coast ocean salmon fisheries (PFMC 2003a) describes cumulative impacts to salmon stocks. From the perspective of groundfish management, take in salmon fisheries themselves represents a factor contributing to cumulative impacts. Commercial and recreational salmon fisheries are managed to optimize harvest of hatchery-produced fish while keeping the take of wild, ESA-listed stocks within limits that will ensure their continued existence. Thus, in managing these stocks all sources of fishing mortality are estimated or accounted for, including incidental take in groundfish fisheries. In addition to factors affecting other fish species, such as fishing mortality and the effect of environmental conditions on stock productivity, salmon are vulnerable to human-caused degradation of freshwater habitat used for spawning. These effects are generally well known and diverse. They include physical barriers to migration (dams), changes in water flow and temperature (often a secondary effect of dams or water diversion projects), and degradation of spawning environments due to increased silt in the water due to adjacent land use. A very large proportion of the long-term, and often permanent, declines in salmon stocks is attributable this class of impacts. For a detailed summary of non-fishing impacts to salmon habitat see Section 3.2.5 of the EFH Appendix A in Amendment 14 to the Pacific Coast salmon FMP (PFMC 2000).

4.4.2 Cumulative Impacts–Sea Turtles

The Western Pacific pelagic fisheries FMP FEIS referenced above identifies these external factors contributing to cumulative effects: (1) fisheries effects (marine and shoreline), (2) impacts on the nesting environment, (3) impacts on the marine environment, and (4) the current and future regulatory regime. This FEIS points out that fishery-related mortality has a particularly strong effect because older, more reproductively important age classes are removed from the population.

Sea turtle populations—particularly loggerheads and leatherbacks—overlap in the eastern and western Pacific, making them vulnerable to a variety of, mainly pelagic, fisheries. However, sea turtles' patchy distribution in time and space makes it difficult to predict which fisheries will most impact them. The Biological Opinion (BO) for the Oregon/California drift gillnet fishery (NMFS 2000a) describes fisheries affecting sea turtles. These include longline and purse seine pelagic fisheries prosecuted by both U.S. and foreign vessels, North Pacific driftnet fisheries before 1993, and a range of commercial and artisanal fisheries off the Pacific coast of Latin America. Until recently sea turtle fisheries were legal in most Pacific Coast Latin American countries. Illegal directed take of sea turtles along with incidental mortality in Baja California, Mexico, is a major source of mortality. West Coast fisheries known to take sea turtles include the California/Oregon drift gillnet fisheries (subject of the referenced BO), California set gillnet fisheries, the West-Coast-based pelagic longline fishery, and the albacore troll fishery. According to the pelagic longline FMP FEIS, shoreline recreational fisheries in Hawaii also affect primarily green sea turtles due to hook ingestion and line entanglement.

Sea turtles nest above the upper high tide mark on beaches, an area often heavily used by humans. They are vulnerable when nesting onshore because of directed take, habitat disturbance, and nest predation. A variety of effects can disturb the nesting environment: increased human presence, including vehicles; coastal construction and other development activities; artificial lighting; shoreline erosion and subsequent sand replenishment; and exotic vegetation. In the marine environment a variety of human activities and natural events can affect sea turtles. Marine debris are a major problem; sea turtles may become entangled and drown, or ingest material leading to intestinal blockage and starvation. Coastal and nearshore development activities such as oil exploration and development, marinas and docks, dredging, power plant cooling, construction blasting, and environmental contaminants, can lead to injury or death. Degradation of marine habitats important to sea turtles—sea grass beds and coral reefs, for example—can limit food sources or refugia. Natural disasters and climate events such as El Niño also harm sea turtles (URS Corporation 2001).

Regulatory regimes under U.S. law are intended to reduce the incidental take of sea turtles. The BO for the Oregon/California driftnet fishery mandated several measures to reduce leatherback and loggerhead take in this fishery. The Hawaii-based and West Coast-based longline fisheries have been subject to controversy over sea turtle take. Litigation (Center for Marine Conservation v NMFS (D. Haw.) Civ. No. 99-00152 DAE) and a subsequent BO imposed a range of measures (closed areas, gear restrictions, prohibitions) to limit sea turtle take in the Hawaii-based longline fishery.[12/] Shallow-set longline fishing, which targets swordfish, has been the major source of sea turtle take, and regulations have focused on limiting or eliminating this fishery.

12/ As a result of further litigation in Federal Court (HLA v. NMFS, Civ No. 01-765 slip op. at 51-62, August 31, 2003), that Biological Opinion and associated regulations were subsequently found unlawful and vacated by the Court. However, in a subsequent October 6, 2003, opinion, the Court ordered that the existing regulations stay in place until April 1, 2004, during which time NMFS needs to prepare a new BO and issue revised regulations.

In response to subsequent litigation, new regulations (along with an FMP amendment) are proposed for implementation by April 1, 2004 (see footnote). This new regime will substitute effort limitation, gear modifications (use of circle hooks and different bait), and sea turtle conservation measures for the area closures and shallow-set prohibitions currently in place for pelagic longline fisheries west of 150º W longitude (69 FR 4098, January 28, 2004). The new HMS FMP developed by the Council makes West Coast pelagic longline vessels subject to the sea turtle take reduction measures currently applicable to the Hawaii-based fishery, but does not prohibit shallow-set longlining east of 150º W longitude. However, NMFS disapproved this aspect of the FMP, based on a BO for West Coast HMS FMP fisheries (NMFS 2004a), so shallow-set swordfish targeting is prohibited east of 150º W longitude. (Under the HMS FMP, pelagic longlining is prohibited altogether in the West Coast EEZ.) West Coast pelagic longline fisheries also will be subject to the management regime currently in place west of 150º W longitude until the HMS FMP can be amended to make it consistent with ESA requirements in the aforementioned HMS FMP BO (NMFS 2004a).

Population viability is another issue related to cumulative impacts. As population declines productivity may be reduced due to density dependent effects, including skewed sex ratios. There are also genetic risks; with a smaller gene pool a population may be less able to evolutionarily adapt to changing environmental conditions. Below a certain point—the minimum viable population—a small population may enter an "extinction spiral" from which recovery is not possible even if mortality is reduced (NMFS 2000a).

4.4.3 Cumulative Impacts–Marine Mammals

Some of the same external factors affecting sea turtles are also relevant to marine mammals. The Western Pacific pelagic fisheries FMP FEIS (URS Corporation 2001) identifies fisheries incidental take, environmental fluctuations, ship traffic and anthropogenic noise, and marine debris as external factors cumulatively affecting marine mammals. According to available data (Table 4-1) it appears that California sea lions and Stellar sea lions are most likely to interact with groundfish gear. California sea lions are not listed under the ESA or listed as strategic under the MMPA. Total human-caused mortality is below the Potential Biological Removals threshold (see Section 5.2.2.1 in Appendix A). The eastern Stellar sea lion stock, which occurs in West Coast Waters, is listed as threatened under the ESA, depleted under the MMPA, and is classified as a strategic stock. However, total take-related mortality to this stock is below the Potential Biological Removal threshold (see Section 5.2.2.6 in Appendix A). The Oregon/California drift gillnet BO (NMFS 2000a) notes that this stock has been in decline. Although the causes are unknown, the BO suggests decreased prey availability due to fisheries and environmental factors may play large role. Fisheries interactions also may be a factor. The BO provides annual mortality estimates for the following fisheries: SE Alaska salmon drift gillnet, Alaska salmon troll, British Columbia aquaculture predator control program, Northern Washington tribal setnet fishery, West Coast Pacific whiting trawl fishery, and the Oregon/California drift gillnet fishery, which is the subject of the BO. This gives an indication of the range of other fisheries, in addition to West Coast groundfish fisheries, that may be cumulatively affecting Stellar sea lions.

4.4.4 Cumulative Impacts–Seabirds

As noted in the description of direct and indirect impacts, fishery-related seabirds mortality is most commonly due to birds striking baited hooks as they are being deployed from longline vessels. The birds become snagged or ingest the hook, are dragged underwater, and drown. Both the Western Pacific pelagic fisheries FMP FEIS (URS Corporation 2001) and the West Coast HMS FMP FEIS (PFMC 2003c) identify three albatross species with interactions in the pelagic longline fisheries: the black-footed albatross (*Phoebastria nigripes*), the most common albatross in West Coast waters; the Laysan albatross (*P. immutabilis*), more common in the Central and Western Pacific; and the short-tailed albatross (*P. albatrus*) which is listed as endangered. The short-tailed albatross is of particular concern because they are severely depleted, with a population estimated at about 1,700 individuals and only two known breeding colonies on small islands off of Japan. These three albatross species have also been observed around West Coast groundfish vessels (Table 4-2). Albatrosses are wide-ranging in the Pacific, and the Western Pacific pelagic fisheries FMP FEIS (URS Corporation 2001) describes a range of foreign high seas longline fisheries that may contribute substantially to mortality of these species. In addition, the FWS has issued BOs addressing incidental take in both the Hawaii-based pelagic longline fishery (FWS 2000), and Alaska demersal longline fisheries and trawl fisheries (USFWS 2003). Section 5.3.2 in Appendix A describes many other seabird species occurring off the West Coast; five of those species are listed under the ESA (see Appendix A, Table 5-5). Many of these species may minimally or modestly interact with West Coast groundfish fisheries or other fisheries but are subject to other factors affecting them cumulatively. The Western Pacific pelagic fisheries FMP FEIS (URS Corporation 2001) identified fluctuations in the oceanic environment, extermination, loss of nesting habitat, marine debris and waste disposal, and air strikes as factors in addition to fisheries take affecting seabirds. Fluctuations in the oceanic environment, such as the PDO and El Niño (discussed in Chapter 3), that affect many marine species, including West Coast groundfish. This FEIS describes past military development on Midway atoll in the Northwest Hawaiian Islands as basis for the extermination of seabird species nesting there. This kind of development also may result in the loss of nesting habitat. Short-tailed albatross nesting habitat, which is confined to two small Japanese islands, is threatened by natural events such as volcanic eruptions and mud slides. The marbled murrelet, listed as threatened, ranges from southern Alaska to Northern California and nests in old growth coniferous forest. Further loss of this habitat could affect the species' reproductive success. This species forages in coastal waters. Salmon gillnet fisheries interact with this species (NMFS 2000a). The effects of groundfish fisheries on the marbled murrelet are unknown.

4.4.5 Potential Unintended Consequences

Because of their very nature, describing unintended consequences is speculative. However, this discussion provides the public with another perspective on cumulative interactions of the proposed action and other actions and events. Protected species interactions could increase if stock rebuilding measures change the distribution and intensity of fishing effort. Recovery of overfished stocks could result in an overall increase in fishing effort leading to more interactions. Changes in the distribution of fishing effort stemming from management measures needed to rebuild stocks could increase or decrease interactions with different protected species. Changes in the configuration of the RCA, for example, could concentrate fishing effort in nearshore or offshore areas, increasing the likelihood of interactions with protected species occurring in those zones. Effort could shift among fishery sectors as a consequence of allocation decisions made on the basis of differential bycatch rates among sectors. (In other words, the Council could preferentially allocate fishing opportunity to sectors with lower bycatch rates of overfished species.) Given that different gear types interact with various protected species in different ways, this could change the interaction rate for a given protected species. For example, if more fishing effort were to shift into fixed gear fisheries this could increase interactions with seabirds while a reduction in trawl fishing effort could decrease interactions with some marine mammal species.

4.5 Summary of Impacts

The impacts of the alternatives to protected species are evaluated in the same way as impacts to habitat and ecosystem. Changes in fishing effort intensity and distribution are inferred and used as a basis for predicting impacts.

4.5.1 No Action Alternative

OYs for bocaccio and cowcod under the precautionary framework (40-10 rule) would require restrictive management for fisheries in Southern California, especially recreational. This could reduce fishery interactions with protected species. Over the long term bocaccio OYs are projected to increase more rapidly under No Action in comparison to the action alternatives, which could result in relatively more fishing effort and potential interactions with protected species. Recreational fisheries in Southern California likely have modest impacts on protected species, particularly those of greatest concern, as discussed above (e.g., Stellar sea lion, short-tailed albatross). The recreational sector would have to be curtailed in the short term since these fisheries account for a large proportion of bocaccio (and cowcod) catches. A large increase in bocaccio OYs in the long term could allow more relaxation of limits on commercial fisheries, if recreational demand were to reach some natural ceiling, but limits on other overfished species, primarily canary rockfish in the Monterey area, would ultimately constrain these fisheries.

As mentioned in Chapter 3, the No Action alternative is not legally viable for widow and yelloweye rockfish because these stocks are not projected to rebuild under the precautionary framework. Leaving aside the question of legality, fisheries north of Cape Mendocino could expand under the No Action alternative. Interactions with marine mammals, including the Stellar sea lion could increase, as well as interactions with seabirds. Since incidental catch of salmon in the Pacific whiting fishery, which is also subject to widow rockfish OYs because of bycatch, is already regulated under a BO any increase in incidental salmon take would be dealt with through this process. There is no evidence that these fisheries interact with sea turtles.

4.5.2 The Action Alternatives

South of Cape Mendocino, the OYs for bocaccio and cowcod under the action alternatives are unlikely to require substantial change in the management measures currently in place. Therefore, impacts to protected species are unlikely to change from current conditions. Changes in OYs for widow rockfish would likely reduce interactions with protected species under Alternative 3 and Alternative 4; effects are unlikely to differ from current conditions under Alternative 1 and Alternative 2. As noted in Chapter 3, there is no practical difference among the alternatives in terms of OYs for yelloweye rockfish; current management measures would not have to be changed substantially specifically to further limit yelloweye rockfish OYs. For these reasons, under any of the action alternatives there is no expectation that take limits established in relevant BOs, or PBR thresholds under the MMPA, would be exceeded as a consequence of the proposed action.

TABLE 4-1. Interactions between marine mammals and the Pacific Coast groundfish fisheries documented by West Coast Groundfish Observers[a/] between September 2001 and October 2002.

Species	Gear Type	Type of Interaction
California Sea Lion (*Zalophus californianus*)	Trawl	7 Individuals Taken
Unidentified Pinniped	Longline	1 Individual Taken
Unidentified Sea Lion	Trawl	1 Individual Taken
Steller sea Lion *(Eumetopias jubatus*)	Trawl	2 Individuals Taken
California Sea Lion (*Zalophus californianus*)	Both Trawl and Longline	Feeding on Discard
Steller sea Lion *(Eumetopias jubatus*)	Both Trawl and Longline	Feeding on Discard
Pacific white-sided Dolphin (*Lagenorhynchus obliquidens*)	Trawl	Feeding on Discard

a/ Between September 2001 and October 2002, approximately 10% of the coastwide limited entry trawl landed weight and 30% of the limited entry fixed gear landed weight was observed.

TABLE 4-2. Interactions between seabirds and the Pacific Coast groundfish fisheries documented by West Coast Groundfish Observers[a/] between September 2001 and October 2002.

Species	Gear Type	Type of Interaction
Unidentified Gull (*Larus species)*	Trawl	1 Individual Taken
Unidentified Sea bird	Trawl	4 Individuals Taken
Short-tailed Albatross (*Phoebastria albatrus*)	Longline and Trawl	Feeding on Discard
California Brown Pelican (*Pelecanus occidentalis californicus*)	Rod and Reel	Feeding on Discard
Marbled Murrelet (*Brachyramphus marmoratus*)	Trawl	Landed on Deck
Black-footed Albatross (*Phoebastria nigripes*)	Trawl, Longline, and Pot	Feeding on Discard
Leach's storm-petrel *(Oceanodroma leucorhoa*)	Trawl	Landed on Deck
Cassin's auklet *(Ptychoramphus aleuticus)*	Trawl	Landed on Deck
Pigeon guillemots *(Cepphus columba*)	Pot	Feeding on Discard
Laysan albatross *(Phoebastria immutabilis)*	Pot	Feeding on Discard
Unidentified Cormorant (*Phalacrocorax species)*	Rod and Reel	Feeding on Discard
Unidentified Storm Petrel (*Oceanodroma species*)	Longline	Landed on Deck
Unidentified Shearwater (*Puffinus species*)	Pot	Feeding on Deck

a/ Between September 2001 and October 2002, approximately 10% of the coastwide limited entry trawl landed weight and 30% of the limited entry fixed gear landed weight was observed.

5.0 OVERFISHED SPECIES SUBJECT TO REBUILDING PLANS EVALUATED IN THIS EIS

5.1 Affected Environment

5.1.1 Management History

This section provides a brief overview of the management history of bocaccio, cowcod, widow rockfish, and yelloweye rockfish including summaries of recent recreational and commercial management measures and catch histories. Additional information can be found in Appendix A, Section 2.4.1.1.

5.1.1.1 Bocaccio

Bocaccio have long been a dominant species in groundfish catches taken off California. In 1962 and 1963, bocaccio comprised over 40% of the rockfish taken by trawling off California, and comprised well over 50% of the rockfish taken by trawl south of San Francisco (Nitsos 1965). There were few restrictions on harvest other than area closures and minimum mesh size requirements prior to federal management of the fishery.

Beginning with implementation of the groundfish FMP in 1983, the Council routinely adopted an acceptable biological catch (ABC) for bocaccio of 4,100 mt for the Monterey INPFC area and 2,000 mt for the Conception area from 1983 through 1990. Landings in other areas were considered too small to warrant a separate ABC. These ABC's were based solely on historical landings during selected periods.

An assessment was conducted in 1990 (Bence and Hightower 1990) in response to concerns about bocaccio stock conditions. The results of that assessment were used by the Council to establish an 800 mt ABC for the combined Conception-Monterey-Eureka INPFC areas for 1991. The Council, after hearing public testimony, established a harvest guideline of 1,100 mt for those INPFC areas. The ABC and harvest guideline applied to all gears and include the recreational fishery. The same ABC and harvest guideline were in effect through 1992. During those two years, actual harvest exceeded the harvest guideline by 300-500 mt.

In 1992, the Council reviewed a new assessment for bocaccio (Bence and Rogers 1992). That assessment stated, "...under current harvesting rates, although fishing mortality is estimated to be below $F_{35\%}$, the expected stock biomass and spawning capacity is projected to decline further, and possibly fall to less than 20% of the levels seen in 1980....we recommend harvesting at the current harvest guideline [1100 mt]." The Council adhered to its $F_{35\%}$ policy and recommended that the 1993 ABC be increased to 1,540 mt and that the harvest guideline be set equal to the ABC in the same INPFC areas. The new assessment accommodated some expected discard in the trawl and set net fisheries that often fished to the trip limits. By 1994 the Council had determined that few trips were being impacted by trip limits and the reduction to account for discard was unnecessary. Therefore, the 1,540 mt ABC and harvest guideline, in effect since 1993, were adjusted to 1,700 mt for 1995 and 1996. Actual landings fell short of these ABC levels and declined so rapidly that even an 1,100 mt harvest guideline would have had little effect.

A stock assessment conducted in 1996 (Ralston *et al.* 1996) showed the resource to be in severe decline and the Council drastically reduced the ABC to 265 mt in 1997, and to 230 mt with adoption of an $F_{40\%}$ policy in 1998 and 1999. Moreover, the long string of recruitment failures during the 1990s continued. In 1999, the stock was formally designated as "overfished" according to the requirements of the newly amended MSA and the overfished/rebuilding threshold for groundfish adopted by the Council in groundfish FMP Amendment 11. The incoming 1999 year class appeared to be relatively strong, helping to buffer the catch restrictions needed to accomplish rebuilding. The interim rebuilding policy adopted by the Council held the rebuilding OY constant at 100 mt for the years 2000-2002.

During the 1983-1990 period, bocaccio were managed in combination with other rockfish in the Sebastes complex. Trip and frequency limits were used to constrain total complex landings only. After 1990, various bocaccio trip limits were used to keep total commercial landings within established harvest guidelines. These limits have been specific to the area south of Cape Mendocino and remain nested within overall Sebastes complex limits (Table 5-1). Constraints on the recreational take of bocaccio were limited to daily bag limits for combined rockfish (Table 5-2). Beginning in 2001, a two-fish daily bag limit was imposed for bocaccio, and time-area closures were implemented in 2002 to reduce the recreational catch of bocaccio. A history of groundfish management and regulatory action taken since FMP implementation in 1982 can be found in the *Status of the Pacific Coast Groundfish Fishery Through 2001 and Acceptable Biological Catches for 2002: Stock Assessment and Fishery Evaluation* (PFMC 2002).

The implementation of bocaccio rebuilding strategies in recent years has resulted in some of the most unstable fishery management environments seen in the history of West Coast groundfish management. Infrequent recruitment of strong year classes drives the production of the southern bocaccio stock, but model uncertainty has also contributed to a volatile management regime. In 2002, a very pessimistic bocaccio assessment (MacCall 2002b) resulted in a near cessation of shelf bottom-fishing activities on the West Coast south of 40°10' N latitude. The 1999 bocaccio assessment (MacCall *et al.* 1999) indicated that the 1999 year class held the promise of strong recruitment; a result not validated in the 2002 assessment. In fact, the 2002 assessment, which used the 2001 NMFS triennial trawl survey as its primary tuning index, showed a very low abundance of bocaccio and no evidence of the 1999 year class. The 2002 rebuilding analysis (MacCall and He 2002b) indicated the stock could not rebuild within the maximum allowable time under the National Standard Guidelines even if exploitation was reduced to zero through the projected 109-year rebuilding period. The Council and NMFS therefore adopted a 2003 bocaccio OY of ≤20 mt to prevent a complete collapse of California fisheries and irretrievable harm to fishermen and fishing communities. This OY accommodated some non-groundfish fisheries with a very low incidental bycatch of bocaccio, such as the market squid fishery and fisheries targeting highly migratory species. Most groundfish-directed fisheries and many non-groundfish fisheries with a history of greater bocaccio bycatch were restricted to waters shallower than 20 fm or deeper than 150 fm to stay within the 20 mt OY. This resulted in significant economic harm to many fishery sectors and communities in 2003 (PFMC 2003b).

However, shortly after the 2002 assessment was adopted for use in management decision-making, Dr. MacCall, the assessment author, recommended a new assessment be conducted in 2003 to rectify shortcomings in the 2002 assessment. He discovered evidence of the strong 1999 year class, rationale for a decreased natural mortality rate, and a revision of the historical catch of bocaccio based on analysis of catches made by foreign fishing fleets during 1963-1973 (Rogers In prep). Therefore, a new bocaccio assessment (MacCall 2003b) and rebuilding analysis (MacCall 2003a) were prepared in 2003. These analyses indicated that the 1999 year class was indeed strong, overall stock abundance was higher, and rebuilding prospects much more optimistic than indicated in 2002. This assessment more closely resembled the 1999 assessment and is the basis for analyses presented in this EIS.

MacCall's 2003 assessment showed evidence of a strong 1999 year class in various indices, including additional CalCOFI larval abundance information and length compositions and CPUE in California recreational fisheries. However, there was still great model uncertainty in the assessment with the Stock Assessment Review (STAR) Panel recommending two competing models (STARb1 and STARb2) to capture this uncertainty (Helser *et al.* 2003) and the stock assessment author recommending a hybrid model (STATc). Model STARb1 omits data from the NMFS triennial surveys and holds estimated recruitment constant to 1959, whereas model STARb2 omits the recreational catch per unit effort (CPUE) data and holds estimated recruitment constant to 1969. Model STATc omits neither data source, holds estimated recruitment constant to 1959, and places a low emphasis on the stock-recruitment relationship to stabilize estimates of recent (post-1999) recruitment. The SSC reviewed the new assessment and rebuilding analysis in June 2003 and recommended all three models for use.

The decision on a rebuilding strategy amid this scientific uncertainty is a difficult one. MacCall prepared a decision table that indicates the effect of choosing a model that ultimately does not represent the true state of nature (Table 5-3). For instance, if the Council's choice of a 250 mt OY for 2004 was consistent with a long term rebuilding strategy, then the rebuilding probability would vary between 70% and 96% depending on which model was true. The rebuilding probability under the base model STATc is 79%. Models STARb1 and STATc incorporate the use of a new recreational CPUE index that filters RecFIN catch and effort records based on the occurrence of known co-occurring species with bocaccio in recreational landings or bags. MacCall (2003b) maintains this approach more reasonably represents fishing efforts that occurred within bocaccio habitats. However, the novelty of this index compelled the NMFS Northwest Fishery Science Center to sponsor a workshop to more thoroughly evaluate this assessment modeling approach. The recreational CPUE workshop is tentatively scheduled for April 2004, after the Council is scheduled to adopt a long term bocaccio rebuilding plan. If the workshop participants, and subsequently the SSC, decides this modeling approach is flawed, then the choice of bocaccio models is STARb2 which omits the recreational CPUE index. Bocaccio fishing mortality would necessarily be constrained further to rebuild the stock and predicted rebuilding times would be extended. Therefore, this EIS analyzed the effects of using all three assessment models as the basis for rebuilding the southern bocaccio stock.

Total catches (estimated landings plus discards) of bocaccio in 2002 and 2003 were slightly over the prescribed OYs (Tables 5-4 and 5-5). Most of this overage was attributed to the California recreational fishery catches which were over the set-aside harvest estimated for that fishery. The Council decided to implement a 50 mt buffer in the 2004 bocaccio OY in response to recreational catch estimation uncertainty and to counter the propensity of the fishery to exceed the OY in recent years. The 2004 bocaccio OY is 250 mt, but the fishery will be managed to attempt to stay under 199 mt. Tables 5-6a, 5-6b, and 5-6c and Figure 5-1 depict the long-term bocaccio ABC and OY projections under each of the rebuilding alternatives for assessment models STATc, STARb1, and STARb2, respectively.

5.1.1.2 Cowcod

Cowcod is an extremely slow-growing, late-maturing, unproductive, and depleted species. Therefore, rebuilding the stock will take much longer than normal for most West Coast rockfish stocks- on the order of a century (Table 2-2). Cowcod stock rebuilding also requires a minimal or near-zero fishing mortality during the entire course of rebuilding, which is a daunting challenge to fishery managers. Cowcod are generally not migratory (Love 1981); therefore, a marine protected area for cowcod was decided as the primary strategy for rebuilding the stock. The Council adopted two Cowcod Conservation Areas (CCAs) in the Southern California Bight in areas of greatest density of adult cowcod in 2000 (Figure 5-2). The bounds of the CCAs were determined with the following considerations: 1) these were the areas with the highest cowcod catch and catch rates in commercial and recreational fisheries, 2) the rectangular bounds are easier to enforce, and 3) the GMT determined this closed area would achieve the Conception area catch reductions called for in the rebuilding analysis.

Another key facet to the cowcod rebuilding strategy was to prohibit retention in all West Coast fisheries. Cowcod had always been highly valued in commercial and recreational fisheries. It was thought that some targeting would still occur if a small landing limit or bag limit of cowcod was allowed to accommodate unavoidable bycatch. The Council weighed the tradeoff of providing retention to diminish discard and wastage versus the increased mortality associated with targeting. They adopted the latter alternative as the best strategy since fishing mortality was considered lower.

Butler et al. (2003) examined fishery removals of cowcod since these regulations were adopted in 2000. They concluded that exploitation of cowcod did decrease dramatically since the rebuilding strategy was implemented. Total removals in fisheries operating in the Conception and Monterey areas were below the

ABC/OY set for cowcod (Action Alternative 1, Table 2-2) every year except for 2000 in the Conception area when 5.6 mt of cowcod were removed. This was largely due to a higher than expected bycatch in the spot prawn trawl fishery which has since been eliminated on the West Coast. The authors noted that the additional yield of 12% in 2000 was within the statistical bounds of error associated with this estimate. The additional protection afforded by the establishment of the Rockfish Conservation Area in late 2002 was not considered in the Butler et al. (2003) review. Stock response to the implemented rebuilding strategy will not be well understood until the next assessment, which is scheduled for November 2005.

Long-term cowcod ABC and OY projections under each rebuilding alternative were not provided in the cowcod rebuilding analysis (Butler and Barnes 2000). A constant harvest strategy was adopted for cowcod until a more informative assessment and rebuilding analysis can be prepared. Such analyses are contemplated to be available in November 2005.

5.1.1.3 Widow Rockfish

A midwater trawl fishery for widow rockfish developed rapidly in the late 1970's and increased rapidly in 1980-82 (Gunderson 1984). Large concentrations of widow rockfish had evidently gone undetected because aggregations of this species form at night and disperse at dawn, an atypical pattern for rockfish. Since the fishery first developed, substantial landings of widow rockfish have been made in all three West Coast states. However, the last directed midwater trawl fishery for widow rockfish and yellowtail rockfish occurred in the fall of 2002. The directed midwater trawl fishery for Pacific whiting is currently where the most bycatch of widow rockfish occurs. However, the Makah Tribe prosecutes a midwater trawl fishery for yellowtail rockfish which can take widow rockfish; however, this fishery is actively managed to minimize widow rockfish bycatch. Other fisheries that take lesser amounts of widow rockfish as bycatch include limited entry and open access fixed gear fisheries, as well as recreational fisheries.

Management of the directed widow rockfish midwater trawl fishery began in 1982 when 75,000 lb trip limits were introduced in an effort to curb the rapid expansion of the fishery (Table 5-7). These were reduced to 30,000 lbs in 1983 and the fishery was managed by alteration of trip limits within the fishing season. A 10,500 mt/yr allowable biological catch (ABC) for widow rockfish was instituted in 1983, but no harvest guideline was established. This form of management continued with alterations in ABC and trip limits until 1989 when a 12,100 mt/yr harvest guideline was implemented. From 1994-1997 the harvest guideline was changed to 6,500 mt and then reduced to 5,090 mt/yr for 1998 to 2000. Harvest guidelines were further reduced to 2,300 mt for 2001, 856 mt for 2002, and 832 mt for 2003 based on the 2000 stock assessment (Williams *et al.* 2000) and the 2002 rebuilding analysis (Punt and MacCall 2002).

A new widow rockfish stock assessment (He *et al.* 2003b) and rebuilding analysis (He *et al.* 2003a) were prepared and adopted for management use in 2003. The assessment used an age-based population model and a Delta general linear model approach to derive annual indices. This assessment was much more pessimistic than previous assessments (Ralston and Pearson 1997; Rogers and Lenarz 1993; Williams *et al.* 2000), based on the conclusion that there is very low compensation in the stock-recruitment relationship, which leads to low productivity. The new assessment also indicates that the proxy MSY harvest rate of $F_{50\%}$ is too aggressive for widow rockfish. However, this assessment was affected by the absence of a fishery-independent stock size index and recent reliable fishery-dependent abundance indices. He et al. (2003b) used the same abundance indices employed by Williams et al. (2000), but the STAR Panel that reviewed the 2003 assessment recommended against continued use of the index of widow bycatch in the whiting fishery pending further data filtering and standardization (Conser *et al.* 2003). The primary source of abundance trend information in the new assessment was Oregon trawl logbook data. However, like the whiting bycatch index, these data were not used after 1999 due to low catch rates from management regulations. Other uncertainties include the pre-specified natural mortality rate of 0.15 and the strength of recent year classes. The STAR

Panel and the SSC recommended the 2003 assessment and rebuilding analysis despite these significant data limitations.

The Council followed the recommendation of He et al. (2003b) to use Model 8 for management use and set the 2004 widow rockfish OY at 284 mt. The 2003 rebuilding analysis (He *et al.* 2003a) indicates this level of harvest comports to a 60% probability of rebuilding the stock in the maximum allowable time. However, the STAR Panel and the SSC recommended models 7 and 9 as well as model 8 to capture the uncertainty of the Santa Cruz midwater trawl recruitment survey. The difference between models 7, 8, and 9 is the specification of the power coefficient that defines the relationship between the curvilinear midwater trawl juvenile survey index and subsequent recruitment. Williams et al. (2000) used a power coefficient of 10.0, but this was judged to inordinately change the relationship. Model 8 assumes a power coefficient of 3.0, while models 7 and 9 assume a coefficient of 2.0 and 4.0, respectively. Widow rebuilding projections are very sensitive to the choice of the power coefficient with 2004 yields ranging from 0-501 mt (Table 2-3). He et al. (2003b) noted that the 2002 midwater trawl survey index was considerably higher than any other estimate since 1989. This year class should recruit to the fishery in 2005 and enhance stock rebuilding. However, the 2002 year class strength cannot be fully validated at this time.

The estimated total catches of widow rockfish in recent years (Tables 5-4 and 5-5) have been significantly under the prescribed OYs with catches well below the OY in 2003. This was largely due to the elimination of the target yellowtail/widow rockfish midwater trawl fishery and reduced bycatch rate in whiting fisheries in 2003. Tables 5-8a, 5-8b, and 5-8c and Figure 5-3 depict the long-term widow rockfish ABC and OY projections under each of the rebuilding alternatives for assessment models 8, 7, and 9, respectively.

5.1.1.4 Yelloweye Rockfish

The first ever yelloweye rockfish stock assessment was conducted in 2001 (Wallace 2002). This assessment incorporated two area assessments: one from Northern California using catch per unit of effort (CPUE) indices constructed from Marine Recreational Fisheries Statistical Survey (MRFSS) sample data and California Department of Fish and Game (CDFG) data collected on board commercial passenger fishing vessels, and the other from Oregon using Oregon Department of Fish and Wildlife (ODFW) sampling data. The assessment concluded current yelloweye rockfish stock biomass is about 7% of unexploited biomass in Northern California and 13% of unexploited biomass in Oregon. The assessment revealed a thirty-year declining biomass trend in both areas with the last above average recruitment occurring in the late 1980s. The assessment's conclusion that yelloweye rockfish biomass was well below the 25% of unexploited biomass threshold for overfished stocks led to this stock being separated from the rockfish complexes in which it was previously listed. Until 2002, when yelloweye rockfish were declared overfished, they were listed in the "remaining rockfish" complex on the shelf in the Vancouver, Columbia, and Eureka INPFC areas and the "other rockfish" complex on the shelf in the Monterey and Conception areas. As with the other overfished stocks, yelloweye rockfish harvest is now tracked separately.

In June 2002 the SSC recommended that managers should conduct a new assessment incorporating Washington catch and age data. This recommendation was based on evidence the biomass distribution of yelloweye rockfish on the West Coast was centered in waters off Washington and that useable data from Washington were available. The Council received that testimony and recommended completing a new assessment in the summer of 2002, before a final decision was made on 2003 management measures. Methot et al. (2002) did the assessment, which was reviewed by a STAR Panel in August 2002 (Lai *et al.* 2003). The assessment result was much more optimistic than the one prepared by Wallace (2002), largely due to the incorporation of Washington fishery data. While the overfished status of the stock was confirmed (24% of unfished biomass), Methot et al. (2002) provided evidence of higher stock productivity than originally assumed (Appendix A Table 2-2). The assessment also treated the stock as a coastwide assemblage. This assessment was reviewed and approved by the SSC and the Council at the September 2002 Council meeting.

Yelloweye rockfish ABCs and OYs are projected from the 2002 rebuilding analysis (Methot and Piner 2002). This slow increase in projected rebuilding yields is indicative of the stock's low productivity and long rebuilding schedules. The low harvest levels considered for rebuilding yelloweye rockfish will significantly constrain fisheries that either target or incidentally catch yelloweye. Although yelloweye are found in higher relief habitats that are more difficult to fish, they are susceptible to targeting by line gears, particularly baited longlines and angling gear. No retention regulations were considered important by the GMT, because they believed even small landing limits for yelloweye rockfish in the fixed gear sectors would provide an incentive to target. Given the high market value of yelloweye rockfish, eliminating targeting opportunities is the primary precautionary strategy recommended by the Council to limit harvest.

Gear restrictions and area closures have been imposed to limit yelloweye harvest. Small footropes on bottom trawls, which cannot effectively fish high relief habitats, are required to land shelf species. The recommendation to prohibit fixed gears in waters shallower than 100 fm (except for the opportunities in nearshore areas) was based on the results of the IPHC Halibut longline survey where 99.1% of the yelloweye rockfish were caught inside 100 fm (Table 5-9). While the IPHC survey indicates most of the fixed gear impacts might be expected in waters shallower than 100 fm, yelloweye are distributed deeper (out to 220 fm, Appendix A Table 2-1). If the new fixed gear observer data suggests that yelloweye rockfish impacts are unacceptably high in commercial line fisheries, then it may be expedient to extend the non-trawl RCA seaward into deeper waters.

Recreational fishery impacts on overfished shelf rockfish species are highly uncertain. Non-retention regulations in recreational fisheries (as in commercial fixed gear fisheries) are designed to eliminate targeting. However, if anglers target other species in areas where yelloweye rockfish occur, there is an incidental mortality, whether or not retention is allowed. When retention is not allowed, incidental catch is discarded and wasted. The benefit of non-retention regulations is to discourage targeting and reduce any incremental fishing-related mortality from targeting. However, there is no quantifiable estimate of this “savings” and there is clearly a cost of increased wastage when the yelloweye catch is truly incidental. The Council weighed the issue and decided to recommend no retention in coastwide recreational fisheries in 2004.

A further concern in northern recreational fisheries is yelloweye bycatch when targeting Pacific halibut. Pacific halibut and yelloweye inhabit similar habitats, making it difficult in some areas to cleanly target Pacific halibut. Therefore, there is an incidental mortality of yelloweye that cannot be addressed solely by eliminating target opportunities. The WDFW proposed closing an area off the north Washington coast to recreational groundfish and Pacific halibut fishing in 2003. This Yelloweye Rockfish Conservation Area (YRCA) is an area of known high density of yelloweye (Figure 5-4). Yelloweye and Pacific halibut were targeted in this area in past years. However, incidental mortality of yelloweye is still a concern when targeting groundfish and Pacific halibut outside the YRCA. In 2003, the WDFW interviewed anglers completing trips targeting Pacific halibut, groundfish (aka bottomfish), and salmon in each of the four coastal Washington ports where they were asked the number of yelloweye incidentally caught and discarded at sea. These anglers were shown color photos of yelloweye to aid in species identification. The WDFW also routinely estimates total angler effort by port and target species type. To estimate the weight of yelloweye caught and discarded, the estimated number of yelloweye caught in each sampling stratum (4 ports, 3 target species types, 2 boat types (charter and private)) was multiplied by 3.4 kg, the mean weight of yelloweye estimated from RecFIN. The estimated 2003 yelloweye catch, based on sampling through July 31, 2003, is 767 fish weighing 2.6 mt (Table 5-10). Most of this catch occurred in the Neah Bay area, which is consistent with the northerly distribution of yelloweye. Nearly half this catch occurred in the recreational groundfish fishery. It is noted that yelloweye impacts are expected to be greatest in fisheries occurring off northern Washington.

The estimated total catches of yelloweye rockfish in recent years (Tables 5-4 and 5-5) have been significantly under the prescribed OYs. This was attributed to the effectiveness of the small footrope restrictions for landing shelf rockfish in the trawl fishery, the size of the non-trawl RCA, and the non-retention regulations implemented beginning in 2002. Table 5-11 and Figure 5-5 depict the long-term yelloweye rockfish ABC and OY projections under each of the rebuilding alternatives.

5.2 Criteria Used to Evaluate Impacts

The two criteria used to evaluate impacts of rebuilding alternatives on the species subject to rebuilding plans evaluated in this EIS are the rebuilding probability (P_{MAX}) and the estimated duration of rebuilding as indicated by the median year to rebuild or T_{TARGET}. The rebuilding probability is a useful index to weigh the tradeoffs associated with the benefit of earlier rebuilding (at the cost of smaller short term harvests) vs. the risk of failing to rebuild as quickly as the National Standard Guidelines mandate. However, P_{MAX} is a stochastic parameter which is accurate only to the extent that past recruitments have been estimated accurately and a long enough time series of recruitments is available to project outcomes in a representative way. Since estimated historical recruitments are used to project the future, a long time series is necessary to capture the range of outcomes in an environmentally-mediated system. If recruits were only estimated during a poor regime shift, the projection model would inaccurately estimate future recruitment during a time when the ocean environment is more productive. Resulting estimates of P_{MAX} would be similarly biased.

The target rebuilding year (T_{TARGET}) is arguably a more important evaluation criterion since it is one of the two strategic rebuilding parameters that is a legal standard for rebuilding plans as adopted under FMP Amendment 16-1. It is also more informative since it indicates how long fishery constraints would be needed under each alternative rebuilding plan before the rebuilding objective is achieved. Therefore, the "costs and benefits" of rebuilding strategies are clearer when evaluated using T_{TARGET} as a criterion.

5.3 Discussion of Direct and Indirect Impacts

5.3.1 Bocaccio

There is a wide range of harvest levels and consequent effects between the bocaccio rebuilding alternatives. The OYs projected in the short term (2004-2006) range from 0-115 mt under the No Action Alternative, (which is a viable rebuilding strategy according to the National Standard Guidelines) depending on which model is judged to most closely resemble a true state of nature. A near-zero exploitation standard would significantly constrain commercial and recreational fisheries south of Cape Mendocino and would be akin to the actions taken in 2003 when most fisheries were closed in the 20-150 fm depth zone to manage for a 20 mt OY. In fact, the presence of a strong 1999 year class (MacCall 2003b) might constrain fisheries to a greater extent since that cohort is now recruited to fisheries and more likely to be incidentally caught. The range of short term harvests under the action alternatives is 130-713 mt annually with a difference of about 13 years in predicted rebuilding times depending on the rebuilding model (Table 2-1).

5.3.2 Cowcod

There is a negligible difference in the harvest levels and subsequent effects of the No Action Alternative and the two action alternatives for rebuilding cowcod. All alternatives are essentially the same, prescribing zero or near-zero harvests and complete avoidance strategies. Realistically, the zero harvest under the No Action Alternative and the most liberal annual harvest level of 4.8 mt in the Conception and Monterey areas combined is functionally the same, given our abilities to detect such small impacts in the affected fisheries. There is a five year difference in projected rebuilding times between the two action alternatives for cowcod, with a T_{TARGET} of 2095 under Action Alternative 1 and 2090 under action alternatives 2, 3, and 4 (Table 2-2).

The No Action Alternative does not rebuild the stock within the time limit prescribed under the National Standard Guidelines and is therefore not a viable rebuilding alternative for cowcod.

Closing areas of highest density and preferred habitat should be a relatively effective way to protect cowcod given the sedentary lifestyle of adults. The existing CCAs in the Southern California Bight are in areas determined to be preferred cowcod habitats based on records showing these areas to be where the highest catch rates in recreational and fixed gears occurred (Butler *et al.* 1999). They are relatively easy to enforce since they are extensive and regularly shaped. It may be possible to rebuild cowcod at a faster rate if such habitats could be found north of Pt. Conception that cowcod could colonize. Since these are high relief habitats, creating marine reserves like the CCAs and small footrope restrictions in trawl fisheries could be expedient measures. Some decommissioned oil and gas platforms in southern California have been shown to attract juvenile and adult cowcod (Love *et al.* 2003). Allowing these submersed structures to remain may provide additional cowcod habitat.

5.3.3 Widow Rockfish

There is significant uncertainty in widow rockfish rebuilding projections which confounds the decision on the most appropriate rebuilding strategy. The base model 8 in the assessment and the rebuilding analysis was considered the most plausible by the STAT Team, STAR Panel, and SSC. Accordingly, the Council interim harvest rate of 0.0093 set for 2004 fisheries estimates an OY of 284 mt with a 60% probability of rebuilding within T_{MAX} (Action Alternative 1, Table 2-3). The target rebuilding year under this strategy is 2038. However, a more risk-averse approach with higher rebuilding probabilities quickly diminishes rebuilding yields and disrupts current fisheries. For instance, Action Alternative 4 specifies a strategy with a P_{MAX} of 90% and a negligible harvest rate which projects near-zero rebuilding yields. The widow rockfish stock would rebuild ten years faster under this alternative relative to Action Alternative 1. Action alternatives 2 and 3 provide some yields of widow rockfish to accommodate incidental bycatch, with intermediate risk relative to action alternatives 2 and 3. The No Action Alternative is not viable for widow rockfish since it does not rebuild within the maximum allowable time specified in the National Standard Guidelines.

However, what if model 8 proves not to represent the true state of nature for widow rockfish? Model 7 scenarios would require lesser widow yields and a longer rebuilding period to rebuild the stock. If model 7 is correct, then a harvest of 284 mt in 2004 would have less than a 50% probability of rebuilding by T_{MAX} and a much longer rebuilding period (>2042). A zero-harvest strategy for the entire rebuilding term under a model 7 scenario has a P_{MAX} of 82.8% and a predicted target rebuilding year of 2030. A significantly larger widow harvest can be accommodated with faster rebuilding times if model 9 is correct. If model 9 is correct, then a harvest of 284 mt would have a greater than 80% P_{MAX} and would predict the stock would rebuild by 2027. A zero-harvest strategy under model 9 predicts the stock would achieve rebuilding goals by 2022. The Council decided to consider rebuilding probabilities 60%-90% under models 7, 8, and 9. Therefore, 2004 widow yields would range from 0-501 mt. If the Council and NMFS were to choose to rebuild widow using the maximum harvest in this range and model 8 is correct, then there would be a 30.9% rebuilding probability and the predicted rebuilding year would be 2052, eleven years beyond T_{MAX}.

The Council chose to eliminate the non-tribal midwater trawl fishery targeting yellowtail and widow rockfish in 2003 to reduce widow rockfish exploitation (PFMC 2003b). The Washington Department of Fish and Wildlife sponsored a midwater trawl EFP in 2002 and 2003 to attempt to shape a fishery that effectively targeted yellowtail while avoiding widow. However, this EFP was discontinued prematurely in 2003 because about 28% of the catch was widow rockfish (B. Culver, personal communication). There is still a tribal midwater trawl fishery that targets yellowtail rockfish, but incidentally catches some widow rockfish. The 2003 and 2004 limits for this fishery were 30,000 lbs of yellowtail per two months with allowed widow landings limited to 10% of yellowtail landings in any two month cumulative limit period (PFMC 2004). The predicted widow rockfish impact in this tribal fishery in 2004 is 40 mt (PFMC 2004), but preliminary tribal observer data suggests the actual impact may be closer to 20 mt (S. Joner, personal communication). Management of the tribal midwater trawl fishery is designed to minimize impacts to canary and widow rockfish through avoidance. Observer data is analyzed daily and vessels are told which areas to avoid when these species are encountered.

The Council also chose to manage widow rockfish bycatch in 2004 by precautionary management of midwater trawl fisheries that target Pacific whiting (PFMC 2004). This has traditionally been the fishery with the greatest incidental bycatch of widow rockfish (excluding the directed yellowtail/widow midwater trawl fishery described above) (Appendix A Table 6-13). While the shoreside whiting sector has exhibited a clear recent trend of reduced widow rockfish bycatch, widow bycatch in the at-sea sectors has been more random (Figure 5-6). All whiting trawl sectors showed a significant decrease in widow rockfish bycatch in 2003. The at-sea vessels receive daily reports of bycatch by vessels in their fishery, where there is 100% observer coverage, and actively avoid areas where there has been a high bycatch of salmonids, widow, and yellowtail rockfish. Another contributing factor to the lower widow bycatch in 2003 was a significantly increased abundance of whiting in 2003 which resulted in shorter tows to fill trawls. In years when whiting are less abundant and more dispersed, widow bycatch can become an increasing concern as vessels extend their search for whiting schools and have longer tow times (D. Myer, personal communication). Shorter tows on aggregated whiting schools would sensibly reduce widow bycatch since whiting tows are made in daylight hours when widow rockfish are dispersed. There was also a greater abundance of whiting off the north Washington coast in 2003 that kept at-sea whiting vessels more northerly and away from Oregon and southern Washington coastal areas where widow are more abundantly distributed.

The GMT recommended consideration of the following management strategies to reduce widow rockfish bycatch in whiting fisheries: 1) a precautionary reduction in whiting OYs, 2) hard widow rockfish bycatch caps by sector in the whiting fisheries, 3) establishing avoidance strategies by timely reporting of widow bycatch rates by area that would compel the fleet to move away from such areas, and 4) prohibiting the whiting fishery in areas of highest widow rockfish densities. There are obvious pros and cons to these strategies with consequent impacts to the stock or the affected whiting sectors. If the whiting fleets can effectively avoid widow rockfish through other mechanisms, then a precautionary reduction of whiting OYs would be an unfair penalty to fishermen. Hard widow bycatch caps by whiting fishery sector is problematic in that sector whiting allocations are specified in the FMP and in regulations. It is noted that the majority of widow rockfish bycatch in whiting fisheries occurs infrequently in "disaster tows" that may be due to inexperience on the part of the skipper or an unpredictable encounter. Since each sector has a different season, it is conceivable that one sector could pre-empt fishing opportunities for another by experiencing a few "disaster tows". Active avoidance of widow may be the best solution if it is effective. If the 2003 experience is indicative of the ability of the at-sea fleets to avoid widow rockfish, then it is hopeful that whiting fisheries could coincide with widow rockfish rebuilding, assuming the rebuilding yields do not fall below a critical threshold of about 150-200 mt (this is because about 60-80 mt of widow are incidentally caught in non-whiting fisheries currently). A similar avoidance strategy could be implemented in the shoreside whiting sector. The shoreside sector currently operates under the Shoreside Whiting EFP which specifies a "penalty box" strategy for minimizing yellowtail rockfish bycatch. Under the terms of the yellowtail "penalty box", shoreside whiting vessels are assessed a days-at-sea penalty where their fishing opportunity is suspended proportional to the amount of yellowtail rockfish landed. A similar penalty for catching widow rockfish could be implemented for the shoreside whiting fleet. This would also benefit from timely reporting to the rest of the fleet of areas where higher widow bycatch occurred. Another specification in the Shoreside Whiting EFP is full retention and landing of all the catch. This allows full sampling of the total catch upon landing. However, catch can be discarded at sea if landing the bag poses an immediate threat to vessel safety. Since the shoreside fleet does not operate with 100% observer coverage, there may be an incentive to discard at sea if a larger than expected bycatch of widow rockfish occurs. The NMFS will start placing cameras on all shoreside whiting vessels in 2004 to determine if discarding occurs on otherwise unobserved trips. All shoreside whiting vessels are expected to be camera-equipped by July 2004.

A general area closure strategy for whiting fisheries is predicated on logbook records showing that the majority of widow bycatch occurs within 5 nm of the 200 m isobath (He *et al.* 2003b). ODFW staff are currently modeling alternative widow RCAs from logbook records. Area-specific observation records from the West Coast Groundfish Observer Program (WCGOP) could benefit this modeling exercise. Area avoidance strategies will be further explored in the 2005-2006 Environmental Impact Statement for the Proposed Groundfish Acceptable Biological Catch and Optimum Yield Specifications and Management Measures.

5.3.4 Yelloweye Rockfish

There is little difference in the No Action Alternative and the action alternatives to rebuild the coastwide yelloweye rockfish stock, at least in the short term (2004-2006) projections provided in Table 2-4. The 4-6 mt difference in harvest limits between the most liberal and most conservative alternatives analyzed is arguably not within the current data monitoring systems' capability to precisely differentiate (see Chapter 7). The difference in predicted rebuilding times between the most liberal and most conservative action alternative is 13 years (Table 2-4). The No Action Alternative for rebuilding yelloweye rockfish is not legally viable given that the stock does not rebuild in the maximum allowable time (T_{MAX}) according to the National Standard Guidelines. This is due to the escalating harvest rate as biomass increases under the 40-10 rule.

Area closures and marine reserves for yelloweye rockfish, similar to the Yelloweye Rockfish Conservation Area in northern Washington waters, may be an effective complement to a yelloweye rockfish rebuilding strategy given the sedentary nature of adults. A more regional management approach may also be advised to avoid further serial depletion of localized yelloweye populations. While the yelloweye population in the southern end of its range may always have been less abundant, both assessments indicate a significant depletion of the resource in the south, particularly in waters off California.

5.4 Cumulative Impacts

The very constraining harvests of cowcod and yelloweye rockfish in particular will likely foster rebuilding of bocaccio and widow rockfish which co-occur in the same general areas (see Chapter 6). The CCAs in the Southern California Bight will especially protect bocaccio, cowcod, and yelloweye rockfish occurring south of Pt. Conception. The YRCA in waters off northern Washington will help protect canary rockfish, lingcod, widow rockfish, and yelloweye rockfish.

Additionally, the recreational, non-trawl, and trawl RCAs currently specified on the West Coast are designed to restrict total fishing mortalities for all the overfished West Coast groundfish species. The size of these RCAs is based on estimated gear- and depth-specific bycatch rates for the most constraining overfished groundfish species. The size of the non-trawl RCA, in particular, is currently based on depth-specific bycatch rates of yelloweye rockfish. If the new fixed gear observer data suggests this RCA needs to be larger to further constrain fishing mortality of yelloweye rockfish and other overfished groundfish, then exploitation of other shelf species will be lessened.

Widow rockfish rebuilding needs could further constrain fisheries if fishing mortality needs to be further decreased. Rebuilding strategies assuming model 7 represents the correct state of nature could dictate the size of the RCAs, especially under action alternatives 3 and 4. Whiting and non-whiting fisheries would be displaced at such low prescribed widow rockfish harvest levels. This could enhance rebuilding of co-occurring overfished shelf species such as bocaccio, canary rockfish, cowcod, lingcod, and yelloweye rockfish (see Chapter 6).

The best estimates of expected total catch mortalities for all the overfished West Coast groundfish species, based on catch data available in early March 2004, are provided in Table 5-12. These estimates do not benefit from the second year of trawl observer data nor any of the WCGOP data for fixed gears which are anticipated to be available in approved bycatch models by April 2004. Mortalities of bocaccio, cowcod, widow rockfish, and yelloweye rockfish will most likely be affected by canary rockfish rebuilding OYs, which are expected to provide the most significant constraints to shelf fisheries in 2004.

5.4.1 Potential Unintended Consequences

Rebuilding any of the species subject to rebuilding plans analyzed herein could affect the abundance and productivity of other groundfish and non-groundfish species. The complexity of the marine ecosystem and the dynamic interactions of fish species make future conditions impossible to predict. For instance, lingcod rebuilding may inhibit rebuilding of other overfished groundfish since lingcod are voracious predators of rockfish. Other species interactions are less direct. Depleted cowcod populations may not rebuild according to rebuilding predictions if smaller prolific rockfish species, such as flag rockfish, selectively prey on cowcod juveniles as is hypothesized. Fish populations can therefore reach a dynamic equilibrium that can have unintended consequences for other populations.

5.5 Summary of Impacts

5.5.1 No Action Alternative

The No Action Alternative is a viable rebuilding strategy for bocaccio in that it rebuilds within the maximum allowable time under the National Standard Guidelines with a greater than 50% probability. The southern bocaccio stock would rebuild by 2025 with a 77.6% rebuilding probability under No Action assuming the STATc model is correct. The No Action Alternative is also viable assuming the competing STARb1 and STARb2 assessment models are correct. The No Action Alternative is not legally viable for rebuilding cowcod, widow rockfish, and yelloweye rockfish since these stocks are predicted to take longer to rebuild than the maximum allowable rebuilding time or not rebuild at all.

Figure 5-7 depicts the annual OY trajectories for all four groundfish stocks subject to rebuilding plans analyzed in this EIS under the No Action Alternative. Figure 5-8 shows the predicted annual increase in spawning biomass relative to the $B_{40\%}$ target for these species under the No Action Alternative. Note that only the southern bocaccio stock is predicted to reach the biomass target under a 40-10 rebuilding strategy (No Action).

5.5.2 Action Alternative 1

Figure 5-9 depicts the annual OY trajectories for all four groundfish stocks subject to rebuilding plans analyzed in this EIS under Action Alternative 1. Figure 5-10 shows the predicted annual increase in spawning biomass relative to the $B_{40\%}$ target for these species under Action Alternative 1.

5.5.3 Action Alternative 2

Figure 5-11 depicts the annual OY trajectories for all four groundfish stocks subject to rebuilding plans analyzed in this EIS under Action Alternative 2. Figure 5-12 shows the predicted annual increase in spawning biomass relative to the $B_{40\%}$ target for these species under Action Alternative 2.

5.5.4 Action Alternative 3

Figure 5-13 depicts the annual OY trajectories for all four groundfish stocks subject to rebuilding plans analyzed in this EIS under Action Alternative 3. Figure 5-14 shows the predicted annual increase in spawning biomass relative to the $B_{40\%}$ target for these species under Action Alternative 3.

5.5.5 Action Alternative 4

Figure 5-15 depicts the annual OY trajectories for all four groundfish stocks subject to rebuilding plans analyzed in this EIS under Action Alternative 4. Figure 5-16 shows the predicted annual increase in spawning biomass relative to the $B_{40\%}$ target for these species under Action Alternative 4.

5.5.6 Action Alternative 5 (Council Preferred)

This alternative will be specified by the Council at its April 2004 meeting in Sacramento, CA.

TABLE 5-1. Bocaccio commercial cumulative limits (pounds) south of Cape Mendocino (40°10' N Latitude), 1995-2004.[a] (Page 1 of 1)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Limited Entry												
1995	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
1996	60,000		60,000		60,000		60,000		60,000		60,000	
1997	12,000		12,000		10,000		10,000		5,000	5,000	5,000	5,000
1998	2,000		2,000		2,000		2,000		15,000	500	500	500
1999	750	750	750	750	1,000[b]		1,000[b]		1,000[b]	500[b]	500[b]	500[b]
2000[c]	300[d]	300[d]	300[d]	300[d]	500	500	500	500	500	500	300	300
2001[c]	300[e]	300[e]	300[e]	300[e]	300[e]	300[e]	500	500	500	Closed	Closed	
2002[c,f]	600		600		1,000		1,000		1,000		600	
2003	Closed											
2004[g]	100	100	100	100	100	100	100	100	100	100	100	100
Open Access												
1997[h]	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
1998[h]	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
1999[h]	500	500	500	500	500	500	500	500	500	500	500	500
2000	200[d]	200[d]	200[d]	200[d]	200	200	200	200	200	200	200	200
2001	200[e]	200[e]	200[e]	200[e]	200[e]	200[e]	200	200	200	Closed	Closed	
2002[i]	200[e]	200[e]	Closed				200	200	Closed			
2003	Closed											
2004[j]	200		Closed		100		100		200		200	

a/ Discrepancies will be resolved in favor of the *Federal Register*.
b/ Sep-Oct two-month limit changed to 500 pound monthly *Sebastes complex* limit on Oct 1.
c/ Trawl cumulative trip limits are allowed only if small footrope gear or midwater gear is used.
d/ Jan-Feb limited entry fixed gear and open access closed south of 36°00' N lat., Mar-Apr limited entry fixed gear and open access closed 40°10' N lat. to 36°00' N lat.
e/ Jan-Feb LE fixed gear and open access closed south of 34°27' N lat., Mar-Jun fixed gear and open access closed 40°10' N lat. to 34°27' N lat.
f/ Limited entry fixed gear same as open access in 2002..
g/ Trawl cumulative limits are allowed only if large footrope gear is used. Limited entry fixed gear same as open access.
h/ Does not include exempted trawl. Cumulative monthly limits are twice the limits shown for 1997-1999 for setnets and trammel nets south of 38°00' N Lat.
i/ Fixed gear and open access south of 34°27' N lat.; Closed Periods 1 & 6, 200 lb/mo. Periods 2-4.
j/ Fixed gear and open access south of 34°27' N lat.; Closed Period 1, 300 lb/2 mo. Periods 2-6.

TABLE 5-2. History of recreational rockfish bag limits, 1995-2004.[a/] (Page 1 of 1)

Recreational Bag Limits (numbers of fish)										
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Rockfish Bag Limit										
Washington	12[b/]	10	10	10	10	10	10	10	10[c/]	10[c/]
Oregon	15	15	15	15	15	10	10	10	10[d/]	10[d/]
California	15	15	15	15	15	10	10	10[e/]	10[f/]	10[g/]
Bocaccio Sub-Limit										
California, north of 40°10' N lat.				3	3	3	2	2	2	2
California, south of 40° 10' N lat.				3	3	3	2	2	NR	1
Canary Rockfish Sub-Limit										
Washington						2	2[h/]	2[h/]	1	NR
Oregon						3	1	1	1	NR
California, north of 40°10' N lat.						3	1	1	1	NR
California, south of 40° 10' N lat.						3	1	1	NR	NR
Cowcod Sub-Limit Cowcod Conservation Area beginning in 2001.										
California						1[i/]	NR	NR	NR	NR
Yelloweye Sub-Limit Yelloweye Rockfish Conservation Area beginning in 2003.										
Washington						2	1[h/]	1[h/]	NR	NR
Oregon								1	1	NR
California, north of 40°10' N lat.								1[j/]	1	NR
California, south of 40° 10' N lat.								1[j/]	NR	NR

a/ Discrepancies will be resolved in favor of the *Federal Register*. NR = Non-Retention.
b/ Rockfish bag limit of 15 south of Leadbetter Point, Washington.
c/ Part of an aggregate bag limit of 15 groundfish.
d/ Included several marine species including rockfish, greenling, cabezon, flounder, sole and other species.
e/ South of 40°10' N lat. May-Jun and Sep-Oct no more than 2 may be shelf rockfish and closed to bocaccio, canary rockfish, cowcod, and yelloweye rockfish retention.
f/ North of 40°10' N lat. part of a 20 marine finfish bag limit. South of 40°10' N lat. Includes sublimits of 2 shallow nearshore rockfish, 3 cabezon and 2 greenling (rock and/or kelp).
g/ Includes sublimits of 3 cabezon and 2 greenling (rock and/or kelp).
h/ Washington sublimit of no more than 2 canary rockfish or 1 canary rockfish plus 1 yelloweye rockfish.
i/ Cowcod bag limit, 1 per person, 2 per boat.
j/ Yelloweye rockfish limit, 1 per person, 2 per boat.

TABLE 5-3. Decision table treating three alternative bocaccio assessment models as true states of nature. Four management decisions are given, corresponding to the correct decision under the three models, and a fourth decision based on average catch from the STARb1 and STARb2 models. Values in bold indicate the correct decision for the associated model if it is true. Table from MacCall (2003a).

	True Model (State of Nature)		
	STARb1	STATc	STARb2
Management Decision:			
STARb1			
C2004	**624.8**	624.7	624.8
F	**0.0801**	0.1039	0.1403
medianT_{REB}(years)	**20.1**	41.6	81.1
Prob Rebuild by T_{MAX}	**70%**	19%	3%
STATc			
C2004	307.2	**306.3**	307
F	0.0387	**0.0498**	0.0669
medianT_{REB}(years)	14.7	**22.7**	28.1
Prob Rebuild by T_{MAX}	94%	**70%**	58%
STARb2			
C2004	250	248.8	**249.6**
F	0.0314	0.0403	**0.0541**
medianT_{REB}(years)	13.9	20.7	**25.2**
Prob Rebuild by T_{MAX}	96%	79%	**70%**

TABLE 5-4 Estimated 2002 total catch mortality of selected groundfish species from West Coast commercial, tribal and recreational fisheries (mt).[a/]

	LANDINGS AND MORTALITY			TARGETS	
Species	Estimated Total Catch	Estimated Commercial Fishery Discard Mortality[b/]	Actual Landings[c/]	Total Catch ABC	Total Catch OY
Lingcod	872.3	51.4	820.9	841	577
Pacific Cod			756.7	3,200	3,200
Pacific Whiting[d/]	129,999.4		129,999.4	188,000	129,600
Sablefish (north)	4,298.3	669.5	3,628.8	8,209	4,367
Sablefish (south)	206.3	16.5	189.8	441	229
Dover sole	6,650.5	331.5	6,319.0	8,510	7,440
English sole			1,179.3	3,100	
Petrale sole			1,798.1	2,762	
Arrowtooth flounder			2,090.7	5,800	
Other flatfish			0.0	7,700	
Pacific Ocean Perch	179.5	28.6	150.8	689	350
Shortbelly			0.3	13,900	13,900
Widow	420.3	66.8	353.5	3,871	856
Canary	78.3	9.8	68.4	272	93
Chilipepper	205.7	30.7	175.0	2,700	2,000
Bocaccio	117.1	5.4	111.7	198	100
Splitnose	67.3	10.8	56.5	615	461
Yellowtail	1,540.7	294.1	1,246.6	3,146	3,146
Shortspine Thornyheads	955.7	189.4	766.3	1,004	955
Longspine Thds. (north)	2,076.6	351.5	1,725.1	2,461	2,461
Longspine Thds. (south)			124.7	390	195
Unspecified Thornyheads			71.6		
Cowcod, Monterey	0.8	0.0	0.8	19	2
Cowcod, Conception	0.0	0.0	0.0	5	2
Yelloweye	9.1	0.0	9.1	52	14
Darkblotched	131.6	25.7	105.9	205	168

a/ Preliminary estimates of total catch mortality based on species discard assumptions used when the OYs were set. These assumptions are currently being revised using data from the West Coast Groundfish Observer Program.

b/ Estimated (unobserved) discard mortality in shoreside commercial fishery. Calculated using discard mortality assumptions in 2002 Groundfish Annual Specs (Magnuson-Stevens Act Provisions, Fisheries off West Coast States and in the Western Pacific, Pacific Coast Groundfish Fishery, Annual Specifications, Pacific Whiting. Federal Register / Vol. 67, No. 72 / Monday, April 15, 2002 / Rules and Regulations, page 18121, Table 1a. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas.

c/ Includes shoreside commercial and tribal landings from PacFIN, observed total catch including estimated discards in the at-sea whiting fishery, and RecFIN recreational catch plus observed discard mortality (A+B1).

d/ Discards of whiting are estimated from observer data and counted towards the OY inseason.

TABLE 5-5. Estimated 2003 total catch mortality of selected groundfish species from West Coast commercial, tribal and recreational fisheries (mt).[a/]

	LANDINGS AND MORTALITY			TARGETS	
Species	Estimated Total Catch	Estimated Commercial Fishery Discard Mortality[b/]	Actual Landings[c/]	Total Catch ABC	Total Catch OY
Lingcod	1,326.2	41.3	1,284.9	841	651
Pacific Cod			1,249.6	3,200	3,200
Pacific Whiting[d/]	141,491.1		141,491.1	188,000	148,200
Sablefish (north)	6,167.5	907.0	5,260.5	8,209	6,500
Sablefish (south)	221.7	17.7	204.0	441	294
Dover sole	7,772.3	386.6	7,385.7	8,510	7,440
English sole			902.4	3,100	
Petrale sole			2,016.2	2,762	
Arrowtooth flounder			2,338.7	5,800	
Other flatfish			0.0	7,700	
Pacific Ocean Perch	163.4	25.2	138.2	689	377
Shortbelly			7.0	13,900	13,900
Widow	49.4	7.6	41.8	3,871	832
Canary	36.2	1.9	34.3	272	44
Chilipepper	38.2	4.1	34.1	2,700	2,000
Bocaccio	22.4	1.8	20.6	198	20
Splitnose	130.4	20.9	109.5	615	461
Yellowtail	592.8	110.4	482.4	3,146	3,146
Shortspine Thornyheads[e/]	1,037.8	205.4	832.4	1,004	955
Longspine Thds. North[e/]	1,818.1	307.2	1,510.9	2,461	2,461
Longspine Thds. South				390	195
Cowcod, Monterey	0.1	0.0	0.1	19	2
Cowcod, Conception	0.0	0.0	0.0	5	2
Yelloweye	6.6	0.0	6.6	52	22
Darkblotched	107.7	19.7	88.1	205	172
Black Rockfish (north)	174.0	0.0	174.0	615	
Black Rockfish (south)	976.1	0.0	976.1	500	
Black Rockfish Total	1,150.1	0.0	1,150.1	1,115	

a/ Preliminary estimates of total catch mortality based on species discard assumptions used when the OYs were set. These assumptions are currently being revised using data from the West Coast Groundfish Observer Program.

b/ Estimated (unobserved) discard mortality in shoreside commercial fishery. Calculated using discard mortality assumptions in 2002 Groundfish Annual Specs (Magnuson-Stevens Act Provisions, Fisheries off West Coast States and in the Western Pacific, Pacific Coast Groundfish Fishery, Annual Specifications, Pacific Whiting. *Federal Register* / Vol. 67, No. 72 / Monday, April 15, 2002 / Rules and Regulations, page 18121, Table 1a. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas.

c/ Includes shoreside commercial and tribal landings from PacFIN, observed total catch including estimated discards in the at-sea whiting fishery, and RecFIN recreational catch plus observed discard mortality (A+B1).

d/ Discards of whiting are estimated from observer data and counted towards the OY inseason.

e/ Includes "unspecified thornyheads" allocated based on ratios estimated from California landings and At Sea north/south ABCs.

TABLE 5-6a. Projected total catch optimum yields for bocaccio (Model STATc) under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P= .5	P= .6	P= .7	P= .8	P= .9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	439.1	376.5	306.3	236.5	130.1	288.6	0.0	585.7
2005	433.3	374.7	307.8	239.9	133.8	290.7	6.7	566.3
2006	427.8	372.7	308.5	242.4	136.9	292.0	28.2	549.2
2007	432.5	379.2	316.3	250.1	142.8	299.8	49.3	547.1
2008	456.5	402.1	336.8	268.0	154.3	319.7	76.1	571.3
2009	492.2	436.8	368.5	295.0	171.3	350.2	114.5	606.2
2010	529.9	471.5	400.1	322.6	188.8	381.3	168.2	644.6
2011	559.6	501.8	429.2	348.2	205.8	409.4	231.5	670.0
2012	589.0	531.5	457.4	373.3	223.1	437.1	302.6	697.1
2013	612.9	556.6	482.5	396.7	240.2	462.2	379.9	713.5
2014	655.5	598.0	520.5	430.2	262.3	498.5	467.7	753.4
2015	688.5	631.6	554.5	462.7	284.9	533.3	574.4	781.2
2016	726.0	670.8	594.1	498.2	310.3	571.4	691.3	813.2
2017	766.0	713.1	634.7	536.3	337.4	611.7	826.5	844.2
2018	806.9	754.5	676.0	574.6	365.6	652.6	972.0	876.4
2019	847.8	799.1	720.8	618.1	397.9	696.5	1,090.4	906.7
2020	894.2	845.8	768.7	663.0	434.2	745.1	1,256.7	943.8
2021	949.1	902.1	824.3	714.0	490.9	799.4	1,422.5	987.2
2022	988.4	946.7	872.6	773.9	669.4	849.0	1,595.4	1,016.0
2023	1,056.0	1,020.1	949.4	876.3	1,993.4	925.4	1,804.7	1,068.6
2024	1,110.0	1,077.3	1,017.9	1,023.1	2,219.9	1,000.3	1,945.6	1,104.7
2025	1,167.8	1,147.1	1,108.5	1,805.6	2,388.7	1,111.9	2,137.0	1,146.8
2026	1,232.1	1,218.7	1,278.5	2,060.1	2,543.4	1,367.2	2,259.1	1,190.5
2027	1,296.7	1,310.8	1,673.4	2,277.1	2,730.4	1,883.5	2,406.6	1,231.4
2028	1,358.9	1,429.9	2,009.2	2,434.3	2,833.3	2,167.7	2,542.5	1,271.8

TABLE 5-6b. Projected total catch optimum yields for bocaccio (Model STARb2) under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P= .5	P= .6	P= .7	P= .8	P= .9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	333.5	295.2	249.6	199.2	126.7	221.3	0.0	446.2
2005	341.2	304.1	259.3	208.7	134.5	231.1	0.0	447.1
2006	343.9	308.3	264.7	214.8	140.0	237.0	0.0	443.0
2007	356.8	321.5	277.8	226.9	149.0	249.6	0.0	452.2
2008	376.3	340.4	295.4	242.8	160.9	266.4	13.8	470.2
2009	399.1	363.4	317.1	262.1	175.4	286.9	40.4	493.5
2010	425.7	388.8	341.3	283.5	191.6	309.7	75.8	518.7
2011	451.4	414.5	366.1	306.3	208.2	333.5	120.2	542.7
2012	479.4	442.3	392.8	331.1	227.2	359.3	170.5	568.0
2013	502.1	465.4	415.5	352.0	244.1	381.0	231.7	586.0
2014	532.1	495.8	445.3	379.6	265.3	409.8	297.4	612.4
2015	567.1	531.1	479.6	412.0	290.6	443.5	378.7	642.8
2016	605.7	569.6	517.5	446.9	317.9	479.7	485.6	676.5
2017	640.7	605.9	553.3	480.5	345.5	514.5	606.2	705.1
2018	671.9	638.7	587.3	512.9	372.3	548.2	728.6	727.9
2019	718.2	685.2	633.4	557.1	406.9	593.6	865.3	766.2
2020	756.1	725.8	674.7	597.8	440.7	634.7	1,018.6	797.6
2021	800.9	771.8	721.6	643.6	479.9	681.3	1,198.9	833.2
2022	844.4	817.9	769.0	689.3	520.6	728.3	1,369.5	865.1
2023	897.6	874.0	824.9	743.6	576.5	783.6	1,551.1	904.0
2024	952.7	931.5	886.9	812.7	674.3	848.0	1,737.5	948.2
2025	1,003.2	985.1	944.4	884.7	1,803.2	914.7	1,976.4	985.2
2026	1,077.9	1,064.1	1,029.6	990.7	2,143.6	1,008.8	2,164.8	1,043.0
2027	1,139.2	1,130.1	1,101.2	1,232.1	2,394.9	1,125.8	2,331.8	1,083.6
2028	1,202.9	1,208.3	1,231.0	2,006.1	2,545.5	1,418.3	2,458.6	1,131.6
2029	1,286.6	1,309.5	1,475.6	2,252.8	2,699.2	2,061.2	2,596.7	1,182.6
2030	1,372.2	1,420.6	1,971.6	2,408.9	2,827.4	2,242.2	2,744.8	1,241.5

TABLE 5-6c. Projected total catch optimum yields for bocaccio (Model STARb1) under different rebuilding scenarios, the default 40-10 policy and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P= .5	P= .6	P= .7	P= .8	P= .9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	784.1	709.8	624.8	525.6	392.0	580.5	13.5	745.1
2005	780.9	712.6	632.9	538.2	407.2	590.9	66.9	745.1
2006	765.4	703.6	630.1	540.7	414.0	590.7	114.9	733.2
2007	766.5	708.4	638.4	552.3	427.6	600.9	160.8	736.4
2008	792.4	736.0	667.8	581.8	454.5	630.3	214.9	762.8
2009	847.9	791.1	722.6	634.2	499.2	684.4	288.8	818.9
2010	904.8	849.7	781.3	689.7	548.4	741.9	400.2	876.7
2011	962.6	909.5	840.3	747.1	601.8	800.2	522.7	935.5
2012	1,023.2	971.9	904.8	812.1	659.0	865.0	676.7	997.1
2013	1,096.6	1,048.2	979.9	884.1	724.1	939.3	843.4	1,071.4
2014	1,148.7	1,104.4	1,039.8	947.2	784.9	1,000.9	1,054.1	1,126.6
2015	1,203.1	1,164.1	1,103.5	1,010.5	845.1	1,065.2	1,254.1	1,183.9
2016	1,292.3	1,257.5	1,199.2	1,105.1	929.8	1,161.7	1,491.7	1,274.9
2017	1,359.0	1,327.9	1,274.8	1,187.5	1,015.7	1,240.4	1,810.0	1,344.0
2018	1,406.9	1,383.5	1,340.0	1,262.4	1,107.8	1,305.3	2,048.2	1,396.4
2019	1,496.7	1,480.5	1,439.8	1,368.1	1,280.8	1,414.1	2,253.3	1,490.3
2020	1,589.6	1,580.1	1,548.4	1,496.9	1,817.6	1,520.8	2,463.3	1,586.1
2021	1,668.9	1,670.9	1,661.0	1,681.5	2,344.5	1,658.1	2,639.7	1,672.7
2022	1,748.7	1,761.0	1,781.9	1,966.9	2,572.7	1,836.3	2,819.2	1,758.3
2023	1,832.7	1,858.8	1,932.4	2,269.4	2,728.0	2,093.5	3,004.1	1,848.1
2024	1,920.8	1,977.7	2,126.9	2,461.4	2,945.9	2,262.4	3,156.1	1,951.8
2025	2,025.0	2,093.8	2,318.8	2,672.5	3,149.4	2,461.6	3,376.1	2,059.6

TABLE 5-7. Commercial regulatory history of widow rockfish, 1982-2004. [a/] (Page 1 of 2)

DATE	REGULATION
10/13/82	75,000 lb trip limit
1/30/83	30,000 lb trip limit
9/10/83	1,000 lb trip limit
1/1/84	50,000 lb trip limit once per week
5/6/84	40,000 lb trip limit once per week
8/1/84	closed fishery with 1,000 trip limit for incidental catch
9/9/84	closed fishery
1/10/85	30,000 lb trip limit once a week or 60,000 lb trip limit once per two weeks, unlimited trips of less than 3,000 lbs
4/28/85	dropped 60,000 lb biweekly option
7/21/85	3,000 lb trip limit, unlimited number of trips
1/1/86	30,000 lb trip limit, only one weekly landing greater than 3,000 lbs
9/28/86	3,000 lb trip limit, unlimited number of trips
1/1/87	30,000 lb trip limit, only one weekly landing greater than 3,000 lbs
11/25/87	closed fishery
1/1/88	30,000 lb trip limit, only one weekly landing greater than 3000 lbs, unlimited number of trips less than 3,000 lbs
9/21/88	3,000 lb trip limit, unlimited number of trips
1/1/89	30,000 lb trip limit, only one weekly landing greater than 3,000 lbs
4/26/89	10,000 lb trip limit once per week
10/11/89	3,000 lb trip limit with unlimited number of trips
1/1/90	15,000 lb trip limit once per week or 25,000 lb trip limit once per two weeks with only one landing greater than 3,000 lbs each week
12/12/90	closed fishery
1/1/91	10,000 lb trip limit per week or 20,000 lb trip limit every two weeks with only one landing greater than 3,000 lbs per week
9/25/91	3,000 lb trip limit with unlimited number of trips
1/1/92	30,000 lbs cumulative landings every 4 weeks
5/9/92	change from 3" mesh to 4.5" mesh in codend for roller gear north of Point Arena
8/12/92	3,000 lb trip limit with unlimited number of trips
12/2/92	30,000 lb cumulative trip limit per 4 weeks
12/1/93	3,000 lb trip limit with unlimited number of trips
1/1/94	30,000 lb cumulative limit per calender month
12/1/94	3,000 lb trip limit with unlimited number of trips
1/1/95	30,000 lb cumulative limit per calender month
4/14/95	45,000 lb cumulative limit per calender month
9/8/95	4.5" mesh applies to entire net and bottom trawl
1/1/96	70,000 lb cumulative limit per two months
9/1/96	50,000 lb cumulative limit per two months
11/1/96	25,000 lb cumulative limit per two months
1/1/97	70,000 lb cumulative limit per two months
5/1/97	60,000 lb cumulative limit per two months
1/1/98	limited entry: 25,000 lb cumulative per two month period, open access: 12,500 lb cumulative per two month period
5/1/98	limited entry: 30,000 lb cumulative per two month period
7/1/98	open access: 3,000 lb cumulative per month
10/1/98	limited entry: 19,000 cumulative per month
1/1/99	limited entry: cumulative limits: phase 1 - 70,000 lbs per period, phase 2 - 16,000 lbs per period, phase 3 - 30,000 lbs per period. Open access: 2,000 lbs per month
5/1/99	limited entry: decrease phase 2 and phase 3 limits to 11,000 lbs
7/2/99	open access: 8,000 lb cumulative limit per month
10/1/99	limited entry: vessels in Oregon and Washington using 30,000 lb cumulative monthly limit must have midwater trawl gear aboard or a state cumulative limit will be imposed
1/1/00	Widow rockfish classified as a shelf species for regulatory purposes, 30,000 lbs/2 months for limited entry trawl, 3,000 lbs/month for limited entry fixed gear and open access
1/1/01	20,000 lbs/2 months for months of Jan-Apr and Sep-Oct; otherwise 10,000 lbs/2 months for midwater limited entry. 1,000 lbs/months for small footrope limited entry. 3,000 lbs/month for fixed gear limited entry. Open access: north - 3,000 lbs/month, south - 3,000 lbs per month with some monthly closures in some areas.
7/1/01	North - limited entry midwater trawl limits: 1,000 lbs/month
10/1/01	closed fishery for all except midwater, which may land 2,000 lbs/month in north for October, then 25,000 lbs/2 months.
1/1/02	North - limited entry trawl: closed through November to midwater trawl except for small bycatch in whiting fishery, in November 13,000 lbs/2 month with no more than 2 trips, small footrope trawl1000 lbs/month through September, then closed Sept-Oct, then 500 lbs/month Nov-Dec. South - limited entry trawl: midwater closed year round except for a small bycatch in the whiting fishery, small footrope trawl 1,000 lbs/month through July, then closed

TABLE 5-7. Commercial regulatory history of widow rockfish, 1982-2004. [a/] (Page 2 of 2)

DATE	REGULATION
1/1/03	North - limited entry trawl: midwater trawl closed through November except for small amount of bycatch in whiting fishery, 12,000 lbs/2 months for Nov-Dec. small footrope trawl - 300 lbs/month Jan-Apr and Nov-Dec, 1000 lbs/month May-Oct. - limited entry fixed gear: 200 lbs/month. - open access gear: 200 lbs/month. South - limited entry trawl: same as north for midwater and small footrope trawl. - limited entry fixed gear: closed Mar-Apr, then variable 100 lbs/2 months to 250 lbs/2 months. - open access gear: same as limited entry fixed gear.
11/21/03	Limited entry trawl closed shoreward of 200 fathom line, limited entry fixed gear closed shoreward of 150 fathom line in Oregon and California and closed shoreward of 200 fathom line in Washington.
1/1/04	North - limited entry trawl: midwater trawl closed through November except for small amount of bycatch in whiting fishery, 12,000 lbs/2 months for Nov-Dec. small footrope trawl - 300 lbs/month Jan-Apr and Nov-Dec, 1000 lbs/month May-Oct. - limited entry fixed gear: 200 lbs/month. - open access gear: 200 lbs/month. South - limited entry trawl: same as north for midwater and small footrope trawl. - limited entry fixed gear: closed Mar-Apr, then variable 100 lbs/2 months to 250 lbs/2 months. - open access gear: same as limited entry fixed gear.

a/ Discrepancies will be resolved in favor of the *Federal Register*. North and South references are relative to Cape Mendocino (40°10' N lat.)

TABLE 5-8a. Projected total catch optimum yields for widow rockfish (Model 8) under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P=0.5	P=0.6	P=0.7	P=0.8	P=0.9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	354.5	284.2	211.9	122.8	3.7	208.2	1439	3460
2005	355.1	285.2	213.0	123.7	3.8	209.3	1359	3218
2006	359.0	288.6	215.9	125.6	3.8	212.2	1317	3059
2007	372.6	299.9	224.6	130.8	4.0	220.7	1347	3037
2008	409.9	330.2	247.4	144.2	4.4	243.1	1558	3271
2009	491.8	396.1	296.9	173.1	5.3	291.7	2082	3929
2010	548.9	442.4	331.7	193.6	5.9	326.0	2570	4265
2011	543.4	438.5	329.2	192.4	5.9	323.5	2624	3993
2012	525.8	424.8	319.3	186.9	5.7	313.9	2451	3646
2013	508.6	411.4	309.7	181.5	5.6	304.4	2230	3343
2014	494.5	400.4	301.7	177.1	5.5	296.6	2038	3085
2015	483.9	392.3	295.9	173.9	5.4	290.8	1879	2888
2016	480.2	389.6	294.1	173.0	5.4	289.2	1782	2758
2017	482.2	391.5	295.8	174.2	5.4	290.8	1727	2675
2018	487.8	396.5	299.8	176.7	5.5	294.8	1706	2610
2019	494.2	402.0	304.2	179.6	5.6	299.1	1688	2539
2020	502.5	409.2	310.0	183.2	5.7	304.8	1676	2474
2021	507.7	413.8	313.8	185.7	5.8	308.6	1657	2384
2022	511.7	417.5	317.0	187.8	5.9	311.7	1621	2289
2023	515.7	421.0	320.0	189.8	5.9	314.7	1581	2204
2024	521.7	426.4	324.3	192.7	6.0	319.0	1541	2125
2025	527.9	432.0	329.0	195.7	6.1	323.6	1515	2054
2026	532.1	435.9	332.4	197.9	6.2	326.9	1483	1980
2027	537.6	440.8	336.4	200.6	6.3	330.9	1456	1914
2028	542.6	445.3	340.2	203.1	6.4	334.7	1431	1848
2029	546.9	449.3	343.6	205.4	6.5	338.0	1408	1784
2030	551.7	453.7	347.4	207.9	6.6	341.7	1379	1721
2031	553.7	455.8	349.1	209.3	6.6	343.5	1352	1654
2032	559.9	461.3	353.8	212.2	6.7	348.1	1331	1599
2033	564.6	465.6	357.5	214.7	6.8	351.8	1312	1542
2034	570.2	470.7	361.7	217.6	6.9	355.9	1299	1491
2035	574.3	474.5	365.0	219.8	7.0	359.2	1279	1436
2036	579.6	479.5	369.3	222.6	7.1	363.4	1255	1386
2037	586.1	485.2	374.0	225.8	7.2	368.1	1236	1340
2038	591.5	490.3	378.3	228.7	7.3	372.4	1227	1292
2039	595.2	493.8	381.4	230.8	7.4	375.5	1208	1247
2040	603.5	501.2	387.5	234.7	7.6	381.4	1200	1208
2041	608.0	505.4	391.2	237.4	7.7	385.1	1186	1165

TABLE 5-8b. Projected total catch optimum yields for widow rockfish (Model 7) under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P=0.5	P=0.6	P=0.7	P=0.8	P=0.9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	248.1	180.5	111.0	29.9	0.1	139.2	1088	3076
2005	246.6	179.7	110.8	29.9	0.1	138.7	1016	2833
2006	247.5	180.6	111.5	30.1	0.1	139.5	974	2670
2007	256.4	187.3	115.7	31.3	0.1	144.8	994	2644
2008	293.1	214.2	132.4	35.8	0.1	165.7	1246	2991
2009	393.0	287.1	177.4	48.0	0.2	222.0	2023	4091
2010	468.6	342.6	211.9	57.3	0.2	265.0	2886	4739
2011	464.6	340.1	210.7	57.1	0.2	263.3	3064	4390
2012	443.3	325.1	201.7	54.8	0.2	251.9	2810	3909
2013	421.8	309.7	192.4	52.3	0.2	240.2	2470	3487
2014	401.6	295.3	183.7	50.1	0.2	229.3	2166	3136
2015	385.9	284.1	177.0	48.3	0.2	220.7	1926	2873
2016	377.6	278.3	173.5	47.4	0.2	216.3	1776	2710
2017	376.5	277.7	173.3	47.4	0.2	215.9	1703	2617
2018	380.3	280.6	175.2	48.0	0.2	218.3	1669	2557
2019	384.3	283.8	177.4	48.6	0.2	220.9	1642	2492
2020	391.0	289.1	180.9	49.6	0.2	225.2	1635	2428
2021	394.8	292.2	183.0	50.3	0.2	227.7	1605	2338
2022	397.2	294.3	184.5	50.8	0.2	229.5	1565	2240
2023	400.4	297.1	186.5	51.4	0.2	231.8	1526	2145
2024	405.2	300.9	189.2	52.2	0.2	235.0	1476	2062
2025	410.2	305.0	191.9	53.0	0.2	238.3	1438	1988
2026	412.2	306.9	193.4	53.5	0.2	240.1	1396	1909
2027	415.4	309.5	195.2	54.0	0.2	242.2	1364	1843
2028	419.2	312.6	197.4	54.7	0.2	244.8	1329	1775
2029	422.5	315.5	199.4	55.4	0.2	247.2	1306	1710
2030	424.7	317.5	200.9	55.8	0.2	249.0	1270	1641
2031	425.9	318.7	201.9	56.2	0.2	250.1	1237	1574
2032	429.7	321.9	204.1	56.9	0.2	252.7	1214	1519
2033	431.7	323.8	205.5	57.3	0.2	254.3	1190	1460
2034	435.7	327.1	207.9	58.1	0.2	257.1	1171	1407
2035	438.3	329.3	209.5	58.6	0.2	259.0	1148	1353
2036	442.3	332.7	211.9	59.3	0.2	261.9	1125	1304
2037	445.4	335.4	213.8	60.0	0.2	264.1	1097	1253
2038	449.6	338.9	216.3	60.7	0.2	267.1	1086	1208
2039	453.9	342.4	218.8	61.5	0.2	270.0	1065	1166
2040	457.1	345.3	220.9	62.2	0.2	272.5	1052	1125
2041	461.8	349.3	223.6	63.0	0.2	275.7	1035	1083
2042	463.2	350.6	224.8	63.4	0.2	277.0	1019	1038

TABLE 5-8c. Projected total catch optimum yields for widow rockfish (Model 9) under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 1)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P=0.5	P=0.6	P=0.7	P=0.8	P=0.9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	582.7	500.7	418.5	322.6	205.5	385.1	1,888	3,909
2005	586.9	505.1	422.9	326.6	208.6	389.5	1,799	3,668
2006	595.4	513.1	430.2	332.8	213.0	396.5	1,755	3,510
2007	617.1	532.4	446.9	346.2	221.9	412.0	1,790	3,484
2008	665.6	574.7	482.7	374.2	240.1	445.1	1,991	3,666
2009	760.5	656.8	551.8	427.9	274.7	508.9	2,441	4,157
2010	823.3	711.5	598.2	464.2	298.3	551.8	2,816	4,385
2011	812.7	703.1	591.8	459.9	296.0	546.2	2,808	4,125
2012	791.4	685.5	577.6	449.5	289.7	533.4	2,641	3,825
2013	772.4	669.8	565.0	440.3	284.2	522.0	2,438	3,559
2014	757.2	657.3	555.1	433.0	280.0	513.0	2,271	3,332
2015	747.0	649.1	548.6	428.5	277.5	507.3	2,127	3,156
2016	745.9	648.8	548.9	429.2	278.3	507.7	2,042	3,035
2017	752.1	654.6	554.4	433.9	281.8	512.9	1,999	2,955
2018	762.2	664.1	562.9	441.0	286.7	521.0	1,981	2,879
2019	772.3	673.5	571.5	448.3	291.8	529.2	1,956	2,806
2020	783.1	683.6	580.6	455.9	297.2	537.8	1,944	2,732
2021	791.7	691.9	588.2	462.5	301.9	545.0	1,914	2,643
2022	798.9	698.9	594.8	468.3	306.1	551.5	1,884	2,546
2023	804.5	704.5	600.2	473.0	309.7	556.7	1,836	2,453
2024	813.4	713.0	608.2	480.0	314.8	564.4	1,801	2,375
2025	824.7	723.7	617.9	488.2	320.6	573.6	1,775	2,306
2026	830.9	729.9	623.9	493.5	324.6	579.4	1,739	2,228
2027	838.9	737.8	631.2	499.8	329.1	586.4	1,713	2,157
2028	846.3	744.9	637.8	505.7	333.5	592.8	1,694	2,091
2029	854.0	752.7	645.3	512.3	338.4	600.0	1,663	2,025
2030	861.5	760.1	652.3	518.3	342.8	606.7	1,638	1,956
2031	865.5	764.1	656.3	522.2	345.9	610.7	1,611	1,884
2032	876.5	774.5	666.0	530.7	352.0	620.1	1,590	1,831
2033	884.3	782.4	673.5	537.3	356.9	627.3	1,575	1,770
2034	892.8	790.7	681.2	543.8	361.7	634.6	1,556	1,714
2035	901.2	798.8	689.1	551.0	367.0	642.2	1,536	1,660
2036	909.2	806.8	696.5	557.6	371.9	649.5	1,515	1,601

TABLE 5-9. Yelloweye rockfish distribution by depth from the IPHC Survey. Halibut distribution by depth from IPHC commercial fishery logbooks. Halibut catch from 1996-2000 commercial logbooks. (Page 1 of 1)

Depth (fm)	Percent Weighted Yelloweye Catch[a/]	Percent Commercial Halibut Catch
0-50	0.5%	2.3%
51-100	99.1%	7.7%
101-150	0.1%	35.2%
151-200	0.3%	36.5%
>200	0.0%	18.2%
All depths	100.0%	100.0%

a/ Yelloweye catch weighted by the number of hooks set per depth stratum (first 20 hooks per skate sampled).

TABLE 5-10. Estimated catch of yelloweye rockfish in 2003 Washington recreational fisheries by port and month through July 31. (Page 1of 1)

		Charter Fishery			Private Boat Fishery					
Port	Month	Angler Trips	YE per Trip	Number of Yelloweye	Angler Trips	YE per Trip	No. Of Yelloweye	Total No.	Weight (Kg)	% of Total
Estimated Catch of Yelloweye Rockfish in the Halibut Fishery										
ILWACO	May	487	0.005	2	31	0.000	0	2	7	0.3
	June	11	0.000	0	0	0.000	0	0	0	0.0
	July	94	0.000	0	0	0.000	0	0	0	0.0
WESTPORT	May	1,737	0.010	17	14	0.000	0	17	58	2.2
	June	406	0.006	2	19	0.000	0	2	7	0.3
	July	400	0.020	8	45	0.000	0	8	27	1.0
LaPUSH	May	378	0.050	19	512	0.060	31	50	170	6.5
	June	71	0.050	4	144	0.040	6	10	34	1.3
	July	0	0.000	0	0	0.000	0	0	0	0.0
NEAH BAY	May	1,102	0.030	33	3,239	0.020	65	98	333	12.8
	June	173	0.080	14	1,209	0.030	36	50	170	6.5
	July	0	0.000	0	0	0.000	0	0	0	0.0
TOTAL		4,859	0.020	99	5,213	0.027	138	237	806	30.9
Estimated Catch of Yelloweye Rockfish in the Bottomfish Fishery										
ILWACO	May	161	0.000	0	80	0.000	0	0	0	0.0
	June	37	0.000	0	53	0.000	0	0	0	0.0
	July	247	0.000	0	133	0.000	0	0	0	0.0
WESTPORT	March	191	0.010	2	130	0.000	0	2	7	0.3
	April	786	0.040	31	60	0.000	0	31	105	4.0
	May	1,327	0.010	13	240	0.000	0	13	44	1.7
	June	205	0.010	2	154	0.030	5	7	24	0.9
	July	2,227	0.003	7	282	0.000	0	7	24	1.0
LaPUSH	May	9	0.000	0	148	0.070	10	10	34	1.3
	June	12	0.000	0	111	0.080	9	9	31	1.2
	July	8	0.000	0	200	0.000	0	0	0	0.0
NEAH BAY	April	4	0.000	0	415	0.002	1	1	3	0.1
	May	73	0.000	0	2,840	0.040	114	114	388	14.9
	June	164	0.200	33	2,218	0.020	44	77	262	10.0
	July	45	0.000	0	1,525	0.070	107	107	364	14.0
TOTAL		5,496	0.016	88	8,589	0.034	290	378	1,285	49.3
Estimated Catch of Yelloweye Rockfish in the Salmon Fishery										
ILWACO	June	230	0.000	0	226	0.000	0	0	0	0.0
	July	4,773	0.000	0	9,950	0.000	0	0	0	0.0
WESTPORT	June	2,115	0.000	0	2,158	0.000	0	0	0	0.0
	July	11,899	0.000	0	8,934	0.000	0	0	0	0.0
LaPUSH	June	50	0.190	10	195	0.103	20	30	102	3.9
	July	355	0.000	0	1,450	0.010	15	15	51	2.0
NEAH BAY	June	174	0.000	0	1,217	0.010	12	12	41	1.6
	July	1,029	0.003	3	9,213	0.010	92	95	323	12.4
TOTAL		20,625	0.001	13	33,343	0.004	139	152	517	19.8
GRAND TOTAL								767	2,608	

TABLE 5-11. Projected total catch optimum yields for yelloweye rockfish under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 1 of 2)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P= .5	P= .6	P= .7	P= .8	P= .9	Yr=T_{MID}	40-10 Rule	ABC Rule
2004	28.3	27.3	26.3	24.9	23.3	20.8	27.1	52.6
2005	29.2	28.2	27.1	25.8	24.1	21.5	29.0	53.6
2006	30.0	29.0	27.9	26.5	24.8	22.2	30.7	54.5
2007	30.7	29.7	28.6	27.2	25.5	22.8	32.3	55.2
2008	31.4	30.4	29.3	27.8	26.1	23.4	33.6	55.8
2009	31.9	30.9	29.8	28.4	26.6	23.9	34.8	56.1
2010	32.4	31.4	30.3	28.8	27.1	24.3	35.8	56.4
2011	32.8	31.8	30.7	29.2	27.5	24.7	36.7	56.5
2012	33.2	32.1	31.0	29.6	27.8	25.1	37.5	56.5
2013	33.5	32.4	31.3	29.9	28.1	25.4	38.1	56.4
2014	33.7	32.7	31.6	30.2	28.4	25.6	38.7	56.3
2015	33.9	32.9	31.8	30.4	28.6	25.9	39.2	56.1
2016	34.1	33.1	32.0	30.6	28.8	26.1	39.7	56.0
2017	34.3	33.3	32.2	30.8	29.0	26.3	40.1	55.8
2018	34.4	33.4	32.4	30.9	29.2	26.4	40.5	55.6
2019	34.6	33.6	32.5	31.1	29.4	26.6	40.9	55.4
2020	34.7	33.7	32.7	31.3	29.5	26.8	41.3	55.2
2021	34.9	33.9	32.8	31.4	29.7	27.0	41.7	55.1
2022	35.0	34.1	33.0	31.6	29.9	27.2	42.1	55.1
2023	35.2	34.3	33.2	31.8	30.1	27.4	42.5	55.0
2024	35.4	34.4	33.4	32.0	30.3	27.5	42.9	54.9
2025	35.5	34.6	33.5	32.1	30.4	27.7	43.3	54.8
2026	35.7	34.8	33.7	32.3	30.6	27.9	43.7	54.8
2027	35.9	35.0	33.9	32.6	30.9	28.1	44.3	54.7
2028	36.1	35.2	34.1	32.8	31.1	28.3	44.6	54.8
2029	36.4	35.4	34.4	33.0	31.3	28.5	44.9	54.8
2030	36.6	35.6	34.6	33.2	31.5	28.8	45.3	54.8
2031	36.7	35.8	34.8	33.4	31.7	28.9	45.6	54.7
2032	36.9	36.0	35.0	33.6	31.9	29.2	46.0	54.7
2033	37.1	36.2	35.2	33.8	32.1	29.3	46.4	54.6
2034	37.3	36.4	35.4	34.0	32.3	29.6	46.8	54.7
2035	37.5	36.6	35.6	34.2	32.5	29.8	47.0	54.6
2036	37.7	36.8	35.8	34.4	32.7	30.0	47.5	54.7
2037	38.0	37.0	36.0	34.7	33.0	30.2	47.9	54.6
2038	38.2	37.2	36.2	34.9	33.2	30.4	48.2	54.6
2039	38.4	37.5	36.5	35.1	33.4	30.7	48.6	54.7
2040	38.6	37.7	36.7	35.4	33.7	30.9	48.9	54.8
2041	38.9	38.0	37.0	35.6	33.9	31.2	49.3	54.8
2042	39.1	38.2	37.2	35.8	34.1	31.4	49.5	54.8
2043	39.3	38.4	37.4	36.0	34.4	31.6	49.7	54.8
2044	39.5	38.6	37.6	36.3	34.6	31.8	50.1	54.7
2045	39.7	38.8	37.8	36.4	34.7	32.0	50.5	54.7
2046	39.9	39.0	38.0	36.7	35.0	32.2	50.7	54.7
2047	40.1	39.2	38.2	36.9	35.2	32.4	51.0	54.7
2048	40.3	39.4	38.4	37.1	35.4	32.6	51.2	54.7
2049	40.5	39.6	38.6	37.3	35.6	32.8	51.5	54.8
2050	40.7	39.8	38.9	37.5	35.8	33.1	51.8	54.8
2051	40.9	40.0	39.1	37.7	36.1	33.3	52.0	54.7
2052	41.1	40.2	39.2	37.9	36.2	33.4	52.3	54.7
2053	41.2	40.4	39.4	38.1	36.4	33.6	52.5	54.7
2054	41.5	40.6	39.6	38.3	36.6	33.9	52.8	54.7
2055	41.6	40.8	39.8	38.5	36.8	34.0	53.0	54.8
2056	41.8	40.9	40.0	38.7	37.0	34.2	53.1	54.7
2057	42.0	41.1	40.2	38.9	37.2	34.4	53.2	54.8
2058	42.2	41.4	40.4	39.1	37.4	34.6	53.5	54.8
2059	42.4	41.6	40.6	39.3	37.6	34.8	53.7	54.8

TABLE 5-11. Projected total catch optimum yields for yelloweye rockfish under different rebuilding scenarios, the default 40-10 policy, and ABC rule (mt). (Page 2 of 2)

	Annual OYs during rebuilding period							
		Alt 1	Alt 2	Alt 3	Alt 4		No Action	
	P= .5	P= .6	P= .7	P= .8	P= .9	Yr=T_{MID}	40-10 Rule	ABC Rule
2060	42.6	41.7	40.8	39.5	37.8	35.0	53.7	54.8
2061	42.8	41.9	40.9	39.6	38.0	35.2	54.2	54.8
2062	42.9	42.1	41.1	39.8	38.2	35.4	54.3	54.8
2063	43.2	42.3	41.4	40.1	38.4	35.6	54.4	54.9
2064	43.4	42.5	41.6	40.3	38.6	35.8	54.5	54.9
2065	43.5	42.7	41.7	40.5	38.8	36.0	54.7	54.9
2066	43.7	42.8	41.9	40.6	38.9	36.2	54.9	54.9
2067	43.9	43.0	42.1	40.8	39.2	36.4	55.3	55.0
2068	44.1	43.2	42.3	41.0	39.4	36.6	55.5	54.9
2069	44.2	43.4	42.5	41.2	39.5	36.7	55.6	54.9
2070	44.4	43.6	42.6	41.3	39.7	36.9	55.7	55.0

TABLE 5-12. Estimated mortality (mt) of overfished West Coast groundfish species by fishery in 2004. (Page 1 of 2)

3/15/2004 13:49

Fishery	Bocaccio[a]	Canary	Cowcod	Dkbl[b]	Lingcod[c]	POP	Whiting[d]	Widow	Yelloweye
Limited Entry Groundfish									
Trawl- Non-whiting[e]	45.0	9.8	0.6	100.7	78.4	68.1		1.5	0.4
Fixed Gear	13.4	0.5	0.1	1.5	12.7	0.2		5.0	0.1
Whiting									
At-sea whiting motherships		0.9		1.4	0.3	1.7	51,720	211.0	0.0
At-sea whiting cat-proc		1.3		7.6	0.4	10.1	73,270		0.4
Shoreside whiting		0.4		0.5	0.7	0.4	90,510		0.0
Tribal whiting		4.7		0.0	0.5	1.5	32,500		0.0
Open Access									
Groundfish directed	10.6	0.3	0.1		62.5				0.6
CA Halibut	0.1			0.0	2.0	0.0			
CA Gillnet[f]	0.5			0.0		0.0		0.0	
CA Sheephead[f]				0.0		0.0		0.0	0.0
CPS- wetfish[f]	0.3								
CPS- squid[g]									
Dungeness crab[f]	0.0		0.0	0.0		0.0			
HMS[f]		0.0	0.0	0.0					
Pacific Halibut[f]	0.0		0.0	0.0		0.0		0.0	0.5
Pink shrimp	0.1	0.5	0.0	0.0	0.5	0.0		0.1	0.1
Ridgeback prawn	0.1	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Salmon troll	0.2	1.6	0.0	0.0	0.3	0.0		0.0	0.2
Sea Cucumber	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Spot Prawn (trap)									
Tribal									
Midwater Trawl		2.3		0.0	0.1	0.0		40.0	0.0
Bottom Trawl		0.5		0.0	9.0	0.0		0.0	0.0
Troll		0.5		0.0	1.0	0.0			0.0
Fixed gear		0.3		0.0	15.0	0.0		0.0	2.3
Recreational Groundfish									
WA		2.5			73.0				3.5
OR		7.0			101.3			2.0	3.3
CA (N)[h]		0.5			195.0			1.0	0.1
CA (S)[h]	62.8	7.6	1.8		151.8			0.4	1.3
Research: **Based on 2 most recent NMFS trawl shelf and slope surveys, the IPHC halibut survey, and LOAs with expanded estimates for south of Pt. Conception.**									
	2.0	1.0		1.6	3.0	3.0		1.5	1.1
Non-EFP Total	135.1	42.2	2.6	113.3	707.5	85.0		262.5	14.0

TABLE 5-12. Estimated mortality (mt) of overfished West Coast groundfish species by fishery in 2004. (Page 2 of 2)

EFPs[i/]									
CA: NS FF trawl	10.0	0.5	0.5		20.0				0.5
OR: DTS[j/]		0.1		6.0		18.0			0.1
WA: AT trawl		1.5		3.0	4.5	8.5		5.5	0.5
WA: dogfish LL		0.1		0.5	2.0	0.5		0.5	1.0
WA: pollock[k/]		0.1					1,000	1.5	0.1
EFP Subtotal	10.0	2.3	0.5	9.5	26.5	27.0	1,000	7.5	2.2
TOTAL	145.1	44.5	3.1	122.8	734.0	112.0		270.0	16.2
2004 OY	250	47.3	4.8	240	735	444	250,000	284	22
Percent of OY	58.0%	94.1%	64.6%	51.2%	99.9%	25.2%		95.1%	73.5%

Key [shaded cell] = either not applicable; trace amount (<0.01 mt); or not reported in available data sources.

a/ South of 40°10' N lat.
b/ Darkblotched harvest limit ("2004 OY" in this table) is the ABC of 240 mt, which is lower than the projected OY of 272 mt under the *Medium OY* alternative.
c/ Lingcod total reflects total catch, not mortality.
d/ Whiting is rebuilt according to the assessment adopted at the March 2004 Council meeting.
e/ Using observer data, all estimates from the Hastie trawl bycatch model with only the inputs from the first year data report.
f/ Mortality estimates are not hard numbers; based on the GMT's best professional judgement.
g/ Bycatch amounts by species unavailable, but bocaccio occurred in 0.1% of all port samples and other rockfish in another 0.1% of all port samples (and squid fisheries usually land their whole catch). In 2001, out of 84,000 mt total landings 1 mt was groundfish. This suggests that total bocaccio was caught in trace amounts.
h/ These estimates have not been revised pending GMT review of the estimation methodology.
i/ Values are proposed EFP bycatch caps, not estimates of total mortality. The EFP is terminated inseason if the cap is projected to be attained early.
j/ The darkblotched rockfish and Pacific ocean perch caps are not defined yet for this EFP, but are expected to be lower than the placeholders in this scorecard.
k/ Whiting impacts are deducted from the shoreside sector only.

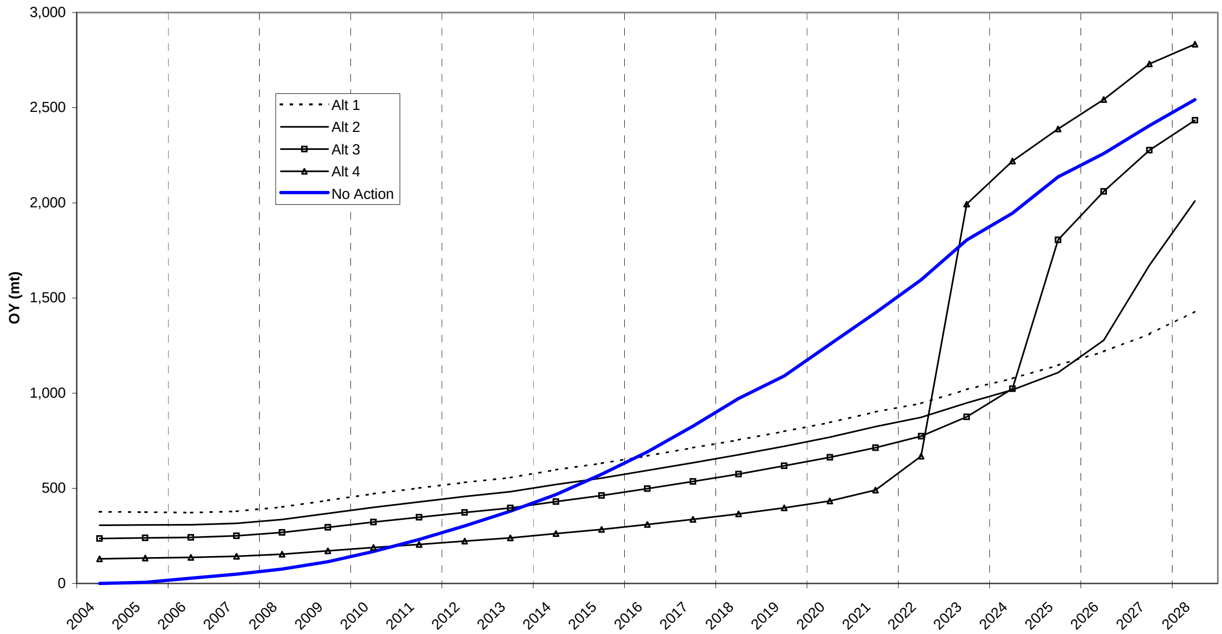

FIGURE 5-1. Projected total catch optimum yields for bocaccio (Model STATc) under the different rebuilding alternatives and No Action alternative.

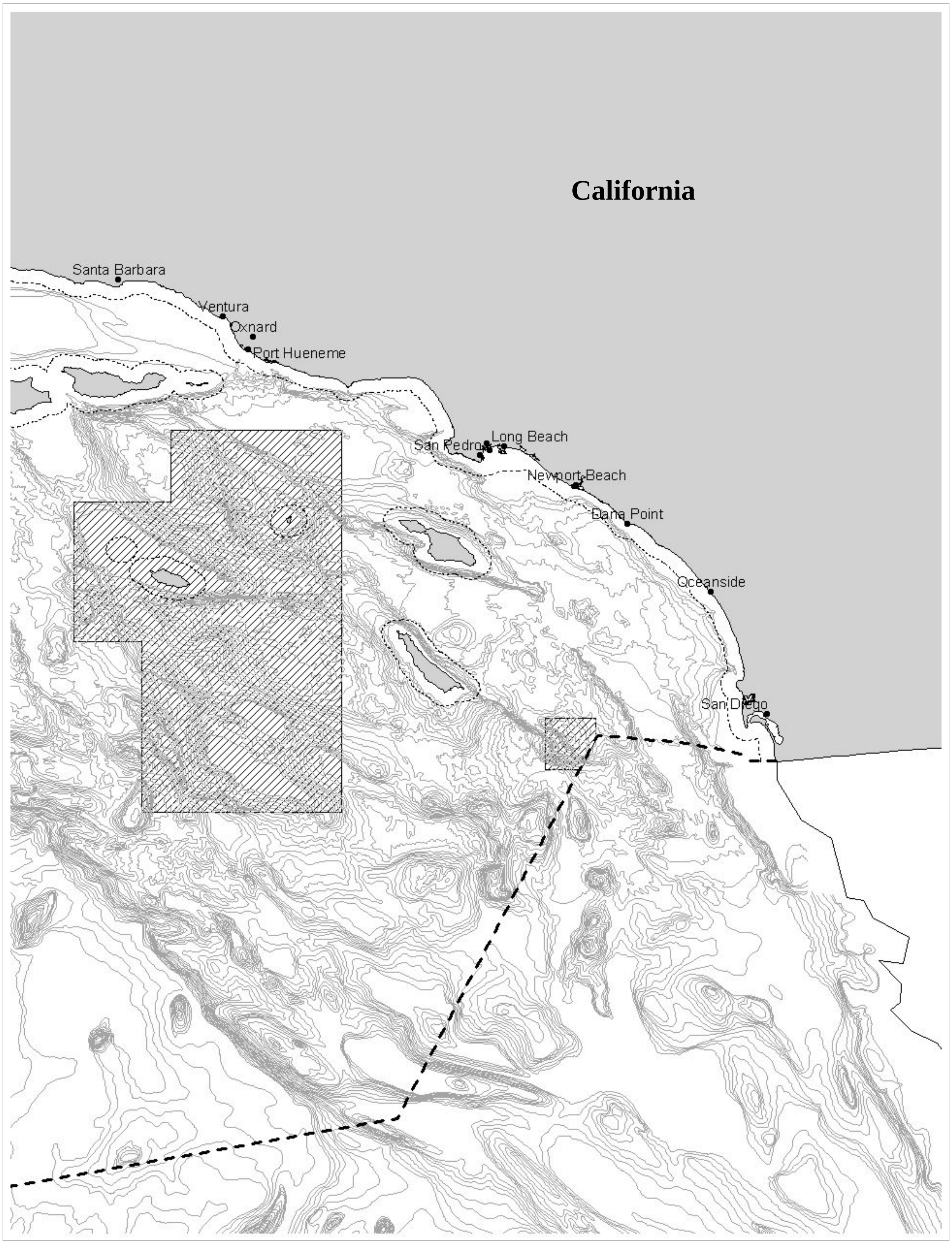

FIGURE 5-2. Cowcod Conservation Areas.

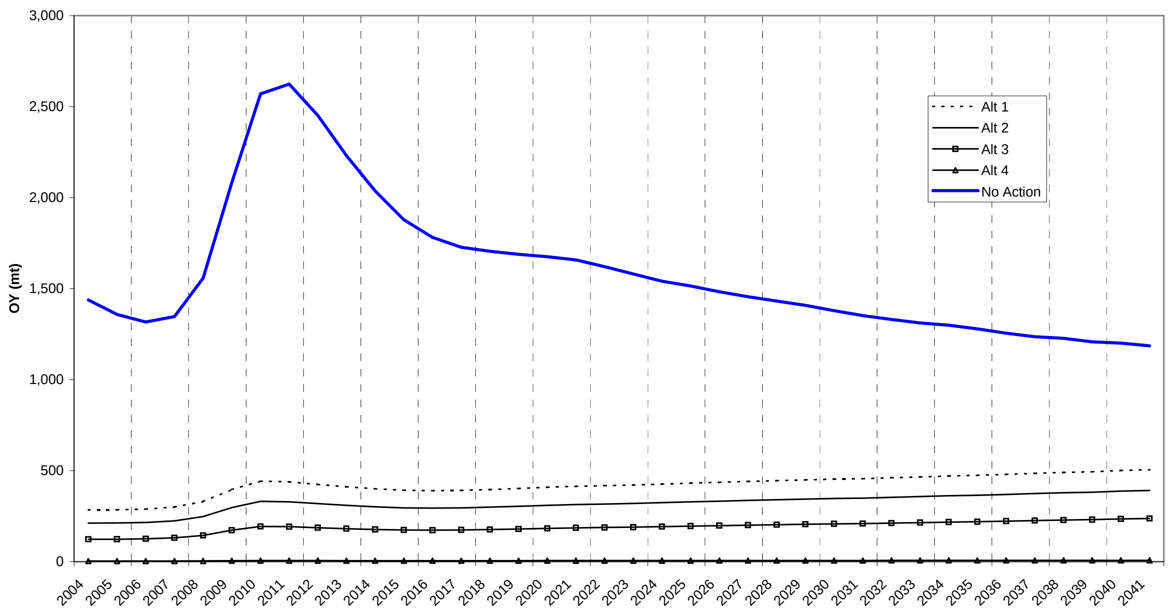

FIGURE 5-3. Projected total catch optimum yields for widow rockfish (Model 8) under the different rebuilding alternatives and No Action alternative.

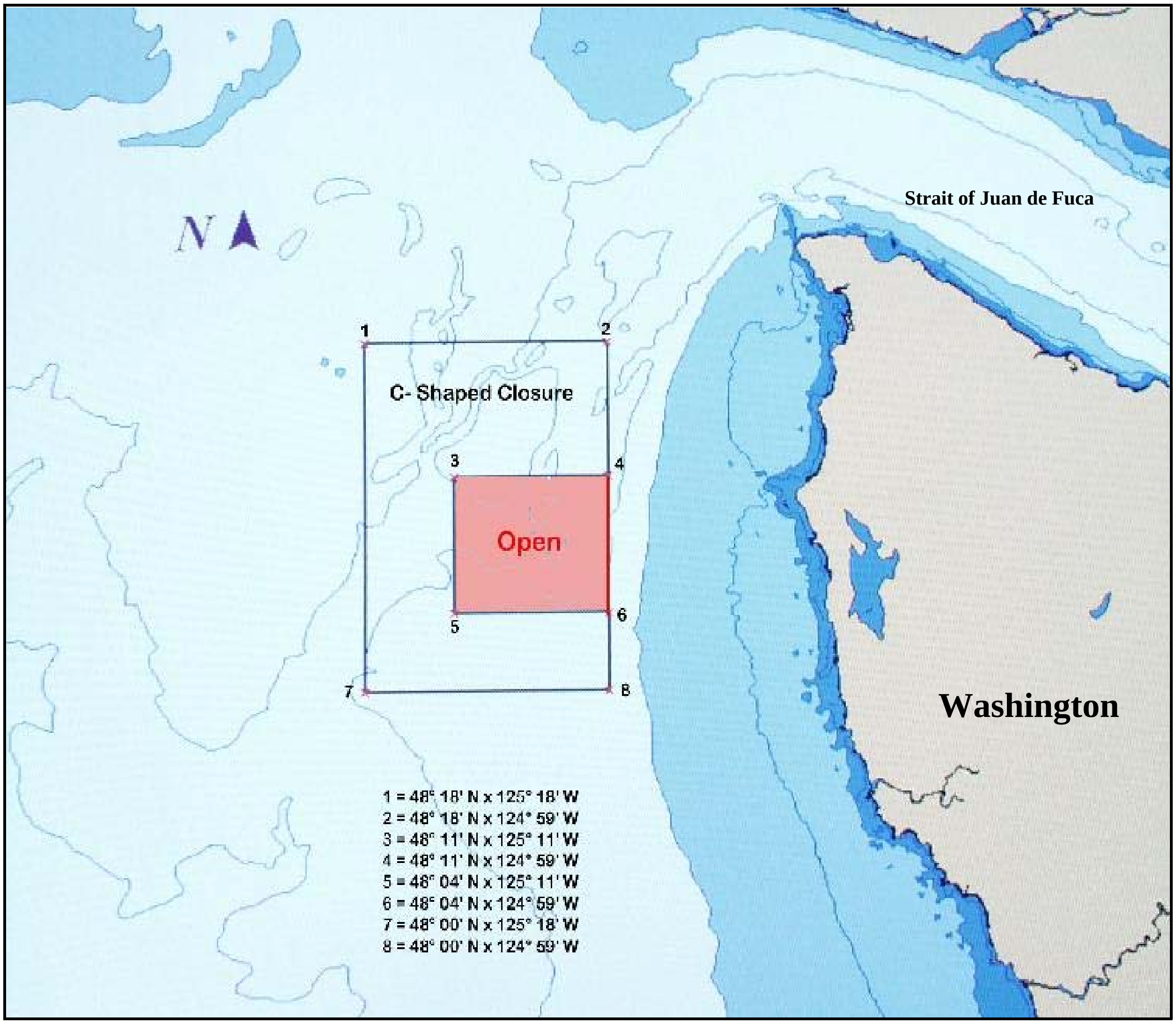

FIGURE 5-4. Yelloweye Rockfish Conservation Area.

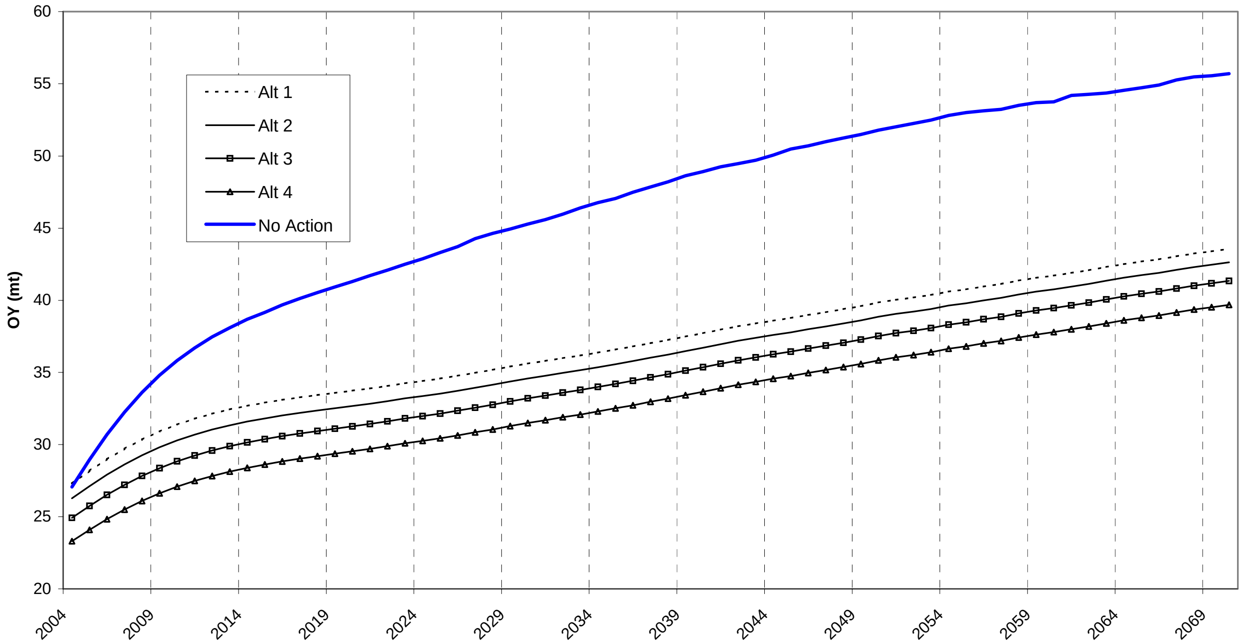

FIGURE 5-5. Projected total catch optimum yields for yelloweye rockfish under the different rebuilding alternatives and No Action alternative.

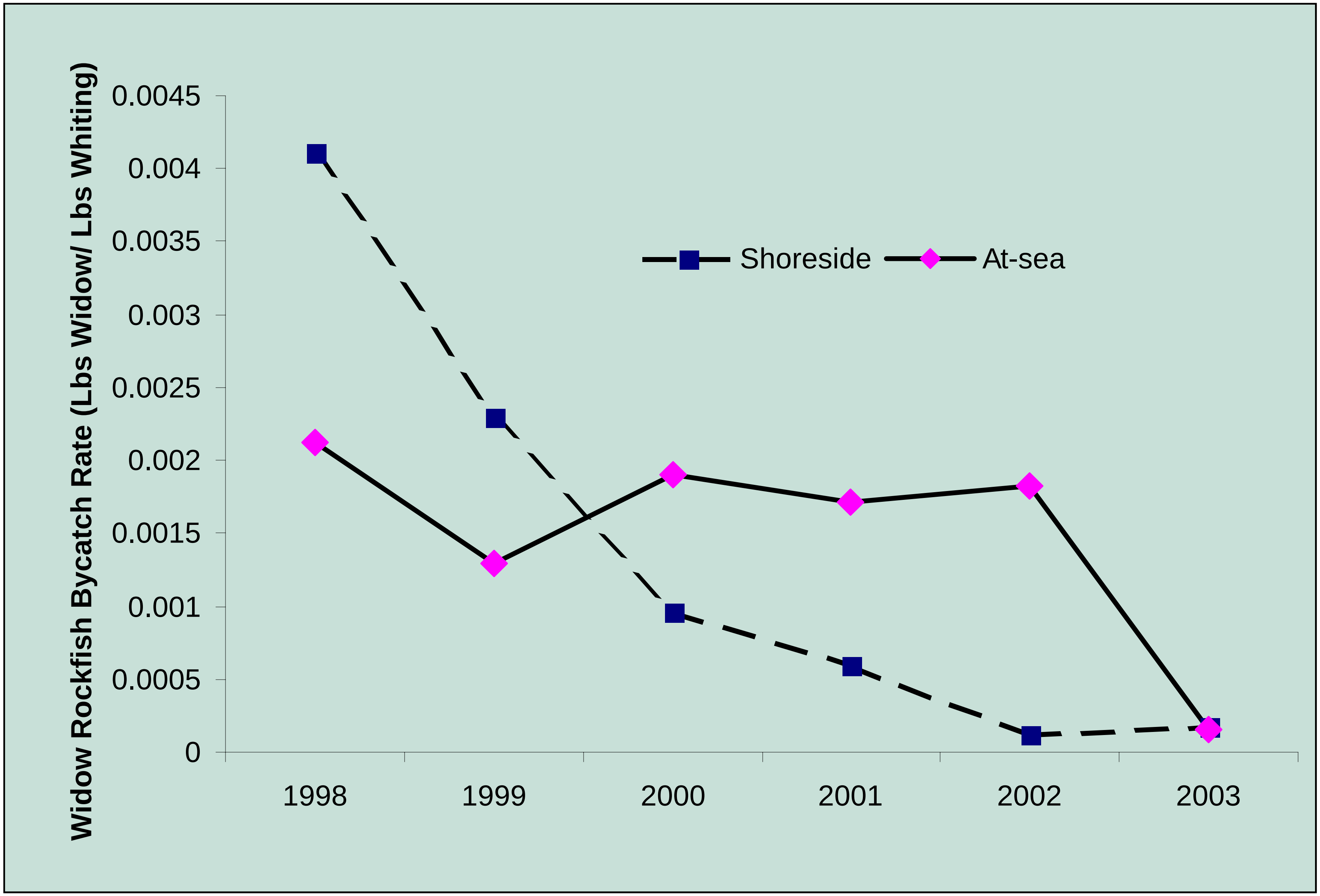

FIGURE 5-6. Widow rockfish bycatch rates in the whiting fishery by year (1998-2003) on the U.S. West Coast.

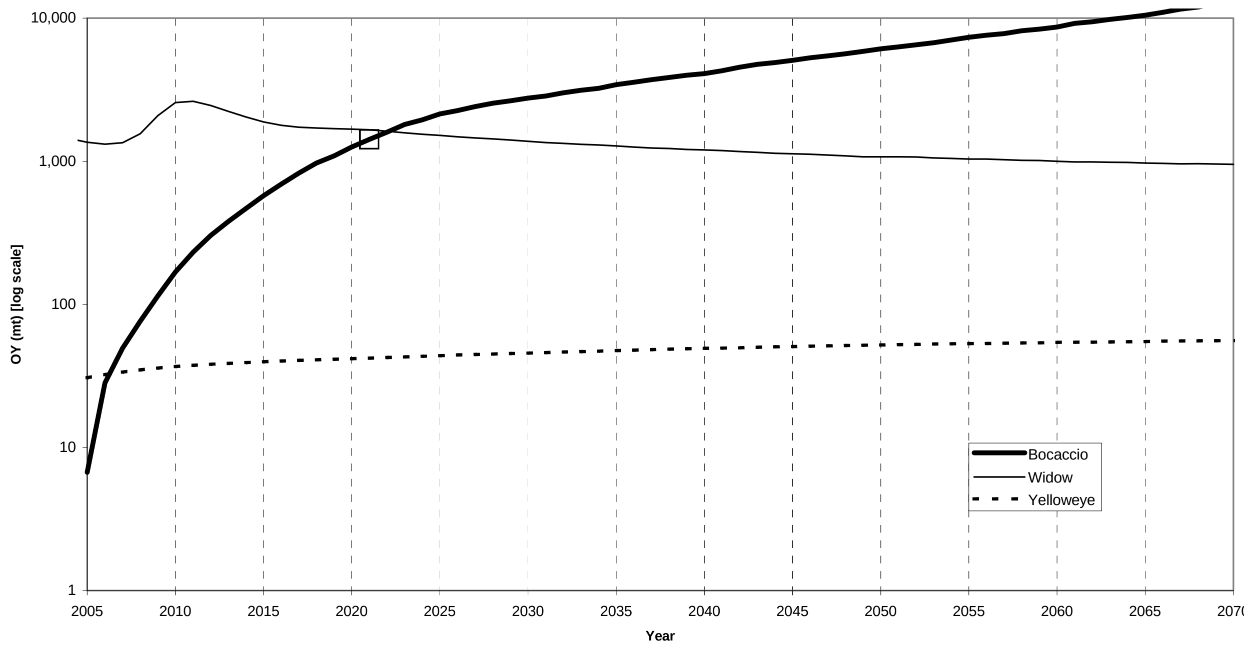

FIGURE 5-7. Projected total catch optimum yields for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under the No Action (40-10 policy) alternative.

Note: Symbols denote median rebuilding year and OY under the alternative, if applicable.

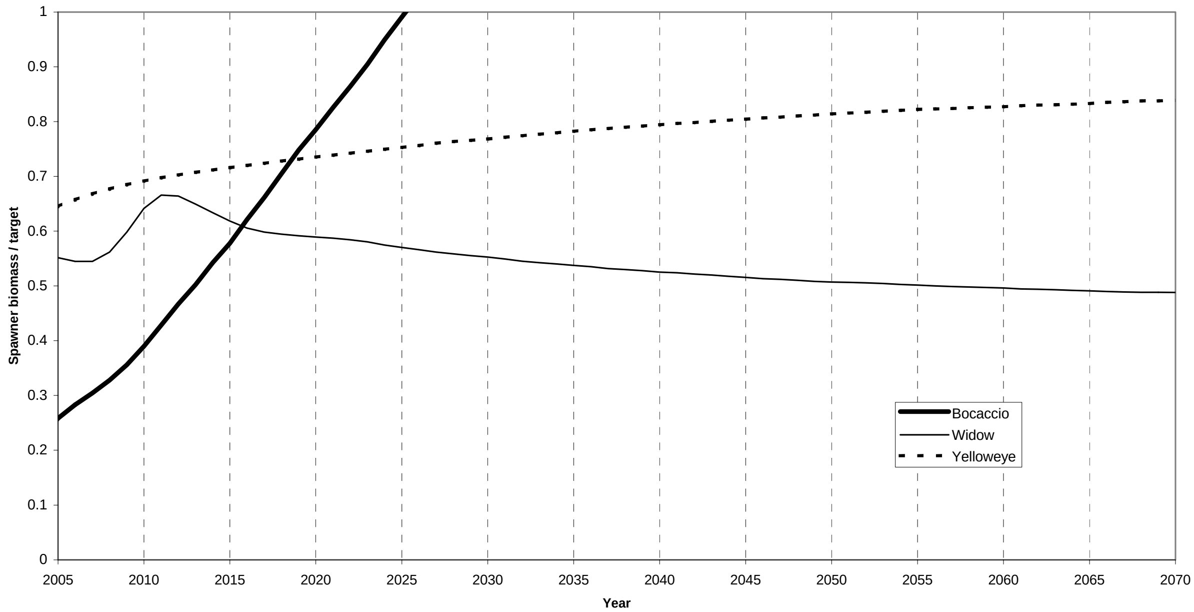

FIGURE 5-8. Projected spawner biomass-to-target ratios for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under the No Action (40-10 policy) alternative.

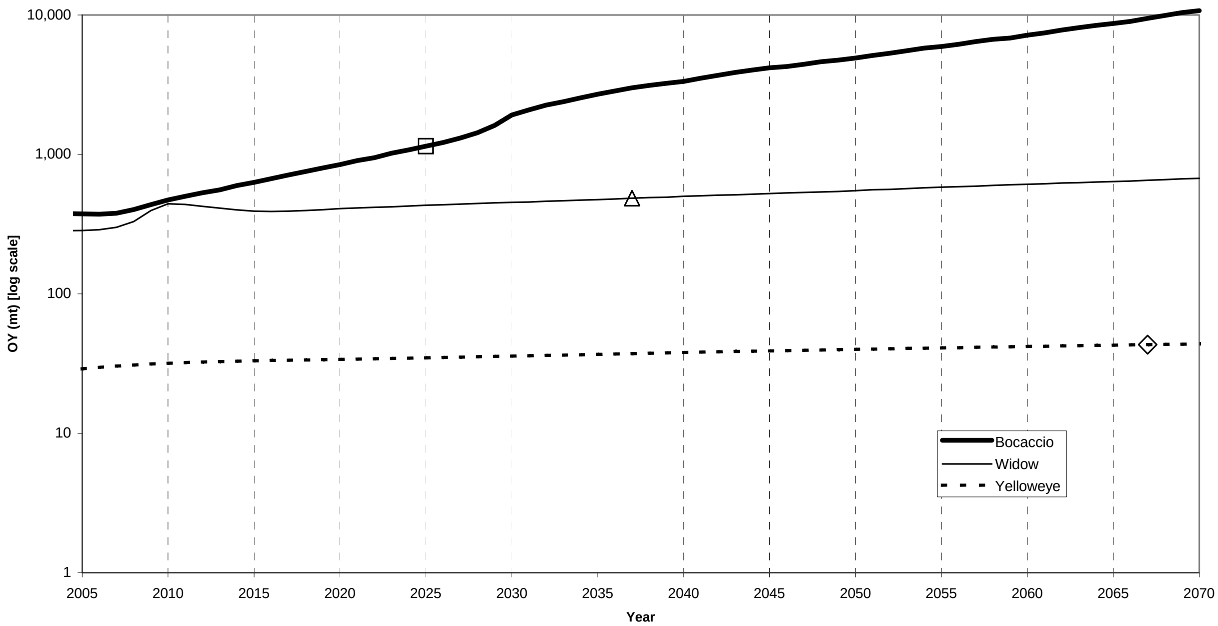

FIGURE 5-9. Projected total catch optimum yields for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 1.

Note: Symbols denote median rebuilding year and OY under the alternative, if applicable.

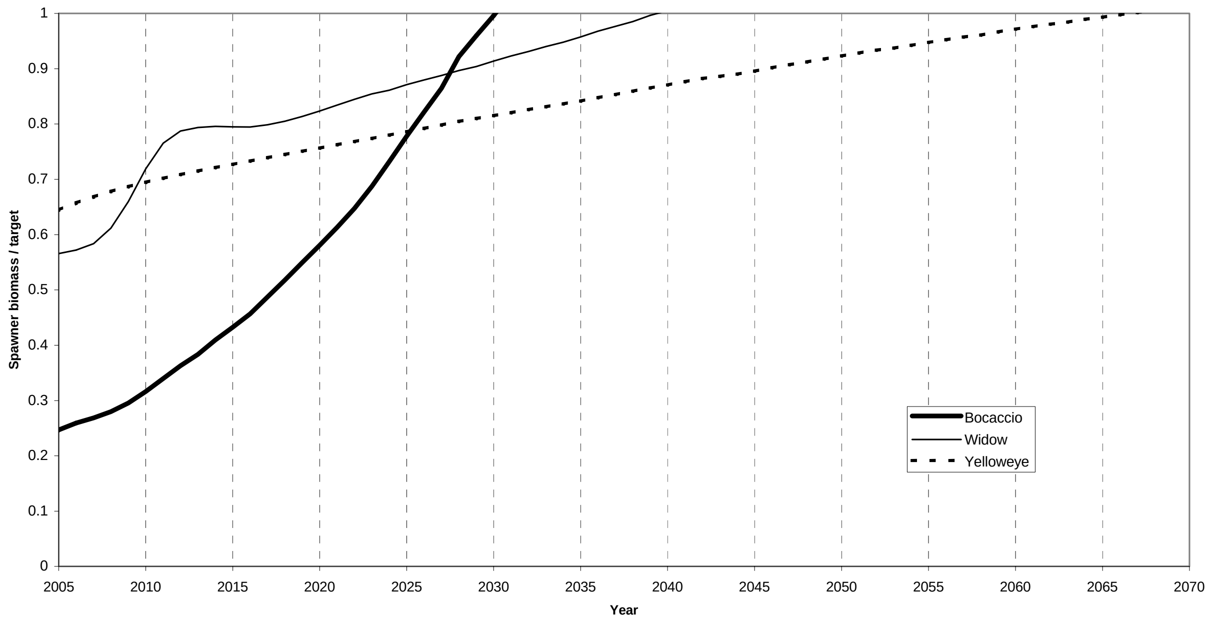

FIGURE 5-10. Projected spawner biomass-to-target ratios for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 1.

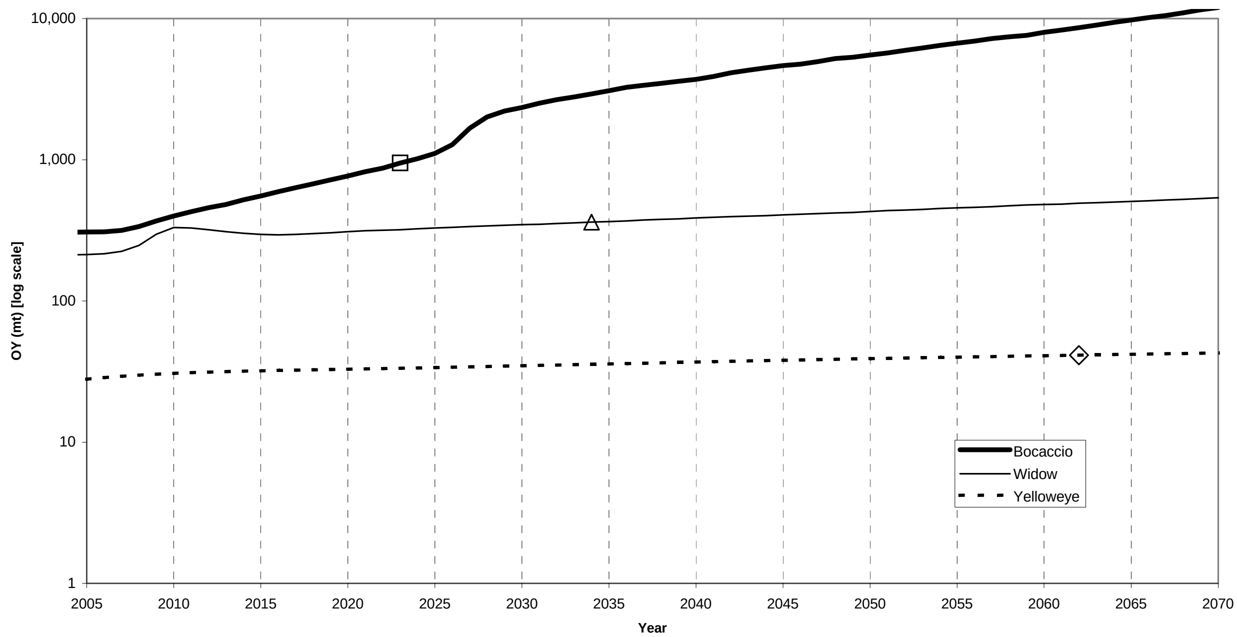

FIGURE 5-11. Projected total catch optimum yields for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 2.

Note: Symbols denote median rebuilding year and OY under the alternative, if applicable.

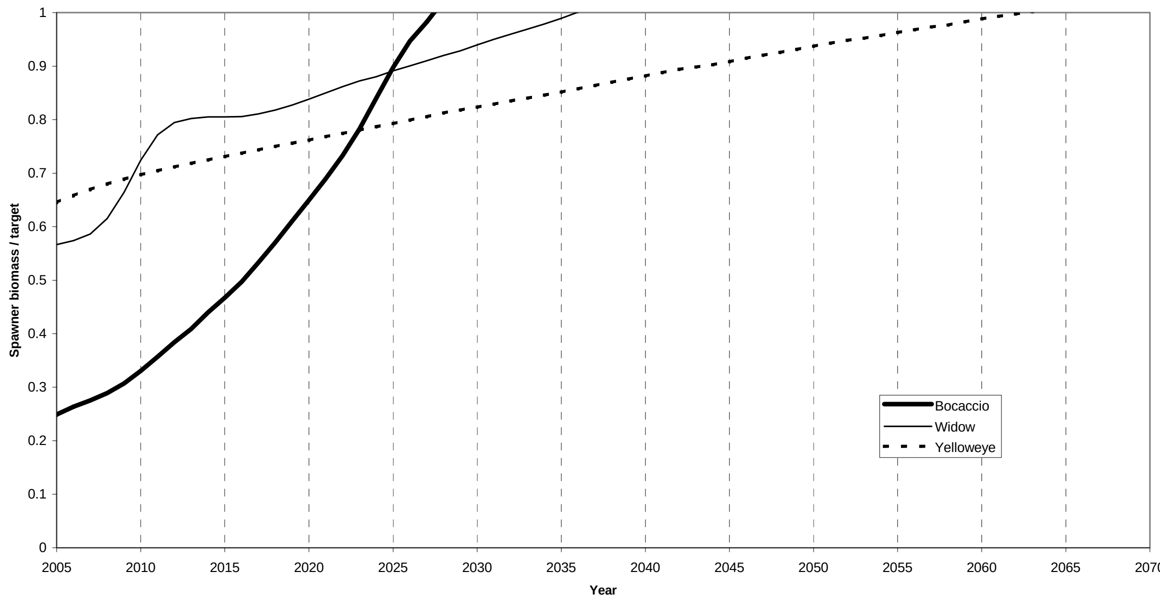

FIGURE 5-12. Projected spawner biomass-to-target ratios for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 2.

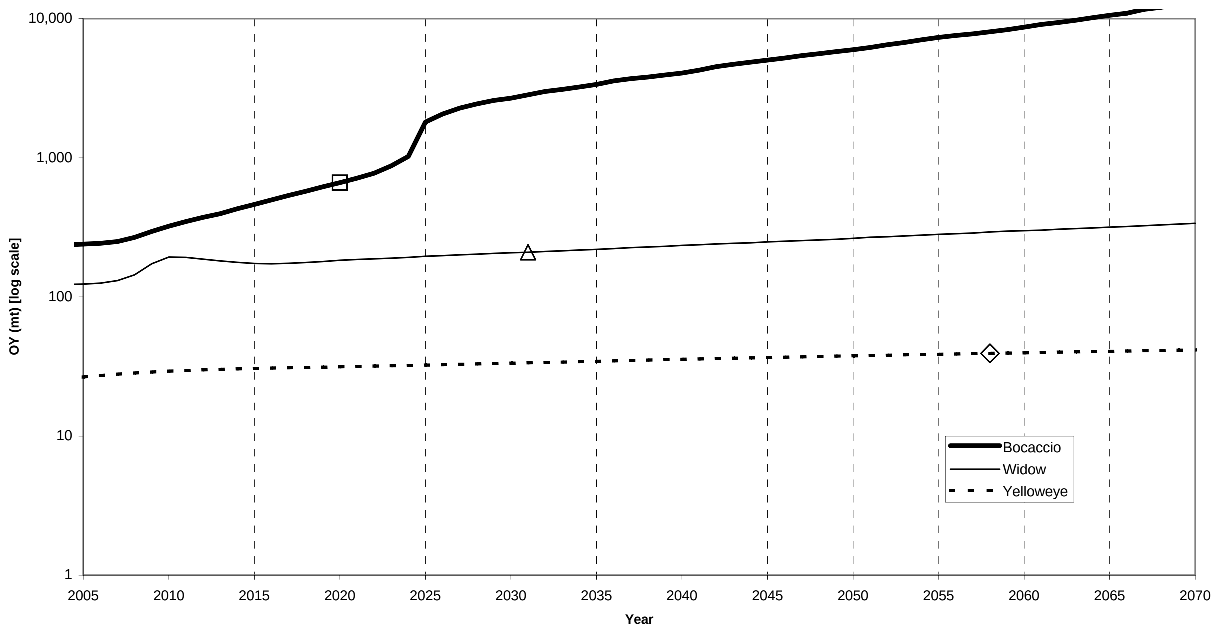

FIGURE 5-13. Projected total catch optimum yields for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 3.

Note: Symbols denote median rebuilding year and OY under the alternative, if applicable.

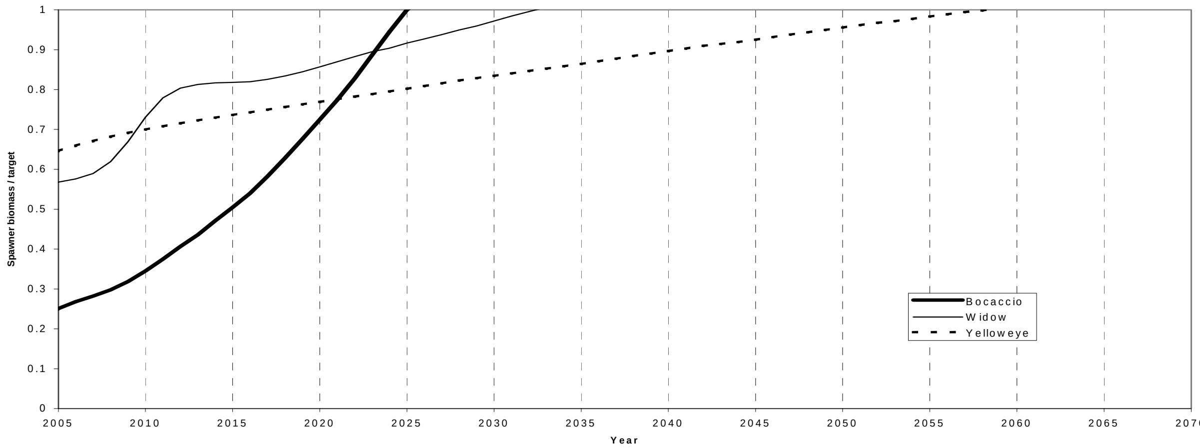

FIGURE 5-14. Projected spawner biomass-to-target ratios for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 3.

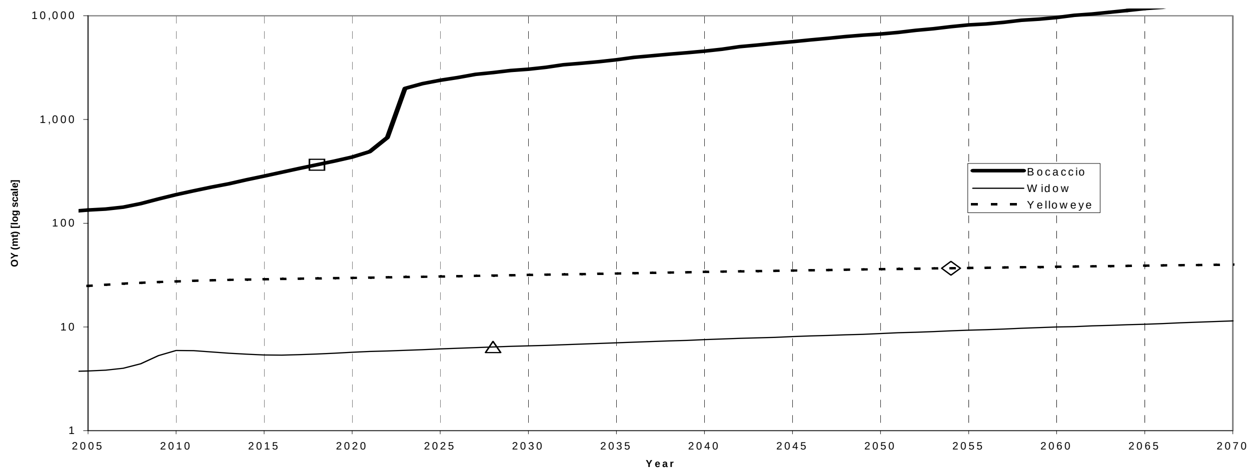

FIGURE 5-15. Projected total catch optimum yields for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 4.

Note: Symbols denote median rebuilding year and OY under the alternative, if applicable.

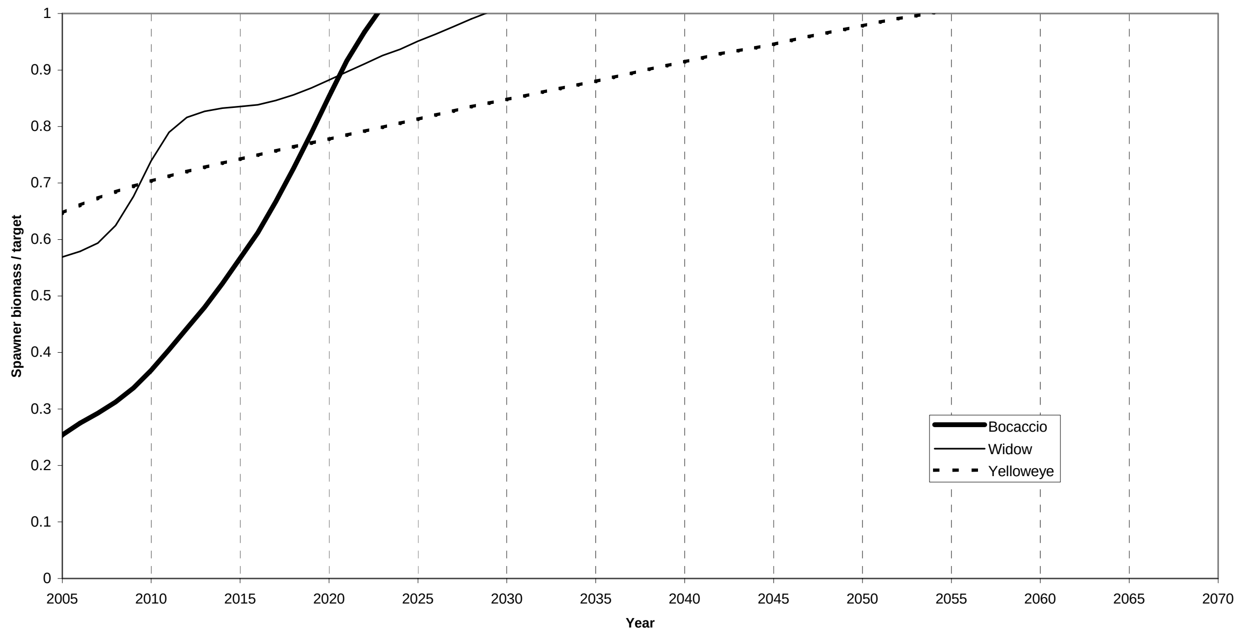

FIGURE 5-16. Projected spawner biomass-to-target ratios for bocaccio (STATc), widow rockfish (Model 8) and yelloweye under rebuilding Alternative 4.

6.0 SPECIES CO-OCCURRING WITH THE OVERFISHED SPECIES SUBJECT TO REBUILDING PLANS EVALUATED IN THIS EIS

6.1 Affected Environment

6.1.1 Species Co-occurring with Bocaccio

The portion of the West Coast bocaccio stock that is declared overfished occurs on the continental shelf south of 40°10' N. latitude. Specifically, overfished bocaccio occur in the 15-180 fm depth range; however they are most prevalent in the 54-82 fm depth zone (Appendix A, Table 2-1). Other parademersal shelf species with an overlapping range are considered co-occurring species with bocaccio. The principal co-occurring groundfish species are California scorpionfish (*Scorpaena gutatta*), canary rockfish (*Sebastes pinniger*), chilipepper rockfish (*S. goodei*), cowcod (*S. levis*), lingcod (*Ophiodon elongatus*), vermillion rockfish (*S. miniatus*), widow rockfish (*S. entomelas*), and yelloweye rockfish (*S. ruberrimus*) (Appendix A, Figure 2-4). Secondary co-occurring groundfish species include Mexican rockfish (*S. macdonaldi*), tiger rockfish (*S. nigrocinctus*), and yellowtail rockfish (*S. flavidus*) (Appendix A, Figure 2-4). Other groundfish species that co-occur with the southern bocaccio stock include shelf flatfish species such as Dover sole (*Microstomus pacificus*), English sole (*Parophrys vetulus*), petrale sole (*Eopsetta jordani*), rex sole (*Glyptocephalus zachirus*), rock sole (*Lepidopsetta bilineata*), and Pacific sanddabs (*Citharichthys sordidus*); as a well as sablefish (*Anoplopoma fimbria*), which co-occurs with bocaccio during summer months when they migrate onto the continental shelf. Important non-groundfish species that are caught in association with bocaccio in the south include California halibut (*Paralichthys californicus*), California sheephead (*Semicossyphus pulcher*), ocean whitefish (*Caulolatilus princeps*), white seabass (*Atractoscion nobilis*), and spot prawns (*Pandalus platyceros*).

6.1.2 Species Co-occurring with Cowcod

Cowcod also have a southern distribution on the West Coast within a similar assemblage as bocaccio. However, cowcod have a deeper distribution than bocaccio (out to about 200 fm) and can therefore associate with slope rockfish species such as blackgill rockfish (*Sebastes melanostomus*) and bank rockfish (*S. rufus*) (Appendix A, Table 2-1). Butler et al. (1999) report that primary species associations with cowcod vary be gear type. In the Monterey INPFC area north of Pt. Conception, cowcod were most often taken in trawls and caught primarily with bocaccio, chilipepper rockfish, and widow rockfish. In the Conception INPFC area south of Pt. Conception, cowcod were most often caught in hook-and-line and set net fisheries and taken primarily with bocaccio, bronzespotted rockfish (*Sebastes gilli*), and vermillion rockfish.

6.1.3 Species Co-occurring with Widow Rockfish

Widow rockfish are a shelf species with a coastwide distribution on the U.S. West Coast. Principal species co-occurring on the shelf with widow rockfish include canary rockfish, lingcod, vermillion rockfish, and yelloweye rockfish coastwide (Appendix A, Figure 2-4). Principal shelf species south of Cape Mendocino include California scorpionfish, chilipepper rockfish, and cowcod; while tiger rockfish is included as a principal species in the north. However, widow rockfish have a midwater distribution and are most often caught with Pacific whiting (*Merluccius productus*) and yellowtail rockfish in midwater trawl fisheries.

6.1.4 Species Co-occurring with Yelloweye Rockfish

Yelloweye rockfish are a principal shelf species coastwide on the U.S. West Coast (Appendix A, Figure 2-4). Yelloweye rockfish are most abundant north of central California with highest densities on the West Coast in waters off of northern Washington (Methot *et al.* 2003). Therefore, they are most associated with the principal shelf groundfish species that occur north of Cape Mendocino. They are also caught in close association with Pacific halibut (*Hippoglossus stenolepsis*) in recreational and commercial longline fisheries. Casillas et al. (1998) note that yelloweye rockfish share many of the same trophic features as quillback rockfish (*Sebastes maliger*). However, their depth distribution is deeper; they occur out to 300 fm and are commonly found out to 220 fm (Appendix A, Table 2-1). Yelloweye rockfish can therefore co-occur with some slope rockfish species such as darkblotched rockfish (*Sebastes crameri*) and Pacific ocean perch (*S. alutus*) in the deeper portion of their range.

6.2 Criteria Used to Evaluate Impacts

The impacts on co-occurring species from rebuilding alternatives for bocaccio, cowcod, widow rockfish, and yelloweye rockfish mostly accrue from the species' associations in the groundfish fisheries where these species are targeted or incidentally caught. While co-occurring species may inhabit similar habitats and reside in the same area as these four overfished species, they are often caught at disparate rates from their relative ratio of abundance due to species-specific gear selectivities. In fact, one oft-used strategy by the Council and NMFS to reduce fishing mortality on overfished groundfish species is to reduce trip limits and/or OYs for co-occurring species in order to reduce the incidental mortality on the species of concern. The ratio of prescribed trip limits for these co-occurring species is determined from the ratios observed in fishery catches. Therefore, species' co-occurrence in fisheries catches is a key criterion used to evaluate impacts.

If establishing marine protected areas is one of the cornerstones to a species rebuilding plan (i.e., the CCAs for cowcod and the YRCA for yelloweye rockfish), then co-occurring species residing in those specific areas will experience less exploitation. In effect, the current management regime, where depth-based RCAs have been established to reduce mortality of overfished groundfish species, does significantly reduce fishing mortalities of many co-occurring species by closing a wide swath of the West Coast shelf to fishing. To the extent that protection of critical habitats will enhance species' productivity, there would be a commensurate benefit to co-occurring species. It is assumed, under the auspices of the current depth-based management regime, that the extent of an RCA is proportional to the available rebuilding OYs for the most constraining stock in a given area. Therefore, the extent of closed areas or RCAs is used as a criterion to evaluate impacts to co-occurring species as well.

6.3 Discussion of Direct and Indirect Impacts

In general, there is a gradient of expected fishing mortalities for co-occurring species from the alternatives analyzed, where Action Alternative 1 provides the highest harvest rates and Action Alternative 4 provides the lowest harvest rates. As rebuilding OYs are reduced, fisheries are increasingly constrained to avoid exceeding these OYs. This, in turn, affects the opportunity to harvest healthy co-occurring species. A sense of the species catch composition in different groundfish sectors by target strategy can be gleaned from information in Appendix B.

6.3.1 Impacts to Species Co-occurring With Bocaccio

Bocaccio rebuilding alternatives are likely to affect fishing opportunities for healthy co-occurring stocks, most notably chilipepper rockfish and other principal shelf rockfish species south of Cape Mendocino, shelf flatfish species, California scorpionfish, California halibut, ocean whitefish, and white seabass. The elimination of spot prawn trawls in 2003 was based on concerns of high bycatch of shelf rockfish, including bocaccio. This should reduce mortality of bocaccio. It is noted that the close association of bocaccio and chilipepper rockfish compelled the Council and NMFS to specify a precautionary reduction in the chilipepper rockfish OY and consequent trip limits in the past to reduce bocaccio mortalities. This may continue to be a bocaccio rebuilding strategy unless fishermen can determine an effective gear or strategy to selectively harvest chilipepper rockfish. The size of the trawl, non-trawl, and recreational RCAs has largely been based on the need to reduce bocaccio mortalities; however, the need to reduce mortalities of canary rockfish, cowcod, and yelloweye rockfish contributed to these decisions.

The rebuilding alternatives have varying effects to co-occurring species with the No Action Alternative constraining fisheries the most in the next two years, followed by action alternatives 4, 3, 2, and 1, respectively. The No Action Alternative is predicted to remain the most binding for bocaccio until about 2011, when Action Alternative 4 is projected to have lower harvests under the STATc model (Table 5-6a).

6.3.2 Impacts to Species Co-occurring With Cowcod

The current strategy of protecting critical cowcod habitats and the existing population with the specification of the CCAs, coupled with non-retention regulations to eliminate targeting, has proven to be effective at keeping impacts below the prescribed OYs south and north of Pt. Conception (Butler *et al.* 2003). The elimination of spot prawn trawls, where cowcod bycatch had been a concern, will aid in cowcod rebuilding by reducing incidental mortalities. Prohibiting most bottom fishing opportunities in the CCAs will protect other demersal shelf and shallow slope species, especially those species that have a sedentary lifestyle like cowcod. Important co-occurring groundfish species that are found in the CCAs include bocaccio, blackgill rockfish, bank rockfish, bronzespotted rockfish, lingcod, vermillion rockfish, and yelloweye rockfish. While canary rockfish occur south of Pt. Conception and have been observed within the CCAs, their abundance in the Southern California Bight is very low. Fishing restrictions in the CCAs may only provide a marginal benefit for canary rockfish.

There is a negligible difference in the expected impacts to co-occurring species from the cowcod action alternatives given the slight difference in OY. The No Action Alternative is not legally viable and therefore, impacts to co-occurring species are not addressed under No Action.

6.3.3 Impacts to Species Co-occurring With Widow Rockfish

The interim strategy for rebuilding widow rockfish has been to eliminate the target widow/yellowtail midwater trawl fishery and to actively manage the whiting fishery for widow bycatch. However, the significantly low OYs under the more conservative rebuilding alternatives and/or more conservative competing model 7 would require more stringent management measures. Therefore, the effects on co-occurring species vary widely by alternative.

The No Action Alternative for widow rockfish is not legally viable and not addressed further. Action alternatives 1 and 2 under the base model 8 and all the action alternatives under competing model 9 specify OYs that are high enough in the short term to consider continuing the interim strategy of managing the widow bycatch in the whiting fishery. In these cases, fishing mortalities for Pacific whiting and yellowtail rockfish would expected to be significantly reduced, with some reduced mortality of canary rockfish, darkblotched rockfish, Pacific ocean perch, widow rockfish, and lingcod (Appendix A, Table 6-13). However, OYs under action alternatives 3 and 4 under the base model 8 and all action alternatives under competing model 7 would affect a greater number of shelf fisheries including recreational groundfish fisheries, especially under the alternatives with the lowest OYs. The impacts (reduced fishing mortalities) to co-occurring shelf species (Appendix A, Table 2-1 and Figure 2-4) would be consequently greater under these more conservative cases.

6.3.4 Impacts to Species Co-occurring With Yelloweye Rockfish

The interim rebuilding strategy for yelloweye rockfish has been to specify the small footrope restriction for landing shelf rockfish, specify the non-trawl RCA, specify the YRCA for recreational groundfish and recreational Pacific halibut fisheries, and specify non-retention regulations to eliminate targeting. All of these measures are estimated to significantly reduce mortalities on co-occurring shelf species (Appendix A, Table 2-1 and Figure 2-4). The non-trawl RCA and the YRCA should significantly reduce mortalities of bocaccio, canary rockfish, cowcod, lingcod, and widow rockfish; all of which are under rebuilding.

The No Action Alternative is not legally viable for rebuilding yelloweye rockfish and therefore not discussed further. There is only a slight variance in OYs among the yelloweye rockfish action alternatives and therefore a slightly varying impact on co-occurring species.

6.4 Discussion of Cumulative Impacts

Bocaccio, cowcod, widow rockfish, and yelloweye rockfish are all shelf species and therefore affected by rebuilding plans for other co-occurring overfished shelf species. Canary rockfish rebuilding OYs currently constrain shelf fisheries to the greatest extent coastwide making it unlikely that low OYs for bocaccio and yelloweye rockfish can be attained (Table 5-12). Cowcod rebuilding and, to a lesser extent, bocaccio and yelloweye rebuilding needs will greatly influence fishing opportunities in the Southern California Bight south of Pt. Conception. Access to healthy groundfish and some non-groundfish stocks in the Conception area may therefore be limited by all the cowcod action alternatives. However, if the fishing restrictions in the current CCAs continue to provide adequate cowcod protection, then bocaccio or yelloweye rebuilding needs could constrain Conception area fisheries outside the CCAs. Widow rockfish rebuilding needs will significantly affect midwater trawl opportunities for Pacific whiting and yellowtail rockfish. The more conservative action alternatives for rebuilding widow rockfish could constrain most all of the other groundfish sectors operating on the shelf. Widow rockfish could be the most constraining stock for most shelf fisheries under the most conservative alternatives.

6.4.1 Potential Unintended Consequences

Unpredictable trophic interactions can occur as fishing mortalities are selectively reduced for some species under rebuilding. For instance, lingcod rebuilding has undoubtedly increased predation on rockfish and other co-occurring species since lingcod are such voracious predators. There can also be area displacement in critical habitats by co-occurring species as their numbers increase, which could prevent colonization by juvenile rockfishes. Other trophic interactions, such as the tendency for some small rockfish species to selectively prey on juveniles of larger rockfish species (see section 5.4.1) can also have the potential unintended consequence of retarding the rebuilding of large-sized overfished rockfish species such as cowcod and yelloweye rockfish.

6.5 Summary of Impacts

6.5.1 No Action Alternative

The No Action Alternative is only legally viable for bocaccio rebuilding since it is predicted to rebuild by T_{MAX} with at least a 50% probability. There would be a significant impact to co-occurring species in the short term under the No Action Alternative assuming the STATc base model due to the prescribed near-zero harvests (Table 2-1). This alternative would therefore significantly constrain shelf fisheries south of Cape Mendocino with a consequent reduction of fishing mortalities for co-occurring species (Appendix A, Table 2-1 and Figure 2-4). This impact on co-occurring species would probably not be significant in the long term as the OY increases significantly in the next ten years (Table 5-6a).

6.5.2 Action Alternative 1

Action Alternative 1 generally prescribes the highest harvests considered by the Council for rebuilding bocaccio, cowcod, widow rockfish, and yelloweye rockfish. It is unlikely that this level of harvest will be attained for bocaccio, cowcod, and yelloweye rockfish under the current management regime because of the constraints imposed by the need to rebuild canary rockfish (Table 5-12). Active management of the midwater trawl fisheries targeting Pacific whiting (see section 5.3.3) may be all that is required to restrict widow rockfish bycatch under Action Alternative 1. This alternative assumes the greatest impacts (in terms of higher fishing mortalities) to co-occurring species since it prescribes the highest OYs that may result in the least extensive RCA designations.

6.5.3 Action Alternative 2

Action Alternative 2 is more constraining to shelf fisheries than Action Alternative 1, but may have similar effects as Action Alternative 1 for non-whiting shelf fisheries due to canary rockfish rebuilding constraints. The whiting fishery would be more dramatically constrained under Action Alternative 2 since there is very little available widow rockfish OY if non-whiting fisheries continue to be held harmless. In this case, species incidentally caught in the whiting trawl fishery (i.e., widow, yellowtail darkblotched, Pacific ocean perch, canary rockfish, and lingcod) would likely experience less mortality. Widow bycatch rates would have to be similar to that experienced in 2003 (Figure 5-6) to avoid more stringent management of the whiting-directed fishery.

6.5.4 Action Alternative 3

Action Alternative 3 is more constraining than action alternatives 1 and 2. The cowcod OY under Action Alternative 3 is the same as for action alternatives 2 and 4. It is likely that the available widow rockfish OY under this alternative will not accommodate current non-whiting shelf fishing opportunities since widow bycatch probably cannot be managed solely within the whiting fishing sectors under this alternative. Therefore, the expected impacts to co-occurring shelf species are likely to be more significant as RCAs are extended and consequent estimated mortalities of shelf species are lessened.

6.5.5 Action Alternative 4

Action Alternative 4 specifies the lowest OYs considered by the Council for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. However, this is the same cowcod OY specified under action alternatives 2 and 3. The bocaccio OY under Action Alternative 4, assuming the STATc base model, becomes much more constraining to shelf fisheries south of Cape Mendocino. Current fishing opportunities in these waters would not likely be fully accommodated under this level of harvest (Tables 2-1 and 5-12). Therefore, it is likely that fishing mortalities of species co-occurring with the southern bocaccio stock would be lessened under this alternative. The widow rockfish OY under Action Alternative 4 is near-zero and would result in very stringent management measures on the shelf coastwide. The whiting fishery could not be accommodated at all under this alternative and any non-whiting shelf fishery with an estimated bycatch of widow (Table 5-12) would have to be dramatically displaced or eliminated altogether. Therefore, under this alternative, widow rockfish becomes the most constraining stock for most shelf fisheries on the U.S. West Coast. Management under this alternative would dramatically lower fishing mortalities for all species co-occurring with widow rockfish.

6.5.6 Action Alternative 5 (Council Preferred)

This alternative will be specified by the Council at its April 2004 meeting in Sacramento, CA.

7.0 THE PUBLIC SECTOR AND FISHERIES MANAGEMENT REGIME

The public sector includes those entities directly affected by changes to the current management regime, but does not include participants in the fishery or the fishing communities of the West Coast (see Chapter 8 for a description of the socioeconomic environment). Therefore, the public sector, as defined in this EIS, represents the policy, science, and management entities that comprise the current management regime. The management regime is an important issue because it generates direct and indirect impacts. The regime is also itself affected by changes in law and policy, which can cumulatively affect the environment. This section discusses stock assessments, catch accounting, observer programs and research fisheries, all crucial components in the process of determining sustainable fishery yields; uncertainty, which underlies the range of alternatives evaluated in this EIS; and enforcement, which affects the efficacy of prescribed management measures. For additional information on the management cycle and legal authorities and jurisdictions, which also directly affect the management regime, see Appendix A, Chapter 1.

7.1 Affected Environment

7.1.1 Managing with Risk and Uncertainty

Uncertainty in fishery management exists for many reasons including imperfect sources of data from the past, inaccurate or inadequate monitoring of current fisheries, and unknown future environmental conditions. All of these factors contribute to the risks associated with the assessment of stock status, the estimation of impacts to fish stocks due to fishery management measures, and the projections of future stock health under varying long term management alternatives. A detailed discussion of short-term costs verses long-term risk can be found in Appendix A, Section 1.2.1. For more information on the assessment of risk in long-term stock population projections see Appendix A, Section 1.1.1.2.

7.1.2 License Limitation, Capacity Reduction, and Fleet Rationalization

Declining fishing opportunity and increased importance in stock rebuilding and sustainable fisheries since the late-1990s have created the need for smaller, more efficient fishing fleets and more responsive management tools and monitoring programs. A full discussion of these long-term management strategies is presented in Appendix A, Section 1.2.4.

7.1.3 Management Data Systems

7.1.3.1 Catch Monitoring and Accounting

Various state/federal catch monitoring systems are used in West Coast groundfish management. These are coordinated through the Pacific States Marine Fisheries Commission (PSMFC). PacFIN (Pacific Fisheries Information Network) is the commercial catch monitoring database and RecFIN (Recreational Fishery Information Network) is the database for recreational fishery catch monitoring. There are two components to total catch, (1) catch landed in port, and (2) catch discarded at sea. Discards occur for regulatory reasons (i.e., catch in excess of trip and/or landing limits) and market reasons (i.e., catch of unmarketable species or size). A description of the relevant data systems used to monitor total catch and discards in commercial, recreational, and research fisheries follows.

Monitoring Commercial Landings

Sorting requirements are now in place for all overfished rockfish species. This requires accounting for the weight of landed overfished rockfish when catches are hailed at sea or landed. Limited entry groundfish trawl fishermen are also required to maintain logbooks that record the start location, time, and duration of trawl tows, as well as the total catch by species market category (i.e., those species and complexes with sorting requirements). Landings are recorded on state fish receiving tickets. Fishtickets are designed by the individual states, but there is an effort to coordinate record-keeping requirements with state and federal managers. Poundage by sorted species category, area of catch, vessel identification number, and other data elements are required on fishtickets. Landings are also sampled in port by state personnel to collect species composition data, otoliths for ageing, lengths, and other biological data. Sample rates vary between fishery and state, but there is an effort to sample about 20% of the landed catch. A suspension of at-sea sorting requirements and full retention of catch is allowed in the whiting fishery (by FMP Amendment 10 and an annual Exempted Fishing Permit [EFP] in the Shoreside Whiting sector). The at-sea whiting fishery has 100% on-board observer coverage, while the shoreside whiting sector brings 100% of their catch to port for sampling. Landings, logbook data, and state port sampling data are reported inseason to the PacFIN database managed by the PSMFC (www.psmfc.org/pacfin/index.html). The GMT and PSMFC manage the QSM dataset reported in PacFIN. All landings of groundfish stocks of concern (overfished stocks and stocks below B_{MSY}) and target stocks and stock complexes in West Coast fisheries are tracked in QSM reports of landed catch. The GMT recommends prescribed landing limits and other inseason management measures to the Council to attain, but not exceed, total catch OYs of QSM species. Stock and complex landing limits are modified inseason to control total fishing-related mortality; QSM reports and landed catch forecasts are used to control the landed catch component.

Monitoring Recreational Catch

Recreational catch is monitored by the states as it is landed in port. These data are compiled by the PSMFC in the RecFIN database. The types of data compiled in RecFIN include sampled biological data, estimates of landed catch plus discards, and economic data. These data are readily available to managers, assessment scientists, and the general public in prepared reports that can be accessed on the Internet at (http://www.psmfc.org/recfin/index.html).

The MRFSS is an integral part of the RecFIN program. Traditionally, there are two primary components of the survey; field intercept surveys (administered under supervision of PSMFC) and a random phone survey of coastal populations (administered by a third party contracted by NMFS). The field intercept surveys were used to estimate catch, and the phone survey was used to estimate effort. The results of these two efforts are combined in the RecFIN data system maintained by PSMFC, and estimates of total effort and fishing mortality are produced along with other data potentially useful for management and stock assessments. However, MRFSS was not designed to estimate catch and effort at the level of precision needed for management or assessment; it was designed to provide a broad picture look of national fisheries. Comparison with independent and more precise estimation procedures has shown wide variance in catch estimates. Inseason management of recreational fisheries using MRFSS has been compromised by huge inseason variance of catch estimates. In recent years, efforts have been made to improve MRFSS. For instance, in 2001 PSMFC, with support from NMFS, began a new survey to estimate party/charter boat (CPFV) fishing effort in California. This survey differed from the traditional MRFSS telephone survey of anglers to determine CPFV trips by two-month period. The survey sampled 10% of the active CPFV fleet each week to determine the number of trips taken and the anglers carried on each trip. This 10% sample is then expanded to make estimates of total angler trips for Southern California and Northern California. However, the requisite precision for managing for the low OYs of overfished species like canary rockfish and bocaccio was still lacking.

Washington and Oregon have used the MRFSS system as a supplement to their port sampling programs from which most of their recreational catch estimates are derived. California has had a greater dependence on MRFSS to estimate their recreational catch. One outcome of this dependence are highly uncertain catch estimates of California recreational catch. This has likely compromised efforts to control total mortality of recreational groundfish species in California such as bocaccio and canary rockfish. Another outcome is an observed lack of credibility in the MRFSS program on the West Coast, policy representatives from the West Coast recommended the development of a new program. In response, staff from the California Department of Fish and Game (the Department) and the Pacific States Marine Fisheries Commission designed a new program for sampling California's recreational fisheries, incorporating both the comprehensive coverage of the MRFSS program and the high quality sampling (for the private vessel mode) of the Ocean Salmon Project. This new program, the California Recreational Fisheries Survey (CRFS), specifically includes the following:

- Integration of California's current marine recreational sampling programs into one program;
- Reporting of catch and effort at a finer geographical resolution;
- Estimation of private/rental (PR) vessel effort using an on-site approach;
- Estimation of beach/bank and private access angler effort using an angler license database with the frame built from one out of every 20 licenses;
- Continuation of the Commercial Passenger Fishing Vessel (CPFV) phone survey with effort;
- Augmentation of CPFV phone surveys with effort data collected directly from the landings and CPFV logbooks;
- Increased creel sampling for PR and CPFV vessels;
- Estimation of effort and catch on man-made structures using instantaneous angler counts, roving effort (pressure) surveys, and creel surveys;
- Reporting of effort and catch estimates for all modes at monthly intervals; and
- Sufficient sampling of PRs to meet ocean salmon management data requirements, including the collection of coded wire tags.

The primary goal of the program will be to produce in a timely manner marine recreational, fishery-based data needed to sustainably manage California's marine recreational fishery resources. The changes proposed in this plan should increase the timeliness and accuracy of recreational fisheries data so that they can be more effectively used for in-season monitoring, estimating take for species of concern, developing harvest guidelines, producing stock assessments, and providing other information critical to management decisions. The initial focus of the program will be to produce timely catch estimates with reasonable confidence limits for those groundfish stocks declared overfished by National Marine Fisheries Service and for those stocks with a directed harvest. The PSMFC and CDFG will fully implement the CRFS plan beginning in January 2004.

Total Catch Accounting

Implementation of the Sustainable Fisheries Act and decreasing OYs have compelled fishery managers and scientists to improve estimates of total fishery-related impacts, particularly impacts to overfished species. Traditionally, total landed catch was considered and adequate accounting of the success of fishery management measures in limiting catch and thereby limiting impacts to the fish resources being accessed. Recent improvements in total catch accounting, that is, landings plus estimated mortality associated with discards have utilized new information from observer programs and fishery sampling (see Section 7.1.3.2).

In estimating total catch, the general methodology is to estimate fishery related sources of mortality including landings and discards attributed to commercial, recreational, and scientific/research activity. This is accomplished by using data from the PacFIN, and RecFIN databases, scientific/research data from various agencies participating in those activities, and discard estimates from the 2002 and 2003 Annual Specifications (Table 5-4 and Table 5-5).

The PacFIN database records landed catch (as opposed to total catch), and thus an estimate of discards and discard-induced mortality associated with recorded landings were needed to generate estimates of total mortality. At the time of the analysis, one year of trawl observer data was being used for management, but no useable estimate of discards was available for other fisheries such as fixed gear and open access. Using observer data from one gear type presented challenges in estimating discards for the fishery as a whole. Although it was feasible to estimate the appropriate weighting for those discard estimates (i.e. establish the proportion of landed catch those discards should be attributed to), there remained the question of what the appropriate level of discard was for remaining fisheries. Based on this notion, it was deemed most appropriate to use discard assumptions described in the 2002 and 2003 Groundfish Annual Specifications, and apply those estimates to total commercial landed catch to get a preliminary estimate of total catch in all commercial fisheries. Future methodology will be focused on augmenting landed catch estimates with a rigorous estimate of discards in each sector.

Recreational mortality was estimated using weight of “A + B1" catch (landed catch examined by samplers (A) + catch reported by the angler as released dead or filleted at sea (B1)) reported in the RecFIN database. This estimate is best described as the weight of fish that are kept or are known to be dead when discarded. At this time, there still lacks an agreed upon discard mortality rate that should be applied to “B2" catch (catch reporter by the angler as fish that were discarded alive), however future analysis plans on applying a discard mortality rate to B2 catch when those rates are developed.

Finally, scientific catch data reported from various agencies often do not have reported weights, and instead report the number of fish that were caught. This problem has been identified by the NMFS Northwest Region and the GMT, but there still lacks an appropriate weighting scheme to apply to the number of fish reported without weights. Therefore, reported scientific/research catch data are incomplete and preliminary at this time.

Table 5-5 shows the overall results of using the described methodology in estimating total catch for 2003. Of note is the fact that additional methodology was used to parse the "unspecified thornyheads" category into shortspine and longspine thornyheads. The "unspecified thornyheads" category comes from California landed catch records and from at-sea records. Those unspecified thornyheads recorded in the state of California were parsed according to the ratio of shortspine and longspine landings recorded in the state of California. At-sea unspecified thornyheads were parsed according to the ABC of northern longspine and shortspine. This was done because no catch records exist in the at-sea data for shortspine and longspine, and the relative ABC's are the best estimate of actual species abundance. An underlying assumption of using the relative ABC's is that the catchability of each species is the same in the at-sea sector, and that the ABC of each species represents the ratio of what was caught.

7.1.3.2 Observer Programs

West Coast Groundfish Observer Program

Limiting discards (defined as bycatch in the MSA) to the extent practicable is an MSA mandate. Effective bycatch accounting and control mechanisms are also critical for staying within target total catch OYs. The first element in limiting bycatch is accurately measuring bycatch rates by time, area, depth, gear type, and fishing strategy. The West Coast Groundfish Observer Program (WCGOP) includes the Observer Team and collaborators from the PSMFC (Pacific States Marine Fisheries Commission) that direct the program, train new observers, and manage and analyze the bycatch data. On May 24, 2001, NOAA Fisheries (NMFS) established the WCGOP to implement the Pacific Coast Groundfish Fishery Management Plan (50 CFR Part 660). This regulation requires all vessels that participate in the groundfish fishery to carry an observer when notified to do so by NMFS or its designated agent. These observers monitor and record catch data, including species composition of retained and discarded catch. Observers also collect critical biological data such as fish length, sex, and weight. The program currently deploys observers coast wide on the permitted trawl and fixed-gear groundfish fleet, as well as on some vessels that are part of the open-access groundfish fleet. Observers improve our understanding of fishing activities and help provide accurate accounts of total catch, bycatch, and discard associated with different fisheries and fish stocks.

The West Coast Groundfish Fishery Observer Program is designed to provide estimates of fleet-wide discards in commercial fisheries; fishtickets are the mandated landings accounting mechanism. Logbook data needs to be available to fully utilize observer data because observers initially record hail weights and logbook data for retained catch, and these values need to be adjusted by fishticket information to achieve total catch estimates. One difficulty is the need for a statistically significant number of observations of discard across all strata to determine representative bycatch rates for these strata. Implementation of depth-based management further exacerbated the data-sparseness of observations, since areas where many observations occurred in the first year of the Observer Program are now closed to fishing.

NMFS first implemented the West Coast Groundfish Fishery Observer Program in August 2001 to make direct observations of commercial groundfish discards. Observer coverage initially extended to about 10% of the West Coast limited entry fleet effort, but increased to about 20% by the summer of 2002 (Elizabeth Clarke, NMFS NWFSC, pers. comm.). Given the skewed distribution of bycatch in West Coast groundfish fisheries, many observations in each sampling strata (i.e. target effort by gear type by area) are needed to estimate representative bycatch rates of overfished groundfish species. The seasonality of bycatch is an important management consideration. Target opportunities for healthy flatfish and DTS species vary seasonally and geographically. It is reasonable to expect bycatch rates of overfished groundfish species to vary in accordance with the concurrence of target species and overfished species. In November 2001, the Council adopted the trawl bycatch model to use for bycatch accounting and control starting in 2002. In 2002, the bycatch rates used in the trawl bycatch model were restratified by depth (using tow start locations in 1999 trawl logbooks) in anticipation of the new depth-based management regime. Depth-based bycatch rates from the trawl bycatch model are applied to landed weight of the target species in the target fisheries to estimate seasonal bycatch of the overfished groundfish species subject to rebuilding plans evaluated in this EIS.

The Council decided in April 2003 to modify the trawl bycatch model by using bycatch rates derived from direct observations of trawl efforts in the WCGOP for 2003 inseason management decision-making. These data were filtered using starting and ending tow locations to emulate, to the extent possible, observations from areas that are outside currently closed trawl Rockfish Conservation Areas (RCAs). The data limitations required aggregation of observations to strata north and south of Cape Mendocino and deeper and shallower than the trawl RCA. Therefore, the seasonal and target strategy strata are collapsed in the trawl bycatch model, and only the trawl fishery is modeled for bycatch accountability.

In September, 2003, the trawl bycatch model was expanded to include observed discard rates for target species to complement the bycatch rates for overfished species already in the model. This new model configuration was used to evaluate the limited entry trawl management measure alternatives for 2004.

The second year of the WCGOP began in September 2002 and ended in August, 2004. The program continued to sample the trawl fleet at a rate of approximately 20% and continued to expand coverage of the limited entry fixed-gear and open access sectors. Scientist at the NOAA Northwest Fisheries Science Center worked over the winter to analyze the second year of data and to update the trawl bycatch model. Perhaps the most significant result of incorporating the new data into the trawl model will be the development of seasonal bycatch rates. In modeling 2003 fisheries, the combination of limited observer data from the first year of the program and the need to evaluate bycatch on a depth-specific basis resulted in discontinued use of seasonal bycatch rates. Additionally, a new bycatch model for the fixed-gear fishery has been developed using data collected in the first two years of the WCGOP. Both trawl and the fixed-gear bycatch models were presented to the SSC at the Council meeting in March 2004. It is anticipated that these models will be approved for use during the April Council meeting for inseason modeling of 2004 fisheries as well as developing management measures for fisheries in 2005 and 2006.

The first report on the WCGOP was released in January 2003, entitled "Northwest Fisheries Science Center West Coast Groundfish Observer Program Initial Data Report and Summary Analyses". That report described the analysis of observer data for various species collected during the first year of the program. Preliminary reports and summary analyses of the second year of data were released in early 2004 and include results from both the limited entry trawl fishery as well as for sablefish-endorsed fixed gear permits. These reports and background materials on the WCGOP are available on the Northwest Fisheries Science Center website at: http://www.nwfsc.noaa.gov/research/divisions/fram/observer/index.cfm.

At-Sea Pacific Whiting Observer Program

To increase the utilization of bycatch that is otherwise discarded as a result of trip limits, Amendment 13 to the groundfish FMP implements an increased utilization program on June 1, 2001, which allows catcher/processors and motherships in the whiting fishery to exceeded groundfish trip limits without penalty, providing specific conditions are met. These conditions include provisions for 100% observer coverage, non-retention of prohibited species, and donation of retained catch in excess of cumulative trip limits a bona fide hunger relief agency.

These provisions have not only given fishery managers the tools necessary to allow the At-Sea Pacific Whiting program to operate efficiently while meeting management goals, but have also provided scientists, through the observer coverage, extensive amount of information on bycatch species. This dataset has not only provided valuable information in the management of Pacific whiting, but has also been used as a data source for the assessment of widow rockfish. Widow rockfish and Pacific whiting are co-occurring species which can result in significant bycatch of widow rockfish in the midwater trawl nets used for Pacific whiting. However, like other fishery-dependent datasets, it is believed that changes to the management measures since 1999 have a greater influence than widow rockfish abundance on the widow rockfish CPUE in the at-sea Pacific whiting fishery (He *et al.* 2003b).

Shore-based Pacific Whiting Observer Program

The Shoreside Whiting Observation Program (SWOP) was established in 1992 to provide information for evaluating bycatch in the directed Pacific whiting fishery and for evaluating conservation measures adopted to limit the catch of salmon, other groundfish and prohibited species. Though instituted as an experimental monitoring program, it has been continued annually to account for all catch in targeted whiting trip landings, enumerate potential discards, and accommodate the landing and disposal of non-sorted catch from these trips. In 1995, the SWOP's emphasis changed from a high observation rate (50% of landings), to a lower rate (10% of landings) and increased collection of biological information (e.g., otoliths, length, weight, sex, and maturity) from Pacific whiting and selected bycatch species (yellowtail rockfish, widow rockfish, sablefish, chub (Pacific) mackerel (*Scomber japonicus*), and jack mackerel (*Trachurus symmetricus*)). The required observation rate was decreased as studies indicated that fish tickets were a good representation of what was actually landed. Focus shifted again due to 1997 changes in the allocation of yellowtail rockfish and increases in yellowtail bycatch rates. Since then, yellowtail and widow bycatch in the shoreside whiting fishery has been dramatically reduced because of increased awareness by fishermen of the bycatch and allocation issues involved in the SWOP program.

The SWOP is a cooperative effort between the fishing industry and state and federal management agencies to observe and collect information on directed Pacific whiting landings at shoreside processing plants. Participating vessels apply for and carry two EFPs issued by NMFS. Permit terms require vessels to land unsorted catch at designated shoreside processing plants. Permitted vessels are not penalized for landing prohibited species (e.g., Pacific salmon, Pacific halibut, Dungeness crab), nor are they held liable for overages of groundfish trip limits. Participants in the SWOP are mid-water trawlers carrying EFPs, designated shoreside processing plants in California, Oregon, and Washington, the Council, the NMFS, PSMFC, ODFW), CDFG, and WDFW. (Excerpt from latest ODFW on the shore-based Pacific Whiting program review (Wiedoff and Parker 2002), for the complete report go to: http://hmsc.oregonstate.edu/odfw/reports/hake.html).

Since 1997, an EFP has been adopted annually that allow suspension of at-sea sorting requirements in the shore-based whiting fishery enabling full retention and subsequent port sampling of the entire catch. However, EFPs are intended to provide for limited testing of a fishing strategy, gear type, or monitoring program that may eventually be implemented on a larger fleet-wide scale and are not a permanent solution to the monitoring needs of the shore-based Pacific whiting fishery. Results of the shore-based Pacific whiting EFPs indicate that it is feasible to retain and appropriately monitor the incidental take of salmon and groundfish other than Pacific whiting in the shore-based Pacific whiting fishery. A permanent monitoring program for the shore-based Pacific whiting fleet is being developed because of the specification in the Pacific Coast salmon and groundfish fishery FMPs and the 1992 Biological Opinion analyzing the effects of the groundfish fishery on salmon stocks listed under the Endangered Species Act (ESA). The issue of salmon retention in the groundfish trawl fisheries was brought before the Council in 1996 in the form of Amendment 10 to the Pacific Coast Groundfish FMP and Amendment 12 to the Pacific Coast Salmon FMP. Based on an Environmental Assessment drafted to analyze these amendments, the Council recommended the exempted fishery permit (EFP) process be used temporarily until a permanent monitoring program could be developed and implemented in the shore-based Pacific whiting fishery.

The National Marine Fisheries Service (NMFS) is developing a preliminary draft Environmental Assessment which includes a range of alternative monitoring systems for the shore-based Pacific whiting fishery. The alternatives currently focus on three major issues: 1) staffing the monitoring program (i.e., federal observers, state monitors, video cameras, or a combination thereof); 2) tracking and disposition prohibited species and groundfish overages; and 3) funding of the monitoring program. It is anticipated that the permanent monitoring program will be implemented in 2005. NMFS and the GMT have expressed concerns about the current EFP program and its adequacy of ensuring full retention and therefore total catch accounting. This is particularly and concern in regards to the rebuilding of widow rockfish. NMFS is currently exploring the testing of onboard video cameras in the summer of 2004 as a means of verifying total retention.

Central California Marine Sport Fish Project

The Central California Marine Sport Fish Project has been collecting angler catch data from the Commercial Passenger Fishing Vessel (CPFV) industry intermittently for several decades in order to assess the status of the nearshore California recreational fishery. The project has focused on rockfish and lingcod angling and has not sampled salmon trips. Reports and analyses from the project document trends by port area in species composition, angler effort, catch, and, for selected species, catch per unit effort (CPUE), mean length and length frequency. In addition, total catch and effort estimates are made based on adjustments of logbook data by sampling information.

Before 1987, catch information was primarily obtained on a general port basis from dockside sampling of CPFVs, also called party boats. This did not allow documentation of specific areas of importance to recreational anglers and was not sufficient to assess the status of rockfish populations at specific locations.

CPFV operators are required by law to record total catch and location for all fishing trips in logbooks provided by the California Department of Fish and Game (CDFG). However, the required information is too general for use in assessing the status of the multi-species rockfish complex on a reef-by-reef basis. Rockfish catch data are not reported by species and information on location is only requested by block number (a block is an area of 100 square miles). Many rockfishes tend to be residential, underscoring the need for site-specific data. Thus, there is a strong need to collect catch information on board CPFVs at sea. However, locations of specific fishing sites are not revealed since that information is confidential.

In May 1987 the Central California Marine Sport Fish Project began on-board sampling of the CPFV fleet. Data collection continued until June 1990, when state budgetary constraints temporarily precluded further sampling, resumed in August 1991, and continued through 1994. The program depends on the voluntary cooperation of CPFV owners and operators. Angler catches on board central and northern California CPFVs were sampled from fourteen ports, ranging from Crescent City in the north to Port San Luis (Avila Beach) in the south. For additional information on this program, see the PSMFC web site at: (www.psmfc.org/recfin/ccmsp.htm).

Oregon Marine Recreational Observers Program

In response to overfished species declarations and increasing concerns about fishery interactions with these species, ODFW started this program to improve understanding of recreational impacts. There were three objectives to this project; (1) document the magnitude of canary rockfish discard in the Oregon recreational fishery; (2) improve the biological database for several rockfish and groundfish species; and (3) gather reef location information for future habitat mapping. Discussion A seasonal observer was stationed in each of the ports of Garibaldi, Newport and Charleston to ride recreational groundfish charter vessels coastwide in Oregon from July through September, 2001. The Garibaldi observer covered boats out of Garibaldi, the Newport observer covered both Newport and Depoe Bay, and the Charleston observer covered Charleston, Bandon, and Brookings charter vessels. During a typical day the observer would ride a 5 to 8 hour recreational groundfish charter trip and spend the remainder of the day gathering biological and genetic data dockside from several rockfish and groundfish species for which little is known mostly due to their infrequency in the catch. When allowed by the captain, the observer also obtained GPS locations of fishing sites for future use by the Habitat Mapping Project of the Oregon Department of Fish and Wildlife (ODFW) Marine Resources Program. Results from this program have been incorporated into recreational fishery modeling by ODFW. For more information on this program as well as other fishery research and survey programs see the ODFW Marine Program web site at: http://hmsc.oregonstate.edu/odfw/reports/finfish.html.

WDFW Groundfish At-Sea Data Collection Program

The WDFW At-Sea Data Collection Program was initiated in 2001 to allow fishers access to healthier groundfish stocks while meeting the rebuilding targets of overfished stocks, and to collect bycatch data through an at-sea observer program. The data collected in these programs could assist with future fishery management by producing valuable and accurate data on the amount, location and species composition of the bycatch of rockfish associated with these fisheries, rather than using calculated bycatch assumptions. These data could also allow the Pacific Council to establish trip limits in the future that maximize fishing opportunities on healthy stocks while meeting conservation goals for depleted stocks.

Over the past four years, WDFW has implemented its At-Sea Data Collection Program through the use of federal EFPs. In 2001, 2002, 2003 and 2004, WDFW sponsored and administered a trawl EFP for arrowtooth flounder and petrale sole, and in 2002, WDFW also sponsored a midwater trawl EFP for yellowtail rockfish. The primary objective for these experimental fisheries was to measure bycatch rates for overfished rockfish species associated with these trawl fisheries. Participating fishers were provided access to healthier groundfish stocks and were constrained by individual vessel bycatch caps. Observers were used to collect data on the amount of rockfish bycatch caught on a per tow basis and to ensure that the vessel complied with the bycatch cap; therefore, vessels participating in the EFP were required to have 100% observer coverage.

The costs associated with these observer programs were covered with federal Disaster Relief funds. The majority of those funds have been spent; however, WDFW has continued its At-Sea Data Collection Program in 2003 and 2004 with having the participating fishers share the costs of the observer program. The average costs associated with providing observer coverage (including salaries, safety equipment, sampling supplies) is approximately $4,000-4,500 per month observed. However, there are additional costs incurred by WDFW in providing staff time to administer, monitor, and oversee the observer program, as well as analyze the data that are collected.

Monitors were hired as temporary employees of the Washington Department of Fish and Wildlife and were assigned to a duty station based on the vessel's home port. WDFW monitors completed a two-week training course, consistent with the National Marine Fisheries Service's Observer Training Manual. Training exercises include U.S. Coast Guard safety training–including survival suit immersion test and vessel safety, and WDFW training on fish identification, random sampling theory, data collection methods, current groundfish management issues, and additional safety measures.

WDFW fishery managers and biologists were involved in hiring and training the observers as well as administering and monitoring the program. WDFW scientific technicians sampled the catch dockside, collected biological data, and entered the data into an electronic database. Research scientists have analyzed the preliminary data from the 2001 and 2002 EFPs, and have finalized summary reports. A more thorough analysis will be completed for the 2003 arrowtooth trawl EFP and will be available in April 2004.

WDFW Ocean Sampling Program

In addition to the At-Sea Data Collection Program, WDFW collects at-sea data through the Ocean Sampling Program. The at-sea portion is not intended to be an observer program for the purposes of enumerating the bycatch alone but is coupled with shore-based sampling of anglers to calculate an estimated discard weight. At-sea observers record biological information from discarded species. Shore-based creel surveys of anglers provide the estimate of total number of discards. Combining these two data sources yields estimates of the weight of total fishery discard by species.

Tribal Observer Program

Tribal directed groundfish fisheries are subject to full rockfish retention. For some rockfish species where the tribes do not have formal allocations, trip limits proposed by the tribes are adopted by the Council to accommodate incidental catch in directed fisheries (i.e. Pacific halibut, sablefish, and yellowtail rockfish). These trip limits are intended to constrain direct catches while allowing for small incidental catches. Incidental catch and discard of overfished species is minimized through the use of full rockfish retention, shore based sampling, observer coverage, and shared information throughout the fleets regarding areas of know interactions with species of concern. Makah trawl vessels often participate in paired tows in close proximity where one vessel has observer coverage. If landings on the observed vessel indicate higher than anticipated catches of overfished species the vessels relocate and inform the rest of the fleet of the results (Steve Joner, pers. comm.). Fleet communication in order to avoid overfished species is practiced by all tribal fleets.

7.1.3.3 Research Fisheries

The reduction in directed fisheries and overall landings has resulted less information available to fishery managers compromising efforts to assess stock abundance and recovery. There is an increasing reliance on fishery-independent sources of information such as research fisheries and surveys. This is particularly true for overfished species such as widow rockfish, cowcod, bocaccio, and canary rockfish as fisheries are designed to avoid areas inhabited by these species. There is a relatively sparse amount of data available for widow rockfish as directed fisheries have been essentially eliminated and the Pacific whiting sectors have modified their behavior to avoid encounters with widow rockfish. The latest widow assessment (He *et al.* 2003b), highlighted the need for long-term datasets for this species and questioned the reliance on bottom trawl logbook data that has diminished with decreased fishing opportunities since 1999 and an index of juvenile rockfish abundance that surveys a small proportion of widow rockfish range. Additionally, future widow rockfish assessments may look to expand use of existing fishery-dependent data such as the observer data in the Pacific whiting fisheries (see Section 7.1.3.2). Assessment scientists will continue to rely on research fisheries as landings, age composition, and logbook catch rate data from many fishery sources decreases. A summary of long-term research fisheries and resource surveys can be found in Appendix A, Section 1.1.1.3.

7.1.3.4 The Stock Assessment Process

Rebuilding plans and stock assessments for overfished species are subject to review every two years. NMFS is currently planning the next round of stock assessments for 2005 for use in developing management measures and harvest specifications for the 2005 - 2006 biennial management cycle. The list of species planned for updated assessments contains over 20 species including bocaccio, cowcod, widow rockfish, and yelloweye rockfish. NMFS will also hold a series of workshops in 2004 focusing on data needs and available data sources for the ambitious list of stock assessments being considered for 2005. Additionally, the SSC is currently working on standards for the required review of rebuilding analyses. These reviews are required every two years for species under rebuilding plans. More information on the stock assessment process can be found in Appendix A, Section 1.1.1.1.

7.1.4 Enforcement

Enforcement of fishery regulations has become increasingly complex with the addition of large closed areas, smaller cumulative trip limits and bag limits, and depth-based closures for commercial and recreational fisheries. At the same time, decreased OYs and the need to rebuild overfished stocks has place additional importance on controlling and monitoring fishery related mortality. Enforcement agencies continue to utilize traditional methods to ensure compliance with groundfish fishery regulations including, dockside sampling, at-sea patrols, and air surveillance. Recent declines in enforcement agency budgets combined with increase regulatory complexity have stressed the ability to adequately monitor fisheries for regulatory compliance. In response, NMFS implemented a Vessel Monitoring System (VMS) which includes satellite tracking of vessel positions and a declaration system for those vessels legally fishing withing an RCA. VMS was implemented beginning on January 1, 2004 and is required on all vessels with a limited entry permit. Expansion of the program to other sectors is currently being considered. VMS dramatically enhances, rather than replaces, traditional enforcement techniques. A more detailed description of fishery monitoring and enforcement is included in Appendix A, Section 1.1.5.

7.2 Criteria Used to Evaluate Impacts

Effects on the public sector correlate with changes in the level of regulatory complexity. Regulatory complexity affects the public costs of implementing a management regime by increasing the burden of monitoring, enforcing, and adjusting fisheries to meet but not exceed intended impact levels. Thus, costs to governmental entities associated with increased regulatory complexity could be one way to evaluate the relative effects of the alternatives on the public sector. Intrinsic to the costs to the public sector is the assessment of risk to the resource. Management alternatives with a high degree of regulatory complexity or a substantial reliance on accurate and timely inseason fishery data not only increase the expense of enforcement and monitoring, they also increase the risk of non-compliance and overfishing and could compromise species rebuilding. Managing fisheries in a cost-effective manner while balancing risks to the resource with socioeconomic benefits is often the objective of public agencies charged with fishery management and enforcement. Therefore, costs, enforcement feasibility, risk to the resource, and reliance on fishery data are the criteria used in the following qualitative evaluation of the impacts to the public sector.

Successful stock rebuilding depends on the ability of management/rebuilding measures to effectively control all sources of fishing-related mortality, including landed catch and bycatch. All rebuilding alternatives analyzed in this EIS have a calculated total catch OY to accommodate landings of unavoidable incidental catch of the four species subject to rebuilding plans analyzed herein. The effectiveness of all rebuilding strategies (given the probabilistic trajectories of future increases in biomass relative to B_{MSY}) depends on managing fishing-related mortality within prescribed total catch OYs. Landed catch allowances for all overfished species are designed to minimize target opportunities on these species while allowing landings of unavoidable bycatch that would otherwise be discarded dead at sea. Management measures consistent with rebuilding should have harvest control rules that are enforceable and effectively stay within total catch targets.

7.3 Discussion of Direct and Indirect Impacts

7.3.1 Catch Monitoring and Accounting

The availability of data is critical to the effective management of fishery resources. Fishery impact modeling, stock assessments, and socioeconomic analyses are not directly affected by the management alternatives, but rely on long-term data sources. Longstanding, fishery-dependent data sources are compromised under rebuilding strategies with reduced OYs or zero impacts as directed groundfish fishing opportunities diminish. Loss of fishery-dependent data is a cost to fishery management agencies through increased uncertainty in resource analyses, such as stock assessments, and the added expense of developing new data collection methods and analytical tools.

7.3.2 Constraining OYs and Bycatch Accounting

Alternatives such as the No Action Alternative and Action Alternative 4 include restrictive OYs for overfished species that have wide ranging constraining effects along the entire coast and across many fisheries. State, federal, and tribal agencies charged with monitoring fishery-related impacts have increased responsibilities in terms of inseason catch accounting, bycatch projection, and timely reporting. This is particularly true when the amount of available OY is low and is attributable to bycatch rather than landed catch. Bycatch accounting often requires costly and time-consuming at-sea observation, shore-based sampling, and logbook programs. The WCGOP has completed two years of at-sea observation of the limited entry trawl and fixed gear fisheries, and trawl logbooks have been in place for several years. Although valuable to resource management, these data require extensive analysis and are not designed for real-time, inseason tracking of impacts. The effects of the alternatives to the public sector are evident in the expense of inseason fishery monitoring, as well as the risks associated with uncertainty. If management measures designed to meet rebuilding strategies with low OYs are projected to meet the available OY for constraining species, such as bocaccio or canary rockfish, the required careful monitoring and frequent inseason management actions could have relatively high costs and risk when compared to alternatives with projected impacts below the OY. Rebuilding alternatives with less constraining OYs would allow more flexible management strategies that are not expected to meet the OYs for constraining species. The remaining OY could be utilized as a "buffer" against the cost of intensive inseason management and the risk of exceeding the OY.

Bycatch accounting and control has been one of the weaker elements in groundfish management. However, bycatch accounting in the commercial sectors is improving rapidly. With the advent of data from the NMFS WCGOP, it is anticipated that more accurate bycatch accounting from the limited entry trawl, limited entry fixed gear, and directed open access sectors will soon be available for management. These data will allow much more accurate bycatch estimation and will be progressively integrated into the models currently used to project total catch under alternative management measures

Rebuilding strategies should always use the best available estimates of bycatch, and managers should always seek to improve bycatch accounting and control mechanisms. Data and resulting analyses from the WCGOP have already demonstrated an ability to provide valuable knowledge where limited information and difficult assumptions have existed in the past. Improved understanding of bycatch rates and total mortality will improve fishery modeling by replacing assumptions and surrogate values with fishery-related mortality estimates from direct observation. Additionally, historic catch data could be adjusted to incorporate new methods of estimating bycatch. Stock assessments and rebuilding analyses will benefit from more accurate sources of data on total fishery removals over time. Reducing the uncertainty in stock status and rebuilding projections will more effectively support sound harvest policy and sustainable fishery resource management.

Rebuilding strategies are sensitive to the actual bycatch rate, since successful rebuilding requires accurate accounting of total catch. If bycatch rates are overestimated in the bycatch models, then there will be negative socioeconomic consequences of lower trip limits and/or early fishery closures. If they are underestimated, rebuilding progress will be compromised. Bycatch accounting and control has been one of the weaker elements in groundfish management. With the low OYs specified under rebuilding, improving bycatch accounting and control is critical. With the advent of data from the NMFS Groundfish Observer Program, it is anticipated that more accurate bycatch accounting data from the limited entry trawl, limited entry fixed gear, and directed open access sectors will be available for management. Rebuilding strategies should always use the best available estimates of bycatch, and managers should always seek to improve bycatch accounting and control mechanisms.

Such measures as full retention of bycatch and/or bycatch caps could significantly reduce fishing-related mortality of overfished groundfish species. The WCGOP could be linked with a program of mandatory full retention of rockfish (or other overfished species that would otherwise be discarded dead at sea) during commercial fishing activities to increase accuracy in estimating total catch. This could ensure rebuilding total catch OYs are not exceeded while attempting to access harvestable groundfish species. Mandatory rockfish retention and observer coverage might allow greater flexibility for managers to consider fishing opportunities that might otherwise be considered risky. As long as total catch controls are reliable and responsive to rapid changes in the fishery, such explorations may be acceptably risk-averse. Full rockfish retention would incur a cost to the processing sector since unmarketable rockfish, due to size or condition, would need to be handled and disposed. Bycatch accounting of retained species that would otherwise be discarded at sea may be considered an additional marginal cost, since dockside sampling of landed catch occurs anyway. Sampling the fully retained catch would add to the time and effort involved in dockside sampling, but would not require the implementation of a new sampling system.

A management strategy of bycatch caps (the fishery is closed once landings plus bycatch reach a critical threshold, notably, the total catch OY) would probably entail the need for a significantly higher observer coverage rate, perhaps 100%, if the caps are imposed at the vessel and not the fleet-wide level[13/].. This is because the distribution of fishing efforts resulting in significant bycatch is skewed to a few efforts. Given the nature of highly variable bycatch by time, area, gear, and fishing strategy, the allocational aspects of a management system relying on bycatch caps creates potentially serious repercussions. Such a system might promote derby fisheries where fishermen would compete to get their fish first before a cap is attained. This creates safety risks, a poor supply and demand marketing situation, and a contracted stream of fishery-dependent data (landings and bycatch information) that might be difficult to assimilate and react to in a timely fashion. One mitigative measure to consider in rationalizing a management strategy that depends on bycatch caps may be to develop ITQs for the overfished groundfish species. An ITQ system could be used to buy and sell overfished species' OY, which could leverage more healthy target species landings while maintaining better accounting and control of overfished species' bycatch. The Congressional ITQ ban was lifted last year enabling the Council and NMFS to pursue such a strategy.

7.3.3 Enforcement

Quantitative analyses of the impacts associated with enforcement under the management measure alternatives is not possible at this time. Prior to 2000, groundfish management mainly regulated the amount of landed fish, based on cumulative trip limits. This type of measure has the advantage that monitoring and enforcement can be shore-based because limits are based on landings. But this approach is problematic because discarded bycatch cannot be directly monitored from shore. Depth-based closed areas will likely continue as a way to reduce bycatch by keeping vessels out of areas where overfished groundfish species occur. However, depth-based management introduces a new set of enforcement issues because compliance must occur at sea, requiring additional, more costly at-sea monitoring and enforcement methods. The efficacy of management measures hinges on the degree to which fishers comply with them. Environmental impacts associated with enforcement therefore mainly result from the degree to which catch levels are exceeded because of non-compliance. Furthermore, management and rebuilding of overfished groundfish relies on depth-based closures to minimize bycatch of these species. Illegal fishing activity in closed conservation areas could result in increased bycatch. The degree to which these catches in excess of limits or in closed areas remain unmonitored or under-reported is of crucial importance to effective management. While recognizing that most fishers comply with the rules, the overall level of compliance is influenced by the tradeoff between risk and reward. Fisheries enforcement generally seeks to deter fishers from violating the rules through severe penalties because the cost of constant and comprehensive monitoring using conventional means is high. This strategy relies on a sufficient level of monitoring and enforcement so that the tradeoff between the risk of being caught and severely penalized and the benefits from harvesting fish illegally is tipped in favor of compliance for the great majority of fishers.

7.3.3.1 Geographic Extent of Closed Areas

The geographic extent and the number of the GCAs (which includes the RCA, YRCA, and CCA) can have a profound effect on regulatory complexity. Their boundaries are complex, involving hundreds of points of latitude and longitude to delineate nearshore and offshore fathom curves. The areas are vast, extending along the entire West Coast from Canada to Mexico, and weather and sea conditions are frequently harsh. As a result, ensuring the integrity of conservation areas using traditional enforcement methods (such as aerial surveillance, boarding at sea via patrol boats, landing inspections, and documentary investigation) is difficult. However, the extent of the RCAs, the most extensive and complex of the closed areas, varies greatly among the rebuilding alternatives for bocaccio but are anticipated to relatively consistent for cowcod and yelloweye rockfish. Both the YRCA and the CCA are relatively easy to enforce as they are extensive in area and are

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13/ The current management regime essentially manages for the total catch OY and includes best estimates of landings and discard. This management strategy may be likened to a bycatch cap on a fleet-wide basis.

regularly shaped. Therefore, regulatory complexity and costs to the public sector, due to the size of commercial closed areas and their distance offshore vary the greatest among bocaccio rebuilding alternatives. New information from the WCGOP could result in an expansion in the size of the non-trawl RCA as fixed gear vessels may be moved into deeper waters to protect yelloweye rockfish, but these adjustments are not anticipated to add significant complexity to the regulations and are not a direct response the rebuilding alternatives. One new aspect of these recreational closures is the establishment of waypoints specified by latitude and longitude which define large closed area boundary lines. Previous depth-based closures in the recreational fisheries have only specified a depth contour as a boundary or had established waypoints for a relatively small geographic area (i.e., the YRCA). Although many recreational vessels carry the necessary electronic equipment to chart their location relative to the closed area, it is uncertain what effect expanding the use of specified boundary lines in recreational fisheries will have on recreational fishery compliance. Increased reliance on depth-based closed areas in recreational fisheries adds regulatory complexity and costs to the public sector.

VMS is a tool that is commonly used to monitor vessel activity in relationship to geographical defined management areas where fishing activity is restricted. VMS transceivers installed aboard vessels automatically determine the vessel's location and transmit that position to a processing center via a communication satellite. Issues of regulatory complexity with large closed areas that differ between fishery sectors are significantly addresses but not alleviated with the implementation of VMS. Updating the system to incorporated new management lines and monitoring declarations to fish within closed areas are not without costs.

GCAs prevent vessels from operating in waters where overfished species are commonly found, reducing the overall incidental take of overfished species. If the integrity of the closed areas are not adequately maintained, harvest assumptions could be inaccurate resulting in indirect effects, such as unaccounted for removals. If the integrity of the closed areas cannot be maintained, the risk of exceeding an OY and thereby missing a rebuilding target is increased.

7.4 Discussion of Cumulative Impacts

Cumulative impacts to the public sector result from the combination of past, present and future direct and indirect impacts of management measures combined with the effects of other activities. Ongoing and dramatic changes in the management, enforcement, and monitoring of groundfish fisheries in response to significant reduction in the amount of available resources have combined to force management agencies to consider changes to the management regime.

7.4.1 VMS Expansion

Enforcement methods of patrolling sea areas either by airplane or ship (carried out primarily by the U.S. Coast Guard, although state agencies have some capacity in this regard), and using fishery observers to monitor vessel position, can be used to monitor and enforce closed areas. However, VMS is a superior enforcement technology because the position of vessels with transmitting units can be tracked at all times. NMFS, in consultation with the Council and the VMSC, published a final rule in the Federal Register on November 4, 2003 that requires VMS on all limited entry trawl and limited entry fixed gear vessels beginning January 1, 2004. A complete analysis of the alternatives considered for this program can be found in the Environmental Analysis/Regulatory Impact Review/Regulatory Flexibility Analysis for A Program to Monitor Time-Area Closures in the Pacific Coast Groundfish Fishery (available online at: http://www.nwr.noaa.gov/1sustfsh/groundfish/VMS/VMS_EA_Final.pdf)(NMFS 2003b).

The risk of exceeding OYs due to non-compliance would be greater without the VMS monitoring program in place. Enforcement relying on monitoring by airplanes and ships to identify incursions into the closed areas would not be as effective as VMS. A lot of time and considerable cost would have to be spent investigating any vessel appearing on enforcement radar, whether or not they are legitimately fishing in an area or not. This would reduce the ability of enforcement vessels to cover a large proportion of the closed area in a timely manner, reducing total monitoring and deterrence.

The risk of exceeding OYs would be less if VMS were implemented under any of these alternatives. One of the major benefits of VMS is its deterrent effect. If fishers know they are being monitored, and a credible enforcement action will result, they are less likely to fish illegally in closed areas. In addition, the data collected with a VMS system can be used to better understand the distribution of fishing effort, which is likely to be affected by closed areas.

Depth-based management started in 2002 and became a major tool in the management of overfished groundfish species. Moving fisheries away from areas critical to the health of rebuilding stocks has quickly become a central aspect of West Coast groundfish management. The need to maintain the integrity of groundfish conservation areas through effective monitoring and enforcement is critical if fishery management agencies aim to provide fishing opportunity for healthy stocks while rebuilding overfished species in the future. The cumulative effect of declining fishery resources, increasing reliance on depth-based closed areas, and the long rebuilding time frames for overfished rockfish species have led management agencies to consider expansion of VMS to fishery sectors beyond limited entry fleets. The Council's Ad Hoc Vessel Monitoring System Committee (VMSC) met in October, 2003 to develop criteria and objectives for identifying key fishery sectors to consider of VMS expansion. The VMSC is expected to give the Council a status report on the existing VMS program in June, 2004. At that time the Council is anticipated to consider the VMSC recommendations for the existing program as well as proposals for its expansion.

7.4.2 Fishery Monitoring and Biennial Management

Fishery management tools recently implemented, such as depth restrictions for recreational fisheries if caps on impacts to overfished species are attained, and tools considered for the future, such as individual quotas or bycatch caps, require timely, inseason catch and bycatch information. A cumulative effect of decreasing fishing opportunity and tightened regulations that rely on inseason tracking of fishery impacts is development of data sources that are timely and accurate. Among the tools being developed or considered are electronic logbooks to improve the speed and ease of incorporating at-sea fishery data into management, redesigning the MRFSS program by putting an emphasis on dock-side sampling for more effective inseason use, and expanding the WCGOP. As these data sources expand and our knowledge of the stocks and fisheries improve, management agencies will need to consider mechanisms for incorporating this new information into biennial management. The Council has formed the Ad Hoc Groundfish Information Committee to look into the use of these new data during a two-year management cycle. Fishery management agencies strive to use the best available science when establishing fishery resource policy, but frequent adjustments to the harvest specifications or management measures could erode the benefits of biennial management.

7.4.3 Fleet Reduction and Fishery Rationalization

Fleet reduction and fishery rationalization have been considered by state and federal management agencies since the 1980's. Overcapitalization of the fishery and optimistic expectations of groundfish stock productivity led to overfished species and compromised fishing industries and communities. In response, the Council and NMFS have completed a trawl vessel buyback program to reduce the size of the limited entry fleet. Additionally, the Council will begin to explore the potential for individual quotas, in part, as a means of providing regulatory flexibility and economically viable fishing communities. The cumulative effects of past management practices, current fishery crises, and the foreseeable need to rebuild overfished species and strengthen coastal economies have combined to make these dramatic changes to the management regime attractive to the fishery regulatory agencies.

7.4.4 Potential Unintended Consequences

Another way of looking at cumulative impacts is to identify the potential unintended consequences of the proposed action. The proposed action has an express purpose, as discussed in Chapter 1. However, when combined with other actions or external effects, the proposed action may have other effects. By definition, any description of unintended consequences must be speculative because they cannot be fully anticipated. But this discussion helps inform the public as to the potential range of effects stemming from the proposed action.

Increased monitoring and enforcement of commercial and recreational fisheries as fisheries are constrained under rebuilding plans could have unintended consequences. Potential results could include information about the status of species not previously assessed that could result in the identification of new conservation concerns or an underutilized resource. Increased reliance on research activities such as trawl surveys, submersible surveys, and acoustic surveys as the availability of long-term fishery-dependent data sources could potentially erode resources that have historically been reserved for long-standing monitoring programs and data systems for tracking landed catch. Management measures designed to achieve lower OYs for overfished species could evolve into fishing techniques, gear types, or fishing grounds that are very different from traditional methods. There could be additional costs to the management regime from development of new programs to monitor catch and bycatch, modification and adjustment of historical and new data sets for stock assessment or population trend analysis, and designing new enforcement techniques.

7.5 Summary of Impacts

7.5.1 No Action Alternative

7.5.1.1 Bocaccio

The near-zero short-term OYs associated with this alternative for bocaccio would have substantial impacts to the public sector and fishery management regime in areas south of Cape Mendocino, California. As occurred in 2003, constraining OYs lead to complex regulations that seek to minimize impacts to bocaccio by limiting fishery access to large areas that bocaccio inhabit. These regulations incur costs to the public sector through increased enforcement burdens and a greater likelihood of frequent inseason management adjustments. Additionally, alternatives with low OYs and corresponding fishery restrictions limit the availability of fishery-dependent data. Increased reliance on research fisheries and surveys and greater uncertainty in the stock assessment results impacts the public sector through increased costs associated with research activities and increased management risk.

7.5.1.2 Cowcod

There is a negligible difference in the harvest levels and subsequent effects of the No Action Alternative and the two action alternatives for rebuilding cowcod. All alternatives are essentially the same, prescribing zero or near-zero harvests and complete avoidance strategies. Realistically, the zero harvest under the No Action Alternative and the most liberal annual harvest level of 4.8 mt in the Conception and Monterey areas combined is functionally the same, given our abilities to detect such small impacts in the affected fisheries.

Closing areas of highest density and preferred habitat should be a relatively effective way to protect cowcod given the sedentary lifestyle of adults. The existing CCAs in the Southern California Bight are in areas determined to be preferred cowcod habitats based on records showing these areas to be where the highest catch rates in recreational and fixed gears occurred (Butler *et al.* 1999). They are relatively easy to enforce since they are extensive and regularly shaped. It is not anticipated that the size or configuration of the CCA will be modified in response to the rebuilding alternative chosen resulting in negligible differences in impacts to the public sector relative to the management regime currently in place for cowcod.

7.5.1.3 Widow

The No Action Alternative is not legally viable for rebuilding widow rockfish since this stock is predicted to take longer to rebuild than the maximum allowable rebuilding time or not rebuild at all.

7.5.1.4 Yelloweye

There is little difference in the No Action Alternative and the action alternatives to rebuild the coastwide yelloweye rockfish stock. The 4-6 mt difference in harvest limits between the most liberal and most conservative alternatives analyzed is arguably not within the current data monitoring systems' capability to precisely differentiate. The No Action Alternative for rebuilding yelloweye rockfish is not legally viable given that the stock does not rebuild in the maximum allowable time (T_{MAX}) according to the National Standard Guidelines. This is due to the escalating harvest rate as biomass increases under the 40-10 rule.

Area closures and marine reserves for yelloweye rockfish, similar to the Yelloweye Rockfish Conservation Area in northern Washington waters, may be an effective complement to a yelloweye rockfish rebuilding strategy given the sedentary nature of adults. A more regional management approach may also be advised to avoid further serial depletion of localized yelloweye populations. It is not anticipated that the size or configuration of the YRCA will be modified in response to the rebuilding alternative chosen resulting in negligible differences in impacts to the public sector relative to the management regime currently in place for yelloweye rockfish.

7.5.2 Action Alternative 1

Action Alternative 1 generally prescribes the highest harvests considered by the Council for rebuilding bocaccio, cowcod, widow rockfish, and yelloweye rockfish. It is unlikely that this level of harvest will be attained for bocaccio, cowcod, and yelloweye rockfish under the current management regime because of the constraints imposed by the need to rebuild canary rockfish (Table 5-12). Active management of the midwater trawl fisheries targeting Pacific whiting (see section 5.3.3) may be all that is required to restrict widow rockfish bycatch under Action Alternative 1. This alternative assumes the lower impacts to the public sector and fisheries management regimes than the No Action Alternative since it prescribes the higher OYs that may result in the least extensive RCA designations. Additionally, higher OYs provide greater management flexibility allowing fishery managers to consider attributing a portion of the available OY as a buffer against exceeding OYs and potentially compromising rebuilding objectives. This risk averse strategy could also result in a decreased need for inseason management including fishery closures. Impacts to the public sector related to enforcement under Action Alternative 1 are potentially mixed. Regulatory complexity could be reduced relative to the other alternatives with less extensive RCAs, fewer closed periods, and less frequent inseason adjustment creating a more enforceable set of management measures. However, this could be offset to some degree as additional fishing opportunity increases fishing effort and the need for more enforcement patrols.

7.5.3 Action Alternative 2

Action Alternative 2 is more constraining to shelf fisheries than Action Alternative 1, but may have similar effects as Action Alternative 1 for non-whiting shelf fisheries due to canary rockfish rebuilding constraints. The whiting fishery would be more dramatically constrained under Action Alternative 2 since there is very little available widow rockfish OY if non-whiting fisheries continue to be held harmless. Impacts to the public sector and the fisheries management regime would likely be similar to those under Action Alternative 1. More stringent management of the whiting-directed fishery would require closer monitoring and inseason tracking of catch and bycatch incurring more costs to the public sector than under Action Alternative 1.

7.5.4 Action Alternative 3

Action Alternative 3 is more constraining than action alternatives 1 and 2. It is likely that the available widow rockfish OY under this alternative will not accommodate current non-whiting shelf fishing opportunities since widow bycatch probably cannot be managed solely within the whiting fishing sectors under this alternative. Therefore, the expected impacts to the public sector and the fisheries management regimes are likely to be more significant as RCAs are extended and regulatory complexity increases. Potential management measures under this alternative are less likely to afford buffers as the lower widow rockfish OY becomes constraining to more fishing sectors. Restricted shelf opportunity could lead to management measures with increased regulatory complexity as specific time and area restrictions proliferate in an attempt to find ways to harvest under utilized species while avoiding overfished species. Enforcement burdens under this alternative would likely be great as large areas are restricted or closed to fishing and fishery seasons become shorter and perhaps more sporadic. Action Alternative 3 would likely incur considerable costs to catch and bycatch monitoring systems as lower OYs create increased management reliance on catch and bycatch accounting.

7.5.5 Action Alternative 4

Action Alternative 4 specifies the lowest OYs considered by the Council for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. However, this is the same cowcod OY specified under action alternatives 2 and 3. The bocaccio OY under Action Alternative 4, assuming the STATc base model, becomes much more constraining to shelf fisheries south of Cape Mendocino. Current fishing opportunities in these waters would not likely be fully accommodated under this level of harvest (Tables 2-1 and 5-12). Therefore, impacts to the public sector and the management regime would be similar to but greater than those under Action Alternative 3. The widow rockfish OY under Action Alternative 4 is near-zero and would result in very stringent management measures on the shelf coastwide. The whiting fishery could not be accommodated at all under this alternative and any non-whiting shelf fishery with an estimated bycatch of widow (Table 5-12) would have to be dramatically displaced or eliminated altogether. Therefore, under this alternative, widow rockfish becomes the most constraining stock for most shelf fisheries on the U.S. West Coast. Constraining OYs for widow rockfish could lead to complex regulations that seek to minimize impacts to widow rockfish by limiting fishery access to large areas that widow rockfish inhabit. These regulations incur costs to the public sector through increased enforcement burdens and a greater likelihood of frequent inseason management adjustments.

7.5.6 Action Alternative 5 (Council Preferred)

This alternative will be specified by the Council at its April 2004 meeting in Sacramento, California.

8.0 SOCIOECONOMIC ENVIRONMENT

8.1 Affected Environment

The Pacific Coast groundfish fishery is a multi-species, multiple gear fishery that takes place off the coasts of Washington, Oregon, and California. Maintaining year-round fishing opportunities for groundfish has been one of the primary management objectives for the fishery. Pacific Coast groundfish support or contribute to a wide range of commercial, recreational, and tribal fisheries and the communities dependent on these fisheries.

Commercial fisheries targeting groundfish are, for the most part, regulated under a license limitation program implemented in 1994. Fisheries targeting groundfish that are not under the license limitation program, and fisheries that catch groundfish incidentally while targeting nongroundfish species, are termed open access. The Council allocates commercial harvest (OYs) between limited entry and open access fisheries.

Chapter 6.0 and 6.1 of the Appendix A describe the historical context of West Coast groundfish fisheries. Detailed information on target strategies and vessels participating in the commercial fisheries is provided in Appendix B to this document.

Buyers and processors and the rest of the seafood distribution chain are important value added components of regional fisheries and are described in Section 8.1.3.

Marine recreational fisheries include operators and passengers of both charter and private vessels. Charter vessels are larger vessels for hire that can typically carry more passengers and fish farther offshore than most private recreational vessels. Both nearshore and shelf opportunities are important for West Coast recreational groundfish fisheries. Recreational fisheries are addressed in Section 8.1.4.

In addition to these fisheries, Native American tribes in Washington, primarily the Makah, Quileute and Quinault, harvest groundfish in the EEZ. There are set tribal allocations for sablefish and Pacific whiting, while allocations for the other groundfish species are determined through the Council process in coordination with the tribes, states and NMFS. Tribal groundfish fisheries are described in Section 8.1.5.

8.1.1 Valuing Consumptive Use, Non-consumptive Use and Non-use

The sectors benefitting from a fisheries resource can be divided into three groups: consumptive users (e.g., commercial harvesters, processors and recreational fishers), nonconsumptive users (e.g., divers interested in viewing wildlife), and nonconsumptive nonusers (e.g., members of the general public who derive value from knowing that fish species are being maintained at healthy biomass levels).

Economic valuation assessments measure the economic welfare that users derive from fish resources. Anglers obtain benefits above and beyond their expenditures, however these benefits are not revealed through spending in the market place. Non-market valuation methods are therefore used, such as the hedonic price approach (Mendelsohn *et al.* 1992), the travel cost method (Smith 1989), and the contingent valuation method (Hoehn 1987).

The hedonic model is limited in its scope of application (Getz and Huang 1978), so the travel cost and contingent valuation methods are more commonly employed. The comparative measurement using any of these methods is to subtract fishing costs from the assessed benefit to derive net economic value (NEV). This differs from gross economic value where the assessed benefit is added to the actual expenditures to fish. Calculating per trip NEV for recreational fishing is controversial because, theoretically, total fisheries effort, total benefits, and total costs would first have to be known. Moreover, this calculation would result in an average value when it is marginal value that should be used for assessing incremental changes in fisheries. (Marginal net economic value is what an angler is willing to pay to catch an additional fish less costs for pursuing that fish.)

Per trip NEV estimates available from other studies are often used as placeholders until more recent information from more relevant studies is available. The borrowing of trip related NEV estimates from other places/studies is called the benefit transfer approach. A major problem with this approach is the assumption that individuals share a common representative utility function. Practically speaking, one individual will place a value on a fishing experience based on a number of variables, including catch rates, size of fish, site characteristics, and their own personal avidity and motives to fish. Intuitively, transferring values from one group fishing in one location to another group at a different location at a different time may introduce large errors in the estimate. When selecting studies to borrow per trip values, minimizing the differences in site and species conditions, angler demographics and motivations will help alleviate errors.

There are also other use values that are not included in trip and angler counts. Data sources generally only tabulate consumptive trip purposes, but trips can be made for nonconsumptive use of fish resources. Diving to observe fish is one example. Other examples of non-consumptive use values include scientific research, indirect benefits from preserving ecological functions, etc. (Bishop 1987).

Non-Use Values

There are also other valuations that can be given to fish resources. Some people are willing to pay for a resource, even though they never use it. This type of non-use value is called existence value, because people are willing to pay to insure that the resource exists. Variations in existence value include the case where people are willing to pay for the chance to use it in the future (option value), or to insure the resource exists for future generations to enjoy (bequest value). These types of values are useful concepts for understanding what it means to measure the worth of resources. While the modeling for this project did not calculate non-use values, all types of values to society may be important to decision makers. For example, if a particular fish resource is not threatened with extinction, then existence values may be less relevant. If there are vary large effects on fish resources through management actions, then the average use values are important. If there are only incremental changes, then the marginal use value would be a more applicable comparison.

Additional discussion on nonconsumptive sectors is provided in Section 7.3 of Appendix A.

In economic terms, the choice between alternative rebuilding trajectories for an overfished species involves a tradeoff between current costs and future benefits. For consumptive users of the resource, in the near term, additional costs are born by the commercial fleet, processors, and recreational fishers who may be left with much smaller harvests than they had been accustomed to. While this near term sacrifice may create greater harvest opportunities in the future once the stock has been rebuilt, many users will be unable to weather a long down period, opting instead to go out of business. Therefore, many of the consumptive users emerging after a stock has been rebuilt may be different from those existing before the rebuilding period began.

From the perspective of a non-user, who may derive benefit primarily from increases in the biomass of a rebuilding species, the faster the rebuilding trajectory generally the better. Public policies that rebuild a species more slowly while maintaining a consistent flow of resource for consumptive users may have less value to the nonconsumptive user than a policy that rebuilds more rapidly by imposing greater constraints on consumptive users.

8.1.2 Primary Seafood Producers (Commercial Vessels)

The annual harvest pattern of the commercial seafood groundfish fishery in the context of all other West Coast fisheries is reported in Tables 6-1 and 6-2 (and displayed graphically in figures 6-1 and 6-2) of Appendix A. These generally show that landings in all species categories declined steeply after 1998, when various groundfish began to be designated overfished. Rockfish harvests show the most precipitous fall—by about three-quarters from 1998 to 2002. Overall, groundfish landings measured by weight peaked in 1994 at 305,312 mt and have declined by about half since then. Measured in constant dollars, the value of groundfish landings was greatest in 1997 at almost $93 million. By 2002 this had fallen by about 45%.

Figures 6-3 through 6-8 graph the seasonal distribution of state landings and at sea deliveries of groundfish and non-groundfish species during 2002. Figures 6-9 through 6-14 repeat the same information but in terms of exvessel revenue. These tables and figures highlight the relative unimportance of groundfish in total landings in California, and the pronounced increase in total groundfish landings in Washington and Oregon during the summer months due to the shoreside whiting fishery. Combined with the at-sea whiting fishery, the coastwide totals show an additional spike in groundfish caught during May due to the inclusion of the at-sea data. However these table and figures also highlight the relatively low exvessel value contributed by the whiting sectors.

8.1.2.1 Commercial Groundfish Vessel Regulatory Groupings

Table 6-3 breaks out historical landings for the limited entry trawl, limited entry fixed gear, and open access fleets. The table clearly shows the decline in weight and value of harvests by the limited entry trawl fleet between 1998 and 2002. In contrast, both weight and value of harvests by limited entry fixed gear vessels has remained fairly constant; and the trend pattern for the open access vessels is less clear.

Appendix B to this report details landings and, where available, total catch estimates of important target and overfished species by West coast fisheries for 1998, 2000 and 2002. These trip target categories were developed following methods developed by (Hastie 2001) trips were categorized by primary target based on the distribution of species present in the trip landings.[14/] Hastie's method only covered the groundfish trawl fisheries. To develop indicators of bycatch in other fisheries, nontrawl trips were assigned a target strategy based on the preponderance of a particular target species in the catch. For nontrawl groundfish trips, any trip in which 50% or more of the species landed was groundfish was categorized as a groundfish trip. Nontrawl groundfish trips were further subdivided by depth association of the species (slope, shelf, and nearshore). Trips in which sablefish were landed were assigned to a sablefish target if the amount of sablefish landed exceeded the amounts landed in the slope, shelf, or nearshore species groups. Trips were assigned to a whiting target strategy if there were more whiting landed than any of the other four species groups (sablefish, slope species, shelf species, nearshore species). Nongroundfish trips (trips with <50% groundfish) were categorized into a target strategy based on the plurality of the species in the catch (i.e., based on the species that was most abundant in the landing, even if that species comprised less than 50% of the total catch).

14/ Beginning in 2003, seven types of trawl target strategies were eliminated from modeling because effort had diminished due to regulatory constraints (POP, chilipepper, yellowtail, canary, widow, other rockfish, and lingcod). However because this analysis included 1998 through 2002 fisheries, these seven target types were included along with the targets used by Hastie for analysis of the 2003 fishery (whiting, arrowtooth, petrale, flatfish, widow/yellowtail midwater, DTS, slope rockfish, and leftover).

Limited Entry Trawl

Table 6-4 of Appendix A shows annual harvests of major species groups recorded by the limited entry trawl fisheries north and south of Cape Mendocino between 1998 and 2002. The table emphasizes the dramatic decline in total groundfish landings over the period. At the same time landings of non-groundfish appeared to increase somewhat.

Among the four overfished species addressed in these rebuilding plans that are listed in Tables 3.4-13 through 3.4-16 of Appendix B (Bocaccio, Cowcod, Widow and Yelloweye), the species most consistently caught by limited entry trawl strategies was widow rockfish in both 1998 and 2002, north and south of Cape Mendocino. There were also fairly consistent encounters with bocaccio, yelloweye and cowcod south of Cape Mendocino in 1998, although these were generally reduced in 2002.

Limited Entry Fixed Gear

Table 6-5 of Appendix A shows annual harvests of major species groups by the limited entry fixed gear fisheries north and south of Cape Mendocino between 1998 and 2002. The table shows that total groundfish landings over the period remained fairly flat, although landings of rockfish species showed significant decline both north and south of Cape Mendocino. At the same time landings of non-groundfish species, especially pacific halibut, appeared to increase.

Among the four overfished species addressed in these rebuilding plans that are listed in Tables 3.4-13 through 3.4-16 of Appendix B (Bocaccio, Cowcod, Widow and Yelloweye), the species most consistently caught by limited entry fixed gear strategies in 1998 were widow north of Cape Mendocino, and yelloweye and bocaccio south. Encounters with all three species dropped fairly dramatically in 2002.

Open Access Groundfish

Table 6-6 of Appendix A shows annual harvests of major species groups recorded by the groundfish open access fisheries north and south of Cape Mendocino between 1998 and 2002. The table shows that total groundfish landings over the period generally declined, led by decrease in rockfish landings. This pattern was most significant south of Cape Mendocino in parallel with the reduction in spot prawn trawl landings. At the same time, total landings of non-groundfish species nearly doubled, led by pink shrimp and CPS.

Among the four overfished species addressed in these rebuilding plans that are listed in Tables 3.4-13 through 3.4-16 of Appendix B (Bocaccio, Cowcod, Widow and Yelloweye), the species most consistently caught by open access strategies in 1998 were widow rockfish (trawl) and yelloweye (fixed gear) north of Cape Mendocino, and widow rockfish (trawl) and bocaccio (trawl and fixed gear) south of Cape Mendocino. Encounters with all three species by the open access fleets dropped substantially in 2002 in both areas.

8.1.2.2 Vessel Involvement and Dependence

The concepts of dependence and involvement in fisheries are derived from national standard 8 in the MSA. This standard requires consideration of the effect of conservation and management measures on fishing communities. The Act defines a fishing community as "a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources." These concepts are, by extension, used to characterize fishing fleets and processors coastwide, with the term involvement substituting for engagement, which is not defined in guidelines. Dependence refers to the proportion of a fishery sector's revenues derived from fishery management unit species. Vessels and processors having a higher proportion of groundfish in their catch or product, for example, are more dependent on groundfish. Involvement refers to the relative importance of a fishery sector in terms of the proportion of the total catch of managed species they account for. A fishery sector or community that accounts for a relatively high proportion of the total groundfish catch, for example, is considered more involved in groundfish fisheries. A community or fishery sector may be heavily involved in groundfish fisheries even if income from these species account for a relatively small proportion of the local economy or a small proportion of total exvessel revenue. Seattle, for example, is substantially involved in groundfish fisheries, but groundfish-related activity accounts for only a small part of the local economy.

Catcher vessel owners and captains employ a variety of strategies to fill out a year of fishing. Fishers from the northern ports may fish in waters off of Alaska, as well as in the West Coast groundfish fishery. Others may change their operations throughout the year, targeting on salmon, shrimp, crab or albacore, in addition to various high-value groundfish species. Factory trawlers and motherships fishing for or processing Pacific whiting off of the West Coast usually also participate in the Alaska pollock seasons, increasing the vessels' and crews' days at sea. Commercial fisheries landings for species other than groundfish vary along the length of the coast. Dungeness crab landings are particularly high in Washington state, squid, anchovies, and other coastal pelagics figure heavily in California commercial landings, with salmon, shrimp, and highly migratory species like albacore more widely distributed, and varying from year to year.

There is also some degree of gear loyalty for groundfish trawl, line and pot vessels participating in nongroundfish fisheries. For example, a notable proportion of the participation in the trawl fisheries for shrimp and prawn is by groundfish trawl vessels. Similarly, groundfish hook-and-line vessels also show high participation in the troll fisheries for salmon and albacore. And, while all three gear groups participate in pot fisheries for crab, groundfish pot vessels generally show the highest levels of participation in pot fisheries for crab and other crustaceans.

Table 6-16 of Appendix A summarizes vessel involvement in groundfish and other West Coast fisheries in a recent year. The table arrays vessels making the greatest total landings (measured in dollars) from all West Coast fisheries activities against those making the greatest landings from groundfish fisheries. The table shows that of the 397 vessels that together claimed 50% of total revenue from fisheries, 221 of these vessels landed some groundfish and together 93 of them claimed 50% of groundfish-related revenue. The table also highlights the very large number of vessels (934 + 1,957 = 2,891) that account for the bottom 10% of total landings and have little or no involvement in groundfish fisheries.

Table 6-17a of Appendix A shows the number of vessels by level of dependence on the groundfish fishery. The table shows that a relatively large number of the most involved (total revenue at least $50,000) groundfish limited entry trawl vessels were most dependent on groundfish (received at least 65% of total revenues from groundfish landings). The most involved limited entry fixed gear vessels were relatively less dependent on groundfish. Most of these vessels received less that 65% of total revenue from groundfish landings. However a majority of the limited entry longline and pot vessels with less than $50,000 total revenue were relatively dependent on groundfish for those revenues. This was also true for most of the open access vessels that had at least 5% of total revenues from groundfish landings. Table 6-17b of Appendix A shows, respectively, total exvessel revenue and gross revenue from groundfish for the vessels categorized in each cell of table 6-17a.

Table 6-18a of Appendix A groups the vessels in the groundfish dependence categories shown in the previous two tables by vessel length. The table shows that a cluster of the most groundfish-dependent limited entry trawl vessels (those receiving at least 65% of total revenues from groundfish landings) were between 50 and 70 feet in length, with another cluster between 70 and 150 feet in length. The limited entry fixed gear fleet tends to be composed of smaller vessels (less than 50 feet) with a less discernable pattern of dependence on groundfish by length. The category of open access vessels with at least 5% of total revenues from groundfish landings were predominantly vessels less than 40 feet in length. The majority of these were also relatively dependent on groundfish. Table 6-18b shows, respectively, total exvessel revenue and gross revenue from groundfish for the vessels categorized in each cell of Table 6-18a.

Table 6-19a of Appendix A shows the number of commercial vessels by length category operating in different fisheries by West Coast fishing area. Coastwide, a majority of vessels operating in limited entry trawl fisheries on the slope and shelf were at least 60 feet in length. The vast majority of the larger vessels and limited entry trawlers were operating from the Eureka area north. Trawl vessels that landed nearshore species, and the vast majority of vessels in the limited entry fixed gear and open access fisheries, tended to be less than 60 feet in length. Most of these smaller vessels were primarily operating from the Monterey area south.

While many limited entry vessels appeared to land both shelf and slope species, slope species were a fairly minor component of total revenue for most vessels except limited entry trawlers. In this vessel category the share of revenue from slope species tends to increase with vessel size, so larger vessels tend to be more invested in slope fisheries than smaller ones. Table 6-19b of Appendix A shows for vessels in each length category engaged in the designated fisheries, the share of exvessel revenue resulting from landings of species caught in the fishery by fishing area. The table shows that smaller trawlers tend to rely on nearshore rockfish for a substantially greater portion of their revenue than do the larger trawlers.

8.1.2.3 Trip Categorization and Catch Composition

Appendix B describes the results of a detailed analysis of groundfish catch in West Coast fisheries. Using methods developed by Hastie (2001), groundfish trawl trips were categorized by primary target based on the primary catch complex present in each trip. However Hastie's method only covered the groundfish trawl fisheries. To develop indicators of bycatch in the other commercial fisheries, nontrawl trips were assigned a target strategy based on the preponderance of a particular target species in the catch. For nontrawl groundfish trips, any trip in which at least half of the species landed were groundfish was categorized as a groundfish trip. Nontrawl groundfish trips were further subdivided by depth association of the species landed (slope, shelf, or nearshore). Trips landing sablefish were assigned to a sablefish target if the amount of sablefish exceeded the amounts of the other species groups landed. Trips were assigned to a whiting target strategy if there was more whiting landed than any of the other four species groups (sablefish, slope species, shelf species, nearshore species). The remaining trips (trips with less than 50% groundfish) were assigned a nongroundfish target strategy based on the plurality of species present in the catch (i.e., based on the species that was most abundant in the landing, even if that species comprised less than 50% of the total catch).

The commercial fisheries target strategies described in Appendix B are used in the discussion in the following section.

8.1.2.4 Species Complex Values and Allocation Among Sectors Over Time

One of the primary functions of the Council is to allocate the commercially available harvest among gear groups, target strategies and time periods. Each period, the Council recommends a suite of harvest regulations designed to allocate available harvest among users in what the Council believes is an optimal fashion. The Council will likely vary the allocation between the different fisheries over the duration of a rebuilding plan based on changing information about bycatch rates, marginal values and the abundance of associated species, management of which may affect the amounts of target species available for harvest. In determining an optimal allocation, the Council takes into account equity, geographic allocation, and other social factors in addition to economic efficiency.

When available harvests of overfished species are low, the economic value of each harvestable pound is likely to be substantially greater than when available harvests are larger. As an extreme example, suppose the rebuilding schedule adopted for a particular overfished species requires zero harvest mortality in a given year. Then even though fishing-related mortality of the overfished species may be rare, all fishery activity that poses any risk of impacting the species may be shut down. Such would be the case under a strategy designed to maximize the probability of rebuilding (P_{MAX}) within the shortest possible time period (T_{MIN}). Although not analyzed in detail for any of the overfished species in this document, adopting such a strategy would maximize benefits that are not dependent on the amount of fish harvested, such as existence values, while eliminating virtually all harvest-related benefits derived from the fishery.

Appendix B Table 3.4-20 shows the value of total landings per pound of overfished species taken (as target or bycatch) by each target strategy. The table includes data for two years (1998 and 2002) and covers the four overfished species treated in this document as well as the four species covered in the previous rebuilding document (Amendment 16-2). These values can be used as an indicator of the possible reductions in exvessel value per pound of overfished species harvest forgone to improve rebuilding prospects for the species. Table 3.4-20 shows, for example, that the value of each pound of bocaccio taken in the 70 pink shrimp trips conducted in 1998 south of Cape Mendocino was about $25,000 dollars. Similarly each pound of lingcod taken was worth about $8,500 to the pink shrimp fishery.

These type of measures may be able to be used in managing the fisheries. In order to maintain high economic value of the available resource, if additional harvest of constraining overfished species is allocated first to the low bycatch rate fisheries with high exvessel revenue per unit of overfished species taken, and then subsequently allocated to fisheries with successively higher bycatch rates and lower revenues per unit of overfished species taken, then the potential economic benefit per pound of overfished species harvested would be maximized. Benefits per pound of overfished species diminish as harvest levels (OY) increase. Thus, the average value per pound of overfished species in a year when only 20 mt of the species is available is likely to be much greater than when there are 120 mt available. Similarly, forgoing harvest of an overfished species when the harvest level is low would reduce revenues substantially more than it would when the allowable harvest level is higher.

8.1.3 Seafood Distribution Chain

The seafood distribution chain begins with deliveries by the harvesters (exvessel landings) to the shoreside networks of buyers and processors, and includes the linkage between buyers and processors and seafood markets. In addition to shoreside activities, processing of certain species (e.g. Pacific whiting and pollock) also occurs offshore on factory ships.

8.1.3.1 Buyers and Processors

The following discussion focusing on buyer involvement and dependence on groundfish fisheries is summarized from Appendix A section 7.1.

The buyer/processor segment of the fishery is quite concentrated with approximately 5% of the buyers responsible for 80% of the purchases (Appendix A Tables 7-1 and 7-2). Several thousand entities have permits to buy fish on the West Coast. Of these 1,780 purchased fish caught in the ocean area and landed on Washington, Oregon or California state fishtickets in the year 2000 (excluding tribal catch) and 732 purchased groundfish (Appendix A Table 7-1). Larger buyers are more apt to handle groundfish than smaller buyers. Of the 546 buyers purchasing at least $20,000 of West Coast landings, 59% bought groundfish (Appendix A Table 7-2). These 546 buyers bought 99% of all Council- managed groundfish. Only 33% of the remaining 1,234 buyers bought groundfish.

Of those buyers handling groundfish, substantially fewer buy groundfish from trawl vessels. Only 17% (125)

of all groundfish buyers, and only 7% of all buyers, handled fish from trawl vessels (Appendix A Table 7-3). These 125 buyers are important to nontrawl vessels as well, handling 60% (by value) of the groundfish caught by nontrawl vessels.

The largest buyers are more apt to handle trawl vessels than are smaller buyers. Of the 38 largest buyers of groundfish, 73% (28) bought from trawl vessels (Appendix A Table 7-1). These 28 buyers accounted for 78% of all groundfish purchases from trawl vessels (Appendix A Table 7-3). These 28 buyers also handle 39% of nontrawl purchases. Mid-size buyers tend to be more important for nontrawl vessels than for trawl vessels, accounting 50% of all exvessel sales from nontrawl vessels, as compared to 22% for trawl vessels (Appendix A Table 7-3).

Without data on processor revenue and costs, gross exvessel value of purchases is used as an indicator of processor dependence on groundfish purchases. Large buyers of groundfish tend to have a lesser percentage of their overall purchases from groundfish than do smaller buyers (Appendix A Table 7-4). In the table, buyers are categorized by the proportion of total purchases that are groundfish. By this measure, the distribution of large buyers has a single mode (a single peak) in the 5% to 35% range. The distribution of smaller buyers tends to be bimodal with peaks in the 0% to 5% range and the 95% to 100% range. For smaller buyers this may indicate either that groundfish are purchased as part of the incidental catch from fisheries targeting other species (the buyers with 0% to 5% of their purchases from groundfish) or that the buyers are specialty buyers or handling their own catch (the small buyers with 95% to 100% of their purchases from groundfish).

8.1.3.2 Seafood Markets

West coast rockfish are generally valued for high quality fillets. Due to their relatively large size and high quality, these species have historically been important targets in their respective fisheries up and down the coast. Rockfish fillets compete generically in regional markets with similar products originating from other domestic fisheries as well as abroad. West Coast rockfish products tend to be marketed in the region rather than exported, although historically Japan was a major buyer, especially of POP. Rockfish fillets are marketed generically as red snapper or Pacific snapper in regional markets.

Some rockfish species have also become an important component of the emerging high-value, live fish fishery supplying West Coast restaurants. Average prices for exvessel deliveries and "processed" live fish products are significantly higher than for fresh or frozen products caught using more traditional means.

8.1.4 Recreational Fishery

The following discussion is summarized from Appendix A section 6.2.

The distribution of resident and non-resident ocean anglers among the West Coast states in 2000 is shown in Appendix A Table 6-7. The table demonstrates the importance of recreational fishing, especially in Southern California. The estimated number of recreational marine anglers in Southern California was two and a half times the number in the next most numerous region, Washington state. While the bulk of recreational fishers in all areas were residents of those areas, a significant share were non-residents. Oregon had the greatest share of non-resident fishers at more than one-fifth of total ocean anglers.

Recreational fishing in the open ocean has generally been on an increasing trend since 1996 (Appendix A Table 6-8); however, charter effort has decreased while private effort increased during that period. Part of this increase is likely the result of longer salmon seasons associated with increased abundance. Some effort shift from salmon to groundfish likely occurred prior to 1996 when salmon seasons were shortened. Groundfish are both targeted and caught incidentally when other species, such as salmon, are targeted. While the contribution of groundfish catches to the overall incentive to engage in a recreational fishing trip is uncertain, it seems likely that the possibility or frequency of groundfish catch on a trip adds to overall enjoyment and perceived value.

8.1.4.1 Recreational catch of overfished species

Estimated recreational catch of overfished groundfish species by vessels operating in ocean areas during 1998 through 2002 is shown in Appendix A Table 6-15. The table splits out catch by sub region (Southern California, Northern California, Oregon, and Washington), and by type of vessel (charter and private, including rentals). These estimates were generated using RecFin data gathered from MRFSS and other port sampling procedures. Note that catch estimates for 2002 are preliminary.

There is no recreational fishery where darkblotched rockfish is either targeted or taken incidentally. Also, no significant amounts of POP are caught recreationally. There is, however, significant recreational catch of several other species. For example, canary rockfish are harvested primarily in Northern California and Oregon, with smaller amounts taken in Southern California and Washington. The bulk of canary rockfish were taken by charter vessels in all years shown except for 2002.

Lingcod is landed coast wide, but the majority of harvest occurs in Northern California and Oregon. Unlike canary rockfish, the bulk of lingcod were taken by private boats. Of the overfished species, lingcod were by far the most commonly caught species in the ocean recreational fisheries each year.

Other overfished groundfish species caught in the recreational fishery include bocaccio, cowcod, widow rockfish and yelloweye rockfish. Note that bocaccio is only considered overfished in Southern California. Cowcod are encountered almost exclusively in Southern California. Cowcod catch has diminished in recent years due to more restrictive management measures, including establishment of an exclusive conservation area. Widow rockfish are caught primarily in Northern California, and occasionally in Oregon, but rarely in Southern California or Washington. Yelloweye rockfish are caught throughout Washington, Oregon, and Northern California, especially north of Cape Mendocino. Yelloweye rockfish are rarely caught in Southern California.

8.1.4.2 Recreational catch by region

Table 8-1 shows ocean recreational catch of major species and species groups by region and mode (private and charter) on the West Coast in 2002. The table shows almost one half of the total recreational groundfish harvest occurred in Northern California. Nearshore rockfish species accounted for one half of this. More than two thirds of shelf rockfish species caught were in Southern California. California claimed more than two thirds of the recreational groundfish harvested, and almost three quarters of the total recreational harvest. Half of the total salmon recreational harvest was landed in Washington. This comprised more than 80% of Washington’s total recreational harvest. While Northern California’s salmon catch was nearly as great as Washington’s, it comprised less than half of the region’s total recreational harvest.

8.1.4.3 Seasonality and Participation in Recreational Fishing

Fishing effort is related to weather, with relatively more effort occurring in the milder months of summer, and relatively less in winter (Appendix A Table 6-9). As might be expected, this effect is more pronounced in higher latitudes, although the reasons include opportunity as well as climate. Salmon seasons are longer in California than in Oregon, which in turn are longer than in Washington. Until recently, groundfish seasons were also more restrictive in Washington, with the lingcod season being closed from November through March.

8.1.4.4 Recreational Charter Industry

The distribution of West Coast charter vessels engaged in ocean fishing in 2001 is shown in Appendix A Table 6-10. The table shows that more than half of the charter vessels operated from California ports. Table 8-1 shows the distribution of catch of major species groups between charter and private recreational vessels in 2002. The table shows that coastwide recreational charters accounted for about one third of salmon caught and more than one half of total groundfish. Charters in Washington and Oregon accounted for about two thirds of total groundfish catch.

8.1.4.5 Private Fishers and Markets for Recreational Fishing Experience

Just as West Coast commercial groundfish is only one segment of a broader food market, the groundfish recreational fishery represents only one segment of a broader recreational market. Other types of marine recreational angler trips, freshwater angling, and other recreational activities are, to varying degrees, potential substitutes ocean groundfish fishing.

Demand for recreational trips and estimates of the economic impacts resulting from recreational fishing are based on numbers of anglers. Unfortunately, reliable data are not available on the number of West Coast anglers targeting specific species.

However, data are available on the total number of saltwater anglers, and it is evident the presence of opportunities to catch species other than directly targeted ones increases the propensity of anglers to fish and the value of the overall recreational fishing experience. In the U.S., over 9 million anglers took part in 76 million marine recreational fishing trips in 2000. The Pacific coast accounted for about 22% of these participants and 12% of trips. Seventy percent of West Coast trips were made off California, 19% off Washington, and 11% from Oregon (Gentner 2001).

8.1.5 Tribal Fishery

The following discussion is summarized from Appendix A section 6.3.

West Coast treaty tribes have formal allocations for sablefish, black rockfish, and Pacific whiting. Members of the four Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) participate in commercial, ceremonial, and subsistence fisheries for groundfish off the Washington coast. Participants in the tribal commercial fisheries use similar gear to non-tribal fishers. Groundfish caught in the tribal commercial fishery pass through the same markets as non-tribal commercial groundfish catch.

There are several groundfish species taken in tribal fisheries for which the tribes have no formal allocations and some species for which no specific allocation has been determined. Rather than try to reserve specific allocations of these species, the tribes annually recommend trip limits for these species to the Council, who try to accommodate these fisheries. Tribal trip limits for groundfish species without tribal allocations are usually intended to constrain direct catch and incidental retention of overfished species in the tribal groundfish fisheries.

Twelve western Washington tribes possess and exercise treaty fishing rights to halibut, including the four tribes that possess treaty fishing rights to groundfish. Tribal allocations are divided into a tribal commercial component and the year-round ceremonial and subsistence component.

The bulk of tribal groundfish landings occur during the March through April halibut and sablefish fisheries. Most continental shelf species taken in the tribal groundfish fisheries are taken during the halibut fisheries, and most slope species are similarly taken during the tribal sablefish fisheries. Approximately one-third of the tribal sablefish allocation is taken during an open competition fishery, in which vessels from the sablefish tribes all have access to this portion of the overall tribal sablefish allocation. The open competition portion of the allocation tends to be taken during the same period as the major tribal commercial halibut fisheries in March and April. The remaining two-thirds of the tribal sablefish allocation is split between the tribes according to a mutually agreed-upon allocation scheme. Specific sablefish allocations are managed by the individual sablefish tribes, beginning in March and lasting into the autumn, depending on vessel participation management measures used.

In addition to these hook-and-line fisheries, the Makah tribe annually harvests a whiting allocation using mid-water trawl gear. Since 1996, a portion of the U.S. whiting OY has been allocated to the Pacific Coast treaty tribes. The tribal allocation is subtracted from the whiting OY before allocation to the nontribal sectors. Since 1999, the tribal allocation has been based on a sliding scale related to the U.S. whiting OY. To date, only the Makah tribe has fished on the tribal whiting allocation. Makah vessels fit with mid-water trawl gear have also been targeting widow rockfish and yellowtail rockfish in recent years.

Appendix A Table 6-11 shows recorded landings of groundfish species by treaty tribes from 1995 to 2002. Since 1996, Pacific whiting have comprised the vast bulk of tribal landings, even though in 2000 and 2001 whiting landings were relatively low due to reduced coastwide allocations. As shown in Appendix A Table 6-12, in terms of exvessel revenue, sablefish landings provided well over half of total tribal groundfish revenue each year except 1998, 1999 and 2002.

Estimated groundfish bycatch in Makah trawl and troll fisheries in recent years is depicted in Table 8-2. Among the overfished species, the table shows some bycatch of widow rockfish and canary rockfish in midwater and bottom trawl, and lingcod bycatch in bottom trawl and salmon troll fisheries. Estimated bycatch in tribal longline fisheries in recent years is shown in Table 8-3. The table shows some bycatch of lingcod, canary rockfish, and yelloweye rockfish in tribal halibut fisheries.

8.1.6 Communities

The following discussion is summarized from Appendix A chapter 8.

Fishing communities on the West Coast participate in commercial and/or recreational fisheries for many species. Participants West Coast fisheries employ a variety of vessels and fishing gear. Many participants are involved in more than one fishery. Buyers and processing facilities in these communities generally handle a variety of species simultaneously or seasonally, although specialization also occurs. Patterns of fishery participation vary coastwide and seasonally, based on species availability, the regulatory environment, and oceanographic and weather conditions.

Table 8-1 and figure 8-1 of Appendix A list the main ports along the West Coast, grouping them by county, port group and state. The port groups identified in the table provide the framework for most of the discussion below. Some information in this section is also presented at different levels of aggregation. The port groups in each state are: Washington--Puget Sound, North Washington Coast, South and Central Washington Coast; Oregon--Astoria-Tillamook, Newport, Coos Bay, Brookings; California--Crescent City, Eureka, Fort Bragg, Bodega Bay, San Francisco, Monterey, Morro Bay, Santa Barbara, Los Angeles, San Diego.

8.1.6.1 County-level Indicators

Tables 8-17a and 8-17b of Appendix A display the most recent (2001) information on the components of total personal income in counties along the West Coast, Puget Sound, and Lower Columbia River. The counties are ranked on the basis of several different average or per capita income measures. In terms of total per capita personal income, the urban Northern California counties of Marin, San Mateo and San Francisco are on top.

San Mateo and San Francisco also rank first and second in terms of average annual wage, a measure of the strength of these economies as centers of high wage employment. King county Washington is number three. The four poorest counties in the region, measured by per capita income, are Del Norte County in California, and Klickitat, Pacific and Grays Harbor counties in Washington.

Transfer payments can be both a measure of how dependent an area is on public assistance or an indicator of how attractive an area is as a retirement destination. By this measure, Pacific County, Washington is number one, followed by Curry County, Oregon and Clallam County in Washington. Looking at dividends, interest and rent (a measure of wealth), Curry and Clallam counties rank relatively high (7th and 11th respectively), but Pacific County is well down the list at 33rd, indicating that Pacific is probably the poorer of the three counties.

Table 8-18 of Appendix A shows 2002 unemployment rates in coastal counties, the latest available county-level data. Counties with relatively high unemployment rates are arrayed along the lower Washington coast, Columbia River, and southern Oregon coast. Monterey and Del Norte were the only counties in California with unemployment rates among the highest ten. Three of the four counties with highest unemployment rates in 2002 were located in southwestern Washington.

Table 8-18 also displays the national average unemployment rate and the state averages for the three coastal states. Unemployment rates for all three states were significantly above the national average in 2002. In Washington, 11 of the 15 counties displayed had higher unemployment rates than the state average. In Oregon, 7 of 11 counties displayed had higher than state-average unemployment. In California, 7 of 19 counties had unemployment rates higher than the state average.

8.1.6.2 Port Area Descriptions

The components most conspicuously associated with fishing communities are commercial vessels and seafood processors. Table 8-4 of Appendix A shows the number of vessels in different fisheries making landings by primary PacFIN port and port area during the November 2000 through October 2001 reference period. The table shows major concentrations of the coastwide total 244 limited entry trawl vessels operating from Oregon and Northern California ports. The largest groundfish limited entry trawl fleets are shown in Astoria, Coos Bay, Newport, Crescent City, Fort Bragg, Westport, and Eureka. These were primarily engaged in the shelf and slope fisheries, but a majority were also engaged nearshore. There were also 28 vessels operating only in the at-sea whiting fishery.

Ninety one limited entry trawl vessels were permanently retired under the recently implemented Pacific Groundfish Limited Entry Trawl Buyback Program. This represents a 35% reduction in the prior limited entry trawl fleet. Retired vessels were distributed from Blaine, WA to Avila, CA. Ports experiencing the greatest percentage reduction in limited entry trawl fleets as a result of the buyback include: Bellingham (-100%, 4 vessels), Crescent City (-88%, 14 vessels), Eureka (-61%, 14 vessels), Avila (-57%, 4 vessels), Port Angeles (-57%, 4 vessels), Brookings (-56%, 5 vessels), Moss Landing (-50%, 4 vessels) and Bodega Bay (-50%, 1 vessel). Ports experiencing the greatest reduction in the number of limited entry trawl vessels include: Crescent City (14), Eureka (14), Astoria (13 vessels, -33%), Coos Bay (8 vessels, -33%) and Newport (6 vessels, -24%). There is an indication that some of the remaining fleet will redistribute to fill some of the obvious holes left by the buyback program. For example available information on permit transfers suggests that three permits will be used this year in the port of Bellingham, which lost all of its prior limited entry trawl fleet.

The 178 vessels in the limited entry fixed gear fleet are concentrated in the northern ports of Bellingham, Port Angeles, Newport, Port Orford, Westport, Astoria, and Moss Landing. This group is dominated by the sablefish fleet operating primarily on the shelf and slope.

Open access vessels deriving at least 5% of revenue from groundfish is the largest groundfish category shown in the table. These 771 vessels are distributed throughout the coast. In the North, these vessels are more engaged in shelf and slope fisheries. The southern fleet is more engaged nearshore. The second most numerous groundfish category is composed of the open access vessels deriving less than 5% of revenue from groundfish. Major concentrations of these 517 vessels operate from Newport, Charleston, Santa Barbara, and Garibaldi. The southern fleet is more active nearshore. Altogether there were 1,710 vessels recorded as landing significant quantities of groundfish of the total 4,589 vessels operating in all fisheries coastwide. Appendix A Table 8-5 shows the geographic distribution of these vessels by length category.

Table 8-6 of Appendix A shows the number of buyers and processors by primary port area buying different species groups from the different categories of fishing vessels during the reference period. (This table is a counterpart to Table 8-4). The table shows that of the 1,283 total active buyers on the West Coast, 451 purchased groundfish from harvesters during the base period. Groundfish buyers are distributed all along the West Coast, but more heavily in some of the larger ports toward the south. The port area with the greatest number of groundfish buyers was San Francisco with 69, led by the Port of San Francisco and Princeton with 31 and 29 buyers, respectively. The table also shows that most of the 70 buyers buying slope species from limited entry trawl vessels (excluding at-sea only purchases) were located north of the Eureka port area, but most of the 78 buyers purchasing slope species from limited entry fixed gear and open access vessels were located south of the Eureka port area.

Table 8-7 of Appendix A shows the distribution of buyers among ports broken down by the level of exvessel purchases. The table shows a relatively large share, 38% (492) of the total number of West Coast buyers had less than $5,000 in gross exvessel purchases, and over half of total buyers had gross purchases less than $20,000.

8.1.6.3 Dependence on and Engagement in Fishing-related Activities

Parts of the following discussion are summarized from Appendix A chapter 8. For additional information on Council economic impact modeling see Appendix C.

Appendix A Tables 8-8a and 8-8b show the distribution among port groups of income and employment impacts resulting from West Coast commercial fisheries during 2001. Total income impacts include direct and indirect effects, composed of the wages and salaries paid to primary producers, processors and suppliers; and induced effects, i.e., the additional income generated when those wages and salaries are spent in the local economy. Income impacts were generated using the Fisheries Economic Assessment Model (FEAM) (Jensen 1996). FEAM uses historical landings data, information on industry cost and margin structure (vessels and processors), and income coefficients generated by IMPLAN (MIG 2000) to estimate local income impact. FEAM income coefficients measure the income actually received by participants in the local economy rather than gross sales or "turnover." Income impacts assume that changes in the stock of durable assets are annualized, so that the impact of purchasing or replacing vessels, gear, buildings, plant, etc. are amortized into a series of annual payments rather than treated as a lump sum purchase in any one year.

Appendix A Table 8-8a displays estimated income and employment resulting from all commercial fishing activities for each port group. Income and employment dependence indices are calculated as the percentage of total personal income or total employment that is generated by commercial fishing and processing activities and local economic linkages.

The rankings in Table 8-8a give an idea of how engaged each port group is in commercial fishing relative to other opportunities in the regional economy. The area most heavily invested in commercial fishing relative to its economy is the south Washington coast. Next most engaged are Newport and Astoria-Tillamook in Oregon, and Crescent City, California. Brookings and Central Washington coast alternate for 5th and 6th place depending on whether the income or employment measure is used. The least engaged port areas are the large, relatively urbanized centers of Puget Sound, San Diego, San Francisco, and Los Angeles. While these areas certainly include local pockets that are heavily engaged in fishing activities, the size and diversity of the surrounding economies tends to mask the significance of locally important factors. The right-most columns of the table show estimated income and employment derived from the groundfish fishery in each region, split between limited entry trawl and other groundfish gear. By this measure, Puget Sound, North Washington Coast, Astoria-Tillamook, and Eureka are dependent on groundfish for at least 50% of fishery-related income and employment. All but four of the port groups generate at least 14% of fishery-related income from groundfish.

Appendix A Table 8-8b splits the groundfish totals into limited entry trawl and other gear components. From this information we see that of the regions highly involved in groundfish (i.e., Astoria-Tillamook, Puget Sound, Newport, and Eureka) derive more than 40% of groundfish income from the limited entry trawl fishery. Only the North Washington coast derives more than one-third of groundfish income from nontrawl sources.

Table 8-9 of Appendix A shows estimated personal income generated in 2001 by the West Coast ocean recreational fishery. Income estimates were generated using FEAM. In 2001 the ocean recreational fishery accounted for $254 million in personal income and almost 10,000 jobs. Groundfish trips accounted for $71 million and 2,800 jobs, respectively, or about 28% of the total. The proportion of income associated with groundfish trips ranged from a low of 17% in Washington to a high of 45% in Oregon. The ratio of charter angler trips to private vessel participation was much greater in Northern and Southern California than in Washington and Oregon, probably reflecting differences in species opportunities, season length and weather along the coast.

8.2 Criteria Used to Evaluate Impacts

The choice between alternative rebuilding strategies for the overfished species in this document is a choice between long-term programmatic options rather than among specific management measures. The Council's choice of a particular rebuilding strategy (combination of P_{MAX} and T_{TARGET}) will identify a maximum total catch OY for each species for each year of the rebuilding period. Management measures governing how these OYs are allocated among fisheries sectors and how each sector prosecutes its fishery will be decided subsequently during the process the Council uses to set biennial groundfish management specifications. This process has a great deal of latitude to specify sector allocations and the areas, depths, gear and seasons when a commercial or recreational fishery may be prosecuted, as well as size and quantity limits for the species that can be harvested. Bycatch rates generated from observed fishing behavior (observer program data) and incorporated into fisheries management models are used to set and monitor the amounts of target stocks that can be taken while not allowing the bycatch and recreational harvest of overfished stocks to exceed the rebuilding OYs.

Since it is not yet known how the rebuilding strategies will actually be implemented under the multiyear groundfish management process, and given that management measures will evolve and change each management period as new information becomes available, the criteria used to assess and compare the impacts of the rebuilding alternatives in this document are qualitative in nature. The narrow range of OY levels presented under the alternatives for yelloweye and cowcod will also means that there is little difference in practical terms between the alternatives for these species. The effects of the alternatives on components of the socioeconomic environment are rated and ranked based on the amount of economic disruption expected in the short term and the prospects for improvement in the future. This is done by directly comparing several different rebuilding parameters between the alternatives.

Table 8-4 compares preseason estimated catch of rebuilding species in 2004 with total catch in 2002 and

2003 and the OY levels in 1998. For each of the four rebuilding species in this document, recent history and key rebuilding parameters under the alternatives are summarized in the tables below. Simple comparisons are constructed by ranking the options according to several different parameters: (1) which alternatives provide the greatest harvest next year, (2) which alternatives provide the greatest harvest ten years in the future, (3) estimated length of the rebuilding period, and (4) probability of rebuilding during the allotted time period.

Recent Year OYs and Total Catch Mortality				
	Bocaccio	Cowcod	Widow	Yelloweye
1998 OY	230 mt	n/a	4,960 mt	n/a
2002 est. total catch mortality	117 mt	0.8 mt	420 mt	9.1 mt
2003 est. total catch mortality	22 mt	0.1 mt	49 mt	6.6 mt
2004 total catch OY	250 mt	4.8 mt	284 mt	22 mt
2004 pre-season total catch estimate	145.1 mt	3.1 mt	270 mt	16.2 mt
Rebuilt OY	3,481 mt	30 mt	7,196 mt	47 mt

2005 OYs				
	Bocaccio (STATc)	Cowcod	Widow (Model 8)	Yelloweye
Most Harvest	Alt 1 (375 mt)	Alt 1 (4.8 mt)	No Action (1,359 mt)	No Action (29 mt)
2nd Most	Alt 2 (308 mt)	Alt 2-4 (4.2 mt)	Alt 1 (285 mt)	Alt 1 (28 mt)
3rd Most	Alt 3 (240 mt)		Alt 2 (213 mt)	Alt 2 (27 mt)
4th Most	Alt 4 (134 mt)		Alt 3 (124 mt)	Alt 3 (26 mt)
Least	No Action (7 mt)	No Action (0 mt)	Alt 4 (4 mt)	Alt 4 (24 mt)

2015 OYs				
	Bocaccio (STATc)	Cowcod	Widow (Model 8)	Yelloweye
Most Harvest	Alt 1 (632 mt)		No Action (1,879 mt)	No Action (39 mt)
2nd Most	No Action (574 mt)		Alt 1 (392 mt)	Alt 1 (33 mt)
3rd Most	Alt 2 (555 mt)		Alt 2 (296 mt)	Alt 2 (32 mt)
4th Most	Alt 3 (463 mt)		Alt 3 (174 mt)	Alt 3 (30 mt)
Least	Alt 4 (285 mt)		Alt 4 (5 mt)	Alt 4 (29 mt)

Median Rebuilding Year (T_{TARGET})				
	Bocaccio (STATc)	Cowcod	Widow (Model 8)	Yelloweye
Quickest	Alt 4 (2018)	Alt 2-4 (2090)	Alt 4 (2028)	Alt 4 (2054)
2nd Quickest	Alt 3 (2020)	Alt 1 (2095)	Alt 3 (2032)	Alt 3 (2058)
3rd Quickest	No Action (2021)		Alt 2 (2035)	Alt 2 (2062)
4th Quickest	Alt 2 (2023)		Alt 1 (2038)	Alt 1 (2067)
Slowest	Alt 1 (2025)	No Action (NA)	No Action (NA)	No Action (NA)

Median Rebuilding Probability (P_{MAX})				
	Bocaccio (STATc)	Cowcod	Widow (Model 8)	Yelloweye
Highest	Alt 4 (90%)	Alt 2-4 (60%)	Alt 4 (90%)	Alt 4 (90%)
2nd Highest	Alt 3 (80%)	Alt 1 (55%)	Alt 3 (80%)	Alt 3 (80%)
3rd Highest	No Action (77%)		Alt 2 (70%)	Alt 2 (70%)
4th Highest	Alt 2 (70%)		Alt 1 (60%)	Alt 1 (60%)
Lowest	Alt 1 (60%)	No Action (NA)	No Action (NA)	No Action (NA)

8.3 Discussion of Direct and Indirect Impacts

8.3.1 Commercial Vessels

Interactions among the rebuilding measures adopted for one species will have a substantial affect on other species. These interactions will be more important to the expected coastwide impacts than are the effects for any single overfished species. Table 8-5 records the presence of overfished species in West Coast fisheries in 1998, 200 and 2002. Whether or not a particular rebuilding policy for a given species has an impact on total harvest depends, in part, on whether or not the species is a constraint on the fisheries complexes in which it is harvested. For example, both overfished bocaccio and canary rockfish are taken largely in shelf fisheries complexes. While canary rockfish is distributed coastwide, the bocaccio stock of concern is located primarily south of Cape Mendocino. Under current stock assessments and rebuilding analyses, canary rockfish is more constraining on associated fisheries than bocaccio due to the very low annual rebuilding OYs adopted for canary rockfish in 2003 under Amendment 16-2. If a sufficiently aggressive policy is implemented to rebuild canary rockfish coastwide, then bocaccio south of Cape Mendocino will also receive substantial protection. Under such circumstances a more liberal bocaccio rebuilding policy may not allow substantially greater fisheries harvests, due to the canary rockfish constraint already in place. Table 8-6 summarizes which rebuilding species are likely to be most constraining to area fisheries under the rebuilding alternatives.

While aggressively conserving one stock, so it is rebuilt substantially earlier than the other overfished stocks in the complex, may provide little benefit in terms of additional current harvest, there may be other ecosystem benefits or benefits related to existence values that may be advanced by rebuilding a given species more rapidly. Overfished species also occur in different ratios in different harvest complexes, and these ratios will change as abundances change. Therefore, there may be some opportunity to balance harvest between complexes to take advantage of a stock that rebuilds more rapidly.

Other factors affecting the opportunities to rebuild multiple species and to expand the harvest of particular complexes as the biomass for a species is rebuilt include inter-species competition for food and habitat, changing bycatch rates over time, and changing species associations with changing ocean conditions.

The value of an additional unit of harvest of an overfished species in terms of the access it provides to healthy stocks is shown in Tables 8-7 through 8-10. This value is likely to diminish over time as the OY for the species increases. This concept is known in economics as “diminishing marginal returns.” Assuming that rebuilding will still occur, only more slowly under the options that allow larger harvests earlier on, this concept of diminishing marginal returns tends to favor alternatives with slower rebuilding rates. However, this fails to weigh the value to nonconsumers of achieving healthy stocks more quickly, nor does it take into account the different risk values (P_{MAX}) associated with postponing rebuilding by harvesting more heavily now. Other factors may also tend to increase the value of future harvests over present harvests.

A key point in determining how much catch must be forgone under a particular strategy in order to reduce mortality of overfished species is whether or not gear or fishing methods can be modified to reduce overfished species mortality without reducing catch of target species. If such changes can be made, then target species harvest can be maintained while still reducing overfished species mortality. However, there are likely to be some increased fishing costs associated with such changes.

In evaluating the likelihood a restriction on an overfished species would affect a particular strategy, the number of trips on which the strategy was employed can be compared to the number of trips on which the overfished species was retained. A higher frequency of overfished species retention may indicate a higher likelihood of a need to restrict the fishery. A low frequency of overfished species retention may indicate employment of a secondary strategy during a particular trip, rather than co-occurrence of the overfished species with the primary target species.

Measures already in place to rebuild canary rockfish and lingcod currently restrict harvest of these and co-occurring species. Also, measures in place to protect cowcod from harvest mortality will probably not be changed under these alternatives. And since there is very little variation in OY levels between the alternatives for yelloweye rockfish, there would not be much practical difference in the effects fisheries. Consequently additional measures to rebuild bocaccio, cowcod, widow rockfish and yelloweye rockfish, short of complete closures that may be necessary under the very low OY scenario for widow rockfish under Alternative 4, will probably not have a great deal of additional impact on fisheries.

Under Alternative 4, only very low annual mortality (less than 10 mt) of widow rockfish would be allowed for more than 20 years, compared with an OY of 284mt in 2004. After rebuilding in 2028 (Table 8-r) total harvest OY may rise to something on the order 7,000 mt (Table 8-p). Also under Alternative 4, the total catch OY allowed for bocaccio is only about half of the 2004 OY (Table 8-p). Consequently additional restrictions affecting a broad range of West Coast fisheries may be necessary under Alternative 4 to keep from exceeding the rebuilding OYs for widow rockfish and bocaccio.

8.3.1.1 Short-Term Effects

Net Profits

Alternatives that rebuild stocks more rapidly will impose more restrictive fishing regulations in the near term. Restrictions on nonoverfished species will also likely be necessary to achieve desired reduction in mortality for overfished species. Catch of target species is likely to decline, increasing average cost per unit of harvest by increasing variable or fixed costs or reducing the total amount of harvest. Revenue will decline with reduced catch. Regulations causing fishers to move to second or lower choice target species, fishing areas or fishing times, or require changes in fishing gear, are likely to reduce net profits. The distribution of impacts across variable costs, fixed costs, and reduced revenues will depend on the exact measures used to achieve the needed reductions. These measures will be analyzed and established as part of annual processes or regulatory amendments.

Deferred Expenses

A common short-term survival mechanism is the deferment of needed maintenance for the vessel and equipment key to safe vessel operation. Such deferrals will likely increase the level of risk to safety. While the individual fisher may be lucky enough to avoid the costs of taking such risks, when the fishing industry as a whole is considered, some may not be so lucky. Assuming the costs of a bad outcome are greater than the reduced costs from the deferred expenditure, the fishery as a whole will likely experience some increase in cost associated with the deferred expenditures.

Continued Operation

Since eventual increases in harvests may occur far in the future, some vessels will have a difficult time adjusting to reduced revenue in the short term. If markets for harvest rights (transferrable quotas) were in place, and there were a reasonable degree of confidence that harvest revenues would increase in the future, firms might survive the short-term harvest restrictions by selling interest in futures harvests. However under the existing system such futures trading is unlikely. If vessels can cover variable costs, they will continue to fish. But their economic survival will depend on debt load and ability to cover fixed operation costs from groundfish or other business activities. If annual fixed costs associated with maintaining and operating a vessel can be covered along with the variable costs associated with fishing, the vessel is likely to remain active. If operating costs can be covered, but the vessel cannot cover the debt load of the current ownership, the vessel may be resold at a lower price that allows for financially viable operation by the new buyer.

Impact on Other Fleets

The reduction in groundfish revenue in the short term may be an indicator of the amount of dislocation and pressure that might be experienced in other fisheries. To survive the near-term reductions in the groundfish fishery, vessels are likely to try to recover revenue first by expanding their effort in other fisheries in which they already participate and then into other fisheries for which the vessel and/or operator expertise is suited.

8.3.1.2 Long-Term Effects

Catch Per Unit Effort

Over time, as stock biomass increases, depending on the distribution of the additional biomass and susceptibility to harvest, CPUE is likely to increase, thereby reducing cost per unit harvest. In order to rebuild overfished species, other species in the same catch complexes are likely to receive protection in excess of that needed for those species. Therefore over time there is likely to be some increase in the biomass and decrease in harvest costs for both overfished and nonoverfished species.

Costs of Mismatches Between CPUE and Stock Assessments

If CPUE accelerates during the rebuilding process before indications of increased biomass are detected in stock assessments, adjustments may be necessary during which regulations become increasingly more restrictive rather than less restrictive. These restrictions would likely increase average fishing costs and may impose reductions in the harvest of nonoverfished species until such time as the biomass increases of overfished species are detected and documented by the stock assessment methods.

Net Profits

Once stocks are rebuilt it is anticipated that harvests will be higher than they were in the fishery over the short term. All the adverse effects discussed under the short-term net profits section will likely be reversed, and net profits will likely be higher than would be the case without rebuilding. This anticipation is premised on the assumption that other stocks in the harvest complex will not become overfished or be declared in an overfished condition.

Over the long term, the degree of net profit will also depend on control of capital flow into the fishery. In spite of the recent buyback groundfish trawlers and permits, the West Coast groundfish fishery is still considered overcapitalized. In the short term, the effects of overcapitalization will be exacerbated if harvest is reduced to rebuild stocks. However over the long term, harvests are expected to increase to levels substantially above those observed currently to levels comparable to or above those observed in 1998. Other efforts are underway to control and reduce capacity in the fishery such that even with no action there may be some increase in net profits.

8.3.1.3 Vessels Most Affected

Bocaccio rebuilding measures will most affect exempt trawl, fixed gear and recreational vessels south of Cape Mendocino (Table 8-6). Cowcod rebuilding measures will affect fixed gear and recreational fisheries south of Cape Mendocino, although there will probably by little change in the measures currently in place to protect cowcod from harvest mortality. Northern midwater trawl and whiting trawl vessels will be those most affected by harvest restrictions to rebuild widow rockfish. At very low widow OY levels, northern fixed gear and recreational fisheries may also be affected. Harvest restrictions to rebuild yelloweye rockfish will primarily affect fixed gear and recreational fisheries north of Cape Mendocino.

However, measures already in place to rebuild canary rockfish and lingcod currently restrict commercial harvest of these and co-occurring species. Also, measures currently in place to protect cowcod from harvest mortality will probably not be changed under these alternatives. Consequently additional measures to rebuild bocaccio, cowcod, widow rockfish and yelloweye rockfish, short of complete closures that may be necessary under the very low OY scenario for widow rockfish under Alternative 4, will probably not have a great deal of additional impact on commercial fishers.

8.3.2 Seafood Markets

Changes in catch by commercial vessels also represents changes in raw products purchased by seafood buyers and processors. Output of these buyers and processors would be expected to change roughly in proportion to the change in the key input, landed fish. The tradeoffs in terms of short- and long-term revenue opportunity and survival for processors are probably similar to those discussed for vessels.

Since many substitutes for West Coast groundfish are available in the regional food distribution chain, the effects on regional seafood markets are generally expected to be small and temporary under the rebuilding alternatives. A possible exception is the local market for fresh and live seafood. This industry relies on access to nearshore species that can be taken live, stored and transported quickly to live seafood restaurants on the West Coast.

Effects on Net Profits

The effect on net revenue will depend on changes in cost associated with the change in output and any changes in the exvessel prices and exprocessor prices. In general reduced harvest would mean reduced revenue for processors and increased difficulty covering costs that do not decline proportionally with the level of production. Conversely profits would be expected to increase with higher levels of production in the future. Wholesale prices and processing/wholesaling costs are not available to assess specific effects of a change in harvest on gross or net processor revenues. In response to a reduction in the availability of raw product, buyers and processors may seek to increase revenue by bidding or finding other ways to acquire a larger portion of the available inputs (in the groundfish or other fisheries), reducing costs, or finding ways to add value to the products they sell. However adding value to a product may be more of a redistribution of profits within the food distribution chain and among competing products than the generation of additional value for the economy.

The specific regulations by which harvest reductions are achieved would not have as much of an impact on processors' operation costs as it does for vessels. However, there are important aspects of the regulatory regime that could increase or decrease processing costs more than proportionally with the change in harvest. One of these is the timing of harvest. A number of processors, larger ones in particular, maintain buying operations year round. There are certain costs associated with shutting down and reopening operations, many of which have to do with maintaining a skilled work force. Figures 6-3 to 6-14 of Appendix A show that for some areas of the coast, groundfish is one of the few fisheries that continue to operate in the late fall. In the past the Council has strived to maintain a constant flow of groundfish product to processors in order to facilitate continuous operation. This task has become increasingly difficult as harvest levels have declined. While specific measures to alter the year-round fishery are not being proposed at this time, it should be anticipated that further declines in the OYs will make maintaining the year-round groundfish fishery more difficult.

Processors Most Affected

Appendix A Table 7-4 shows The numbers of buyers by size (purchases) and fishery identified by the degree of dependence on a particular fishery. Buyers and processors most dependent on midwater and whiting fisheries are likely to be most affected by harvest restrictions to rebuild widow rockfish, while vessels most dependent on fixed gear landings are most likely to be affected by harvest restrictions to rebuild yelloweye. Restrictions to rebuild bocaccio are most likely to affect buyers who purchase from exempted trawl and fixed gear fisheries. There will probably by little additional effect on buyers and processors of measures to protect cowcod from harvest mortality.

Seafood Markets

Effects on regional seafood markets are generally expected to be small and temporary under the rebuilding alternatives because there are many substitutes for West Coast groundfish available in the regional food distribution chain. Most super markets and restaurants do not rely on locally-caught produce to stock their shelves or prepare menus. Locally-caught products no longer available would be replaced with close substitutes for the local products that are obtained from elsewhere in the global supply chain.

Possible exceptions are the local fresh and live seafood markets, especially under Alternative 4. These types of Markets and restaurants featuring fresh and live catch supplied from local fisheries may be adversely affected by the closures necessary to implement Alternative 4. Businesses in this market have already been adversely affected by measures to rebuild canary rockfish and lingcod. The effect of very low OY levels for widow rockfish under Alternative 4 may spill over into closures of most groundfish activity on the Coast. Reduced availability of locally obtained supplies of fresh and live fish may reduce the appeal of these type of specialty markets with visitors and tourists. It is also possible that reduced supplies may increase prices for live seafood, thereby somewhat mitigating adverse impacts on vessels and distributors.

8.3.3 Recreational Experience Markets

Because all four species are caught in recreational fisheries to some extent, measures implemented to rebuild these species will affect recreational fisheries. However, measures already in place to rebuild canary rockfish and lingcod currently restrict recreational harvest of these and co-occurring species. Also, measures in place to protect cowcod from harvest mortality will probably not be changed under these alternatives. And since there is very little variation in OY levels between the alternatives for yelloweye rockfish, there would not be much practical difference in the effects fisheries. Consequently additional measures to rebuild bocaccio, cowcod, widow rockfish and yelloweye rockfish, short of complete closures that may be necessary under the very low OY scenario for widow rockfish under Alternative 4, will probably not have a great deal of additional impact on recreational fishers.

Under Alternative 4, only very low annual mortality (less than 10 mt) of widow rockfish would be allowed for more than 20 years, compared with an OY of 284 mt in 2004. Total harvest OY may rise to something on the order 7,000 mt (Table 8-11) after rebuilding in 2028 (Table 8-12). Also under Alternative 4, the total catch OY allowed for bocaccio is only about half of the 2004 OY (Table 8-11). These imply that additional restrictions on West Coast fisheries may be necessary under Alternative 4 to keep from exceeding the OYs for widow rockfish and bocaccio.

8.3.4 Tribal Fisheries

Tables 6-11 and 6-12 of Appendix A demonstrate the importance of pacific whiting to the tribal fishery operating from ports on the Washington Coast. In most recent years, whiting provided the lion's share of harvest tonnage and a major portion of exvessel revenue. These fisheries do take quantities of widow rockfish. Tribal longline fisheries also take some yelloweye rockfish. Measures to rebuild these two species will affect tribal fisheries in much the same way as they would affect the non-tribal commercial groundfish fleet. While additional impacts on tribal fisheries are not likely to be very significant under most of the rebuilding alternatives, there would probably be large adverse impacts under the very low take measures for rebuilding widow rockfish under Alternative 4. And since there is very little variation in OY levels between the alternatives for yelloweye rockfish, there would not be much practical difference in the effects on tribal longline fisheries.

8.3.5 Communities

Discussion in this section is focused around impacts on West Coast fishing-oriented communities resulting from anticipated short-term harvest restrictions implemented to rebuild bocaccio, cowcod, widow rockfish, and yelloweye rockfish under the different rebuilding alternatives. The effects on communities are the net sum of impacts on commercial fisheries, tribal fisheries, recreational fisheries and buyers and processors. Communities in certain geographical areas will likely be affected differently by rebuilding measures for the different species. Southern California communities may feel the impact of restrictions imposed to rebuild cowcod and bocaccio, but will be less affected by rebuilding measures for widow rockfish and yelloweye rockfish. The reverse is true for communities located on the Oregon and Washington coasts.

Fleets most likely to be negatively affected by additional harvest restrictions under widow rockfish and yelloweye rebuilding plans are clustered in ports along the Northern California, Oregon and Washington coasts. Historically, large concentrations of limited entry trawl and limited entry fixed gear vessels fishing on the continental shelf and slope are based in these ports. The fleets most likely to be affected by additional harvest restrictions to rebuild bocaccio and cowcod are located in ports in Central and Southern California.

While the data demonstrate the ability of many types of vessels to shift operation between the slope and the shelf, the array of species currently under rebuilding plans coupled with recently adopted depth-based closures will prevent vessels from easily shifting activity from one stratum or target species to another in order to continue operations.

Ports in the northern areas have a high proportion of relatively small buyers and processors. Since the ability to withstand downsizing or to shift processing to other species or products is more limited for smaller-volume operations than for larger ones, small operators are more likely to be adversely affected by restricted supply and likely increased handling costs under the more stringent rebuilding management measures (e.g. Alternative 4).

Tribal fisheries that may be affected by reduced OY levels in order to rebuild widow rockfish and yelloweye rockfish are clustered in ports along the Northwest Olympic Peninsula and Central Washington Coast. The dependence of ports along the Northwest Olympic Peninsula and Central Washington Coast on tribal fisheries will exacerbate the negative impact in these areas if the most conservative harvest levels under Alternative 4 are chosen.

Recreational fisheries most vulnerable to rebuilding-induced limitations and closures are located primarily in Central and Southern California. Any additional harvest restrictions implemented to rebuild bocaccio and cowcod will affect recreational fishers, charter boats and rental boat operators located in Central and Southern California.

Commercial and recreational fishing support a number of additional jobs and income in coastal communities through economic linkages between vessels, crews, suppliers, buyers, processors, and consumers. Relative to all commercial-fishery-related income, ports most dependent on income from groundfish limited entry trawl are located in Northern California and the Oregon coast (Appendix A Table 8-8). These areas are likely to be most adversely affected by short-term harvest restrictions under Alternative 4 for widow rockfish.

The proportion of income from the recreational fishery resulting from groundfish trips was highest in Oregon and North/Central California (Appendix A Table 8-9). These areas are likely to be adversely affected by short-term harvest restrictions under Alternative 4 for widow rockfish.

8.4 Discussion of Cumulative Impacts

Between 1998 and 2002, significant actions were taken to constrain fish harvest. As a result of those actions, it is likely that stock biomass and potential harvests in the coming years will be greater than they would have otherwise been. At the same time, the industries and communities relying on the fisheries are already under economic and social stress. These stresses vary by the geographic region and fisheries in which vessels participate. Looking at the tribal and nontribal fisheries for all species, exvessel revenue north of Cape Mendocino has increased slightly from $119 million in 1998 to $125 million in 2002 (Appendix A Table 6-2b). South of Cape Mendocino revenue from all fisheries has increased from $89 million in 1998 to $98 million in 2002. However over that period the groundfish fishery has seen substantial reductions. In 1998, the total value of West Coast groundfish harvest was $71 million (including the at-sea whiting fishery). By 2002, lower harvests had reduced total vessel receipts to $51 million. These values are not adjusted for inflation. The groundfish fishery was declared an economic disaster in the year 2000.

8.4.1 Rebuilding Overfished Species as a Constraint Over Time

The time period used for the analysis in this section covers the years from 2005 until T_{MAX} for each rebuilding species. Under the rebuilding alternatives, rebuilding is expected to occur prior to T_{MAX}. Values of the rebuilding parameters for the four species under the different rebuilding alternatives are shown in Table 2-1.

The aggregate amount of overfished species that would be allowed under the first year of rebuilding is an indicator of the magnitude of additional restriction that might be necessary to attain rebuilding harvest levels. Harvest levels only slightly below recent year harvests may impose little additional restriction, while those substantially below recent year harvests may result in substantially more restrictive regulations and greater adverse impacts on net profits over the short term.

It should be emphasized that the analysis in this section is focused on each rebuilding species in isolation using a constant valuation, rather than in the context of co-occurring species simultaneously targeted and harvested incidentally by vessels using different fishing strategies that are changing over time. As such, there are several reasons why future harvests of each rebuilding species may be more or less valuable than current harvests. One reason is discounting over time. This concept was discussed in Section 3.4.9 of the Amendment 16-2 EIS. Using discounting, the present value of even greatly increased harvests available many years in the future may be very low.

Also, the true commercial value of an overfished species may lie not in harvest of the species itself, but rather in the access that the bycatch constraint implied by a particular OY level allows to harvest target species caught in conjunction with the rebuilding stock. Such is the case with many of the overfished groundfish species on the West Coast. The value of a resource in terms of how much it constrains access to a target fishery is known as its “shadow price.” The value or shadow price of relaxing a bycatch constraint is likely to fall as the OY for the rebuilding species increases over time. Thus, an additional metric ton of rebuilding species OY is probably worth more to the commercial fishery now, when OYs are low and access is limited, than in the future when the rebuilding species is more abundant, and therefore, less constraining on bycatch allowed in the target fishery.

8.4.2 Potential Unintended Consequences

All alternatives except the No Action alternatives for cowcod, widow rockfish and yelloweye rockfish are expected to rebuild the species by T_{MAX}. Thus in the long term, once stocks are rebuilt, there is no difference between the alternatives in terms of the annual catches that will be available, except for the No Action alternatives for cowcod, widow rockfish and yelloweye rockfish.

The differences between the options are therefore the length of the rebuilding period, the risk of not rebuilding during the prescribed time period, and the annual harvest levels available during the rebuilding period. Financial survival during the near term for vessels, suppliers, buyers and processors will depend on the annual harvest levels allowed over the duration of the rebuilding period. Harvests occurring far in the future will more likely affect option or bequethal values than current use values. A business leaving the fishery might also receive some additional value from selling a permit if higher harvest levels are expected in the future as a result of rebuilding actions.

8.5 Summary of Impacts

The range of 2005 OYs under the alternatives for bocaccio is fairly significant, ranging from a low of 7 mt under No Action to 375 mt under Alternative 1 (Table 8-11). This compares with estimated total harvests of 117 mt in 2002 and 22 mt in 2003. Under the No Action alternative bocaccio would probably be the most binding constraint on fisheries south of Cape Mendocino until about 2009 (Table 5-6). By 2015 the range in OYs ratchets upward considerably, from 285 mt under Alternative 4 to 632 mt under Alternative 1. The range in median rebuilding year (T_{TARGET}) between the alternatives is only 7 years, 2018 under Alternative 4 and 2025 under Alternative 1 (Table 8-12). Under the No Action alternative, bocaccio is expected to rebuild by 2021.

There is virtually no difference in range of 2005 OYs under the alternatives for cowcod (4.2 mt under

Alternatives 2-4 and 4.8 mt under Alternative 1). The OY under the Alternative 1 is the same as the OY in 2004. Interim rebuilding management measures limited estimated total harvest of cowcod to 0.8 mt in 2002 and to 0.1 mt in 2003. This was chiefly accomplished by closing the area of highest cowcod density to all forms of fishing with the possibility of taking cowcod. The range in median rebuilding year (T_{TARGET}) between the alternatives is only 5 years, 2090 under Alternatives 2-4 and 2095 under Alternative 1. More than 80 years in the future, the difference between these two rebuilding times is insignificant.

The range of 2005 OYs under the rebuilding alternatives for widow rockfish is significant, ranging from a low of 4 mt under Alternative 4 to 393 mt under Alternative 1. (Note that the 2005 OY of 1,879 mt under No Action is not a rebuilding alternative since it fails to rebuild widow rockfish within T_{MAX}.) This compares with estimated total harvests of 420 mt in 2002 and 49 mt in 2003. Under Alternative 4 widow rockfish would probably become the most binding constraint on fisheries north of Cape Mendocino until it is rebuilt in about 2028 (Table 5-8). By 2015 the range in widow OYs ratchets upward to 5 mt under Alternative 4 to 392 mt under Alternative 1. The range in median rebuilding year (T_{TARGET}) between the alternatives is 10 years, 2028 under Alternative 4 and 2038 under Alternative 1. Although more than 20 years in the future, the difference between these rebuilding times probably has important implications for West Coast fisheries.

There is virtually no difference in the near term between the rebuilding alternatives for yelloweye rockfish in their impact on commercial fisheries. The range between the alternative with the highest OY in 2005 (No Action, 29 mt) and the lowest OY in 2005 (Alternative 4, 24 mt) is almost indistinguishable for management purposes. The range of OYs under the alternatives is slightly higher than the 22 mt allocated in 2004. Interim rebuilding management measures limited estimated total harvest of yelloweye to 9.1 mt in 2002 and to 6.6 mt in 2003. By 2015 the range in OYs broadens to 10 mt (No Action OY 39 mt, Alternative 4 OY 29 mt). The range in median rebuilding year (T_{TARGET}) between the yelloweye alternatives is 13 years, 2054 under Alternative 4 and 2067 under Alternative 1. A half-century in the future, the difference between these rebuilding times rebuilding times is probably insignificant.

8.5.1 Impacts on Commercial Vessels

8.5.1.1 No Action Alternative

This alternative allows the most harvest in the near term for widow and yelloweye. This alternative would be the most beneficial to commercial vessels operating in the midwater trawl and whiting trawl fisheries because of the high OY for widow. While rebuilding is projected to occur under this alternative for bocaccio, extremely low OYs for this species in the near term would severely constrain most fisheries south of Cape Mendocino. Canary rockfish and yelloweye would be the biggest constraints north of Cape Mendocino. However the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.1.2 Action Alternative 1

This alternative allows the most harvest in the near term for bocaccio and cowcod, and the highest near term OYs under an actual rebuilding alternative for widow and yelloweye. This alternative would maintain the same general level and distribution of commercial fishing activity planned for 2004, and would allow the highest level of activity among rebuilding alternatives in the midwater trawl and whiting trawl fisheries because of the relatively high OY for widow; and in exempted trawl and fixed gear fisheries south of Cape Mendocino due to the high OY for bocaccio. Under this alternative, canary rockfish and yelloweye would be the biggest constraints to commercial fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.1.3 Action Alternative 2

This alternative allows the second most harvest in the near term for bocaccio, the lowest for cowcod, and the second highest near term OYs under an actual rebuilding alternative for widow and yelloweye. This alternative would allow maintenance of the general level and distribution of commercial fishing activity planned for 2004, although a lower OY for widow rockfish may constrain the midwater trawl and whiting trawl fisheries relatively more than in 2004. Under Alternative 2, canary rockfish and yelloweye would be the biggest constraints to commercial fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.1.4 Action Alternative 3

This alternative allows the third most harvest in the near term for bocaccio, the lowest for cowcod, and the third highest near term OYs under an actual rebuilding alternative for widow and yelloweye. This alternative would allow maintenance of the general level of most commercial fishing activity planned for 2004, with the exception of midwater trawl and whiting trawl fisheries which would be constrained relatively more than in 2004 due to a considerably lower OY for widow rockfish. Under Alternative 3, widow rockfish would join canary rockfish and yelloweye as the biggest constraints to commercial fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.1.5 Action Alternative 4

This alternative allows the least harvest in the near term for widow and yelloweye, the lowest OY for cowcod, and the fourth highest near term OYs for bocaccio. This alternative would result in considerably lower levels of activity for most commercial fisheries than is planned for 2004. Very low OYs for bocaccio would greatly constrain most fisheries south of Cape Mendocino. Very low OYs for widow rockfish would greatly constrain most fisheries north of Cape Mendocino and would probably virtually eliminate the midwater trawl and whiting fishery. Under Alternative 4, widow rockfish would become the biggest constraint to commercial fisheries north of Cape Mendocino. Bocaccio would supercede canary rockfish and cowcod as the major constraint south of Cape Mendocino.

8.5.1.6 Action Alternative 5 (Council Preferred)

8.5.2 Summary of Impacts on Buyers and Processors

8.5.2.1 No Action Alternative

This alternative would be the most beneficial to whiting processors because of the high OY for widow. Extremely low near term OYs for bocaccio would severely limit harvests from most fisheries south of Cape Mendocino. However the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.2.2 Action Alternative 1

This alternative would maintain the same general level and distribution of commercial harvest as is planned for 2004, and should allow increased activity in the whiting sectors because of the relatively high OY for widow. Harvests from exempted trawl and fixed gear fisheries south of Cape Mendocino should also be relatively higher due to the high OY for bocaccio under this alternative.

8.5.2.3 Action Alternative 2

This alternative would allow maintenance of the same general level and distribution of commercial harvests as planned for 2004, although a lower OY for widow rockfish would make this alternative relatively less favorable for whiting harvesters and processors than in 2004. May allow some increase in harvests from exempted trawl and fixed gear sectors south of Cape Mendocino.

8.5.2.4 Action Alternative 3

This alternative would allow maintenance of a similar general level of commercial harvest as planned for 2004 for most fisheries. However whiting harvest would be relatively more constrained than in 2004 due to a considerably lower OY for widow rockfish. Under Alternative 3, widow rockfish would join canary rockfish and yelloweye as the biggest constraints to commercial harvests north of Cape Mendocino.

8.5.2.5 Action Alternative 4

This alternative would result in considerably lower commercial fisheries harvests than is planned for 2004. Very low OYs for bocaccio would depress harvests of most fisheries south of Cape Mendocino. Very low OYs for widow rockfish would greatly constrain harvests north of Cape Mendocino and would probably virtually eliminate the midwater trawl and whiting fishery. Under Alternative 4, widow rockfish would probably become the biggest constraint to commercial fisheries north of Cape Mendocino. Bocaccio would supercede canary rockfish and cowcod as the major constraint south of Cape Mendocino.

8.5.2.6 Action Alternative 5 (Council Preferred)

8.5.3 Impacts on Recreational Fishery

8.5.3.1 No Action Alternative

While this alternative allows the most harvest in the near term for widow and yelloweye, extremely low OYs for bocaccio in the near term, coupled with a probably zero OY for cowcod, would virtually eliminate recreational groundfish fisheries south of Cape Mendocino. However the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.3.2 Action Alternative 1

This alternative allows the highest near term harvests for bocaccio and cowcod, and the highest near term OYs under an actual rebuilding alternative for widow and yelloweye. This alternative would maintain the same general level of recreational fishing activity as planned for 2004 north of Cape Mendocino, and may allow an increase in activity south of Cape Mendocino due to the high OY for bocaccio. Under this alternative, canary rockfish and yelloweye would be the biggest constraints to recreational fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.3.3 Action Alternative 2

This alternative would maintain the same general level of recreational fishing activity as planned for 2004. Under Alternative 2, canary rockfish and yelloweye would be the biggest constraints to recreational fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.3.4 Action Alternative 3

This alternative would allow maintenance of a similar general level of recreational fishing activity planned for 2004, although recreational fisheries north of Cape Mendocino may be more constrained than in 2004 due to a considerably lower OY for widow rockfish. Under Alternative 3, widow rockfish may join canary rockfish and yelloweye as constraints to recreational fisheries north of Cape Mendocino. Canary rockfish and cowcod would be the biggest constraints south of Cape Mendocino.

8.5.3.5 Action Alternative 4

This alternative would result in much lower levels of activity for most recreational groundfish fisheries than is planned for 2004. Very low OYs for widow rockfish and bocaccio would constrain most recreational groundfish fisheries north and south of Cape Mendocino, and may significantly limit non-groundfish recreational fisheries. Under Alternative 4, widow rockfish may become the major constraint to recreational fisheries north of Cape Mendocino. Bocaccio would likely supercede canary rockfish and cowcod as the major constraint south of Cape Mendocino.

8.5.3.6 Action Alternative 5 (Council Preferred)

8.5.4 Impacts on Tribal Fisheries

Commercial fisheries prosecuted by tribal vessels occur off Washington and so are not directly affected by the OYs for bocaccio and cowcod. Some yelloweye are taken by tribal longline fleet. However the range of OYs between the yelloweye rebuilding alternatives is probably too narrow to have differential effects on the tribal longline fleet. Consequently the only significant impact of the rebuilding plans in this document on tribal fisheries will result from measures to rebuild widow rockfish, which is taken in the tribal midwater trawl and whiting trawl fisheries.

8.5.4.1 No Action Alternative

This alternative would be the most beneficial to tribal vessels operating in the midwater trawl and whiting trawl fisheries because of the high OY for widow. However the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.4.2 Action Alternative 1

Since this alternative allows the highest near term OYs under an actual rebuilding alternative for widow and yelloweye, it would maintain the same general level of tribal fishing activity planned for 2004, and result in the highest level of activity among rebuilding alternatives for the tribal midwater trawl and whiting trawl fisheries because of the relatively high OY for widow.

8.5.4.3 Action Alternative 2

This alternative allows the second highest near term OYs under an actual rebuilding alternative for widow and yelloweye. Under this alternative a lower OY for widow rockfish may constrain the tribal midwater trawl and whiting trawl fisheries relatively more than in 2004.

8.5.4.4 Action Alternative 3

This alternative would constrain tribal midwater trawl and whiting trawl fisheries relatively more than in 2004 due to a considerably lower OY for widow rockfish. Under Alternative 3, widow rockfish would join canary rockfish and yelloweye as the biggest constraints to fisheries north of Cape Mendocino.

8.5.4.5 Action Alternative 4

Very low OYs for widow rockfish would probably virtually eliminate the tribal midwater trawl and whiting fishery. Under Alternative 4, widow rockfish would probably become the biggest constraint to commercial fisheries north of Cape Mendocino.

8.5.4.6 Action Alternative 5 (Council Preferred)

8.5.5 Impacts on Communities

The effects on communities are the net sum of impacts on commercial fisheries, tribal fisheries, recreational fisheries and buyers and processors. Southern California communities will be impacted by restrictions imposed to rebuild cowcod and bocaccio under some of the alternatives. Communities located on the Oregon and Washington coasts will be impacted by restrictions imposed to rebuild widow rockfish and yelloweye rockfish under some of the alternatives.

8.5.5.1 No Action Alternative

This alternative would negatively impact fishing communities in southern and central California due to the extremely low near term OYs for bocaccio, and probable near zero OY for cowcod. These two factors would combine to severely restrict commercial and recreational groundfish fisheries in these areas, and negatively impact processors. The combination of relatively high near term OY levels for widow rockfish and yelloweye rockfish would make this the most favorable alternative for communities north of Cape Mendocino. While measures to rebuild yelloweye would be no more restrictive than any of the other alternatives, very high OYs for widow rockfish would facilitate access to viable whiting and other healthy groundfish stocks by commercial vessels. For these reasons this alternative may be the most favorable for harvesters and processors north of Cape Mendocino. However the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.5.2 Action Alternative 1

This alternative allows near term harvest levels for bocaccio, cowcod, widow and yelloweye that are at least as high as the 2004 OYs. Hence this alternative should maintain at least the same general level and distribution of benefits to communities along the West Coast as is expected in 2004. May allow increased benefits from whiting harvest for communities north of Cape Mendocino. May allow increased benefits from exempted trawl and fixed gear fisheries for communities south of Cape Mendocino.

8.5.5.3 Action Alternative 2

This alternative allows near term harvest levels for bocaccio and yelloweye that are at least as high as in 2004. The OYs for cowcod and widow rockfish are somewhat lower than in 2004. This alternative should generally maintain the level and distribution of benefits to West Coast communities expected in 2004, although a lower OY for widow rockfish may constrain midwater trawl and whiting trawl fisheries relatively more than in 2004. Communities supporting these fisheries are overwhelmingly ocated north of Cape Mendocino.

8.5.5.4 Action Alternative 3

Near term OYs under this alternative are somewhat lower than in 2004 for bocaccio and cowcod, and slightly larger than in 2004 for yelloweye, but less than half the 2004 level for widow rockfish. Consequently the level of benefits will be lower than expected in 2004, especially for communities north of Cape Mendocino engaged in midwater trawl and whiting trawl fisheries.

8.5.5.5 Action Alternative 4

This alternative would result in considerably lower commercial and recreational harvests than expected for 2004. Very low OYs for bocaccio would severely depress harvests south of Cape Mendocino. Very low OYs for widow rockfish would greatly constrain harvests north of Cape Mendocino and would probably virtually eliminate the midwater trawl and whiting fishery.

8.5.5.6 Action Alternative 5 (Council Preferred)

8.5.6 Impacts on Nonconsumers and Nonusers

From the perspective of a non-consumptive user or non-user who derive non-use benefits from knowing the biomass of a rebuilding species is healthy and increasing, the faster the rebuilding trajectory generally the better. A public policies that rebuild a species more rapidly may have less value to nonconsumers and non-users than a policy that rebuilds more slowly by preserving greater benefits for consumptive users.

8.5.6.1 No Action Alternative

While rebuilding is projected to occur under this alternative for bocaccio, the absence of realistic rebuilding probabilities for widow, yelloweye and cowcod probably disqualifies this alternative.

8.5.6.2 Action Alternative 1

While rebuilding is projected to occur under this alternative for all four species, the rebuilding periods are the longest of the rebuilding alternatives, and so probably have the least value to nonconsumers and non-users.

8.5.6.3 Action Alternative 2

Compared with Alternative 1 the rebuilding period is two years shorter for bocaccio, five years shorter for cowcod and yelloweye, and three years shorter for widow.

8.5.6.4 Action Alternative 3

Compared with Alternative 2 the rebuilding period is three years shorter for bocaccio, no different for cowcod, three years shorter for widow and four years shorter for yelloweye.

8.5.6.5 Action Alternative 4

This alternative rebuilds the fastest for all species. Compared with Alternative 3 the rebuilding period is two years shorter for bocaccio, no different for cowcod, and four years shorter for widow and yelloweye. This alternative probably has the highest value to nonconsumers and non-users.

8.5.6.6 Action Alternative 5 (Council Preferred)

8.5.7 Environmental Justice Considerations

8.5.7.1 Identifying Communities of Concern

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* requires federal agencies to identify and address "disproportionately high adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations in the United States." Fishery management actions promulgated by the Pacific Council and implemented by NMFS can have environmental and socioeconomic impacts over a very wide area; the affected area of many actions covers all West Coast waters and adjacent coastal communities involved in fishing. This makes it difficult to identify minority and low-income populations that may be disproportionately affected.

Section 8.5 in Appendix A describes a methodology, using 2000 U.S. Census data, to identify potential "communities of concern" because their populations have a lower income or a higher proportion of minorities than comparable communities in their region. West Coast ports identified in the PacFIN database were examined in this way. These ports were evaluated using five criteria: the percentage nonwhite population, percentage Native American population, percentage Hispanic population, average income, and the poverty rate. Data were evaluated for both census places and census block groups corresponding to the area around these census places. (Several ports are not identified as census places; in these cases only data from block group approximating the extent of the port community could be evaluated.) The values for these statistics were compared to the average value for one of three regions, covering coastal block groups in Washington, Oregon, and Northern California; Central California; and Southern California. For each of the five statistics, Table 8-20 in Appendix A summarizes the results by showing potential communities of concern. These are communities that have a significantly higher percentage minority population and poverty rate or lower average income than the surrounding reference region. (See Appendix A, Section 8.5 for a more detailed discussion of the qualification threshold.)

About two-thirds of the port communities listed in Appendix A Table 8-20 are above the cutoff threshold for one or more of the statistics, measured either by the census place value or the equivalent block groups. This suggests that additional criteria need to be applied to more realistically identify which ports should be of concern. It should be noted that the population affected by the proposed action, which would be predominantly fishers and those involved in allied industries (e.g., marine supplies, fish processing) is a small percentage of the population in most communities. It stands to reason that in larger communities and more urban areas fishery participants are a smaller and potentially less representative component of the population. In isolated rural communities there are usually fewer alternative employment alternatives, making it harder to find work or switch from one occupation to another in response to changes in one economic sector such as fisheries. Given these conditions, another criterion to focus on communities of concern would be population size and urbanization. (Appendix A, Table 8-10 lists the percent of the population classified as urban in the census.) Eliminating ports with a population greater than 50,000, and of those ports with a population less than 50,000, those for which the block group area is more than 75% urban leaves the following ports as potential communities of concern:

Name	Qualifying Demographic Criteria
Blaine, Washington	poverty rate
La Conner, Washington	% Hispanic
Neah Bay, Washington	% nonwhite, % Native American, average income, poverty rate
La Push, Washington	% nonwhite, % Native American, poverty rate
Copalis Beach, Washington	income
Westport, Washington	income, poverty rate
Willapa Bay	income, poverty rate
Salmon River, Oregon	% Native American
Siletz Bay, Oregon	% Native American
Waldport, Oregon	income
Winchester Bay, Oregon	income, poverty rate
Port Orford, Oregon	income, poverty rate
Brookings, Oregon	% Native American, income
Trinidad, California	% Native American, income, poverty rate
Fort Bragg, California	% Hispanic
Albion, California	% Hispanic
Point Arena, California	% Native American, % Hispanic
Moss Landing, California	% Native American, % Hispanic

Only the statistics for the equivalent block group areas were considered in identifying these ports. This is a more consistent basis for comparison, because a common demographic unit is used (the block group). Also, for ports in rural areas block groups were chosen to include the region surrounding the census place on the premise that fishery participants, and the local economy in general, draws on population over a wider area.

It should be noted that fishery participants usually make up a small component of the population and fisheries may be a small part of the local economy in many places. Thus, even if a community has a high proportion of minority or low income residents, these people might not participate in fisheries and are thus minimally affected by the proposed action. Furthermore, within the affected population some segments are more likely to be low income and minority than others. For example, employees in a fishing processing plant may be predominantly from a minority group, or deckhands on vessels are likely to have a lower income than the skipper or vessel owner, making them more likely to be low income. Unfortunately, the kind of detailed population data necessary to determine the characteristics of the population affected by the proposed action are unavailable. For this reason, the ports identified above represent an initial screening. In the future NMFS may be able to collect more information about the characteristics of fishery participants in these communities (in contrast to the general population).

8.5.7.2 Effect of the Proposed Action on Communities of Concern

In evaluating disproportionate impacts, Executive Order 12898 emphasizes the role of environmental contaminants—pollution—as sources of stress on the community. Because of the nature of the proposed action, these types of effects will not occur. The direct source of stress would be any decline in employment and related personal income in response to additional restrictions placed on groundfish fisheries. For those most directly affected—for example, by loss of a job—this could have secondary effects stemming from income declines and unemployment. At the extreme, vulnerable members of a family that depends on fishing income could suffer health effects due to a shift to a poorer diet. Unemployment can also engender psychological stress due to uncertainty and loss of self esteem and self identity.

Management measures required to meet rebuilding targets for widow rockfish under Alternative 3 and Alternative 4 are most likely to have a disproportionate effect on the communities of concern identified above. Indian tribes on the Pacific coast in Washington participate in whiting and midwater trawl fisheries that account for the bulk of widow rockfish fishing mortality. To meet these targets these fisheries would have to be significantly curtailed or eliminated. Neah Bay and La Push would be affected as a result, along with other coastal communities in Washington and the north and central Oregon coast. The OYs resulting from yelloweye rockfish rebuilding targets do not differ enough under the action alternatives to require different management measures and disproportionate effects are not anticipated. Bocaccio and cowcod rebuilding measures would affect fishing communities in Central and Southern California. The projected OYs for bocaccio under Alternatives 1 through 3 are greater than the projected total fishing mortality for 2004. Alternative 4 would require some additional restrictions in the short term while No Action would require many fisheries to be essentially shut down in the short term. Cowcod OYs do not differ enough to require additional measures beyond what is currently in place. Moss Landing is the only community of concern identified in this region; other communities were eliminated based on their size and urban character, as discussed above. However, as noted, the status of fishery participants affected by the action (as distinct from the port communities where they may live) is unknown. Recreational fisheries in Central and Southern California would be most affected by restrictions required under Alternative 4 and No Action because they account for the largest share of bocaccio fishing mortality. Minority and low income people may participate in segments of this fishery—for example, working on charter fishing boats—and be directly affected by the proposed action.

8.6 Social Cost-Benefit Analysis

8.6.1 Overall Approach

Cost-benefit analysis is conducted to evaluate net social benefits attributed to taking a particular action as opposed to not taking the action. With respect to regulatory actions, changes in net benefits are measured as the difference in the present value of the discounted stream of costs and benefits accruing with the regulatory action compared with the stream that would have occurred without the action. In situations where a specific outcome is mandated, a cost-effectiveness analysis may be used to compare alternatives rather than a cost-benefit analysis. A cost effectiveness analysis seeks to find the regulatory design that minimizes costs rather than evaluating whether or not the action is warranted. The advantage of a cost-effectiveness analysis is that there is no need to evaluate the benefits of the mandated policy outcome (in this case, rebuilt stocks). Many of the benefits of rebuilt stocks are intangible or difficult to measure, for example, the value of ecosystem services and existence values.

8.6.1.2 Social vs. Private Costs and Benefits

Cost-benefit analysis conducted for public decisions, such as fishery management, generally assess net social benefits. Social costs and benefits differ from private costs and benefits in that social costs and benefits include total economic costs and benefits, while private costs and benefits measure only those effects that show up on the balance sheet of a firm or agency or as a financial or consumption effect to the consumer.

For example, in an environment of high unemployment, if a vessel hires an unemployed worker, that vessel incurs an accounting cost in the form of the additional wages it must pay. However, from a social point of view, there may be little cost if the individual would have otherwise been unemployed. From a social point of view, no productive output was forgone in order to employ the worker, so there was no opportunity cost. On the other hand, in an environment of low unemployment, if a worker is taken away from some other productive employment in order to work on the vessel, then the loss in production from the worker's previous role is considered a cost to society, an opportunity cost.

The alternatives for each species are compared with respect to how these relative differences will affect commercial and tribal fishers, buyers and processors, recreational fishers, non-consumptive users, nonusers and public sector expenditures for enforcement and monitoring.

8.6.1.3 Note on Quality of Results

The minimum standard for a cost-benefit analysis is a qualitative listing of positive and negative impacts. From there, an attempt is made to quantify or provide some indicators of the scale of the impacts and, if possible, to assign a monetary value to those changes.

There is not sufficient information on West Coast groundfish fisheries for a complete enumeration of net economic benefits from the fishery. However, by examining the elements that go into a net benefits analysis, it is possible to show qualitatively how net social benefits are likely to be affected under different policy options. Additionally, a sense of the magnitude of the impacts can be gauged by examining quantitative information on certain components (e.g., variable amounts of fish available for harvest over time), and for some elements it may be possible to associate a dollar value with some of the quantified changes. The dollar value provides some sense of the potential magnitude of effect compared with activities in other sectors of the economy. However, the values available are usually only some of the elements that would go into a full quantification of costs and benefits. For example, a dollar measure frequently available is the exvessel revenue from sales to seafood handlers and processors. While this is an important item in the calculation of producer surplus, it is only one of the elements necessary for a full determination of costs and benefits.

8.6.2 Key Trade-Offs for Analysis

The choice of alternatives before the Council involves a trade-off between the probability that a stock will rebuild and the costs and benefits associated with that probability. In general, a higher probability of rebuilding within T_{MAX} is achieved by reducing annual harvest rates. However lower annual harvests reduce income and employment generating opportunities in fishing communities. Conversely, while higher annual harvest rates generally imply a lower probability of rebuilding within T_{MAX}, the higher harvests are better able to sustain fishing communities during the rebuilding period.

8.6.2.1 Risk vs. Uncertainty

Risk is generally defined as a situation in which different outcomes are possible, but the probability of a particular outcome is known. Uncertainty is a situation in which the probability of different outcomes is unknown. There are often many influences that lead to a particular outcome. To the degree that the relationship between the influences and outcome is known, and the variability of the influences can be modeled, uncertainty can be reduced to measures of absolute risk.

Measures of absolute risk are difficult to develop; but we do know enough about population dynamics to say something about the relative risk among the different harvest policy alternatives. Few would argue that under overfished stock conditions, lower harvests increase the probability of higher stock biomass in the future. Thus, we can rank the harvest policies relative to one another in terms of the risk that stocks will not rebuild. Notwithstanding all the other sources of uncertainty about the exact outcome of a particular harvest policy, those policies with higher harvests in the short term have a lower probability of rebuilding biomass over the long term.

Estimated costs and benefits for each harvest policy alternative are based on these median results from the Monte Carlo simulations. To assess the harvest policy alternative in terms of its effect on future harvest, the expected median biomass each year is used along with the associated median OY. The biomass and OY values under a particular harvest policy represent the median of the values from the distribution of biomass and OY levels from Monte Carlo simulations of that harvest policy. While these measures are used to indicate the likely harvest level each year under the rebuilding policy, it should also be noted that in almost half the simulations under the rebuilding policy, rebuilding failed to occur by the target year.

8.6.2.2 Present vs. Future Costs and Benefits

Quantitative comparisons are more informative when uncertainty can be portrayed as a quantified risk by establishing reasonable probability distribution for factors generating the uncertainty. One of the key areas of uncertainty with respect to future rebuilding outcomes is recruitment (or recruits per spawner) that may be expected from a given stock in a given year. In that regard, an attempt has been made in the species rebuilding analyses to reduce uncertainty to risk by assuming a probability distribution from a range of historic observations.

In the rebuilding analyses, the probability of rebuilding within certain time frames was modeled using "Monte Carlo simulations." For a given harvest policy, this method projects future population trends hundreds of times in separate computer simulations. Each simulation is different because the assumed annual recruitments (or recruits per spawner relationships) are drawn randomly from a range of historic observations. Taken together these simulations depict a distribution of possible biomass and OY levels each year under the harvest policy.

The probability of rebuilding by a particular year is taken as the percentage of simulations that show projected biomass levels at least equal to the rebuilt level in or before that year. A lower annual harvest causes a greater number of simulations to reach the rebuilt biomass level by a particular year, and so a greater probability of achieving stock rebuilding by that year (and *vice versa)*. Several of the alternatives are identified by the associated P_{MAX}, the probability that the stocks will be rebuilt by the maximum year allowed under the law, as computed by the proportion of the Monte Carlo runs projecting that the stock will be rebuilt by or before that year. (Note that most of the species modeled under the *No Action* (40-10 rule) do not rebuild within T_{MAX} and so are not "rebuilding alternatives.") The "target year" for each rebuilding alternative is the first year in which 50% of the runs reached rebuilt biomass levels. Thus, the target year has been equated with the median rebuilding year under each rebuilding alternative. In this situation, median refers to the year where exactly 50% of the biomass projections were greater than the rebuilt value, and 50% were lower. Note that this also implies that about 50% of the time we would not expect to achieve rebuilding by the nominal target year.

8.6.3 Factors Considered in Assessing Net Social Benefits

Social net benefit analysis uses measures of costs and benefits to all entities affected by an action in order to assess the net effect on the nation. Net benefits from groundfish fisheries consist of producer surplus and consumer surplus accrued over time. If there are no market distortions[15/] and all goods are traded in markets, consumer surplus and producer surplus can, at least theoretically, be measured or approximated by market

15/ The prices paid for goods and quantities consumed reflected true opportunity costs as described in Section 4.5.1.

demand and supply curves (NMFS 2000b). Producer surplus can also be calculated from revenue and cost data using opportunity costs rather than accounting costs.

Benefits and costs may accrue to consumers or producers not only through their own direct activity, but also through changes in public expenditures (NMFS 2000b). For example, the governmental expense to administer a VMS program is ultimately covered by a transfer payment from consumers or producers to the government (taxes). Thus rather than the economy producing a good demanded directly by producers or consumers, the economy produces a VMS monitoring system demanded indirectly by producers and consumers through actions taken to achieve social objectives administered by the government. In some cases, the cost of a new governmental activity is not met by a transfer through taxes, but rather by a reprogramming of existing governmental assets. For example, if budgets are not increased when there is a new regulation requiring increased enforcement effort, then the opportunity cost of increased enforcement activity may be the loss of other activities in order to pursue fishery enforcement.

8.6.3.1 Producer Surplus

Total producer surplus is the difference between the amounts producers actually receive for providing goods and services and the economic costs producers bear to do so. Economic costs are measured by the opportunity cost of all resources including the raw materials, physical capital, and human capital used in the process of supplying these goods and services to consumers (NMFS 2000b).

The main capital investment for which a return must be earned is the vessel gear and associated fishing permits. On an individual fishing business basis, producer surplus is the difference between gross revenues and all costs, including payments to labor and owners of the business. At the industry or fishery level, producer surplus is the sum of net economic rent accruing to owners who control the relatively fixed factors of production (e.g., vessels, permits, fishing rights, specific knowledge, entrepreneurial capacity). Producer surplus in the fishing sector can increase through a reduction in unit harvesting costs (improved economic efficiency) or an increase in exvessel prices received.

Vessel as Proxy for the Seafood Fishing Firm

Because information is readily available on fishing vessels, but not the businesses that own those vessels, we generally use the fishing vessel as a proxy for the fishing business. For analytical purposes, the vessel is viewed as a profit center owned by the fishing business that must cover all fishing costs, including materials and equipment, payments to captain and crew, and a return to the owners.

Other Affected Producers

In addition to commercial fishing vessels, other fishery-dependent businesses include buyers who act as intermediaries between the vessels and consumers, processors who purchase raw materials from commercial vessels to produce seafood products for shipment to regional, national and/or export markets, and charter or party vessels that provide recreational fishing experience for paying customers. A thorough accounting of net benefits would include measurement of producer surpluses accruing in these business sectors as well as the fishing vessels.

8.6.3.2 Consumer Surplus

Consumer surplus is the net value of products to the consumer, or the difference between what the consumer actually pays and what they would be willing to pay (i.e., the value to the consumer over and above the actual purchase price). Consumer surplus can increase through a reduction in prices paid, an increase in the quantities consumed or improvement in product quality. Consumer surplus exists because, while some people would be willing to pay more than the going price, the forces of supply and demand in competitive markets determine a single price for a good at any given time. Consumer surplus can, therefore, be loosely interpreted as the extra income available for spending on other items, because some individuals pay less than they would be willing to pay. However, not all goods and services important to consumers are exchanged through markets with market prices.

Market Consumer Goods

Seafood: For goods sold in markets where a consumer price can be determined, for example the market for seafood, available price, and quantity, information can allow estimation of the amount consumers might be willing to pay above the purchase price. However, if changes in the quantity of fish available are not expected to change prices because of ready availability of imports or other protein substitutes, a given regulatory action may have little or no impact on consumers.

Charter and Headboat Recreational Fisher Trips: On charter and headboats, individuals pay fees to participate in a recreational fishing trip. Price and quantity information from markets for these trips might allow estimation of the amount consumers are willing to pay above the purchase price. However, charter trips may often be purchased as part of a bundle of goods and services that include other nonfishing recreational activities for the participant or other members of his or her party. Therefore, the consumer surplus estimation problems may be on a par with those described below for private recreational trips.

Non-Market Consumer Goods - Consumptive (Use Values)

For other consumer goods, especially bundles of goods and services like a recreational fishing trip taken on a private vessel, the prices and quantities associated with each transaction are very difficult to determine.

Private Recreational Fisher Trips: The term “private” is used to designate a recreational fisher fishing from a private vessel, the shore, bank, or a public pier. This term is used to distinguish private fishers from those who take part in trips on charter vessels. For the private recreational fisher, the amount spent on fishing gear, licenses and other goods necessary to carry out a particular fishing trip is difficult to separate. Additionally, depending on the value a particular individual places on alternatives to fishing, the consumer surplus associated with the trip may far exceed actual trip expenditures.

Non-Market Consumer Goods - Nonconsumptive and Nonuse

Nonconsumptive users may experience benefits from the use and non-use values provided by the resource. A use value would be wildlife viewing or the derivation of secondary benefits from ecosystem services. One or more of the following non-use benefits may accrue to some individuals from preservation of fish stocks at higher levels of abundance (1) existence value derived from knowing a fish population or ecosystem is protected without intent to harvest, observe, or otherwise derive direct benefits from the resource; (2) option value placed on knowing a fish population, habitat, or ecosystem has been protected and is available for use, regardless of whether the resources are actually used; and (3) bequethal value placed on knowing a fish population, habitat, or ecosystem is protected for the benefit of future generations. These values may be closely related and overlap with values the general public places on wildlife and natural parks.

The existence of coastal fishing communities in themselves may have intrinsic social value. For example, the Newport Beach dory fishing fleet, founded in 1891, is an historical landmark designated by the Newport Beach Historical Society. The city grants the dory fleet use of the public beach in return for the business and tourism this unique fishery generates.

8.6.4 Comparison of the Alternatives

Introduction

The general approach in this section is to summarize for each alternative the qualitative and quantitative private costs and benefits, as covered in previous sections of the socioeconomic analysis, and where applicable, to point out how social costs and benefits may diverge from private ones. Where possible, the analysis will indicate the performance of the alternatives relative to one another and the magnitude of the difference in economic effects that may separate the alternatives.

The specific measures for achieving desired harvest levels will be adopted each biennium as part of the multi-year specifications process. When measures of a new kind, such as a VMS system, are introduced, a separate process and analyses will be conducted to evaluate the effects of the proposed new measure. For the purposes of this analysis it is assumed that OYs will be managed through measures similar to those imposed for the 2004 fisheries.

The economic effects of the proposed actions evaluated in the social net benefit analysis below arise from two direct impacts, (1) the impacts on current and future stock biomass, and (2) the impacts on current and future harvests. The following discussion summarizes the analyses shown for the individual species covered in this rebuilding plan (Tables 8-13 through 8-16).

Producer Surplus

Commercial Vessels

Over time, harvest costs will be reduced through increased CPUE. This effect will enhance producer surplus. In the long term, this benefit will be equivalent between the rebuilding alternatives. Alternatives that rebuild faster have a higher probability of achieving these benefits sooner. However, in the near term there will be much higher adjustment costs under the lower harvest alternatives as more vessels must switch to second best alternatives or are idled. In the long term there may also be secondary benefits to the harvesting sector derived from an enhanced condition of the marine ecosystem. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, while allowing higher current harvests, would not provide this long-term benefit.

Buyers and Processors

Increased abundance and average size of rebuilding species may increase product recovery rates and reduce processing costs in the long term. While alternatives that rebuild faster may realize these benefits sooner, there will be much higher adjustment costs in the near term under the lower harvest alternatives as processors must switch to second best alternatives or are forced to idle excess capacity. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, while allowing higher current harvests, would not provide this long-term benefit.

Recreational Charter Vessels

Likely, near-term closures for species caught in the recreational fishery under Alternative 4 for widow rockfish will increase adjustment costs for charter vessels, and may push some operators into second best activities, such as excursions or wildlife viewing, or out of business. In the long run, as stocks rebuild under the rebuilding alternatives, there should be increased demand from consumers for recreational experiences, both consumptive fishing and nonconsumptive viewing. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, are not expected to provide this long-term benefit.

Consumer Surplus

Seafood Consumers

In the near term under the lower harvest alternatives, some consumers may experience a reduction in consumer surplus as the availability of live fish in restaurants and speciality seafood markets is reduced or eliminated. This applies primarily to widow rockfish rebuilding under Alternative 4, since the very low OY levels may negate most fishing. In the long term and for most consumers of fresh and frozen seafood products, there should be little difference between the alternatives, since locally-caught products no longer available would be replaced with close substitutes obtained from elsewhere in the global supply chain.

Recreational Fishers

For species caught in recreational fisheries, in the long run, under the rebuilding alternatives there should be higher recreational CPUEs as stocks are rebuilt. This may lead to higher trip values. Likely, near-term closures under widow rockfish rebuilding under Alternative 4 will reduce consumer surplus for recreational fishers as reduced supply of fishing opportunities moves anglers to second best recreational experiences. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, would support higher activity levels in the near-term, but are not expected to increase long-term benefits.

Nonconsumptive Users

In the long run, increased stocks may indirectly enhance the value of wildlife viewing experience for non-consumptive users. Presumably faster rebuilding will enhance these benefits. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, are not expected to enhance this long-term benefit.

Nonusers

In the long run, increased stocks may enhance nonuse values. Increases in existence value, options value and bequethal value for nonusers may be proportional to the probability of rebuilding within T_{MAX}. Alternatives ranked from highest to lowest probability of rebuilding within T_{MAX} for widow and yelloweye are: Alternative 4, Alternative 3, Alternative 2 and Alternative 1. Alternatives ranked from highest to lowest probability of rebuilding within T_{MAX} for bocaccio are: Alternative 4, Alternative 3, No Action, Alternative 2 and Alternative 1. Alternatives ranked from highest to lowest probability of rebuilding within T_{MAX} for cowcod are: Alternative 2-4 and Alternative 1. Alternatives that do not rebuild, such as No Action for cowcod, widow and yelloweye, are not expected to enhance this long-term benefit.

Public Expenditures Affecting Either Consumer or Producer Surplus

Enforcement Issues

For alternatives other than Alternative 4, higher enforcement intensity may be necessary in the near term in order to enforce more complex regulations. Alternative 4 for widow rockfish would likely imply closures in the near term, which may be cheaper to enforce. In the long term, once overfished stocks are rebuilt, enforcement costs should be identical under the alternatives.

Science and Monitoring Costs

Alternatives with very low OYs will reduce the quantity of fisheries-dependent data gathered, or increase the cost of gathering the data. This may necessitate higher expenditures for collection of fisheries independent data. In the long term, once overfished stocks are rebuilt, there is no difference between the alternatives.

TABLE 8-1. Estimated recreational fishery harvest by region for charter and private boats for 2002 (mt). (Page 1 of 1)

Area	Fishing Mode	Lingcod	Nearshore Rockfish	Shelf Rockfish	Other Nearshore Groundfish	Other Shelf Groundfish	Other Groundfish	Total Groundfish	Salmon	Halibut	Highly Migratory Species	Other	Total
Washington	Charter	36	139	3	1	0	1	180	648	21	41	1	891
	Private	46	42	3	7	5	1	103	965	27	3	0	1,097
	Total	81	181	5	8	5	2	283	1,613	48	44	2	1,988
Oregon	Charter	43	219	11	11	0	19	303	30	1	16	0	350
	Private	31	83	3	9	0	4	129	85	1	12	0	227
	Total	74	302	14	20	0	23	432	115	2	27	1	577
Northern California	Charter	192	270	20	9	0	13	504	366	8	99	34	1,011
	Private	232	391	6	41	0	16	686	1,117	164	467	84	2,519
	Total	424	661	26	50	0	29	1,190	1,483	173	565	119	3,530
Southern California	Charter	29	97	76	89	3	1	295	4	16	187	894	1,396
	Private	45	118	41	46	0	3	253	80	369	166	1,389	2,256
	Total	74	214	117	135	3	4	547	85	385	353	2,283	3,653
California Total	Charter	221	367	96	97	3	13	799	370	24	286	929	2,407
	Private	277	509	46	87	0	19	939	1,198	533	633	1,473	4,775
	Total	498	876	143	185	3	33	1,737	1,568	557	919	2,402	7,183
West Coast Total	Charter	300	725	109	110	4	34	1,282	1,049	46	342	930	3,649
	Private	353	633	52	103	5	24	1,170	2,247	561	647	1,474	6,099
	Total	653	1,358	162	212	9	58	2,452	3,296	607	990	2,404	9,748

Source: RecFIN data. Includes estimated catch from non-ocean areas.

TABLE 8-2. Bycatch of groundfish species (pounds) in Makah trawl and troll fisheries in 2000, 2001 and 2002. (Page 1 of 1)

2000	2001	2002	
Gear/Species	Pounds	Pounds	Pounds
MIDWATER TRAWL			
black	0	0	0
lingcod	0	6	215
canary	306	1,366	3,594
yelloweye	0	0	53
widow	2,036	11,549	27,639
yellowtail	67,872	190,494	586,438
POP	0	0	0
darkblotched	0	102	3,611
SST [a/]	0	0	0
BOTTOM TRAWL [b/]			
black	0	53	0
lingcod	7	508	9,003
canary	24	0	1,068
yelloweye	0	0	0
widow	0	0	0
yellowtail	563	505	5,909
POP	0	0	0
darkblotched	0	0	0
SST [a/]	0	0	283
TROLL			
black	0	0	0
lingcod	1,958	773	2,006
canary	381	607	1,189
yelloweye	988	43	83
widow	0	32	0
yellowtail	8,948	7,060	7,071
POP	0	0	0
darkblotched	0	0	0
SST [a/]	0	0	0
TOTAL			
black	0	53	0
lingcod	1,965	1,287	11,224
canary	711	1,973	5,851
yelloweye	988	43	136
widow	2,036	11,581	27,639
yellowtail	77,383	198,059	599,418
POP	0	0	0
darkblotched	0	102	3,611
SST [a/]	0	0	283

a/ Shortspine thornyhead
b/ No data available for bycatch by target species in bottom trawl. Primary target species are Pacific cod and flatfish.

TABLE 8-3. Bycatch of groundfish species in tribal longline fisheries in 2000, 2001 and 2002. (Page 1 of 1)

2000				2001				2002			
Target Species	Pounds	Bycatch Species	Pounds	Target Species	Pounds	Bycatch Species	Pounds	Target Species	Pounds	Bycatch Species	Pounds
Quinault [a]											
Halibut	85,252	[b]		Halibut	85,644	rock	49	Halibut	104,191	canary	4
Sablefish	309,762	[b]		Sablefish	288,511	rougheye	7,964			yelloweye	10
						blackgill	2,444			yellowtail	4
						shortraker	3,710			shelf	19
						SST [c]	542	Sablefish	114,269	slope	4,121
										SST [c]	570
Quileute											
Halibut	42,666	black	30	Halibut	45,034	black	0	Halibut	67,290	black	0
		lingcod	144			lingcod	1,599			lingcod	1,074
		canary	74			canary	25			canary	117
		yelloweye	2,365			yelloweye	4,224			yelloweye	3,287
		yellowtail	63			yellowtail	19			yellowtail	74
		widow	0			widow	0			widow	0
		POP	0			POP	0			POP	0
		darkblotched	0			darkblotche	0			darkblotche	0
		SST [c]	0			SST [c]	0			SST [c]	0
Sablefish	164,016	black	0	Sablefish	143,591	black	0	Sablefish	92,438	black	0
		lingcod	0			lingcod	0			lingcod	0
		canary	0			canary	0			canary	0
		yelloweye	0			yelloweye	0			yelloweye	0
		yellowtail	0			yellowtail	0			yellowtail	0
		widow	0			widow	0			widow	0
		POP	0			POP	0			POP	0
		darkblotched	0			darkblotche	0			darkblotche	0
		SST [c]	624			SST [c]	482			SST [c]	91
Makah											
Halibut	151,268	black	0	Halibut	270,365	black	0	Halibut	294,618	black	0
		lingcod	2,289			lingcod	4,092			lingcod	10,793
		canary	19,547			canary	2,330			canary	597
		yelloweye	523			yelloweye	2,075			yelloweye	1,819
		yellowtail	0			yellowtail	382			yellowtail	235
		widow	3			widow	19			widow	0
		POP	0			POP	0			POP	0
		darkblotched	0			darkblotche	0			darkblotche	0
		SST [c]	0			SST [c]	0			SST [c]	0
Sablefish	490,229	black	0	Sablefish	464,723	black	0	Sablefish	227,740	black	0
		lingcod	0			lingcod	0			lingcod	0
		canary	0			canary	0			canary	0
		yelloweye	0			yelloweye	0			yelloweye	0
		yellowtail	0			yellowtail	0			yellowtail	0
		widow	0			widow	0			widow	0
		POP	0			POP	0			POP	0
		darkblotched	0			darkblotche	0			darkblotche	0
		SST [c]	7,662			SST [c]	10,081			SST [c]	9,229

a/ No black rockfish, lingcod, Pacific ocean perch, widow, or darkblotched caught for these fisheries/years for Quinault.
b/ Data unavailable.
c/ Shortspine thornyhead

TABLE 8-4. 1998 Total Catch OYs, Estimated 2002 and 2003 Total Catch Mortality, and Pre-Season Estimated 2004 total catch mortality by fishery sector for overfished species (mt). (Page 1 of 1)

				Preseason Catch Estimates for 2004 d/									
	1998 Total Catch OY	Estimated 2002 Total Catch Mortality a/	Estimated 2003 Total Catch Mortality b/	Total Preseason Catch Estimate	Recre-ational	Limited Entry Fixed Gear	Directed Open Access	Other Commercial	Tribal	Research	Exempt Fishing Permits	Limited Entry Trawl (Shoreside & At Sea)	Limited Entry Shoreside Non-whiting Trawl only
Am 16-3 Species:													
Bocaccio c/	230	117.1	22.4	145.1	62.8	13.4	10.6	1.3	-	2	0.5	45	45
Cowcod	n/a	0.8	0.1	3.1	1.8	0.1	0.1	0	-	-	0.2	0.6	0.6
Widow	4,960	420.3	49.4	270	3.4	5	-	0.1	40	1.5	7.5	212.5	1.5
Yelloweye	n/a	9.1	6.6	16.2	8.2	0.1	0.6	0.8	2.3	1.1	2.3	0.8	0.4
Am 16-2 Species:													
Lingcod	838	872.3	1,326.2	734	521.1	12.7	62.5	2.8	25.1	3	26.5	80.3	78.4
Canary e/	1,045	78.3	36.2	44.5	17.6	0.5	0.3	2.1	3.6	1	2.3	17.1	9.8
POP f/	650	179.5	163.4	112	-	0.2	-	0	0	3	27	81.8	68.1
Darkblotched	n/a	131.6	107.7	122.8	-	1.5	-	0	0	1.6	9.5	110.2	100.7

a/ From Table 5-4.

b/ From Table 5-5.

c/ 1998 OY is for Eureka, Monterey, and Conception INPFC areas. 2002 and 2003 estimates are coastwide.

d/ These values are from Table 5-12 (updated 3/04 from Table 2.2.5-1 in the 2004 Groundfish Annual Specifications EIS (PFMC 2003)).

e/ 1998 OY is for Vancouver and Columbia INPFC areas. 2002 and 2003 estimates are coastwide.

f/ 1998 OY is for landed catch in the Vancouver and Columbia INPFC areas. 2002 and 2003 estimates are coastwide.

TABLE 3.8-5. Presence of any of the eight overfished species a/ in West Coast fisheries (summarized from Appendix B Tables 3.4-3 through 3.4-17). (Page 1 of 1)

	North of Mendocino			South of Mendocino		
Target	1998	2000	2002	1998	2000	2002
Limited Entry Trawl, Whiting	+++	+++	+++	-	-	-
Limited Entry Trawl, Non-whiting	+++	+++	+++	+++	+++	+++
Limited Entry Fixed Gear	+++	+++	++	+++	++	++
Open Access Groundfish	+++	+++	+++	+++	++	+++
Pink Shrimp	+++	+++	+++	+	+	-
Prawns	-	-	-	+	+	+
Dungeness Crab	+	+	+	+	-	-
Other Crustaceans	+	+	-	+	+	+
Pacific Halibut	+	++	++	+	-	-
California Halibut	-	-	+	+	+	++
Salmon	++	+++	++	+	+	++
Sea Cucumbers	-	-	-	+	-	+
Sea Urchins	-	-	-	+	-	+
California Sheephead	-	-	-	+	+	+
Gillnet Complex	-	-	-	+	-	+
Squid	-	-	-	-	-	-
CPS Finfish	-	-	-	+	+	+
Highly Migratory Species	+	+	-	+	+	+
Other Species	++	++	++	+	+	+

a/ Bocaccio, Canary, Cowcod, Darkblotched, Lingcod, POP, Widow or Yelloweye.
+++ = >10,000 pounds of any single overfished species in landings with the indicated primary target species.
++ = >10,000 pounds of all overfished species combined in landings with the indicated primary target species.
+ = <=10,000 pounds of all overfished species combined in landings with the indicated primary target species.
- = no overfished species present in landings with the indicated primary target.

TABLE 8-6. Rebuilding species constraining West Coast fisheries in 2005 under each alternative (assuming management regime similar to 2003 and 2004)a/.

No Action	North of Cape Mendocino: Yelloweye (recreational and fixed gear); Canary (all fisheries) South of Cape Mendocino: Bocaccio (exempt trawl, fixed gear, recreational); Cowcod (fixed gear, recreational) b/
Alternative 1	North of Cape Mendocino: Yelloweye (recreational and fixed gear); Canary (all fisheries) South of Cape Mendocino: Cowcod (fixed gear, recreational); Canary (all fisheries) b/
Alternative 2	North of Cape Mendocino: Yelloweye (recreational and fixed gear); Canary (all fisheries) South of Cape Mendocino: Cowcod (fixed gear, recreational); Canary (all fisheries) b/
Alternative 3	North of Cape Mendocino: Yelloweye (recreational and fixed gear); Widow (whiting and midwater trawl); Canary (all fisheries)
Alternative 4	North of Cape Mendocino: Yelloweye (recreational and fixed gear), Widow (whiting trawl, midwater trawl, fixed gear, recreational); Canary (all fisheries)
Council Preferred	

a/ Including impact of rebuilding measures adopted under Amendment 16-2. Under Amendment 16-2, canary rockfish was the most generally constraining species due to its coastwide distribution and very low annual OYs.

b/ Yelloweye may also become constraining South of Cape Mendocino depending on allocation of canary OY between commercial and recreational sectors.

TABLE 8-7. Catch and/or landed catch of **bocaccio** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 1 of 3)

Primary Target for Trip	Trips	Percent of Primary Target Trips with Bocaccio in Landing	Total Exvessel Revenue	Bocaccio Landed (mt)	Bocaccio Landed or Estimated Catch (mt)	Cumulative Bocaccio (mt)	Total Exvessel Revenue for Area: Percent of Total	Total Exvessel Revenue for Area: Cumulative Percent	Exves Rev/Lb Bocaccio (Landed & Bycatch)
1998									
North of Mendocino									
LE TWL, Canary	35	2.9%	159,373	0.004	0.004	0.004	0.1%	0%	17,708
Pink Shrimp	1,105	0.2%	4,960,814	0.005	0.005	0.010	4.4%	5%	413,401
LE Fxd Gr SF, Shelf	182	0.5%	710,550	0.006	0.006	0.016	0.6%	5%	50,754
LE Fxd Gr, Oth GF, Nearshore	215	0.5%	119,541	0.010	0.010	0.026	0.1%	5%	5,197
OA, Nearshore	2,201	0.2%	498,681	0.032	0.032	0.058	0.4%	6%	7,124
OA TWL, Oth, >50% GF	43	2.3%	172,602	0.036	0.036	0.094	0.2%	6%	2,185
LE TWL, Yellowtail	93	2.2%	399,104	0.044	0.044	0.138	0.4%	6%	4,114
LE TWL, Leftover	106	2.8%	330,150	0.117	0.117	0.254	0.3%	7%	1,285
LE TWL, Midwater	255	3.1%	1,461,986	0.140	0.140	0.395	1.3%	8%	4,731
OA, Shelf	1,265	2.4%	556,667	0.533	0.533	0.927	0.5%	8%	474
Oth GF (plurality but <50%)	179	3.4%	241,047	0.611	0.611	1.538	0.2%	9%	179
Oth Species	1,428	1.1%	9,261,628	0.672	0.672	2.209	8.3%	17%	6,254
LE TWL, Flatfish	957	2.3%	4,000,469	0.720	0.720	2.929	3.6%	21%	2,521
LE Fxd Gr, Oth GF, Shelf	313	2.9%	295,262	0.762	0.762	3.691	0.3%	21%	176
LE TWL, Slope RF	212	7.5%	1,325,816	2.182	2.182	5.873	1.2%	22%	276
LE TWL, DTS	1,627	5.0%	10,067,097	2.613	2.613	8.486	9.0%	31%	1,748
LE TWL, Widow	144	12.5%	1,583,364	3.196	3.196	11.681	1.4%	32%	225
LE TWL, Oth RF	165	9.7%	1,393,426	3.678	3.678	15.359	1.2%	34%	172
Total All Northern Fisheries	37,630		111,519,070	15.359	15.359				
South of Mendocino									
Oth Crustaceans	9,856	0.0%	7,214,809	0.000	0.000	0.000	8.2%	8%	7,214,809
OA, SF, Slope	58	1.7%	13,780	0.001	0.001	0.002	0.0%	8%	4,593
HMS Plan Species	2,783	0.0%	24,316,147	0.003	0.003	0.005	27.6%	36%	3,473,735
LE Fxd Gr SF, Slope	690	0.1%	669,160	0.003	0.003	0.008	0.8%	37%	95,594
Sea Cuc	947	0.1%	465,629	0.005	0.005	0.014	0.5%	37%	38,802
Pink Shrimp	70	2.9%	323,932	0.006	0.006	0.020	0.4%	37%	24,918
CPS Plan Species	2,768	0.1%	6,693,748	0.011	0.011	0.030	7.6%	45%	278,906
California Sheephead	860	0.2%	695,882	0.014	0.014	0.044	0.8%	46%	23,196
OA TWL, Halibut, >50% GF	284	1.4%	95,758	0.015	0.015	0.059	0.1%	46%	2,902
LE Fxd Gr SF, Shelf	27	7.4%	23,517	0.022	0.022	0.081	0.0%	46%	490
California Halibut	3,194	0.1%	1,829,470	0.023	0.023	0.103	2.1%	48%	36,589
No landing wt or 2 equal wts	605	0.3%	235,323	0.032	0.032	0.135	0.3%	48%	3,362
LE TWL, Leftover	12	58.3%	38,218	0.467	0.066	0.201	0.0%	48%	262
LE Fxd Gr, Oth GF, Slope	830	0.4%	648,550	0.079	0.079	0.281	0.7%	49%	3,706
Salmon	7,526	0.2%	3,004,940	0.131	0.131	0.412	3.4%	53%	10,398
Oth Species	3,114	0.4%	3,211,706	0.166	0.166	0.578	3.6%	56%	8,751
OA TWL, Oth, >50% GF	129	5.4%	28,139	0.173	0.173	0.752	0.0%	56%	74
LE TWL, Petrale Sole	41	22.0%	115,007	0.217	0.183	0.934	0.1%	56%	285

TABLE 8-7. Catch and/or landed catch of **bocaccio** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 2 of 3)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Bocaccio in Landing	Total Exvessel Revenue	Bocaccio Landed (mt)	Bocaccio Landed or Estimated Catch (mt)	Cumulative Bocaccio (mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Bocaccio (Landed & Bycatch)
OA, Nearshore	6,201	0.2%	2,559,930	0.269	0.269	1.203	2.9%	59%	4,317
Gillnet Complex	2,272	0.5%	1,167,329	0.309	0.309	1.512	1.3%	61%	1,714
LE TWL, Yellowtail	3	33.3%	11,596	0.348	0.348	1.860	0.0%	61%	15
LE TWL, Canary	5	80.0%	28,778	0.577	0.577	2.437	0.0%	61%	23
LE TWL, Midwater	16	31.3%	87,598	0.827	0.827	3.265	0.1%	61%	48
Oth GF (plurality but <50%)	333	4.5%	243,485	0.934	0.934	4.198	0.3%	61%	118
OA TWL, Prawn, >50% GF	38	39.5%	85,181	1.452	1.452	5.651	0.1%	61%	27
LE TWL, Widow	29	55.2%	265,582	2.177	2.177	7.828	0.3%	61%	55
LE TWL, DTS	548	24.8%	3,415,746	10.999	2.276	10.104	3.9%	65%	681
Prawns	3,132	1.8%	6,235,599	2.360	2.360	12.464	7.1%	72%	1,199
OA, Slope	166	7.2%	86,129	2.375	2.375	14.839	0.1%	73%	16
LE Fxd Gr, Oth GF, Shelf	312	37.2%	352,549	6.661	6.661	21.500	0.4%	73%	24
LE TWL, Slope RF	316	30.4%	1,791,897	7.902	7.902	29.402	2.0%	75%	103
LE TWL, Oth RF	141	49.6%	854,102	7.902	7.902	37.305	1.0%	76%	49
LE TWL, Chilipepper	111	45.9%	747,542	9.121	9.121	46.426	0.8%	77%	37
LE TWL, Flatfish	386	24.1%	1,151,322	7.137	19.412	65.839	1.3%	78%	27
OA, Shelf	2,441	27.3%	1,655,175	56.781	56.781	122.620	1.9%	80%	13
Total All Southern Fisheries	63,298		88,009,673	119.502	122.620				
2002									
North of Mendocino									
Pink Shrimp	1,963	0.1%	15,093,298	0.004	0.004	0.004	11.5%	12%	1,886,662
LE TWL, Whiting	632	0.2%	4,824,800	0.004	0.004	0.007	3.7%	15%	603,100
LE TWL, DTS	1,020	0.1%	7,477,358	0.010	0.010	0.018	5.7%	21%	325,103
LE TWL, Slope RF	19	5.3%	108,415	0.029	0.029	0.046	0.1%	21%	1,721
LE TWL, Flatfish	1,275	0.9%	4,975,044	0.154	0.154	0.200	3.8%	25%	14,632
Total All Northern Fisheries	43,556		131,046,019	0.200	0.200				
South of Mendocino									
Oth Crustaceans	8,526	0.0%	6,399,995	0.002	0.002	0.002	7.2%	7%	1,599,999
CPS Plan Species	2,969	0.0%	7,175,550	0.002	0.002	0.004	8.1%	15%	1,435,110
OA, Nearshore	3,838	0.1%	1,760,441	0.003	0.003	0.007	2.0%	17%	293,407
California Sheephead	387	0.3%	378,451	0.005	0.005	0.011	0.4%	18%	37,845
Gillnet Complex	2,767	0.1%	1,495,473	0.007	0.007	0.018	1.7%	19%	99,698
Salmon	8,117	0.0%	7,058,263	0.008	0.008	0.026	8.0%	27%	415,192
No landing wt or 2 equal wts	143	2.1%	701,249	0.014	0.014	0.040	0.8%	28%	22,621
Oth Species	3,651	0.1%	3,028,537	0.016	0.016	0.056	3.4%	32%	84,126
LE TWL, Leftover	3	66.7%	10,750	0.066	0.020	0.076	0.0%	32%	244
LE TWL, Slope RF	53	5.7%	250,821	0.023	0.023	0.099	0.3%	32%	4,918
Prawns	2,083	0.2%	3,990,047	0.025	0.025	0.124	4.5%	36%	72,546
OA, Slope	269	0.7%	185,765	0.027	0.027	0.151	0.2%	37%	3,149
California Halibut	4,326	0.0%	1,805,186	0.034	0.034	0.185	2.0%	39%	24,394

TABLE 8-7. Catch and/or landed catch of **bocaccio** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 3 of 3)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Bocaccio in Landing	Total Exvessel Revenue	Bocaccio Landed (mt)	Bocaccio Landed or Estimated Catch (mt)	Cumulative Bocaccio (mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Bocaccio (Landed & Bycatch)
OA, SF, Slope	281	0.4%	180,345	0.041	0.041	0.226	0.2%	39%	1,982
LE Fxd Gr, Oth GF, Slope	746	0.3%	740,909	0.057	0.057	0.283	0.8%	40%	5,927
OA TWL, Oth, >50% GF	29	10.3%	29,406	0.065	0.065	0.348	0.0%	40%	204
LE TWL, Petrale Sole	53	13.2%	287,972	2.300	0.150	0.498	0.3%	40%	870
LE Fxd Gr, Oth GF, Shelf	32	31.3%	29,006	0.168	0.168	0.666	0.0%	40%	78
LE TWL, Lingcod	6	33.3%	3,680	0.310	0.310	0.976	0.0%	40%	5
Oth GF (plurality but <50%)	180	10.6%	170,145	0.388	0.388	1.364	0.2%	40%	199
LE TWL, Oth RF	28	17.9%	193,986	1.330	1.330	2.693	0.2%	41%	66
LE TWL, Chilipepper	54	35.2%	137,730	2.122	2.122	4.815	0.2%	41%	29
OA, Shelf	928	15.3%	250,132	2.609	2.609	7.424	0.3%	41%	43
LE TWL, DTS	625	11.7%	4,279,277	6.318	2.905	10.329	4.8%	46%	668
LE TWL, Flatfish	369	19.0%	1,025,588	4.777	18.255	28.584	1.2%	47%	25
Total All Southern Fisheries	61,427		88,511,363	20.715	28.584				

a/ See Sections 3.4.2.1 and 4.4.2 for important caveats and assumptions.

TABLE 8-8. Catch and/or landed catch of **cowcod** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 1 of 1)

Primary Target for Trip	Trips	Percent of Primary Target Trips with Cowcod in Landing	Total Exvessel Revenue	Cowcod Landed (mt)	Cowcod Landed or Estimated Catch (mt)	Cumulative Cowcod (mt)	Total Exvessel Revenue for Area: Percent of Total	Total Exvessel Revenue for Area: Cumulative Percent	Exves Rev/Lb Cowcod (Landed & Bycatch)
1998									
North of Mendocino									
LE TWL, Flatfish	957	0.2%	4,000,469	0.021	0.021	0.021	3.6%	4%	85,116
Total All Northern Fisheries	37,630	0.2%	111,519,070	0.021	0.021				
South of Mendocino									
Gillnet Complex	2,272	0.0%	1,167,329	0.001	0.001	0.001	1.3%	1%	583,665
LE Fxd Gr SF, Slope	690	0.1%	669,160	0.001	0.001	0.002	0.8%	2%	223,053
California Sheephead	860	0.1%	695,882	0.002	0.002	0.005	0.8%	3%	139,176
LE Fxd Gr, Oth GF, Slope	830	0.1%	648,550	0.006	0.006	0.011	0.7%	4%	46,325
LE TWL, Widow	29	3.4%	265,582	0.014	0.014	0.024	0.3%	4%	8,853
OA TWL, Prawn, >50% GF	38	2.6%	85,181	0.016	0.016	0.041	0.1%	4%	2,366
Oth Species	3,114	0.1%	3,211,706	0.035	0.035	0.076	3.6%	8%	41,176
LE TWL, Midwater	16	12.5%	87,598	0.053	0.053	0.129	0.1%	8%	755
OA, Nearshore	6,201	0.0%	2,559,930	0.086	0.086	0.215	2.9%	11%	13,473
LE TWL, DTS	548	1.5%	3,415,746	0.105	0.105	0.320	3.9%	15%	14,787
LE TWL, Oth RF	141	2.8%	854,102	0.161	0.161	0.481	1.0%	16%	2,406
OA, Slope	166	3.6%	86,129	0.172	0.172	0.653	0.1%	16%	227
OA TWL, Oth, >50% GF	129	4.7%	28,139	0.190	0.190	0.843	0.0%	16%	67
Oth GF (plurality but <50%)	333	2.7%	243,485	0.257	0.257	1.100	0.3%	16%	430
LE TWL, Slope RF	316	3.5%	1,791,897	0.376	0.376	1.476	2.0%	18%	2,159
LE TWL, Chilipepper	111	9.9%	747,542	0.459	0.459	1.935	0.8%	19%	739
Prawns	3,132	0.6%	6,235,599	0.552	0.552	2.487	7.1%	26%	5,124
LE Fxd Gr, Oth GF, Shelf	312	9.9%	352,549	1.480	1.480	3.967	0.4%	26%	108
OA, Shelf	2,441	3.2%	1,655,175	7.702	7.702	11.668	1.9%	28%	97
Total All Southern Fisheries	63,298	61.5%	88,009,673	11.668	11.668				
2002									
North of Mendocino									
Total Northern Fisheries	43,556	0	131,046,019	0.000	0.000	0.000			
South of Mendocino									
LE TWL, Chilipepper	54	1.9%	137,730	0.000	0.000	0.000	0.2%	0%	137,730
LE TWL, DTS	625	0.2%	4,279,277	0.009	0.009	0.009	4.8%	5%	225,225
LE Fxd Gr SF, Slope	695	0.1%	613,422	0.018	0.018	0.027	0.7%	6%	15,336
LE TWL, Flatfish	369	0.8%	1,025,588	0.024	0.024	0.051	1.2%	7%	19,351
Total All Southern Fisheries	61,427	3.0%	88,511,363	0.051	0.051				

a/ See Sections 3.4.2.1 and 4.4.2 for important caveats and assumptions.

TABLE 8-9. Catch and/or landed catch of **widow rockfish** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 1 of 4)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Widow in Landing	Total Exvessel Revenue	Widow Landed (mt)	Widow Landed or Estimated Catch (mt)	Cumulative Widow (Mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Widow (Landed & Bycatch)
1998									
North of Mendocino									
Dungeness Crab	15,336	0.0%	38,526,779	0.000	0.000	0.000	34.5%	35%	38,526,779
LE Fxd Gr SF, No Strata	600	0.2%	1,487,843	0.002	0.002	0.002	1.3%	36%	371,961
HMS Plan Species	1,533	0.1%	15,868,173	0.004	0.004	0.006	14.2%	50%	1,983,522
LE Fxd Gr, Oth GF, Slope	7	14.3%	5,649	0.004	0.004	0.010	0.0%	50%	706
OA, SF, Shelf	94	2.1%	198,436	0.007	0.007	0.017	0.2%	50%	12,402
LE Fxd Gr, Oth GF, Nearshore	215	2.8%	119,541	0.020	0.020	0.036	0.1%	50%	2,780
Pacific Halibut	214	0.5%	755,531	0.021	0.021	0.057	0.7%	51%	16,425
OA, Slope	11	27.3%	1,768	0.037	0.037	0.094	0.0%	51%	22
Oth Crustaceans	2,060	0.4%	1,421,789	0.101	0.101	0.195	1.3%	52%	6,376
LE Fxd Gr SF, Shelf	182	3.3%	710,550	0.102	0.102	0.298	0.6%	53%	3,158
Salmon	4,027	1.6%	2,763,425	0.313	0.313	0.610	2.5%	55%	4,011
GF/Shrimp Combinations	11	54.5%	16,294	0.417	0.417	1.027	0.0%	55%	18
LE TWL, Petrale Sole	115	15.7%	630,545	6.391	1.159	2.186	0.6%	56%	247
OA, Nearshore	2,201	1.0%	498,681	1.271	1.271	3.457	0.4%	56%	178
LE TWL, Leftover	106	23.6%	330,150	16.013	1.971	5.428	0.3%	57%	76
Oth Species	1,428	1.8%	9,261,628	2.502	2.502	7.930	8.3%	65%	1,679
Oth GF (plurality but <50%)	179	20.1%	241,047	3.382	3.382	11.312	0.2%	65%	32
LE TWL, POP	14	71.4%	67,290	3.653	3.653	14.965	0.1%	65%	8
Pink Shrimp	1,105	11.4%	4,960,814	4.396	4.396	19.361	4.4%	70%	512
LE Fxd Gr, Oth GF, Shelf	313	20.4%	295,262	4.661	4.661	24.021	0.3%	70%	29
LE TWL, Flatfish	957	26.0%	4,000,469	104.139	6.071	30.093	3.6%	74%	299
LE TWL, DTS	1,627	35.8%	10,067,097	344.652	14.167	44.259	9.0%	83%	322
LE TWL, Yellowtail	93	59.1%	399,104	18.971	18.971	63.230	0.4%	83%	10
LE TWL, Canary	35	60.0%	159,373	24.401	24.401	87.631	0.1%	83%	3
OA, Shelf	1,265	24.5%	556,667	36.463	36.463	124.093	0.5%	84%	7
OA TWL, Oth, >50% GF	43	32.6%	172,602	83.618	83.618	207.711	0.2%	84%	1
LE TWL, Slope RF	212	75.0%	1,325,816	128.314	128.314	336.025	1.2%	85%	5
LE TWL, Oth RF	165	80.6%	1,393,426	212.939	212.939	548.964	1.2%	86%	3
LE TWL, Arrowtooth	257	81.7%	3,574,020	395.761	346.988	895.952	3.2%	90%	5
LE TWL, Whiting	1,326	67.3%	5,399,567	368.152	368.152	1,264.104	4.8%	94%	7
LE TWL, Widow	144	100.0%	1,583,364	665.161	665.161	1,929.265	1.4%	96%	1
LE TWL, Midwater	255	91.4%	1,461,986	952.043	952.043	2,881.309	1.3%	97%	1
Total All Northern Fisheries	37,630		111,519,070	3,377.909	2,881.309				

TABLE 8-9. Catch and/or landed catch of **widow rockfish** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 2 of 4)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Widow in Landing	Total Exvessel Revenue	Widow Landed (mt)	Widow Landed or Estimated Catch (mt)	Cumulative Widow (Mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Widow (Landed & Bycatch)
1998									
South of Mendocino									
LE Fxd Gr SF, Slope	690	0.1%	669,160	0.003	0.003	0.003	0.8%	1%	111,527
LE Fxd Gr, Oth GF, Nearshore	169	0.6%	160,641	0.003	0.003	0.006	0.2%	1%	22,949
Gillnet Complex	2,272	0.0%	1,167,329	0.005	0.005	0.010	1.3%	2%	116,733
LE Fxd Gr SF, Shelf	27	3.7%	23,517	0.017	0.017	0.027	0.0%	2%	636
Oth Species	3,114	0.0%	3,211,706	0.017	0.017	0.044	3.6%	6%	84,519
Salmon	7,526	0.0%	3,004,940	0.019	0.019	0.063	3.4%	9%	73,291
OA TWL, Prawn, >50% GF	38	2.6%	85,181	0.026	0.026	0.089	0.1%	9%	1,469
LE TWL, Yellowtail	3	33.3%	11,596	0.091	0.091	0.181	0.0%	9%	58
OA, Nearshore	6,201	0.0%	2,559,930	0.103	0.103	0.283	2.9%	12%	11,327
LE TWL, Petrale Sole	41	9.8%	115,007	0.098	0.136	0.419	0.1%	13%	383
LE TWL, Leftover	12	41.7%	38,218	0.099	0.151	0.570	0.0%	13%	115
LE Fxd Gr, Oth GF, Slope	830	1.0%	648,550	0.224	0.224	0.794	0.7%	13%	1,316
California Halibut	3,194	0.1%	1,829,470	0.226	0.226	1.020	2.1%	15%	3,674
OA TWL, Oth, >50% GF	129	0.8%	28,139	0.409	0.409	1.429	0.0%	15%	31
Pink Shrimp	70	5.7%	323,932	0.925	0.925	2.354	0.4%	16%	159
LE TWL, DTS	548	19.3%	3,415,746	60.116	1.315	3.669	3.9%	20%	1,179
Oth GF (plurality but <50%)	333	0.9%	243,485	1.834	1.834	5.503	0.3%	20%	60
LE TWL, Canary	5	100.0%	28,778	4.120	4.120	9.623	0.0%	20%	3
LE TWL, Flatfish	386	18.1%	1,151,322	25.853	5.449	15.072	1.3%	21%	96
LE Fxd Gr, Oth GF, Shelf	312	10.6%	352,549	5.820	5.820	20.892	0.4%	22%	27
LE TWL, Chilipepper	111	36.0%	747,542	43.536	43.536	64.428	0.8%	23%	8
LE TWL, Midwater	16	100.0%	87,598	62.149	62.149	126.577	0.1%	23%	1
LE TWL, Slope RF	316	28.5%	1,791,897	63.077	63.077	189.654	2.0%	25%	13
LE TWL, Oth RF	141	54.6%	854,102	71.714	71.714	261.368	1.0%	26%	5
LE TWL, Widow	29	100.0%	265,582	113.831	113.831	375.199	0.3%	26%	1
OA, Shelf	2,441	16.1%	1,655,175	121.588	121.588	496.787	1.9%	28%	6
Total All Southern Fisheries	63,298		88,009,673	575.902	496.787				
2002									
North of Mendocino									
Oth GF (plurality but <50%)	336	0.3%	791,167	0.001	0.001	0.001	0.6%	1%	395,584
OA, SF, Shelf	128	0.8%	311,694	0.001	0.001	0.002	0.2%	1%	103,898
LE Fxd Gr, Oth GF, Shelf	52	1.9%	225,343	0.002	0.002	0.004	0.2%	1%	56,336
LE Fxd Gr, Oth GF, Nearshore	185	0.5%	174,051	0.005	0.005	0.010	0.1%	1%	14,504

TABLE 8-9. Catch and/or landed catch of **widow rockfish** and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 3 of 4)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Widow in Landing	Total Exvessel Revenue	Widow Landed (mt)	Widow Landed or Estimated Catch (mt)	Cumulative Widow (Mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Widow (Landed & Bycatch)
LE TWL, Lingcod	8	12.5%	3,899	0.005	0.005	0.015	0.0%	1%	325
LE Fxd Gr SF, Shelf	105	1.0%	905,116	0.015	0.015	0.030	0.7%	2%	26,621
Salmon	8,390	0.1%	7,139,761	0.021	0.021	0.052	5.4%	7%	151,910
LE TWL, Slope RF	19	10.5%	108,415	0.050	0.050	0.102	0.1%	7%	977
OA, Shelf	381	0.5%	96,087	0.057	0.057	0.159	0.1%	7%	769
Oth Species	3,880	0.1%	7,786,606	0.069	0.069	0.228	5.9%	13%	50,893
OA, Nearshore	4,229	0.2%	1,501,444	0.129	0.129	0.357	1.1%	15%	5,287
Pink Shrimp	1,963	1.3%	15,093,298	0.174	0.174	0.531	11.5%	26%	39,305
LE TWL, Petrale Sole	229	2.6%	1,570,707	0.574	1.208	1.740	1.2%	27%	590
LE TWL, Leftover	158	3.8%	491,678	0.011	1.493	3.233	0.4%	28%	149
LE TWL, Whiting	632	18.8%	4,824,800	5.318	5.318	8.551	3.7%	31%	411
LE TWL, DTS	1,020	3.1%	7,477,358	1.213	7.045	15.596	5.7%	37%	481
LE TWL, Flatfish	1,275	7.2%	4,975,044	2.285	8.187	23.783	3.8%	41%	276
OA TWL, Oth, >50% GF	135	29.6%	510,025	12.687	12.687	36.469	0.4%	41%	18
LE TWL, Arrowtooth	184	33.2%	2,345,701	18.777	18.991	55.461	1.8%	43%	56
LE TWL, Midwater	63	96.8%	601,804	223.765	223.765	279.225	0.5%	43%	1
Total All Northern Fisheries	43,556		131,046,019	265.162	279.225				
2002									
South of Mendocino									
Gillnet Complex	2,767	0.0%	1,495,473	0.000	0.000	0.000	1.7%	2%	1,495,473
OA TWL, Oth, >50% GF	29	3.4%	29,406	0.001	0.001	0.001	0.0%	2%	14,703
LE Fxd Gr, Oth GF, Shelf	32	3.1%	29,006	0.010	0.010	0.012	0.0%	2%	1,261
LE TWL, Leftover	3	33.3%	10,750	0.133	0.100	0.112	0.0%	2%	49
California Halibut	4,326	0.1%	1,805,186	0.135	0.135	0.247	2.0%	4%	6,078
OA, Shelf	928	2.3%	250,132	0.268	0.268	0.514	0.3%	4%	424
LE TWL, Petrale Sole	53	5.7%	287,972	0.108	0.301	0.815	0.3%	4%	434
LE TWL, Slope RF	53	9.4%	250,821	0.426	0.426	1.241	0.3%	5%	267
LE TWL, Oth RF	28	14.3%	193,986	0.583	0.583	1.824	0.2%	5%	151
LE TWL, Midwater	2	100.0%	1,277	0.749	0.749	2.573	0.0%	5%	1
LE TWL, Chilipepper	54	33.3%	137,730	0.894	0.894	3.467	0.2%	5%	70
LE TWL, Widow	1	100.0%	3,728	1.264	1.264	4.731	0.0%	5%	1
LE TWL, DTS	625	6.2%	4,279,277	1.290	1.662	6.392	4.8%	10%	1,168
LE TWL, Flatfish	369	9.8%	1,025,588	1.093	3.307	9.699	1.2%	11%	141
Total All Southern Fisheries	61,427		88,511,363	6.953	9.699				

a/ See Sections 3.4.2.1 and 4.4.2 for important caveats and assumptions.

TABLE 8-10. Catch and/or landed catch of **yelloweye** rockfish and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 1 of 2)

Primary Target for Trip	Trips	Percent of Primary Target Trips with Yelloweye in Landing	Total Exvessel Revenue	Yelloweye Landed (mt)	Yelloweye Landed or Estimated Catch (mt)	Cumulative Yelloweye (mt)	Total Exvessel Revenue for Area: Percent of Total	Total Exvessel Revenue for Area: Cumulative Percent	Exves Rev/Lb Yelloweye (Landed & Bycatch)
1998									
North of Mendocino									
LE Fxd Gr SF, Shelf	182	0.5%	710,550	0.001	0.001	0.001	0.6%	1%	355,275
OA, Slope	11	9.1%	1,768	0.014	0.014	0.015	0.0%	1%	57
LE TWL, Widow	144	1.4%	1,583,364	0.043	0.043	0.058	1.4%	2%	16,844
Oth GF (plurality but <50%)	179	4.5%	241,047	0.054	0.054	0.112	0.2%	2%	2,009
LE TWL, Oth RF	165	2.4%	1,393,426	0.103	0.103	0.215	1.2%	4%	6,112
LE TWL, DTS	1,627	0.7%	10,067,097	0.324	0.324	0.540	9.0%	13%	14,080
LE Fxd Gr, Oth GF, Nearshore	215	9.3%	119,541	0.554	0.554	1.094	0.1%	13%	98
OA, Nearshore	2,201	3.7%	498,681	0.991	0.991	2.085	0.4%	13%	228
OA, Shelf	1,265	6.1%	556,667	1.574	1.574	3.659	0.5%	14%	160
LE Fxd Gr, Oth GF, Shelf	313	6.4%	295,262	1.676	1.676	5.334	0.3%	14%	80
Total All Northern Fisheries	37,630		111,519,070	5.334	5.334				
1998									
South of Mendocino									
Salmon	7,526	0.0%	3,004,940	0.000	0.000	0.000	3.4%	3%	3,004,940
LE TWL, Flatfish	386	0.3%	1,151,322	0.002	0.002	0.003	1.3%	5%	230,264
No landing wt or 2 equal wts	605	0.2%	235,323	0.002	0.002	0.005	0.3%	5%	47,065
LE Fxd Gr SF, Slope	690	0.3%	669,160	0.005	0.005	0.010	0.8%	6%	66,916
OA TWL, Halibut, >50% GF	284	0.4%	95,758	0.012	0.012	0.022	0.1%	6%	3,547
LE TWL, Midwater	16	6.3%	87,598	0.015	0.015	0.037	0.1%	6%	2,576
OA, SF, Shelf	22	9.1%	10,482	0.017	0.017	0.054	0.0%	6%	283
LE TWL, Yellowtail	3	66.7%	11,596	0.046	0.046	0.100	0.0%	6%	114
Prawns	3,132	0.0%	6,235,599	0.052	0.052	0.152	7.1%	13%	54,223
LE TWL, Slope RF	316	2.8%	1,791,897	0.092	0.092	0.244	2.0%	15%	8,827
LE TWL, DTS	548	1.3%	3,415,746	0.100	0.100	0.345	3.9%	19%	15,456
LE TWL, Widow	29	13.8%	265,582	0.112	0.112	0.457	0.3%	19%	1,071
LE TWL, Chilipepper	111	6.3%	747,542	0.138	0.138	0.596	0.8%	20%	2,451
Oth GF (plurality but <50%)	333	1.2%	243,485	0.145	0.145	0.740	0.3%	20%	763
OA, Nearshore	6,201	0.3%	2,559,930	0.207	0.207	0.947	2.9%	23%	5,614
LE Fxd Gr, Oth GF, Nearshore	169	5.3%	160,641	0.263	0.263	1.210	0.2%	24%	277
LE Fxd Gr SF, Shelf	27	18.5%	23,517	0.380	0.380	1.590	0.0%	24%	28
LE TWL, Oth RF	141	10.6%	854,102	0.919	0.919	2.509	1.0%	25%	422
LE Fxd Gr, Oth GF, Shelf	312	13.8%	352,549	3.477	3.477	5.986	0.4%	25%	46

TABLE 8-10. Catch and/or landed catch of **yelloweye** rockfish and exvessel revenue by trip target type (1998 & 2002).[a/] (Page 2 of 2)

							Total Exvessel Revenue for Area		
Primary Target for Trip	Trips	Percent of Primary Target Trips with Yelloweye in Landing	Total Exvessel Revenue	Yelloweye Landed (mt)	Yelloweye Landed or Estimated Catch (mt)	Cumulative Yelloweye (mt)	Percent of Total	Cumulative Percent	Exves Rev/Lb Yelloweye (Landed & Bycatch)
OA, Shelf	2,441	4.8%	1,655,175	6.014	6.014	12.000	1.9%	27%	125
Total All Southern Fisheries	63,298		88,009,673	12.000	12.000				
2002									
North of Mendocino									
OA, Shelf	381	0.3%	96,087	0.000	0.000	0.000	0.1%	0%	96,087
OA, Nearshore	4,229	0.0%	1,501,444	0.002	0.002	0.002	1.1%	1%	375,361
LE Fxd Gr SF, Slope	316	0.6%	2,068,272	0.002	0.002	0.005	1.6%	3%	413,654
LE TWL, Arrowtooth	184	0.5%	2,345,701	0.005	0.005	0.009	1.8%	5%	234,570
Pink Shrimp	1,963	0.1%	15,093,298	0.005	0.005	0.015	11.5%	16%	1,257,775
OA, SF, Slope	216	0.5%	1,100,262	0.011	0.011	0.026	0.8%	17%	44,010
LE TWL, Petrale Sole	229	0.9%	1,570,707	0.027	0.027	0.053	1.2%	18%	26,178
LE TWL, DTS	1,020	1.3%	7,477,358	0.094	0.094	0.147	5.7%	24%	35,949
Pacific Halibut	379	0.5%	1,564,532	0.202	0.202	0.350	1.2%	25%	3,508
LE TWL, Flatfish	1,275	1.7%	4,975,044	0.215	0.215	0.565	3.8%	29%	10,474
Total All Northern Fisheries	43,556		131,046,019	0.565	0.565				
2002									
South of Mendocino									
LE TWL, DTS	625	0.2%	4,279,277	0.002	0.002	0.002	4.8%	5%	1,069,819
LE TWL, Petrale Sole	53	1.9%	287,972	0.002	0.002	0.004	0.3%	5%	71,993
LE TWL, Slope RF	53	1.9%	250,821	0.009	0.009	0.013	0.3%	5%	12,541
LE TWL, Flatfish	369	0.8%	1,025,588	0.019	0.019	0.032	1.2%	7%	24,419
OA, Nearshore	3,838	0.1%	1,760,441	0.032	0.032	0.064	2.0%	9%	25,149
Total All Southern Fisheries	61,427		88,511,363	0.064	0.064				

a/ See Sections 3.4.2.1 and 4.4.2 for important caveats and assumptions.

TABLE 8-11. 2005 Total catch OYs for each rebuilding species under each alternative compared with adopted 2004 total catch OYs and estimated long-term MSY (mt). (Page 1 of 1)

	2005 Total Catch OYs under the Rebuilding Alternatives					2004 Total Catch OYs a/	Approximate Long-term MSY b/
	No Action	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*		
Am 16-3 Species:							
Bocaccio c/	7	375	307	240	134	250	3,481
Cowcod	0	4.8	4.2	4.2	4.2	4.8	30
Widow d/	1,359	285	213	124	4	284	7,196
Yelloweye	29	28	27	26	24	22	47
Am 16-2 Species:							
Lingcod						735	1,373
Canary						47.3	622
POP						444	1,164
Darkblotched						240	360

a/ Total catch OYs shown are those adopted by the Council as shown in Table 2.2.5-1 of the 2004 Groundfish Annual Specifications EIS (PFMC 2003).

b/ MSY proxy harvest levels shown were generally derived by calculating the yield estimate that results from applying the proxy F_{MSY} to the proxy B_{MSY} ($B_{40\%}$). The proxy F_{MSY} generally used is $F_{50\%}$. Exceptions to this are canary rockfish and yelloweye rockfish, in which case F_{MSY} was estimated by finding the fishing mortality rate at which yield is maximized from a fitted spawner-recruit curve. Converted to units of $F_{x\%}$, the estimate of F_{MSY} for canary rockfish is $F_{73\%}$, and for yelloweye rockfish $F_{57\%}$ (Methot and Piner, 2002; and Methot et al. 2003). These F_{MSY} rates were then applied to the estimated $B_{40\%}$ biomass level (the target biomass level for rebuilding) to produce the MSY estimates shown here. *Note: These MSY estimates should be interpreted with great caution.* They are an over simplification and should not be used to evaluate long-term management options for West Coast groundfish. Evidence of low productivity for many of the overfished rockfish stocks suggests that the proxy F_{MSY} rates may overestimate true F_{MSY} and MSY. Harvest rates approaching $F_{50\%}$ are too aggressive for unproductive stocks like most rockfish species. Unlike canary rockfish and yelloweye rockfish, the fit of a stock-recruit curve to the spawner-recruit data for bocaccio was not adequate to estimate F_{MSY} directly. Therefore, the proxy F_{MSY} rate used for bocaccio may be too high, nor is there currently a straightforward way to estimate a more appropriate value.

c/ Bocaccio rebuilding analysis STATc model.

d/ Widow rebuilding analysis Model 8.

TABLE 8-12. Median rebuilding year (T_{TARGET}) for each rebuilding species under each alternative.

	T_{TARGET}				
	No Action	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
Am 16-3 Species:					
Bocaccio a/	2025	2025	2023	2020	2018
Cowcod	NA	2095	2090	2090	2090
Widow b/	NA	2038	2035	2032	2028
Yelloweye	NA	2067	2062	2058	2054
Am 16-2 Species: c/					
Lingcod	*2009*	*2009*	*2009*	*2009*	*2009*
Canary	*2074*	*2074*	*2074*	*2074*	*2074*
POP	*2027*	*2027*	*2027*	*2027*	*2027*
Darkblotched	*2030*	*2030*	*2030*	*2030*	*2030*

a/ Bocaccio rebuilding analysis STATc model.

b/ Widow rebuilding analysis Model 8.

c/ T_{TARGET} for these overfished species determined in Amendment 16-2.

TABLE 8-13. Summary of net social benefit analysis for impacts of the **bocaccio** rebuilding alternatives. (Page 1 of 1)

Socioeconomic Effect **(Note: Higher number implies higher net benefits)**	Alternatives: *No Action (40-10)*	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
PRODUCER SURPLUS					
Seafood Harvesters					
Longterm Catch Per Unit Effort (rankings based on number of years until rebuilt : 1= lowest CPUE (slowest rebuilding), 5 = highest CPUE (fastest rebuilding))	3	1	2	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	5	4	3	2
Seafood Processors and Handlers					
Longterm Product Recovery Rates (rankings based on number of years until rebuilt : 1= lowest PRR (slowest rebuilding), 5 = highest PRR (fastest rebuilding))	3	1	2	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	5	4	3	2
Recreational Charter Vessels					
Ability to supply higher quality experience (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	3	1	2	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	5	4	3	2
CONSUMER SURPLUS					
Seafood Consumers					
Availability of fresh and frozen products, if applicable.	NA	NA	NA	NA	NA
Recreational Fishers					
Supply of recreational opportunities (rankings based on OY in 2005: 1 = lowest OY, 5 = highest OY))	1	5	4	3	2
Longterm Recreational CPUEs (rankings based on number of years until rebuilt : 1=slowest rebuilding (lower CPUE), 5 = fastest rebuilding (higher CPUE))	3	1	2	4	5
Nonconsumptive Users					
Value of wildlife viewing experience (rankings based on number of years until rebuilt : 1 = slowest rebuilding (lower value), 5 = fastest rebuilding (higher value))	3	1	2	4	5
Nonusers					
Option, existence and bequethal values (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	3	1	2	4	5
PUBLIC EXPENDITURES (May affect either consumer or producer surpluses.)					
Enforcement costs (1 = higher, 2 = lower)	2	1	1	1	1
Survey and monitoring costs (rankings based on OY in 2005 : 1 = highest cost (lowest OY), 5 = lowest cost (highest OY))	1	5	4	3	2

TABLE 8-14. Summary of net social benefit analysis for impacts of the **cowcod** rebuilding alternatives. (Page 1 of 1)

Socioeconomic Effect **(Note: Higher number implies higher net benefits)**	Alternatives *No Action (40-10)*	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
PRODUCER SURPLUS					
Seafood Harvesters					
Longterm Catch Per Unit Effort (rankings based on number of years until rebuilt : 1= lowest CPUE (slowest rebuilding), 5 = highest CPUE (fastest rebuilding))	1	2	3	3	3
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	3	2	2	2
Seafood Processors and Handlers					
Longterm Product Recovery Rates (rankings based on number of years until rebuilt : 1= lowest PRR (slowest rebuilding), 5 = highest PRR (fastest rebuilding))	1	2	3	3	3
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	3	2	2	2
Recreational Charter Vessels					
Ability to supply higher quality experience (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	3	3
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	1	3	2	2	2
CONSUMER SURPLUS					
Seafood Consumers					
Availability of fresh and frozen products, if applicable.	NA	NA	NA	NA	NA
Recreational Fishers					
Supply of recreational opportunities (rankings based on OY in 2005: 1 = lowest OY, 5 = highest OY))	1	3	2	2	2
Longterm Recreational CPUEs (rankings based on number of years until rebuilt : 1=slowest rebuilding (lower CPUE), 5 = fastest rebuilding (higher CPUE))	1	2	3	3	3
Nonconsumptive Users					
Value of wildlife viewing experience (rankings based on number of years until rebuilt : 1 = slowest rebuilding (lower value), 5 = fastest rebuilding (higher value))	1	2	3	3	3
Nonusers					
Option, existence and bequethal values (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	3	3
PUBLIC EXPENDITURES (May affect either consumer or producer surpluses.)					
Enforcement costs (1 = higher, 2 = lower)	2	1	1	1	1
Survey and monitoring costs (rankings based on OY in 2005 : 1 = highest cost (lowest OY), 5 = lowest cost (highest OY))	1	3	2	2	2

TABLE 8-15. Summary of net social benefit analysis for impacts of the **widow rockfish** rebuilding alternatives. (Page 1 of 1)

Socioeconomic Effect **(Note: Higher number implies higher net benefits)**	*No Action (40-10)*	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
PRODUCER SURPLUS					
Seafood Harvesters					
Longterm Catch Per Unit Effort (rankings based on number of years until rebuilt : 1= lowest CPUE (slowest rebuilding), 5 = highest CPUE (fastest rebuilding))	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
Seafood Processors and Handlers					
Longterm Product Recovery Rates (rankings based on number of years until rebuilt : 1= lowest PRR (slowest rebuilding), 5 = highest PRR (fastest rebuilding))	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
Recreational Charter Vessels					
Ability to supply higher quality experience (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
CONSUMER SURPLUS					
Seafood Consumers					
Availability of fresh and frozen products, if applicable.	NA	NA	NA	NA	NA
Recreational Fishers					
Supply of recreational opportunities (rankings based on OY in 2005: 1 = lowest OY, 5 = highest OY))	5	4	3	2	1
Longterm Recreational CPUEs (rankings based on number of years until rebuilt : 1=slowest rebuilding (lower CPUE), 5 = fastest rebuilding (higher CPUE))	1	2	3	4	5
Nonconsumptive Users					
Value of wildlife viewing experience (rankings based on number of years until rebuilt : 1 = slowest rebuilding (lower value), 5 = fastest rebuilding (higher value))	1	2	3	4	5
Nonusers					
Option, existence and bequethal values (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	4	5
PUBLIC EXPENDITURES (May affect either consumer or producer surpluses.)					
Enforcement costs (1 = higher, 2 = lower)	2	1	1	1	1
Survey and monitoring costs (rankings based on OY in 2005 : 1 = highest cost (lowest OY), 5 = lowest cost (highest OY))	5	4	3	2	1

TABLE 8-16. Summary of net social benefit analysis for impacts of the **yelloweye rockfish** rebuilding alternatives. (Page 1 of 1)

Socioeconomic Effect **(Note: Higher number implies higher net benefits)**	Alternatives: *No Action (40-10)*	*Alternative 1*	*Alternative 2*	*Alternative 3*	*Alternative 4*
PRODUCER SURPLUS					
Seafood Harvesters					
Longterm Catch Per Unit Effort (rankings based on number of years until rebuilt : 1= lowest CPUE (slowest rebuilding), 5 = highest CPUE (fastest rebuilding))	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
Seafood Processors and Handlers					
Longterm Product Recovery Rates (rankings based on number of years until rebuilt : 1= lowest PRR (slowest rebuilding), 5 = highest PRR (fastest rebuilding))	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
Recreational Charter Vessels					
Ability to supply higher quality experience (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	4	5
Adjustment costs (rankings based on OY in 2005: 1 = highest adjustment cost (lowest OY), 5 = lowest adjustment cost (highest OY))	5	4	3	2	1
CONSUMER SURPLUS					
Seafood Consumers					
Availability of fresh and frozen products, if applicable.	NA	NA	NA	NA	NA
Recreational Fishers					
Supply of recreational opportunities (rankings based on OY in 2005: 1 = lowest OY, 5 = highest OY))	5	4	3	2	1
Longterm Recreational CPUEs (rankings based on number of years until rebuilt : 1=slowest rebuilding (lower CPUE), 5 = fastest rebuilding (higher CPUE))	1	2	3	4	5
Nonconsumptive Users					
Value of wildlife viewing experience (rankings based on number of years until rebuilt : 1 = slowest rebuilding (lower value), 5 = fastest rebuilding (higher value))	1	2	3	4	5
Nonusers					
Option, existence and bequethal values (rankings based on probability of rebuilding within T_{MAX} : 1 = lowest probability, 5 = highest probability)	1	2	3	4	5
PUBLIC EXPENDITURES (May affect either consumer or producer surpluses.)					
Enforcement costs (1 = higher, 2 = lower)	1	1	1	1	1
Survey and monitoring costs (rankings based on OY in 2005 : 1 = highest cost (lowest OY), 5 = lowest cost (highest OY))	1	1	1	1	1

9.0 SUMMARY OF OTHER ENVIRONMENTAL MANAGEMENT ISSUES

Based on the environmental impacts disclosed in Chapters 3 through 8, this chapter summarizes a range of issues that an EIS must address. These issues are identified at 40 CFR 1502.6, describing the analysis of environmental consequences in an EIS. The last two sections in this chapter describe mitigation measures (as required by 40 CFR 1502.1(h)) and identify unavoidable adverse impacts (as required by 40 CFR 1502.16).

9.1 Short-term Uses Versus Long-term Productivity

Section 1.2.1 in Appendix A discusses short-term costs versus long-term risk in setting OYs. As noted there, this tradeoff is possibly the most important tradeoff governing the management of renewable resources. Balancing short-term use and long-term productivity is the essence of the proposed action. The Magnuson-Stevens Act and NSGs establish a framework for rebuilding overfished stocks—establishing long-term productivity—while recognizing short-term use as reflected in the needs of fishing communities. National Standard 1 guidelines establish outer boundaries for balancing this tradeoff: T_{MIN}, which places greatest emphasis on rapidly returning to maximum long-term productivity (MSY), and T_{MAX}, which places greatest emphasis on short-term use while rebuilding stocks. The specific tradeoff between short-term use and long-term productivity is expressed by the choice of a target year, T_{TARGET}, which must fall within these boundaries. If a T_{TARGET} closer to T_{MAX} is chosen, harvest rates will be higher, and short-term use is thus favored. If a T_{TARGET} closer to T_{MIN} is chosen, harvest rates will be lower, and the stock is more likely to rapidly rebuild, favoring long-term productivity.

9.2 Irreversible Resource Commitments

An irreversible commitment represents some permanent loss of an environmental attribute or service. The use of non-renewable resources is irreversible; unsustainable renewable resource use may be irreversible if future production is permanently reduced or, at the extreme, is extinguished.

The use of non-renewable energy resources, such as fossil fuel, represents a pervasive irreversible commitment associated with the proposed action, because fishing vessels are mechanically powered. The use of energy is discussed below in Section 9.4.

The proposed action does not by itself represent an irreversible commitment because renewable resources are being managed within an adaptive framework. If a stock were extirpated or species went extinct, this would represent an irreversible resource commitment. Although the proposed action is intended to rebuild stocks, there is some risk—albeit very small—that measurement or model error would lead to mis-specification of harvest rates. Such mis-specification would have to occur over a long period of time in order to drive stocks down to a level where the population was no longer viable and entered an extinction spiral. Even if stocks do not go extinct, however, stock condition could result in an irreversible resource commitment. First, although not conclusively demonstrated for the four overfished stocks considered in this EIS, ecological relationships can produce a depensation effect (Walters and Kitchell 2001). Smaller-sized co-occurring species whose population is kept in check, due to predation by adults of the overfished stock, are released from this constraint. They then prey on larvae and juveniles of the overfished stock, thus suppressing recruitment. If such a situation pertains, stocks may be very slow to rebuild even if fishing mortality is substantially decreased. A very long recovery period, amounting to hundreds of years, may be considered irreversible from a practical standpoint. Although the stock may eventually recover, it would have little relevance to any policy or planning time horizon.

9.3 Irretrievable Resource Commitments

A resource is irretrievably committed if its use is lost for time, but is not actually or practically lost permanently. The proposed action establishes a framework for setting harvest rates that allow overfished stocks to recover to target biomass over some time period. Rebuilding targets indirectly constrain fish harvests based on the harvest specifications necessary to rebuild stocks. The fish that are harvested represent an irretrievable resource commitment, as do the inputs in terms of capital and labor (including energy and resources) needed to harvest and market these fish.

9.4 Energy Requirements and Conservation Potential of the Alternatives

The proposed action indirectly affects energy use primarily in the form of fossil fuels used to power surveillance craft and fishing vessels. Energy used in at-sea and aerial monitoring and enforcement activities is a direct effect. Change in the level of this type of monitoring is hard to predict because it depends on the types of management measures that will be implemented biennially and inseason. Generally, the Rockfish Conservation Area, which was first implemented in late 2002, would require more surveillance to be effective. However, the vessel monitoring system implemented at the beginning of 2004 will compensate for the increased surveillance need because vessel positions can be remotely monitored. Finally, the availability of ships and aircraft to conduct surveillance, which is partly contingent on U.S. Coast Guard mission priorities, will also dictate the level and the number of patrols, affecting energy use. For these reasons, it is difficult to predict how energy use would change from baseline conditions. The proposed action indirectly affects fishing activity, and thus, the consumption of fuel by fishing vessels. Fuel consumption is likely to correlate with harvest levels, which are, in part, determined by the effect of rebuilding measures. For example, Alternative 4 would likely sharply reduce much commercial and recreational fishing on the West Coast, with a corresponding reduction in vessel fuel consumption. The other alternatives would allow higher harvest levels, but it is not possible to forecast how they might affect fuel consumption.

The proposed action could affect overall production efficiency, including energy consumption. Production efficiency can be likened to CPUE, except the effort measure would account for all energy consumption, not just energy consumed during gear deployment.[16/] Although overfished species may account for a small part of the production side of the balance sheet, they act as constraining stocks, limiting the amount of target species that can be caught on a given fishing trip due to restrictive management measures. Lower harvest limits for overfished species could, therefore, translate into lower overall production efficiency. All of the action alternatives are intended to allow stocks to return to B_{MSY}, so production efficiency should increase over time. For example, under the Alternative 4, the most restrictive alternative, groundfish fishing would be more restricted until stocks recovered in comparison to the other alternatives, but the target year for a given species is shorter. There would be a period of relatively low production efficiency but reaching the target biomass sooner would produce higher efficiencies than the other alternatives. Of course these scenarios do not account for a wide range of mitigating factors that could affect efficiency. For example, the number of fishing vessels could decrease, either through policy initiatives such as the implementation of individual fishing quotas, or fisheries reaching a new, lower open access equilibrium. In response to increases in cost resulting from lower production efficiency, fishermen could also invest in new technology, depending on availability and cost, which might reduce energy consumption (and thereby, costs). This might happen over

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16/ The unit value of the effort term can be highly variable, depending on what measures are available. If effort were measured by total days at sea, then fishing effort and production efficiency would be closely correlated. However, if effort is measured as the amount of time fishing gear is deployed, then various "fixed cost" commitments, such as energy used transiting to fishing grounds and searching for fish to set on, would not be accounted for.

the long term, but even a general trend is not predictable because of the various countervailing factors that could affect this type of capital investment.

9.5 Urban Quality, Historic Resources, and the Design of the Built Environment

The Newport Beach dory fleet, which would be affected by the proposed action, is considered a historic resource locally. Although the proposed action does not directly affect urban quality, other historic resources, or the design of the built environment, it may have indirect effects. Fishing fleets add to the character of many West Coast communities and are a determining factor in investment in port infrastructure, including the maintenance of navigation channels. Aside from any broad effects on community income, continued decline in the number of vessels, which is likely to occur under more restrictive management measures, could affect infrastructure investment and might contribute to changes in the character of waterfront areas.

9.6 Possible Conflicts Between the Proposed Action and Other Plans and Policies For the Affected Area

Overfished groundfish species are caught incidentally in fisheries managed under other Council FMPs (for salmon, coastal pelagic species, and highly migratory species). More restrictive measures, such as those that would be required to meet the harvest limits under the Alternative 4, are likely to affect these fisheries and thus conflict with some of the objectives of these FMPs. (FMPs try to strike a balance between conservation and utilization, so they include objectives related to resource use.)

9.7 Significant and Unavoidable Adverse Impacts

The EIS must include a discussion of those adverse effects that cannot be avoided (40 CFR 1502.16). This discussion focuses on potentially significant adverse impacts of the proposed action, as implemented by the different alternatives. CEQ regulations at 40 CFR 1508.27 define “significantly” in terms of both context and intensity, and provide ten factors to consider when evaluating the intensity of an impact. NOAA provides agency guidance in determining significant impacts of fishery management actions in administrative order NAO 216-6 at §6.02, which expands on the CEQ definition. These criteria focus on the components of the human environment most likely to be affected by these types of actions.

Based on the guidance in these two sources, the proposed action could *potentially* jeopardize the sustainability of any target or non-target species that may be affected by the action (NAO 216-6 §6.02a & b). This could occur due to both individual and cumulative effects (NAO 216-6 §6.02f, 40 CFR 1508.27(b)(7)). Each of the action alternatives establishes targets for rebuilding four overfished groundfish stocks. If a stock did not rebuild within the maximum permissible time period (T_{MAX}), this would constitute a significant impact. Under the No Action alternative only bocaccio is projected to rebuild by $_{TMAX}$. Under the action alternatives the stocks are projected to rebuild by T_{MAX}, but the rebuilding probability, which indicates the likelihood that the stock will rebuild, also presents the risk of this not occurring. Alternative 1 has the highest risk: a 40% chance that bocaccio, widow rockfish, and yelloweye rockfish would not rebuild, and a 45% change that cowcod would not rebuild. In addition, the rebuilding probability estimates are based on recruitment variability alone. There are a variety of other uncertainties that, if quantifiable, could contribute to this risk. These include both measurement errors (e.g., inaccurate bycatch monitoring) and model uncertainty (e.g., errors in the causal relationships in stock assessment models) that could contribute to the over-specification of OYs, which could allow overfishing to occur, or at least delay stock rebuilding. In addition, the effect of environmental conditions, including ecological interactions and shifts in the climate regime, have not been integrated into stock assessment models. These factors are complex and over time could have both adverse and beneficial impacts on stock rebuilding. CEQ regulations identify highly uncertain effects, including unique or unknown risks, as a factor in judging significance (40 CFR 1502.27(b)(5)). Both the risk and uncertainty involved in stock rebuilding, especially given the context of long rebuilding periods for many species, qualifies as a potentially significant impact.

CEQ regulations also state that "the degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future consideration" (40 CFR 1502.27(b)(6)) should be part of the significance evaluation. The proposed action would establish rebuilding targets upon which future actions are predicated, which differ depending on which alternative is chosen. First, in order to meet these targets, management measures have to be specified during biennial management. Management measures result in direct and indirect impacts, depending on the location and intensity of regulated fisheries. The most likely significant impacts would be socioeconomic, resulting from any potential reductions in fishing opportunity. (Note, however, that if rebuilding is successful, fishing opportunity will increase.) The choice of rebuilding targets for these four species also must be considered cumulatively in combination with rebuilding plans for canary rockfish, darkblotched rockfish, lingcod, and Pacific ocean perch adopted by Amendment 16-2. Where two or more species regularly co-occur in a fishery, the OY for one overfished species can act as a constraint on the harvest of other overfished species (as well as non-overfished species). The 2004 groundfish harvest specifications offer a good example of this phenomenon, relevant to species considered in this EIS. The canary rockfish OY of 47.3 mt is low enough that projected bocaccio total fishing mortality, at 145.1 mt, is well below the bocaccio OY of 250 mt (see Table 5-12) because of the need to manage for the canary rockfish fishing mortality.

The proposed action may potentially impact biodiversity and ecosystem function within the affected area (NAO 216-6 §6.02g). Under the No Action alternative, only bocaccio is projected to recover. Under the action alternatives, although unlikely, stocks could decline further, even if stocks are managed to rebuilding targets, due to the risk and uncertainty factors already discussed. Further decline could result in shrinking ranges and local extinctions for affected species, constituting a loss in biodiversity. Unrecovered stocks also affect ecosystem structure and function.

The proposed action could have significant social or economic impacts interrelated with the potential significant natural or physical environmental effects discussed above (NAO 216-6 §6.02h). In the short term, significant socioeconomic effects, resulting from lost fishing opportunity, could occur. Comparing projected OYs for 2005 and 2006 under the different alternatives to the OYs adopted by Council for 2004 gives an indication of whether fishing opportunity would increase or decrease (see Tables 2-1 through 2-4). For each of the alternatives the picture is somewhat different. For example, for bocaccio, OYs would be lower under Alternative 4 and No Action than they were in 2004. However, looking at impacts over a longer time frame is more relevant. Stock rebuilding measures have necessitated substantial decreases in fish harvests since 1999. But if rebuilding strategies are successful, there will be significant socioeconomic benefits in terms of increased fishing opportunity. The risk and uncertainty discussed above makes it difficult to determine what the actual trends will be like. The recent history of bocaccio stock assessments offers an instructive example. The 2002 stock assessment was very pessimistic, necessitating an OY of 20 mt, which required severe cutbacks in fishing opportunity in Southern California in 2003. A new stock assessment from 2003 presented a more optimistic scenario, primarily because a strong 1999 year class began to show up in the data. The 250 mt 2004 OY is the result. Bocaccio may be an extreme example, but rockfish tend to have highly variable reproductive success and resulting recruitment into the fishery. This can cause destabilizing shifts in fishing opportunity as stock assessment results are fed into the management system.

Overall, the proposed action is beneficial. This net benefit, although unquantified, will occur if long-term benefits from rebuilding overfished stock outweigh the short-term costs. Potential significant impacts would occur if rebuilding strategies are unsuccessful, which is contingent on risk and uncertainty.

9.8 Mitigation

An EIS must discuss "means to mitigate the adverse environmental impacts" stemming from the proposed action (40 CFR 1502.1(h)), even if the adverse impacts are not by themselves significant. Under all the alternatives, four overfished groundfish stocks will be rebuilt to the target biomass. The alternatives differ in terms of the tradeoff between how quickly stock are likely to rebuild and the reduction in OYs necessary to rebuild the stock in a given time period. (Under the No Action alternative, however, only bocaccio is projected to rebuild.) In order to meet these targets, total fishing mortality for each species would be limited to different annual OY levels projected to allow the stocks to rebuild. However, implementation of the means—or management measures—that would constrain fishing mortality is not part of the proposed action. This will be accomplished through the biennial specification of ABCs, OYs, and management measures authorized by the FMP management framework. Given this context, in comparison to the *No Action* alternative, any of the action alternatives would reduce adverse impacts resulting from the regulated activity. Nonetheless, further mitigation measures could address the adverse impacts that would still occur with implementation of any of the action alternatives. Potential mitigation measures are discussed with respect to the components of the human environment potentially affected by the proposed action.

<u>Habitat and ecosystem</u>: Although adverse impacts to overfished species' habitats may be caused by a range of natural events and human activities, mitigation measures within the scope of NMFS authority would address fishing-related impacts. The Rockfish Conservation Area, currently used to reduce overfished species bycatch, also reduces related adverse impacts to benthic habitat within its boundaries, because bottom trawling is prohibited in these areas. In a separate action, NMFS is preparing an EIS to identify and describe groundfish essential fish habitat, and identify habitat areas of particular concern (HAPCs) within EFH. The alternatives in this EIS will include measures to minimize adverse effects on EFH caused by fishing. These measures could supplement existing closed areas, by proposing marine protected areas that maximize habitat protection while still keeping fishing vessels out of areas where overfished species bycatch is high.

<u>Groundfish, including overfished species</u>: Management measures implemented through the biennial process could provide additional mitigation if overfished species bycatch (or total fishing mortality on these stocks) is less than the OYs computed for a given rebuilding target. In some cases, this is simply a function of the constraints imposed by the overfished species with the lowest OY. Management measures needed to stay within this OY limit keeps harvests of all co-occurring stocks—including other overfished species—to levels below their OYs. (Tables 5-4 and 5-5 show estimated total fishing mortality of various managed species compared to OYs for 2002-2003.) This is not intended mitigation but does have a mitigative effect. Management measures intended to further reduce bycatch rates below current rates would be explicitly mitigative. (A reduction in the bycatch *rate* means, that for every unit of target species harvested, a smaller increment of the overfished species is caught.) NMFS and the Council released a groundfish bycatch mitigation draft programmatic EIS on February 20, 2004 (NMFS 2004b), which evaluates different bycatch reduction programs for the groundfish fishery. Alternatives in this EIS propose a variety of new management measures. Many of these measures will require additional FMP amendments and/or regulatory actions to implement. In addition, accurate bycatch monitoring is necessary, both to ensure total fishing mortality is actually below the OY for a species and to evaluate the efficacy of new management measures. NMFS implemented the West Coast Groundfish Observer Program in May 2001, which is providing more accurate data to estimate bycatch rates than previously used data sources (trawl logbooks, for example). However, the observer program covers a fraction of the fleet at any given time (in the first year of the program about 20% of bottom trawl trips carried observers). A higher level of observer coverage, resulting in more reliable estimates of total fishing mortality on a per-vessel basis, would make a wider range of bycatch reduction measures feasible. For example, sector- or vessel-specific bycatch caps or a tradable quota system could be implemented. Tradable quotas would likely be allocated for both target and bycatch species. In addition to limiting total mortality, these types of management programs could provide incentives for fishermen to find ways to reduce their bycatch rates, since they would more directly bear the cost of producing bycatch. Gear

modifications can also reduce bycatch rates. Experimental bycatch reducing gear could be more widely tested through the exempted fishing permit program authorized under the groundfish FMP.

Socioeconomic sectors: Adverse socioeconomic impacts are attributable to reductions in commercial harvests and recreational fishing opportunities necessary to rebuild stocks. Evaluating these impacts is made difficult because of the tradeoff between short- and long-term costs and benefits. Imposing short-term costs in the form of harvest reductions should result in a long-term net benefit in the form of future MSY harvests. (Note that the MSY concept encompasses both maximum *and* sustainable harvests, so that once rebuilt, these stocks could support an ongoing stream of higher harvests.) One general form of mitigation is to compensate fishermen directly through subsidies or the provision services, such as job retraining programs for displaced workers. The forms of mitigation discussed above for impacts to groundfish stocks are also a form of socioeconomic mitigation if target species harvests can be sustained or increased while reducing overfished species bycatch.

9.9 Environmentally Preferred Alternative and Rationale for Preferred Alternative

NEPA regulations, at 40 CFR 1505.2(b), state that the record of decision (ROD) will identify an alternative or alternatives considered "environmentally preferable." In order to inform the public and facilitate preparation of the ROD, the rationale for identifying *Alternative 4* as the environmentally preferable alternative is summarized here. Guidance, in the form of *Forty Most Asked Questions Concerning CEQ's NEPA Regulations*, states that the environmentally preferable alternative is "the alternative that will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources" (Question 6.A). Alternative 4 represents the environmentally preferable alternative because it is the most risk averse (a 90% P_{MAX} for all species except cowcod, for which it is 60%) and because it is estimated to have the least effect on biological resources in terms of impacts to habitat and ecosystem, total fishing mortality, and harm to protected species. However, in comparison to the other action alternatives Alternative 4 could have a greater adverse impact, especially cumulatively, on West Coast fishing communities substantially engaged in or dependent on groundfish fisheries. Generally, the more severe short-term impacts are projected to result in faster rebuilding in comparison to the other alternatives.[17/] Once a stock is recovered, it should be possible to increase OYs and still, on average, keep the population size above the precautionary threshold ($B_{40\%}$). Thus, earlier recovery under Alternative 4 would allow these higher harvests sooner. On the other hand, given the fairly long recovery times under all the alternatives, income from these future harvests is heavily discounted in the present. Combined with substantial declines over the past five years, harvest limits in the short term under Alternative 4 could affect the character and viability of these communities. Furthermore, NEPA describes national policy in terms of the human environment, which includes the relationship of people with the natural and physical environment (40 CFR 1508.14). Fishing, whether commercial or recreational, is a direct expression of this relationship.

The Council will recommend a preferred alternative at its April 4-9, 2004, meeting in Sacramento, California. The rationale for their choice will be documented in the FEIS.

17/ The No Action alternative, based on the 40-10 rule in the FMP management framework, uses a variable harvest rate, depending on stock size. In the case of bocaccio and cowcod, OYs are lower in the early years than under the other alternatives. However, application of the 40-10 rule is projected to allow recovery only in the case of bocaccio.

10.0 CONSISTENCY WITH THE GROUNDFISH FMP AND MAGNUSON-STEVENS ACT NATIONAL STANDARDS

10.1 FMP Goals and Objectives

The groundfish FMP goals and objectives are listed below. They way in which Amendment 16-3 addresses each objective is briefly described in italics below the relevant statement.

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. 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.

Measures in this amendment may affect this objective. Currently, stock assessments depend, in part, on data derived from fisheries. Reduction or elimination of fisheries would affect the availability of these data and require new, fishery independent assessment methods.

Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group.

Measures in this amendment indirectly affect this objective. Rebuilding plans establish a strategy based on specific targets. Harvest specifications adopted subsequently must be consistent with the rebuilding strategy.

Objective 3. For species or species groups which are below the level necessary to produce MSY, consider rebuilding the stock to the MSY level and, if necessary, develop a plan to rebuild the stock.

Rebuilding plans directly address this objective.

Objective 4. Where conservation problems have been identified for nongroundfish species and the best scientific information shows 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 nongroundfish 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 nongroundfish 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.

Measures in this amendment do not affect this objective.

> 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.

Although actions specifically intended to conserve or enhance EFH are not part of the proposed action, habitat impacts are discussed in the EIS as part of the evaluation of alternatives. New EFH protection measures could be implemented as part of a separate, future action in support of rebuilding.

Economics.

> Objective 6. Attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Net benefits are evaluated for the different alternatives considered in the EIS. Rebuilding plan implementation should increase net benefits in the long term.

> 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.

Management measures required to achieve the rebuilding targets identified in this amendment may require re-evaluation of the feasibility of year-round fisheries. Implementation of management measures is not part of the proposed action, but measures affecting the objective of a year-round fishery could be implemented in the future in order to achieve targets adopted by this amendment.

> Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable.

Although the adoption of rebuilding plan-specific management measures is not part of the proposed action, gear restrictions are discussed in the EIS as part of the evaluation of the alternatives. New gear restrictions may be implemented as part of a separate, future action in support of rebuilding targets.

Utilization.

> Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing) of the Pacific Coast groundfish resources by domestic fisheries.

Although management measures are not part of the proposed action, the effect of the alternatives on full utilization is evaluated as part of the EIS.

> Objective 10. Recognizing the multispecies nature of the fishery, establish a concept of managing by species and gear or by groups of interrelated species.

Rebuilding plans are species- or stock-specific, although, associated management measures will necessarily affect more abundant stocks that co-occur with overfished stocks. These effects are considered in evaluating the alternatives in the EIS.

> Objective 11. Strive to reduce the economic incentives and regulatory measures that lead to wastage of fish. Also, 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. In addition, 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.

Rebuilding plans must take into account total fishing mortality including bycatch mortality.

Objective 12. Provide for foreign participation in the fishery, consistent with the other goals to take that portion of the OY not utilized by domestic fisheries while minimizing conflict with domestic fisheries.

This objective is no longer relevant, because the fishery has been declared fully utilized.

Social Factors.

Objective 13. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

Rebuilding plans may discuss allocation among sectors. Potential allocation is discussed as part of the evaluation of alternatives in the EIS. Separate, future actions supporting the targets adopted in this amendment could affect allocation.

Objective 14. Minimize gear conflicts among resource users.

Measures in this amendment do not address this objective.

Objective 15. 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 environment.

Disruption of fishing, marketing, and the environment is discussed as part of the evaluation of alternatives in the EIS. Some disruption is unavoidable.

Objective 16. Avoid unnecessary adverse impacts on small entities.

Rebuilding plan measures may entail adverse impacts, but these are necessary to rebuild overfished stocks. Impacts on small entities are discussed as part of the evaluation of alternatives in the EIS.

Objective 17. 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.

The evaluation of alternatives in the EIS considers impacts to communities.

Objective 18. Promote the safety of human life at sea.

The proposed action will not directly effect safety. Management measures needed to constrain harvests to rebuilding targets could affect safety. These management measures are not part of the proposed action; they are implemented as part of the biennial harvest specification process. The impacts of management measures are separately evaluated as part of this process, in an EA or EIS.

10.2 National Standards

A FMP or plan amendment and any pursuant regulations must be consistent with ten national standards contained in the Magnuson-Stevens Act (§301). These are:

National Standard 1 states that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the United States fishing industry.

This amendment supports National Standard 1 by adopting rebuilding plans for four overfished species. Rebuilding plans lay out a strategy for stock rebuilding. Management measures implemented to achieve rebuilding must constrain harvests to a level below the overfishing threshold (maximum fishing mortality rate) for a given overfished species. Thus, in addition to establishing a strategy for stock rebuilding, they also dictate the implementation of measures to prevent overfishing.

National Standard 2 states that conservation and management measures shall be based on the best scientific information available.

Rebuilding plans are based on rebuilding analyses that use the most recent stock assessment data and incorporate statistical measures of the likelihood overfished stocks will recover within a mandated time period. These stock assessments and analyses are conducted by state and federal agency staff scientists with expertise in Pacific groundfish biology, ecology, and fishery science. They employ the best available data.

National Standard 3 states that, to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

Pacific groundfish are managed on the basis of known stocks when these can be differentiated from the total range of the species. Overfished species are managed individually, in that harvest levels are determined for each stock; but managers recognize that many groundfish stocks share common habitats and ecosystems, and fishers may catch them as part of a multi-species complex. This allows unit management of interrelated stocks. Thus, management measures are applied to more abundant stocks co-occurring with overfished species that may limit harvests of the healthy stock below OY in order to ensure rebuilding of the associated overfished stocks.

National Standard 4 states that 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 allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. The proposed measures will not discriminate between residents of different states.

Rebuilding plans should contain a discussion of potential or likely allocations among sectors, and allocation decisions may be guided by rebuilding plan objectives and specific policies described in the plans. To the degree that rebuilding plans specify allocation between sectors, they will do so in a fair and equitable manner. These decisions are made through the Council process and in accordance with its established procedures and policies. In addition, the evaluation of alternatives in the EIS considers their effect on allocation between sectors.

National Standard 5 states that 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.

Rebuilding plans do not address this National Standard directly, except that no measures are intended to allocate groundfish resources solely for the purpose of economic efficiency.

National Standard 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

Rebuilding plans recognize the differences between the various groundfish fishery sectors. Different sectors may have different catch levels for overfished species and capacity to avoid or minimize catch of overfished species. Although the primary purpose of targets described in this amendment are to allow overfished stocks to recover, differential impacts were considered when formulating them. Contingencies considered in the EIS include variation in stock assessment results, the effect of long-term changes in ocean conditions, and the stock-recruitment relationship for overfished groundfish stocks.

National Standard 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

Rebuilding plan measures are implemented through the harvest specifications and management measures process developed for the whole groundfish fishery. This approach is intended to minimize cost and duplication.

National Standard 8 states that conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The analyses supporting the adoption of individual rebuilding plans through this amendment (organized around NEPA requirements) consider the socioeconomic impacts of rebuilding to fishing communities. Rebuilding plans generally do not employ a policy that would rebuild stocks in the minimum time period, which would very likely require a complete cessation of many fisheries. This is meant to minimize impacts to communities by allowing some level of fishing mortality on overfished stocks while identifying a trajectory that will lead to their eventual recovery.

National Standard 9 states that conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Most overfished species are no longer targeted, and in many cases only constitute bycatch due to regulatory discards. Because rebuilding plans must account for total fishing mortality, strategies must minimize bycatch. The environmental impact analysis for this amendment evaluates the impact of alternative management measures on bycatch.

National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The proposed action will not directly effect safety. Management measures needed to constrain harvests to rebuilding targets could affect safety. These management measures are not part of the proposed action; they are implemented as part of the biennial harvest specification process. The impacts of management measures are separately evaluated as part of this process, in an EA or EIS.

10.3 Other Applicable Magnuson-Stevens Act Provisions

This amendment and associated rebuilding plans conform to Section 304(e)–Rebuild Overfished Fisheries. Rebuilding plans contain the elements required by Section 304(e)(4) and discussed in National Standards Guidelines (50 CFR 600.310).

Chapter 3 in this EIS constitutes an EFH assessment of the proposed action's impacts, as required by 50 CFR 600.920 (e)(3). NMFS is currently preparing an EIS evaluating programmatic measures designed to identify and describe West Coast groundfish EFH, and minimize potential fishing impacts on West Coast groundfish EFH. According to the current schedule, NMFS will publish a draft EIS for this action in February 2005. Publication of the final EIS for this action is scheduled for December 2005, with implementation of any measures pursuant to the EIS occurring in 2006.

11.0 CROSS-CUTTING MANDATES

11.1 Other Federal Laws

11.1.1 Coastal Zone Management Act

Section 307(c)(1) of the federal Coastal Zone Management Act (CZMA) of 1972 requires all federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The *Preferred Alternative* would be implemented in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of Washington, Oregon, and California. This determination has been submitted to the responsible state agencies for review under Section 307(c)(1) of the CZMA. The relationship of the groundfish FMP with the CZMA is discussed in Section 11.7.3 of the groundfish FMP. The groundfish FMP has been found to be consistent with the Washington, Oregon, and California coastal zone management programs. The recommended action is consistent and within the scope of the actions contemplated under the framework FMP.

Under the CZMA, each state develops its own coastal zone management program which is then submitted for federal approval. This has resulted in programs which vary widely from one state to the next. Rebuilding plans adopted under Amendment 16-3 establish strategies for rebuilding four overfished groundfish stocks and are not expected to affect any state’s coastal management program.

11.1.2 Endangered Species Act

NMFS issued Biological Opinions (BOs) under the ESA on August 10, 1990, November 26, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999 pertaining to the effects of the groundfish fishery on chinook salmon (Puget Sound, Snake River spring/summer, Snake River fall, upper Columbia River spring, lower Columbia River, upper Willamette River, Sacramento River winter, Central Valley spring, California coastal), coho salmon (Central California coastal, southern Oregon/northern California coastal), chum salmon (Hood Canal summer, Columbia River), sockeye salmon (Snake River, Ozette Lake), and steelhead (upper, middle and lower Columbia River, Snake River Basin, upper Willamette River, central California coast, California Central Valley, south-central California, northern California, southern California). During the 2000 Pacific whiting season, the whiting fisheries exceeded the chinook bycatch amount specified in the Pacific whiting fishery BO (December 15, 1999) incidental take statement estimate of 11,000 fish, by approximately 500 fish. In the 2001 whiting season, however, the whiting fishery’s chinook bycatch was about 7,000 fish, which approximates the long-term average. After reviewing data from, and management of, the 2000 and 2001 whiting fisheries (including industry bycatch minimization measures), the status of the affected listed chinook, environmental baseline information, and the incidental take statement from the 1999 whiting BO, NMFS determined in a letter dated April 25, 2002 that a re-initiation of the 1999 whiting BO was not required. NMFS has concluded that implementation of the FMP for the Pacific Coast groundfish fishery is not expected to jeopardize the continued existence of any endangered or threatened species under the jurisdiction of NMFS, or result in the destruction or adverse modification of critical habitat. The proposed action is within the scope of these consultations.

11.1.3 Marine Mammal Protection Act

The MMPA of 1972 is the principle federal legislation that guides marine mammal species protection and conservation policy in the United States. Under the MMPA, NMFS is responsible for the management and conservation of 153 stocks of whales, dolphins, porpoise, as well as seals, sea lions, and fur seals; while the U.S. Fish and Wildlife Service is responsible for walrus, sea otters, and the West Indian manatee.

Off the West Coast, the Steller sea lion (*Eumetopias jubatus*) Eastern stock, Guadalupe fur seal (*Arctocephalus townsendi*), and Southern sea otter (*Enhydra lutris*) California stock are listed as threatened under the ESA and the sperm whale (*Physeter macrocephalus*) Washington, Oregon, and California stock, humpback whale (*Megaptera novaeangliae*) Washington, Oregon, and California - Mexico Stock, blue whale (*Balaenoptera musculus*) Eastern north Pacific stock, and Fin whale (*Balaenoptera physalus*) Washington, Oregon, and California stock are listed as depleted under the MMPA. Any species listed as endangered or threatened under the ESA is automatically considered depleted under the MMPA.

The West Coast groundfish fisheries are considered a Category III fishery, indicating a remote likelihood of or no known serious injuries or mortalities to marine mammals, in the annual list of fisheries published in the *Federal Register*. Based on its Category III status, the incidental take of marine mammals in the West Coast groundfish fisheries does not significantly impact marine mammal stocks. Amendment 16-3 adopts rebuilding plans establishing targets for rebuilding four overfished groundfish stocks. These rebuilding strategies may indirectly affect the intensity, duration, and location of groundfish fisheries through subsequent management measures implemented to achieve strategic targets. But these changes would not change the effects of the groundfish fisheries on marine mammals.

11.1.4 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource. The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. The proposed action is unlikely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act.

11.1.5 Paperwork Reduction Act

The proposed action, as implemented by any of the alternatives considered in this EIS, does not require collection-of-information subject to the Paperwork Reduction Act.

11.1.6 Regulatory Flexibility Act

The purpose of the RFA is to relieve small businesses, small organizations, and small governmental entities of burdensome regulations and record-keeping requirements. Major goals of the RFA are; (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. An initial regulatory flexibility analysis (IRFA) is conducted unless it is determined that an action will not have a “significant economic impact on a substantial number of small entities." The RFA requires that an initial regulatory flexibility analysis (IRFA) include elements that are similar to those required by EO 12866 and NEPA. Therefore, the IRFA has been combined with the RIR and NEPA analyses.

Section 11.3 (below) summarizes the analytical conclusions specific to the RFA and EO 12866.

11.2 Executive Orders

11.2.1 EO 12866 (Regulatory Impact Review)

EO 12866, Regulatory Planning and Review, was signed on September 30, 1993, and established guidelines for promulgating new regulations and reviewing existing regulations. The EO covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. Section 1 of the EO deals with the regulatory philosophy and principles that are to guide agency development of regulations. It stresses that in deciding whether and how to regulate, agencies should assess all of the costs and benefits across all regulatory alternatives. Based on this analysis, NMFS should choose those approaches that maximize net benefits to society, unless a statute requires another regulatory approach.

The RIR and IRFA determinations are part of the combined summary analysis in Section 11.3 of this document.

11.2.2 EO 12898 (Environmental Justice)

EO 12898 obligates federal agencies to identify and address "disproportionately high adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States" as part of any overall environmental impact analysis associated with an action. NOAA guidance, NAO 216-6, at §7.02, states that "consideration of EO 12898 should be specifically included in the NEPA documentation for decision-making purposes." Agencies should also encourage public participation—especially by affected communities—during scoping, as part of a broader strategy to address environmental justice issues.

The environmental justice analysis must first identify minority and low-income groups that live in the project area and may be affected by the action. Typically, census data are used to document the occurrence and distribution of these groups. Agencies should be cognizant of distinct cultural, social, economic, or occupational factors that could amplify the adverse effects of the proposed action. (For example, if a particular kind of fish is an important dietary component, fishery management actions affecting the availability, or price of that fish, could have a disproportionate effect.) In the case of Indian tribes, pertinent treaty or other special rights should be considered. Once communities have been identified and characterized, and potential adverse impacts of the alternatives are identified, the analysis must determine whether these impacts are disproportionate. Because of the context in which environmental justice is developed, health effects are usually considered, and three factors may be used in an evaluation: whether the effects are deemed significant, as the term is employed by NEPA; whether the rate or risk of exposure to the effect appreciably exceeds the rate for the general population or some other comparison group; and whether the group in question may be affected by cumulative or multiple sources of exposure. If disproportionately high adverse effects are identified, mitigation measures should be proposed. Community input into appropriate mitigation is encouraged.

[summarize EJ impacts]

Participation in decisions about the proposed action by communities that could experience disproportionately high and adverse impacts is another important principle of the EO. The Council offers a range of opportunities for participation by those affected by its actions and disseminates information to affected communities about its proposals and their effects through several channels. In addition to Council membership, which includes representatives from the fishing industries affected by Council action, the GAP, a Council advisory body, draws membership from fishing communities affected by the proposed action. While no special provisions are made for membership to include representatives from low income and minority populations, concerns about disproportionate effects to minority and low income populations could be voiced through this body, or to the Council directly. Although Council meetings are not held in isolated coastal communities for logistical reasons, they are held in different places up and down the West Coast to increase accessability. In addition, fishery management agencies in Oregon and California sponsored public hearings in coastal communities to gain input on the proposed action. The comments were made available to the Council in advance of their decision to choose a preferred alternative.

The Council disseminates information about issues and actions through several media. Although not specifically targeted at low income and minority populations, these materials are intended for consumption by affected populations. Materials include a newsletter, describing business conducted at Council meetings, notices for meetings of all Council bodies, and fact sheets intended for the general reader. The Council maintains a postal and electronic mailing list to disseminate this information. The Council also maintains a website (www.pcouncil.org) providing information about the Council, its meetings, and decisions taken. Most of the documents produced by the Council, including NEPA documents, can be downloaded from the website.

11.2.3 EO 13132 (Federalism)

EO 13132, which revoked EO 12612, an earlier federalism EO, enumerates eight “fundamental federalism principles.” The first of these principles states “Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people.” In this spirit, the EO directs agencies to consider the implications of policies that may limit the scope of or preempt states’ legal authority. Preemptive action having such “federalism implications” is subject to a consultation process with the states; such actions should not create unfunded mandates for the states; and any final rule published must be accompanied by a “federalism summary impact statement.”

The Council process offers many opportunities for states (through their agencies, Council appointees, consultations, and meetings) to participate in the formulation of management measures. This process encourages states to institute complementary measures to manage fisheries under their jurisdiction that may affect federally-managed stocks.

The proposed action does not have federalism implications subject to EO 13132.

11.2.4 EO 13175 (Consultation and Coordination With Indian Tribal Government)

EO 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared federal and tribal fishery resources. At Section 302(b)(5), the Magnuson-Stevens Act reserves a seat on the Council for a representative of an Indian tribe with federally-recognized fishing rights from California, Oregon, Washington, or Idaho.

The U.S. government formally recognizes the four Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) have treaty rights to fish for groundfish. In general terms, the quantification of those rights is 50% of the harvestable surplus of groundfish available in the tribes' U and A fishing areas (described at 50 CFR 660.324). Each of the treaty tribes has the discretion to administer their fisheries and to establish their own policies to achieve program objectives.

Accordingly, rebuilding plans adopted by this amendment have been developed in consultation with the affected tribe(s) and, insofar as possible, with tribal consensus.

11.2.5 EO 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)

EO 13186 supplements the MBTA (above) by requiring federal agencies to work with the U.S. Fish and Wildlife Service to develop memoranda of agreement to conserve migratory birds. NMFS is scheduled to implement its memorandum of understanding by January 2003. The protocols developed by this consultation will guide agency regulatory actions and policy decisions in order to address this conservation goal. The EO also directs agencies to evaluate the effects of their actions on migratory birds in environmental documents prepared pursuant to the NEPA.

Chapter 4 in this EIS evaluates impacts to seabirds and concludes that the proposed action will not significantly impact seabirds.

11.3 Regulatory Impact Review and Regulatory Flexibility Analysis

In order to comply with EO 12866 and the RFA, this document also serves as an RIR and an IRFA. A summary of these analyses is presented below.

11.3.1 EO 12866 (Regulatory Impact Review)

EO 12866, Regulatory Planning and Review, was signed on September 30, 1993, and established guidelines for promulgating new regulations and reviewing existing regulations. The EO covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. Section 1 of the Order deals with the regulatory philosophy and principles that are to guide agency development of regulations. It stresses that in deciding whether and how to regulate, agencies should assess all of the costs and benefits across all regulatory alternatives. Based on this analysis, NMFS should choose those approaches that maximize net benefits to society, unless a statute requires another regulatory approach.

The regulatory principles in EO 12866 emphasize careful identification of the problem to be addressed. The agency is to identify and assess alternatives to direct regulation, including economic incentives such as user fees or marketable permits, to encourage the desired behavior. Each agency is to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only after reasoned determination the benefits of the intended regulation justify the costs. In reaching its decision agency must use the best reasonably obtainable information, including scientific, technical and economic data, about the need for and consequences of the intended regulation.

NMFS requires the preparation of an RIR for all regulatory actions of public interest; implementation of rebuilding plans includes the publication of strategic rebuilding parameters in federal regulations. The RIR provides a comprehensive review of the changes in net economic benefits to society associated with proposed regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems. The purpose of the analysis is to ensure the regulatory agency systematically and comprehensively considers all available alternatives, so the public welfare can be enhanced in the most efficient and cost-effective way. The RIR addresses many of the items in the regulatory philosophy and principles of EO 12866.

The RIR analysis and an environmental analyses required by NEPA have many common elements and they have been combined in this document. The following table shows where the elements of an RIR, as required by EO 12866, are located.

Required RIR Elements	Corresponding Sections
Description of management objectives	Sections 1.2 & 1.3
Description of the fishery[a/]	Section 8.1 Appendix A, Chapters 6 & 7
Statement of the problem	Section 1.2.2
Description of each alternative considered in the analysis	Chapter 2
An economic analysis of the expected effects of each selected alternative relative to the *No Action* alternative	Chapter 8

a/ In addition to the information in this document, basic economic information is provided annually in the Council's Stock Assessment and Fishery Evaluation document.

The RIR is designed to determine whether the proposed actions could be considered "significant regulatory actions" according to EO 12866. The EO 12866 test requirements used to assess whether or not an action would be a "significant regulatory action" and the expected outcomes of the proposed management alternative are discussed below. Changes are relative to the *No Action* Alternative. A regulatory program is "economically significant" if it is likely to result in the following effects:

1. Have a annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities.

   <u>No Action alternative:</u> Rebuilding measures mandated under MSA would constrain fisheries even without adoption of specific rebuilding plans. (Commercial and recreational groundfish fisheries generated an estimated $228 million income in 2001.)
   <u>Alternative 1:</u> Least amount of disruption compared with the other action alternatives.
   <u>Alternative 2:</u>
   Alternative 3:
   <u>Alternative 4:</u> Lower harvest limits for the four rebuilding species would severely constrain commercial and recreational groundfish fisheries in the near term.

Overall Long Term Risk to Productivity
(All Long Term Risk Levels Are Within Magnuson-Stevens Act Guidelines)

2. Create a serious inconsistency or otherwise interfere with action taken or planned by another agency.

   None identified under any of the alternatives.

3. Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof.

   None identified under any of the alternatives.

4. Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this EO.

   None identified under any of the alternatives.

   None of the alternatives appear to meet the significance criteria enumerated in the Executive Order.

11.3.2 Impacts on Small Entities (Regulatory Flexibility Act, RFA)

The RFA requires government agencies to assess the effects that regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those effects. A fish-harvesting business is considered a "small" business by the Small Business Administration if it has annual receipts not in excess of $3.5 million. For related fish-processing businesses, a small business is one that employs 500 or fewer persons. For wholesale businesses, a small business is one that employs not more than 100 people. For marinas and charter/party boats, a small business is one with annual receipts not in excess of $5 million.

The data available for this analysis is based on data sets that have vessel and buyer/processor identifiers. The commercial data is from the PacFIN data system, and the recreational data was provided by the states. The vessel and processor counts are based on unique vessel and buyer/processor identifiers. However, it is known that in many cases a single firm may own more than one vessel or buyer/processing facility, more than one profit center. Therefore, the counts should be considered upper bound estimates. Additionally, businesses owning vessels and/or buyer/processors may have revenue from fisheries in other geographic areas, such as Alaska, or from nonfishing activities. Therefore, there is some possibility that when all operations of a firm are aggregated, some of the small entities identified here are larger than indicated.

Most of the vessels, processors and related businesses engaged in the West Coast groundfish fishery would be classified as small businesses under these definitions. Table 8-4 in Appendix A shows that in 2000-2001 of a total 4,588 commercial vessels fishing from West Coast ports, 1,709 vessels had some involvement in West coast groundfish fisheries. Of these, 421 held groundfish limited entry permits, and an additional 771 participated in open access groundfish fisheries and derived more than 5% of total revenue from groundfish.

Regarding buyers and processors, Table 7-1 in Appendix A shows that out of a total 1,780 fish buyers on the West Coast, 732 bought at least some groundfish from commercial fishermen. All but 19 of these purchased less than $2 million worth of total harvest during the year 2000.

In 2001 there were an estimated 753 recreational fishing charter vessels operating on the West Coast: 106 in Washington, 232 in Oregon and 415 in California. Recreational fisheries mainly catch widow rockfish incidentally, although Table 6-15 in Appendix A shows significant catches in Northern California. There has been a small recreational catch of yelloweye rockfish, primarily in California and Oregon (Table 6-15 in Appendix A). Bocaccio and cowcod are mainly caught in Southern California. Bocaccio is the most important recreational species of the four overfished species considered in this amendment.

Section 603 (b) of the RFA identifies the elements that should be included in the IRFA. These are bulleted below, followed by information that addresses each element.

- A description of the reasons why action by the agency is being considered.

The purpose and need for the proposed action are discussed in Section 1.2. The Secretary has declared nine groundfish stocks overfished. The currently overfished stocks are: canary rockfish, bocaccio, cowcod, darkblotched rockfish, lingcod, Pacific ocean perch, widow rockfish, and yelloweye rockfish. (Pacific whiting was declared overfished, but the latest stock assessment shows that it is not currently overfished nor did it fall below the MSST in the past.) National Standard 1 in the Magnuson-Stevens Act requires conservation and management measures that prevent overfishing. Amendment 16-1 established a framework for adopting codifying rebuilding plans for overfished species. Amendment 16-2 adopted rebuilding plans for canary rockfish, darkblotched rockfish, lingcod, and Pacific ocean perch. This document contains the subsequent rebuilding plans for the remaining four currently overfished species listed above.

- A succinct statement of the objectives of, and legal basis for, the proposed rule.

The objective of the proposed action is to rebuild bocaccio, cowcod, widow rockfish, and yelloweye rockfish stocks managed under the groundfish FMP according to the requirements of the MSA and National Standards.

- A description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply.

The proposed action adopts rebuilding plans for four overfished species. The economic impact of implementing these rebuilding plans will be shared among groundfish buyers, commercial harvesters, and recreational operators. It is estimated there are about 730 groundfish buyers, 1,700 commercial vessels and 750 recreational charter operators that may be affected by these actions. Most of these would qualify as small businesses under Small Business Administration criteria.

- A description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirements of the report or record.

There are no new reporting or record keeping requirements that are proposed as part of this action.

- An identification, to the extent practicable, of all relevant federal rules, which may duplicate, overlap, or conflict with the proposed rule.

No federal rules have been identified that duplicate, overlap, or conflict with the Council Preferred alterative. Public comment is hereby solicited, identifying such rules.

- A description of any significant alternatives to the proposed rule that accomplish the stated objectives that would minimize any significant economic impact of the proposed rule on small entities.

The implementation of rebuilding plans for overfished species may entail substantial economic impacts for groundfish buyers, commercial harvesters, and in the case of bocaccio, cowcod, and yelloweye rockfish, recreational charter operators. A majority of these businesses would be classified as small businesses by the Small Business Administration.
No alternatives, other than those considered here, have been identified that would reduce the impact on small entities. The Council process for developing a preferred alternative is conducted in an open forum with industry advisory groups that assist the Council in developing options that meet regulatory objectives and conservation goals, in particular, with the least possible impact on fishing business.

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Dr. Ray Conser	NMFS, Southwest Fisheries Science Center	Cowcod rebuilding review
Dr. Paul Crone	NMFS, Southwest Fisheries Science Center	Cowcod rebuilding review
Dr. Edward J. Dick	NMFS, Southwest Fisheries Science Center	Widow rockfish stock assessment
Mr. Robert Hannah	Oregon Department Of Fish and Wildlife	Pink shrimp fishery bycatch analysis
Dr. Jim Hastie	NMFS, Northwest Fisheries Science Center	Trawl bycatch model
Dr. Xi He	NMFS, Southwest Fisheries Science Center	Widow rockfish stock assessment (first author) and rebuilding analysis (first author)
Dr. Alec MacCall	NMFS, Southwest Fisheries Science Center	Bocaccio stock assessment and rebuilding analysis, widow rockfish rebuilding analysis

Dr. Richard Methot	NMFS, Northwest Fisheries Science Center	Yelloweye rockfish stock assessment (first author) and rebuilding analysis (first author)
Dr. Donald E. Pearson	NMFS, Southwest Fisheries Science Center	Widow rockfish stock assessment
Dr. Kevin Piner	NMFS, Southwest Fisheries Science Center	Yelloweye rockfish stock assessment and rebuilding analysis
Dr. Andre Punt	University of Washington, School of Aquatic & Fishery Sciences	Rebuilding simulation software, widow rockfish rebuilding analysis
Dr. Stephen Ralston	NMFS, Southwest Fisheries Science Center	Widow rockfish stock assessment and rebuilding analysis
Mr. Farron Wallace	Washington Department of Fish and Game	Yelloweye rockfish stock assessment
Mr. John Wallace	NMFS Northwest Fisheries Science Center	Yelloweye rockfish rebuilding analysis–computer simulation runs

13.0 AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS STATEMENT WERE SENT

The Council makes both the DEIS and FEIS available on its website, so anyone with computer access may download an electronic copy. Electronic copies on CD-ROM and paper copies are made available upon request. The Council distributes a notice of availability for the DEIS and FEIS through its electronic list, which include state and federal agencies, tribes, and individuals. Copies of the FEIS are sent to anyone who comments on the DEIS. In addition, NOAA Fisheries distributes copies of the DEIS to the following agencies:

Department of Interior
Department of State
U.S. Coast Guard, Commander Pacific Area
Marine Mammal Commission
Pacific States Marine Fisheries Commission
Washington Coastal Zone Management Program, Shoreline Environmental Assistance, Department of Ecology, Washington State
Ocean-Coastal Management Program, Department of Land Conservation and Development, State of Oregon
California Coastal Commission

ACRONYMS AND GLOSSARY

ABC	acceptable biological catch. The ABC is a scientific calculation of the sustainable harvest level of a fishery, and is used to set the upper limit of the annual total allowable catch. It is calculated by applying the estimated (or proxy) harvest rate that produces maximum sustainable yield to the estimated exploitable stock biomass (the portion of the fish population that can be harvested).
B_{MSY}	The biomass that allows maximum sustainable yield to be taken.
BO	Biological Opinion
B_o	Unfished biomass; the estimated size of a fish stock in the absence of fishing.
BRD	bycatch reduction device
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations. A codification of the regulations published in the *Federal Register* by the executive departments and agencies of the federal government. The CFR is divided into 50 titles that represent broad areas subject to federal regulation Title 50 contains wildlife and fisheries regulations.
Council	Pacific Fishery Management Council
CPFV	commercial passenger fishing vessel
CPS	coastal pelagic species. Coastal pelagic species are schooling fish, not associated with the ocean bottom, that migrate in coastal waters. They usually eat plankton and are the main food source for higher level predators such as tuna, salmon, most groundfish, and humans. Examples are herring, squid, anchovy, sardine, and mackerel.
CPUE	catch per unit effort
CZMA	Coastal Zone Management Act
DBCA	Darkblotched Rockfish Conservation Area
DEIS	draft environmental impact statement
DTS	Dover sole, thornyhead(s), and trawl-caught sablefish complex
EA	environmental assessment. As part of the National Environmental Policy Act (NEPA) process, an EA is a concise public document that provides evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact.
EDCP	Enhanced Data Collection Project

EEZ	Exclusive Economic Zone. A zone under national jurisdiction (up to 200 nautical miles wide) declared in line with the provisions of the 1982 United Nations Convention of the Law of the Sea, within which the coastal state has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources.
EFH	essential fish habitat. Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.
EFP	exempted fishing permit
EIS	environmental impact statement. As part of the National Environmental Policy Act (NEPA) process, an EIS is an analysis of the expected impacts resulting from the implementation of a fisheries management or development plan (or some other proposed action) on the environment. EISs are required for all fishery management plans as well as significant amendments to existing plans.
ENSO	El Niño southern oscillation
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act. An act of federal law that provides for the conservation of endangered and threatened species of fish, wildlife, and plants. When preparing fishery management plans, councils are required to consult with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service to determine whether the fishing under a fishery management plan is likely to jeopardize the continued existence of an ESA-listed species, or to result in harm to its critical habitat.
F	The instantaneous rate of fishing mortality. The term “fishing mortality rate” is a technical fishery science term that is often misunderstood. It refers to the rate at which animals are removed from the stock by fishing. The fishing mortality rate can be confusing because it is an “instantaneous” rate that is useful in mathematical calculations, but is not easily translated into the more easily understood concept of “percent annual removal.”
FEAM	Fisheries Economic Assessment Model
fecundity	The potential to produce offspring.
FEIS	final environmental impact statement
fm	fathom
FMP	Fishery management plan. A plan, and its amendments, that contains measures for conserving and managing specific fisheries and fish stocks.
FONSI	Finding of No Significant Impact. As part of the National Environmental Policy Act (NEPA) process, a finding of no significant impact (FONSI) is a document that explains why an action that is not otherwise excluded from the NEPA process, and for which an environmental impact statement (EIS) will not be prepared, will not have a significant effect on the human environment.

FRFA	Final Regulatory Flexibility Analysis. the FRFA includes all the information from the initial regulatory flexibility analysis. Additionally, it provides a summary of significant issues raised by the public, a statement of any changes made in the proposed rule as a result of such comments, and a description of steps taken to minimize the significant adverse economic impact on small entities consistent with stated objectives.
GAP	Groundfish Advisory Subpanel. The Council established the GAP to obtain the input of the people most affected by, or interested in, the management of the groundfish fishery. This advisory body is made up of representatives with recreational, trawl, fixed gear, open access, tribal, environmental, and processor interests. Their advice is solicited when preparing fishery management plans, reviewing plans before sending them to the Secretary, reviewing the effectiveness of plans once they are in operation, and developing annual and inseason management.
GMT	Groundfish Management Team. Groundfish management plans and annual and inseason management recommendations are prepared by the Council's GMT, which consists of scientists and managers with specific technical knowledge of the groundfish fishery.
HAPC	habitat areas of particular concern
INPFC	International North Pacific Fishery Commission
IPHC	International Pacific Halibut Commission. A commission responsible for studying Pacific halibut stocks and the halibut fishery. The IPHC makes proposals to the U.S. and Canada concerning the regulation of the halibut fishery.
IRFA	Initial Regulatory Flexibility Analysis. Anytime an agency publishes a notice of proposed rule making and the rule may have a significant impact on a substantial number of small entities, an IRFA is required. It describes the impact of the proposed rule on small entities and includes a description of the action, why it is necessary, the objectives and legal basis for the action, the small entities that will be impacted by the action, and the projected reporting, record-keeping, and other compliance requirements of the proposed rule. Rules that duplicate, overlap, or conflict with the proposed rule are also identified.
ITQ	individual transferrable quota
kg	kilogram
m	meter
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act. The MSA, sometimes known as the "Magnuson-Stevens Act," established the 200-mile fishery conservation zone, the regional fishery management council system, and other provisions of U.S. marine fishery law.
MBTA	Migratory Bird Treaty Act

mean generation time	A measure of the time required for a female to produce a reproductively-active female offspring.
MFMT	maximum fishing mortality threshold. A limit identified in the National Standard Guidelines. A fishing mortality rate above this threshold constitutes overfishing.
MHHW	mean high high water
mixed stock exception	In "mixed-stock complexes," many species of fish swim together and are caught together. This becomes a problem when some of these stocks are healthy and some are overfished, because even a sustainable harvest of the healthy stocks can harm the depleted stock. In order to avoid having to shut down all fisheries to protect one particular overfished stock, the national standard guidelines allow a "mixed-stock" exception to the "overfished" definition. This would allow higher catches of some overfished species than ordinarily allowed in order to avoid severe hardship to fishing communities.
MMPA	Marine Mammal Protection Act. The MMPA prohibits the harvest or harassment of marine mammals, although permits for incidental take of marine mammals while commercial fishing may be issued subject to regulation. (See "incidental take" for a definition of "take".)
MPA	marine protected area
MRFSS	Marine Recreational Fisheries Statistical Survey
MRPZ	Marine Resources Protection Zone
MSA	Magnuson-Stevens Fishery Conservation and Management Act (see Magnuson-Stevens Act, above).
MSST	minimum stock size threshold. A threshold biomass used to determine if a stock is overfished. The Council proxy for MSST is $B_{25\%}$.
MSY	maximum sustainable yield. An estimate of the largest average annual catch or yield that can be continuously taken over a long period from a stock under prevailing ecological and environmental conditions. Since MSY is a long-term average, it need not be specified annually, but may be reassessed periodically based on the best scientific information available.
mt	metric ton. 1,000 kilos or 2,204.62 pounds.
NAO	NOAA Administrative Order
NEPA	National Environmental Protection Act
NMFS	National Marine Fisheries Service. A division of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA). NMFS is responsible for conservation and management of offshore fisheries (and inland salmon). The NMFS Regional Director is a voting member of the Council.
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

NRDC	Natural Resources Defense Council
NSG	National Standard Guidelines
NWR	Northwest Region
ODFW	Oregon Department of Fish and Wildlife
overfished	Any stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding. The term generally describes any stock or stock complex determined to be below its overfished/rebuilding threshold. The default proxy is generally 25% of its estimated unfished biomass; however, other scientifically valid values are also authorized.
overfishing	Fishing at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. More specifically, overfishing is defined as exceeding a maximum allowable fishing mortality rate. For any groundfish stock or stock complex, the maximum allowable mortality rate will be set at a level not to exceed the corresponding MSY rate (B_{MSY}) or its proxy.
OY	optimum yield. The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems. The OY is developed on the basis of the MSY from the fishery, taking into account relevant economic, social, and ecological factors. In the case of overfished fisheries, the OY provides for rebuilding to a level that is consistent with producing the MSY for the fishery.
PacFIN	Pacific Coast Fisheries Information Network
PDO	Pacific Decadal Oscillation
PEIS	programmatic environmental impact statement
P_{MAX}	The estimated probability of reaching T_{MAX}. May not be less than 50%.
PMCC	Pacific Marine Conservation Council
POP	Pacific ocean perch
PSMFC	Pacific States Marine Fisheries Commission
QSM	quota species monitoring
RCA	Rockfish Conservation Area
Rebuilding	Implementing management measures that increase a fish stock to its target size.
RecFIN	Recreational Fishery Information Network

RFA	Regulatory Flexibility Act (see IRFA and FRFA above). The Regulatory Flexibility Act (5 U.S.C. 601-612) requires federal agencies to consider the effects of their regulatory actions on small businesses and other small entities and to minimize any undue disproportionate burden.
RIR	Regulatory Impact Review. RIRs are prepared to determine whether a proposed regulatory action is "major." The RIR examines alternative management measures and their economic impacts.
ROD	Record of Decision
SAFE	Stock Assessment and Fishery Evaluation. A SAFE document is a document prepared by the Council that provides a summary of the most recent biological condition of species in the fishery management unit, and the social and economic condition of the recreational and commercial fishing industries, including the fish processing sector. It summarizes, on a periodic basis, the best available information concerning the past, present, and possible future condition of the stocks and fisheries managed in the FMP.
Secretary	U.S. Secretary of Commerce
SEIS	supplemental environmental impact statement
SFA	Sustainable Fisheries Act (see Magnuson-Stevens Act, above).
SSC	Scientific and Statistical Committee. An advisory committee of the Council made up of scientists and economists. The Magnuson-Stevens Act requires that each council maintain an SSC to assist in gathering and analyzing statistical, biological, ecological, economic, social, and other scientific information that is relevant to the management of Council fisheries.
STAR	Stock Assessment Review Panel. A panel set up to review stock assessments for particular fisheries. In the past there have been STAR panels for sablefish, rockfish, squid, and other species.
STAT	Stock Assessment Team. Stock assessment authors from the National Marine Fisheries Service fisheries science centers.
SWFSC	Southwest Fisheries Science Center (NMFS)
TAC	total allowable catch
T_{MAX}	The maximum time period to rebuild an overfished stock, according to National Standard Guidelines. Depends on biological, environmental, and legal/policy factors.
T_{TARGET}	The target year, set by policy, for a fish stock to be completely rebuilt.
T_{MIN}	The minimum time period to rebuild an overfished stock, according to National Standard Guidelines. Technically, this is the minimum amount of time in which a fish stock will have a 50% chance of rebuilding if no fishing occurs (depends on biological and environmental factors).
U and A	usual and accustomed

USEPA	United States Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VMS	Vessel Monitoring System
WDFW	Washington Department of Fish and Wildlife
WOC	Washington/Oregon/California
YRCA	Yelloweye Rockfish Conservation Area

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Appendix D: Proposed Groundfish FMP Amendment 16-3 Language

Note: Differences in amendment language contingent on the choice of a preferred alternative are indicated in **[boldface and brackets]**. These differences in language relate to the choice of strategic rebuilding parameter values. These values are listed below according to the following order of the alternatives: No Action/Alternative 1/Alternative 2/Alternative 3/Alternative 4.

4.5.4 Summary of Rebuilding Plan Contents

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4.5.4.5 Bocaccio Rockfish

Status of the Bocaccio Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption

Assessment scientists and managers have treated West Coast bocaccio as independent stocks north and south of Cape Mendocino. The southern stock, which has been declared overfished, occurs south of Cape Mendocino and the northern stock north of 48° N latitude in northern Washington (off Cape Flattery). The overfished southern bocaccio rockfish stock occurs in Central and Southern California waters, on the continental shelf and in nearshore areas, often in rocky habitat. They are caught in both commercial and recreational fisheries in approximately equal amounts. Commercial catches mainly occur in limited entry trawl fisheries.

Bocaccio have long been an important component of California rockfish fisheries. Catches increased to high levels in the 1970s and early 1980s as relatively strong year-classes recruited to the stock. The Council began to recommend increasingly restrictive regulations after an assessment of the southern stock in 1990 (Bence and Hightower 1990) indicated that fishing rates were too high. The southern stock has been assessed six times (Bence and Hightower 1990; Bence and Rogers 1992; MacCall 2002; MacCall 2003b; MacCall *et al.* 1999; Ralston *et al.* 1996b) and has suffered poor recruitment during the warm water conditions that have prevailed off Southern California since the late 1980s. The 1996 assessment (Ralston *et al.* 1996b) indicated the stock was in severe decline. NMFS formally declared the stock overfished in March 1999 after the groundfish FMP was amended to incorporate the tenets of the Sustainable Fisheries Act. MacCall et al. (1999) confirmed the overfished status of bocaccio and estimated spawning output of the southern stock to be 2.1% of its unfished biomass and 5.1% of the MSY level. The northern stock of bocaccio has not been assessed.

While previous assessments only used data from central and northern California, an assessment in 2002 (MacCall and He 2002) also included data for southern California. While relative abundance increased slightly from the last assessment (4.8% of unfished biomass), potential productivity appears lower than previously thought, making for a more pessimistic outlook. The Council assumed a medium recruitment scenario for the 1999 year class, which was not assessed (MacCall *et al.* 1999). The 2002 assessment revealed the 1999 year class experienced relatively lower recruitment. Therefore, although the 1999 year class contributed a substantial quantity of fish to the population, it did not contribute as much to rebuilding as was previously thought.

The 2003 bocaccio assessment differs greatly from the 2002 assessment. It is driven by the strength of the incoming 1999 year class that had not recruited into the indices used for the 2002 assessment and by a revised lower estimate of natural mortality (MacCall 2003b). In addition to the 2001 Triennial Survey data, the 2003 assessment used larval abundance data from recent CalCOFI surveys as well as length and catch-per-unit-effort (CPUE) data from recreational fisheries. In calculating the recreational CPUE information, a new method was used that identifies relevant fishing trips by species composition and adjusts the catch history for regulatory changes that effect the level of discard and avoidance. The results of these calculations suggest that recreational CPUE has increased dramatically in recent years and is at a record high level in central California north of Pt. Conception. The STAR Panel recommended the use of two assessment models as a means of bracketing uncertainty from the very different signals between the Triennial Survey and the recreational CPUE data. Following the STAR Panel meeting, MacCall presented a third "hybrid" model that incorporated the data from all of the indices. The SSC recommended and the Council approved the use of this third modeling approach. This resulted in modest improvement in estimated stock size, but significantly affected the estimated productivity of the stock. These results had substantial effects on the rebuilding outlook for bocaccio which, under the 2002 assessment, was not expected to rebuild within T_{MAX} even with no fishing related mortality. Total mortality in 2003 fisheries was restricted to less than 20 metric tons as a means of conserving the stock while minimizing adverse socioeconomic impacts to communities. The current rebuilding analysis (MacCall 2003a), using the "hybrid" model, suggests the stock could rebuild to B_{MSY} within 25 years while sustaining an OY of approximately 300 metric tons in 2004.

The Council adopted a rebuilding plan for bocaccio rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by MacCall (2003b).

Methods Used to Calculate Stock Rebuilding Parameters

The methods used by MacCall in his rebuilding analysis (2003) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (MacCall 2003b). Using the STATc base model from the most recent stock assessment (MacCall 2003a), the Council chose a value of **[77.6%/60%/70%/80%/90%]** for P_{MAX}, based on a harvest control rule of F = **[variable/0.615/0.0498/0.0363/0.0209]**. This results in a target year of **[2025/2025/2023/2020/2018]**.

Bocaccio Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for bocaccio rockfish was a fishing mortality rate of **[variable/0.615/0.0498/0.0363/0.0209]**. Based on the 2003 rebuilding analysis, this harvest rate is likely to rebuild the stock by the target year of **[2025/2025/2023/2020/2018]**. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

As noted, a large proportion of bocaccio catch occurs in recreational fisheries in Central and Southern California. Recreational depth closures, restricting fishing to shallow waters, bag limits, and seasonal closures have been used to reduce recreational bocaccio catches.

4.5.4.6 Cowcod

Status of the Cowcod and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption

Relatively little is known about cowcod, a species of large rockfish that ranges from Ranger Bank and Guadalupe Island in central Baja California to Usal, Mendocino County, California (Miller and Lea 1972b), and may infrequently occur as far north as Newport, Oregon. Cowcod have been assessed only once (Butler *et al.* 1999). Adult cowcod are primarily found over high relief rocky areas (Allen 1982). They are generally solitary, but occasionally aggregate (Love *et al.* 1990).

While cowcod are not a major component of the groundfish fishery, they are highly desired by both recreational and commercial fishers because of their bright color and large size. The cowcod stock south of Cape Mendocino has experienced a long-term decline. The cowcod stock in the Conception area was assessed in 1998 (Butler *et al.* 1999). Abundance indices decreased approximately tenfold between the 1960s and the 1990s, based on commercial passenger fishing vessel (CPFV) logs (Butler *et al.* 1999). Recreational and commercial catch also declined substantially from peaks in the 1970s and 1980s, respectively.

B_0 was estimated to be 3,370 mt, and 1998 spawning biomass was estimated at 7% of B_0, well below the 25% overfishing threshold. As a result, NMFS declared cowcod in the Conception and Monterey management areas overfished in January 2000. Large areas off southern California (the Cowcod Conservation Areas) have been closed to fishing for cowcod. The stock's low productivity and declined spawning biomass also necessitates an extended rebuilding period, estimated at 62 years with no fishing-related mortality (T_{MIN}), to achieve a 1,350 mt B_{MSY} for the Conception management area.

There is relatively little information about the cowcod stock and there are major uncertainties in the one assessment that has been conducted. The assessment authors needed to make estimates of early landings based on more recent data and reported total landings of rockfish. Age and size composition of catches are poorly sampled, population structure is unknown, and the assessment was restricted to southern California waters.

A cowcod rebuilding review was completed in 2003, which validated the assumption that non-retention regulations and area closures have been effective in constraining cowcod fishing mortality (Butler *et al.* 2003). These results, although encouraging, are based on cowcod fishery-related removals from CPFV observations and angler reported discards. Non-retention regulations and limited observation data have increased the need for fishery independent population indices.

The Council adopted a rebuilding plan for bocaccio rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Butler and Barnes (2000).

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis used to develop the rebuilding plan do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis (Butler and Barnes 2000) used in formulating the rebuilding plan. The Council chose a value of **[0%/55%/60%]** for P_{MAX}, based on a harvest control rule of F = **[variable/0.0100/0.009]**. This results in a target year of **[>2104/2095/2090]**.

Cowcod Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for cowcod was a fishing mortality rate of **[variable/0.0100/0.009]**. Based on the 2000 cowcod rebuilding analysis (Butler and Barnes 2000) , this harvest rate is likely to rebuild the stock by the target year of **[>2104/2095/2090]**. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because cowcod is a fairly sedentary species, establishment of a marine protected area, considered one of the GCAs, is the key strategy for limiting cowcod fishing mortality. The Cowcod Conservation Area (CCA) in the Southern California Bight encompasses two areas of greatest cowcod density, as estimated in 2000, based on historical cowcod catch and catch rates in commercial and recreational fisheries. To aid in enforcement, the CCA is bounded by straight lines enclosing simple polygons. Butler, et al. (2003) concluded that the CCAs have been effective in reducing bycatch to levels projected to allow stock rebuilding. Estimated fishery removals have been at levels sufficient to rebuild the stock since the CCAs were implemented, except in 2001, when 5.6 mt was caught in the Conception management area. Most of this catch occurred in the spot prawn trawl fishery, which was subsequently prohibited.

4.5.4.7 Widow Rockfish

Status of the Widow Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption

Widow rockfish are an important commercial species from British Columbia to central California, particularly since 1979, when an Oregon trawl fisherman demonstrated the ability to make large catches at night using midwater trawl gear. Since that time, many more participants entered the fishery and landings of widow rockfish increased rapidly (Love *et al.* 2002). Widow rockfish are a minor component of recreational groundfish fisheries. Historically, there have been target fisheries for widow rockfish. Since declared overfished, most widow rockfish catches have occurred in the midwater fishery for Pacific whiting. Tribal midwater trawl fisheries account for most of the remainder of recent catches.

Williams, et al. (2000) assessed the widow rockfish in 2000. The spawning output level (8,223 mt), based on that assessment and a revised rebuilding analysis (Punt and MacCall 2002) adopted by the Council in June 2001, was at 23.6% of the unfished level (33,490 mt) in 1999. This result was computed using the average recruitment from 1968 to 1979 multiplied by the spawning output-per-recruit at F = 0. The analysis concluded the rebuilding period in the absence of fishing is 22 years, and with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 38 years. Widow rockfish were declared overfished in 2001 based on these analyses.

The most recent assessment (He *et al.* 2003b) concluded that the widow rockfish stock size is 22.4% of the unfished biomass, but indicates that stock productivity is considerably lower than previously thought. Data sparseness was a significant problem in this widow rockfish assessment (Conser *et al.* 2003; He *et al.* 2003b). Limited logbook data prior to 1990 is available from bottom trawl fisheries, a questionable data source for a midwater species. The NMFS laboratory at Santa Cruz conducts a midwater trawl survey from which a juvenile index is derived. This index has been highly variable in its ability to predict recruitment in part due to the survey's limited geographical area relative to the overall distribution of widow rockfish. The widow rockfish rebuilding analysis considered a wide range of model formulations that investigated different hypothesis on natural mortality, stock-recruitment variability, and the use of a power coefficient to reduce variability of the Santa Cruz midwater juvenile survey. The SSC recommended model formulations that pre-specify the recruitment for 2003-2005, do not use a stock-recruitment relationship (recruits per spawner ratios were used instead to project future recruitment), and vary the power coefficient between two and four in the Santa Cruz midwater juvenile survey. The SSC did not recommend a power coefficient higher than four because the relationship between the Santa Cruz midwater survey recruitment index and other recruitment indices changed dramatically with higher powers. The previous rebuilding analysis (Punt and MacCall 2002) had used a power coefficient of 10 that dampened the estimate of recruitment variability and suggested much higher stock productivity.

Many of the rebuilding parameters for widow rockfish did not change dramatically with the new rebuilding analysis. The rebuilding period in the absence of fishing increased to 25 years and, with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 41 years. However, the harvest rate associated with different rebuilding strategies dropped significantly in response to the new understanding of decreased stock productivity. Thus, the interim rebuilding OY for 2003 using the 2000 rebuilding analysis was 832 mt, while in 2004, using the 2003 rebuilding analysis (He *et al.* 2003a), the OY was 284 mt (using the base model, Model 8, which uses a power coefficient of three).

The Council adopted a rebuilding plan for widow rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by He, et al. (2003a).

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis He, et al. (2003a) used to develop the rebuilding plan do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (He, et al. 2003a). Using Model 8, the base model from the 2003 stock assessment He, et al. 2003), the Council chose a value of **[0%/60%/70%/80%/90%]** for P_{MAX}, based on a harvest control rule of F = **[variable/0.0093/0.0070/0.0040/0.0001]**. This results in a target year of **[>2102/2038/2035/2032/2028]**.

Widow Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of **[variable/0.0093/0.0070/0.0040/0.0001]**. Based on the 2003 widow rockfish rebuilding analysis (He, et al. 2003a), this harvest rate is likely to rebuild the stock by the target year of **[>2102/2038/2035/2032/2028]**. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. Because widow rockfish are mainly caught in the water column, bottom trawl gear restrictions have little effect on widow rockfish catch rates.

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because widow rockfish occur in midwater and aggregate at night, elimination of target fishery opportunities is a relatively easy way of reducing widow rockfish bycatch. The Council has taken a policy approach of establish management measures to reduce incidental catch in the Pacific whiting fishery sufficient to constrain total mortality below harvest levels (OYs) needed to rebuild the stock. At the time of rebulding plan adoption, catch in other fisheries is sufficiently small so that rebuilding targets can be met without applying any special measures, beyond those needed to discourage targeting, to reduce widow rockfish fishing mortality in these fishery sectors.

Widow rockfish catches in recreational fisheries are relatively modest. Catches in this sector are managed mainly through bag limits, size limits, and fishing seasons established for each West Coast state. No recreational bag and size limits have been established for widow rockfish. However, general bag limits for rockfish may have some constraining effect on widow recreational catches.

4.5.4.8 Yelloweye Rockfish

Status of the Yelloweye Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption

Yelloweye rockfish are common from Central California northward to the Gulf of Alaska. They are bottom-dwelling, generally solitary, rocky reef fish, found either on or just over reefs (Eschmeyer *et al.* 1983; Love 1991; Miller and Lea 1972b; O'Connell and Funk 1986). Boulder areas in deep water (>180 m) are the most densely populated habitat type, and juveniles prefer shallow-zone broken-rock habitat (O'Connell and Carlile 1993). They also reportedly occur around steep cliffs and offshore pinnacles (Rosenthal *et al.* 1982). The presence of refuge spaces is an important factor affecting their occurrence (O'Connell and Carlile 1993). Yelloweye rockfish are potentially caught in a range of both commercial and recreational fisheries. Because of their preference for rocky habitat, they are more vulnerable to hook and line gear.

The first ever yelloweye rockfish stock assessment was conducted in 2001 (Wallace 2002). This assessment incorporated two area assessments: one from Northern California using CPUE indices constructed from Marine Recreational Fisheries Statistical Survey (MRFSS) sample data and California Department of Fish and Game (CDFG) data collected on board commercial passenger fishing vessels, and the other from Oregon using Oregon Department of Fish and Wildlife (ODFW) sampling data. The assessment concluded current yelloweye rockfish stock biomass is about 7% of unexploited biomass in Northern California and 13% of unexploited biomass in Oregon. The assessment revealed a thirty-year declining biomass trend in both areas with the last above average recruitment occurring in the late 1980s. The assessment's conclusion that yelloweye rockfish biomass was well below the 25% of unexploited biomass threshold for overfished stocks led to this stock being separated from the rockfish complexes in which it was previously listed. Until 2002, when yelloweye rockfish were declared overfished, they were listed in the "remaining rockfish" complex on the shelf in the Vancouver, Columbia, and Eureka management areas and the "other rockfish" complex on the shelf in the Monterey and Conception areas. As with the other overfished stocks, yelloweye rockfish harvest is now tracked separately.

In June 2002 the SSC recommended that managers should conduct a new assessment incorporating Washington catch and age data. This recommendation was based on evidence that the biomass distribution of yelloweye rockfish on the West Coast was centered in waters off Washington and that useable data from Washington were available. Based on that testimony, the Council recommended completing a new assessment in the summer of 2002, before a final decision was made on 2003 management measures. Methot et al. (2002b) did the assessment, which was reviewed by a STAR Panel in August 2002. The assessment result was much more optimistic than the one prepared by Wallace (2002), largely due to the incorporation of Washington fishery data. While the overfished status of the stock was confirmed (24% of unfished biomass), Methot et al. (2002b) provided evidence of higher stock productivity than originally assumed. The assessment also treated the stock as a coastwide assemblage. This assessment was reviewed and approved by the SSC and the Council at the September 2002 Council meeting. Methot and Piner (2002) prepared a rebuilding analysis based on this assessment.

The Council adopted a rebuilding plan for yelloweye rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Methot and Piner (2002)

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (Methot and Piner 2002) used to develop the rebuilding plan do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Piner 2002). The Council chose a value of **[0%/60%/70%/80%/90%]** for P_{MAX}, based on a harvest control rule of F = **[variable/0.0167/0.0161/0.0153/0.0142]**. This results in a target year of **[>2351/2067/2062/2058/2054]**.

Yelloweye Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of **[variable/0.0167/0.0161/0.0153/0.0142]**. Based on the 2002 rebuilding analysis (Methot and Piner 2002), this harvest rate is likely to rebuild the stock by the target year of **[>2351/2067/2062/2058/2054]**. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

In addition to the more general measures described above, which are intended to reduce bycatch of all overfished species, the Yelloweye Rockfish Conservation Area (YRCA), a C-shaped closed area off the Washington coast, near Cape Flattery, prevents recreational fishers from targeting this species in an area where they are concentrated. Yelloweye rockfish are relatively sedentary, making this closed area an effective management tool. Recreational bag and size limits are also used to manage total yelloweye rockfish fishing mortality.

TABLE 4-1. Specified rebuilding plan parameters at the time of plan adoption. (Page 1 of 1)

Species	Year Stock Declared Overfished	Year Rebuilding Plan Adopted	B_0	B_{MSY}	T_{MIN}	T_{MAX}	P_{MAX}	T_{TARGET}	Harvest Control Rule
Darkblotched Rockfish	2000	2003	29,044 mt	11,618 mt	2014	2047	80%	2030	F = 0.027
Pacific Ocean Perch	1999	2003	60,212 units of spawning output	24,084 units of spawning output	2012	2042	70%	2027	F = 0.0082
Canary Rockfish	2000	2003	31,550 mt	12,620 mt	2057	2076	60%	2074	F = 0.022
Lingcod	1999	2003	28,882 mt N; 20,971 mt S	9,153 mt N; 8,389 mt S	2007	2009	60%	2009	F = 0.0531 N; F = 0.061 S
Bocaccio*	1999	2004	13,387 B eggs in 2003	5,355 B eggs	2018	2032	**[77.6% 60% 70% 80% 90%]**	**[2025 2025 2023 2020 2018]**	**[F = variable F = 0.0615 F = 0.0498 F= 0.0383 F= 0.0209]**
Cowcod	2000	2004	3,367 mt	1,350 mt	2062	2099	**[0% 55% 60%]**	**[<2104 2095 2090]**	**[F = variable F = 0.0100 F = 0.009]**
Widow Rockfish**	2001	2004	43,580 M eggs	17,432 M eggs	2026	2042	**[0% 60% 70% 80% 90%]**	**[>2102 2038 2035 2032 2028]**	**[F = variable F= 0.0093 F= 0.0070 F= 0.0040 F = 0.0001]**
Yelloweye Rockfish	2002	2004	3,875 mt	1,550 mt	2027	2071	**[0% 60% 70% 80% 90%]**	**[>2351 2067 2062 2058 2054]**	**[F = variable F = 0.0167 F = 0.0161 F= 0.0153 F = 0.0142]**

* Based on the STATc base model in MacCall (2003)
** Based on the Model 8 base model in He, *et al.* (2003)

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Exhibit C.12.b
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON FISHERY MANAGEMENT PLAN AMENDMENT 16-3: REBUILDING PLANS FOR BOCACCIO, COWCOD, AND WIDOW AND YELLOWEYE ROCKFISH

As noted in our statement under agenda item C.8, the Groundfish Advisory Subpanel (GAP) deferred until this agenda item any recommendations on acceptable biological catch (ABC) /optimum yield (OY) levels for Amendment 16-3 species. Our recommendations for rebuilding plans are presented below; we recommend the appropriate ABC/OY levels for these species be set to correspond with rebuilding plan options. Tables 2-1 through 2-4 on pages 33-36 of Exhibit C.12.a Attachment 1 are the best references to use in considering the GAP recommendations.

Bocaccio - the GAP recommends that the Council use the base model (identified as STATc) or the rebuilding plan. This model is the one used for setting 2004 harvest levels and represents a blending of the other models presented. Within this model, the majority of the GAP recommends using the harvest level values associated with PMAX = 70%. Although the GAP normally recommends a PMAX = 60% as appropriately precautionary, the fluctuating nature of the bocaccio assessment over the last few years dictates additional caution. A minority of the GAP recommends using PMAX = 60% in keeping with the GAP's customary recommendation.

Cowcod - the GAP recommends using a rebuilding alternative with PMAX = 60%.

Widow rockfish - the GAP recommends using Model 8 (the base model) for rebuilding, since this is a middle ground between the other two models. Within this model, the GAP recommends the PMAX = 60% alternative be used. This is consistent with previous GAP recommendations on widow rockfish rebuilding. The GAP stresses the need to find better ways to survey and assess widow rockfish, a point made by the last widow rockfish Stock Assessment Review (STAR) Panel. The GAP notes that cooperative efforts between industry and the Northwest Fisheries Science Center have begun, which may lead to improved widow rockfish surveys. The GAP urges the Council to encourage those efforts.

Yelloweye rockfish - a majority of the GAP recommends using PMAX = 60% as the alternative for rebuilding on the basis that this is precautionary, and there are only slight differences in the near-term OY values between this option and the others. A minority of the GAP recommends an alternative of PMAX = 80%.

PFMC
04/08/04

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 16-3: REBUILDING PLANS FOR BOCACCIO, COWCOD, AND WIDOW AND YELLOWEYE ROCKFISH

Council staff briefed the Scientific and Statistical Committee (SSC) on the Amendment to the groundfish FMP that contains rebuilding plans for bocaccio, cowcod, widow rockfish, and yelloweye rockfish (Exhibit C.12.a Attachment 1).

The SSC considered whether it is possible to reduce the number of models for boccacio and widow rockfish, but found no compelling scientific reasons for doing so.

The rebuilding analysis for cowcod is not based on the same rebuilding software as those for boccacio, widow rockfish, and yelloweye rockfish. While this is unlikely to impact the OYs for cowcod in the short-term, this may not be the case for the long-term. The assessment team tasked with the 2005 cowcod assessment should, therefore, attempt to select a model whose output can be used in the rebuilding software.

The SSC notes that each rebuilding plan needs to include standards for evaluating the progress of rebuilding. These standards need to be developed for use in the assessments that will be conducted during 2005. As directed by the Council, the SSC Groundfish Subcommittee will develop standards and include them in its Terms of Reference for Rebuilding Analyses. This may require a meeting of the SSC Groundfish Subcommittee, particularly if a draft set of standards are to be provided to the Council for revision in September 2004 and final adoption in November 2004. The standards are likely to include a comparison of current stock status relative to that expected under the current rebuilding plan. The SSC therefore recommends that the trajectories of spawning output relative to the target level of $0.4B_0$ (e.g. Figure 5.10) for each alternative and species be added to Amendment 16-3 in table form.

The SSC notes that the alternatives in Amendment 16-3 are compared in terms of their impacts on fisheries and communities in a qualitative manner. It recommends that future rebuilding plans contain a more quantitative economic analysis of the short-term and long-term cumulative implications of rebuilding. The results of models that estimate Net Present Value for a range of discount rates and rebuilding probabilities could form the basis for such analyses.

PFMC
04/07/04

In the FMP amendatory language at the end of Section 4.5.4.6 (Appendix D, Exhibit C.12.a, Supplemental Attachment 3) on Cowcod and following the description of the Cowcod Conservation Areas as a part of the cowcod rebuilding strategy, insert the following language:

> "Given the particular life history characteristics of cowcod, the Council will continue to use species-specific area closures to protect cowcod. As new information becomes available on cowcod behavior and fisheries interactions with cowcod, the boundaries or related regulations concerning the current CCAs may change and additional CCAs may be established by regulation."

In the FMP amendatory language at the end of Section 4.5.4.8 (Appendix D, Exhibit C.12.a, Supplemental Attachment 3) on Yelloweye Rockfish and following the description of the yelloweye rockfish rebuilding strategy, insert the following language:

> "Given the particular life history characteristics of yelloweye rockfish, the Council will continue to use a species-specific area closure or closures to protect yelloweye rockfish. As new information becomes available on yelloweye rockfish behavior and fisheries interactions with yelloweye rockfish, the boundaries or related regulations concerning the current YRCA may change and additional YRCAs may be established by regulation."

Exhibit C.13
Situation Summary
April 2004

BYCATCH MONITORING PROGRAM
DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Situation: At its November 2003 meeting, the Council reviewed a preliminary draft of the Groundfish Bycatch Programmatic Environmental Impact Statement (PEIS) in advance of its release for public comment as required by federal regulations. The draft PEIS (DPEIS) was made available for public comment on February 27, 2004. It was also was posted on the Council and NMFS websites in February, and copies were distributed to the Council and advisory bodies at the March Council meeting. The required public comment period will end on April 27, 2004. This closing date allows Council staff time to prepare and submit the Council's comments and recommendations stemming from decisions taken at the April Council meeting.

At this meeting, the Council is scheduled to choose its preferred alternative from among the six alternatives described in Chapter 2 of the DPEIS. The Council's preferred alternative will be identified in the final EIS (FEIS), which will be published after the public comment period. In the cover letter and text of the DPEIS it is stated that, once the FEIS is published, the Council is expected to immediately begin preparing a groundfish fishery management plan (FMP) amendment. That amendment would update the description of the current bycatch mitigation program, add any new goals and objectives, and include any conservation measures necessary to minimize bycatch and the mortality of bycatch that cannot be avoided, to the extent practicable.

The DPEIS differs from the preliminary draft in several ways. The DPEIS reflects Council and public comments made at the November 2003 meeting, as well as substantial expansion of the economic analysis. Descriptions of the alternatives were expanded and, in some cases, modified slightly to clarify how they could be implemented.

In discussing future steps to amend the FMP to reflect the preferred alternative, the Council may wish to consult on and consider the concept of practicability.

Council Action:

1. **Adopt the Council's preferred alternative.**
2. **Discuss steps necessary to prepare an FMP amendment to implement the preferred alternative.**

Reference Materials:

1. Exhibit C.13.a, Attachment 1: Executive Summary, West Coast Groundfish Bycatch Mitigation Program Draft Programmatic Environmental Impact Statement.

(Note: The full document was distributed to the Council and advisory bodies as an informational item at the March Council meeting.)

Agenda Order:

a. Agendum Overview — Kit Dahl
b. NMFS Report — Jim Glock
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Adopt Final Preferred Alternatives

PFMC
03/19/04

Executive Summary

ES.1 The Proposed Action

> The Proposed Action is to establish policies and program direction that minimize bycatch to the extent practicable, minimize the mortality of unavoidable bycatch, and ensure that bycatch is reported and monitored as required by law.

The Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS, also called NOAA Fisheries - National Oceanic and Atmospheric Administration, U.S. Department of Commerce) propose to evaluate, at a broad scale, how to minimize bycatch in the West Coast groundfish fisheries to the extent practicable, minimize the mortality of unavoidable bycatch, and ensure that bycatch is reported and monitored as required by law. The proposed action would establish the policies and program direction to achieve this purpose. When this Programmatic Environmental Impact Statement (PEIS) is final, the Council is expected to immediately undertake preparation of a new groundfish fishery management plan amendment that will include the conservation and management measures necessary to minimize bycatch and to minimize the mortality of bycatch that cannot be avoided, to the extent practicable. This PEIS is intended to provide the analytical underpinnings for that effort.

ES.1.1 Why is Action Needed?

The 1996 Sustainable Fisheries Act requires that every federal fishery management plan (FMP) must be consistent with National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). National Standard 9 requires that "Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch." Section 303(a)(11) of the Magnuson-Stevens Act requires each FMP "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority –

(A) minimize bycatch; and
(B) minimize the mortality of bycatch which cannot be avoided."

The Council's Groundfish FMP includes provisions relating to bycatch mitigation. Some measures, such as gear definitions and restrictions, have been established as long-term regulations that remain in effect for until the Council and NMFS amend them. Other measures are established through the annual management process and expire at the end of each year (or every two years, under the Council's new two-year management process). The current bycatch mitigation program is not clearly spelled out in a single place. Rather, elements are spread throughout the FMP, the regulations as recorded in the *Code of Federal Regulations*, various FMP amendments, and numerous *Federal Register* notices. The proposed action is needed to describe the elements of the groundfish bycatch program, to identify the various bycatch mitigation tools available to the Council, to evaluate the effects and effectiveness of those tools, and to evaluate potential improvements that might result from other combinations and applications of bycatch mitigation tools. A comprehensive program to minimize bycatch and bycatch mortality to the extent practicable in the groundfish fishery would (1) reduce waste, discard, and collateral damage to marine plants and animals by groundfish fishing activities on the Pacific coast, (2) collect and report appropriate and adequate information to support the groundfish fishery management program, and (3) balance these needs with environmental and social values (i.e., need to allow for fishing).

ES.1.2 What is the Purpose of the Proposed Action?

The Council appointed an ad hoc Environmental Impact Statement Oversight Committee (Committee) to provide direction to drafters of this EIS. The committee identified the following objectives for the groundfish bycatch mitigation program. These objectives define the purpose of the proposed action:

- account for total fishing mortality by species
- establish monitoring and accounting mechanisms to keep total catch of each groundfish stock from exceeding the specified limits
- reduce unwanted incidental catch and bycatch of groundfish and other species
- reduce the mortality of animals taken as bycatch
- provide incentives for fishers to reduce bycatch and flexibility/opportunity to develop bycatch reduction methods
- monitor incidental catch and bycatch in a manner that is accurate, timely, and not excessively costly
- reduce unobserved fishing-caused mortalities of all fish
- gather information on unassessed and/or non-commercial species to aid in development of ecosystem management approaches.

This draft EIS has been prepared as a programmatic document to assist the Council and NOAA Fisheries in taking the next steps necessary to meet the bycatch requirements of the Magnuson-Stevens Act.

ES.1.3 Background

Since 1996, the Council prepared two FMP amendments to bring the FMP into compliance with the Magnuson-Stevens Act requirements. The first attempt was Amendment 11. NMFS disapproved the bycatch provisions of that amendment as inadequate and returned it to the Council for further consideration. The Council and NMFS worked together to prepare Amendment 13, which NMFS subsequently approved. However, the amendment was challenged in federal district court. The court disapproved Amendment 13 and its accompanying Environmental Assessment (EA) as inadequate in Pacific Marine Conservation Council v. Evans, 200 F.Supp.2d 1194 (N.D. Calif. 2002). This court ruling is referred to as PMCC in this EIS. In PMCC, the court made several rulings with respect to the adequacy of the Amendment 13 bycatch revisions and the EA. The court held that Amendment 13 failed to establish a standardized reporting methodology because it established neither a mandatory nor an adequate observer program. Further, the amendment did not minimize bycatch and bycatch mortality because it failed to include all practicable management measures in the FMP itself. The court also found a lack of reasoned decisionmaking, as the amendment rejected four specific bycatch reduction measures (fleet size reduction, marine reserves, vessel incentives, and discard caps) without consideration on their merits. With respect to NEPA, the EA prepared for Amendment 13 failed to address adequately the ten criteria for an action's significance set forth in the CEQ regulations at 40 CFR 1508.27(b), and also failed to analyze reasonable alternatives, particularly the immediate implementation of an adequate at-sea observer program and bycatch reduction measures.

This draft EIS addresses the specific legal deficiencies identified by the court in the PMCC decision. When the EIS is final, the Council is expected to immediately undertake preparation of a new FMP amendment that will include the conservation and management measures necessary to minimize bycatch and to minimize the mortality of bycatch that cannot be avoided, to the extent practicable. This EIS is intended to provide the analytical underpinnings for that effort. In addition to other bycatch mitigation tools, it includes consideration of fleet size reduction, marine reserves, vessel incentives, and discard caps, as required by the PMCC decision.

Since the early 1990s the FMP required fishing vessels to carry observers at the request of NMFS. In August 2001, a mandatory observer program was begun under these regulations. This program is conducted by the Fishery Resource Analysis and Monitoring Division of the NMFS Northwest Fisheries Science Center. Later, the Council and NMFS adopted a mandatory observer program in FMP Amendment 16-1. NMFS approved this amendment on November 14, 2003.

The Groundfish FMP covers more than 80 species of groundfish, many of which are caught together with a variety of fishing gears that are used to target groundfish. Groundfish are also caught incidentally in fisheries for non-groundfish species such as pink shrimp and California halibut. As of January, 2004, nine groundfish species have been declared overfished. These are darkblotched rockfish, canary rockfish, lingcod, yelloweye rockfish, bocaccio rockfish, cowcod (also a rockfish species), widow rockfish, Pacific ocean perch (another rockfish), and Pacific whiting. The Council has prepared (or is in the process of preparing) a plan to rebuild each of these species.

The groundfish fishery off the West Coast of the United States is executed from the Canadian to Mexican borders. Multiple vessel types participate in this fishery. They range in size from 8 foot long kayaks to 120 foot trawlers, and vessels fish in nearshore to offshore waters. The vessels use various types of gear including bottom trawls, midwater trawls, pots, longlines and other hook and line gear. Trawlers take the majority of groundfish. The catch can be incredibly diverse in species and fish size and overall catch size can vary widely as well. In many cases, a portion of the catch is retained and another portion of the catch, that may be of the wrong size, species, or is over management retention limits, is discarded at sea. Discarded fish are called "bycatch."

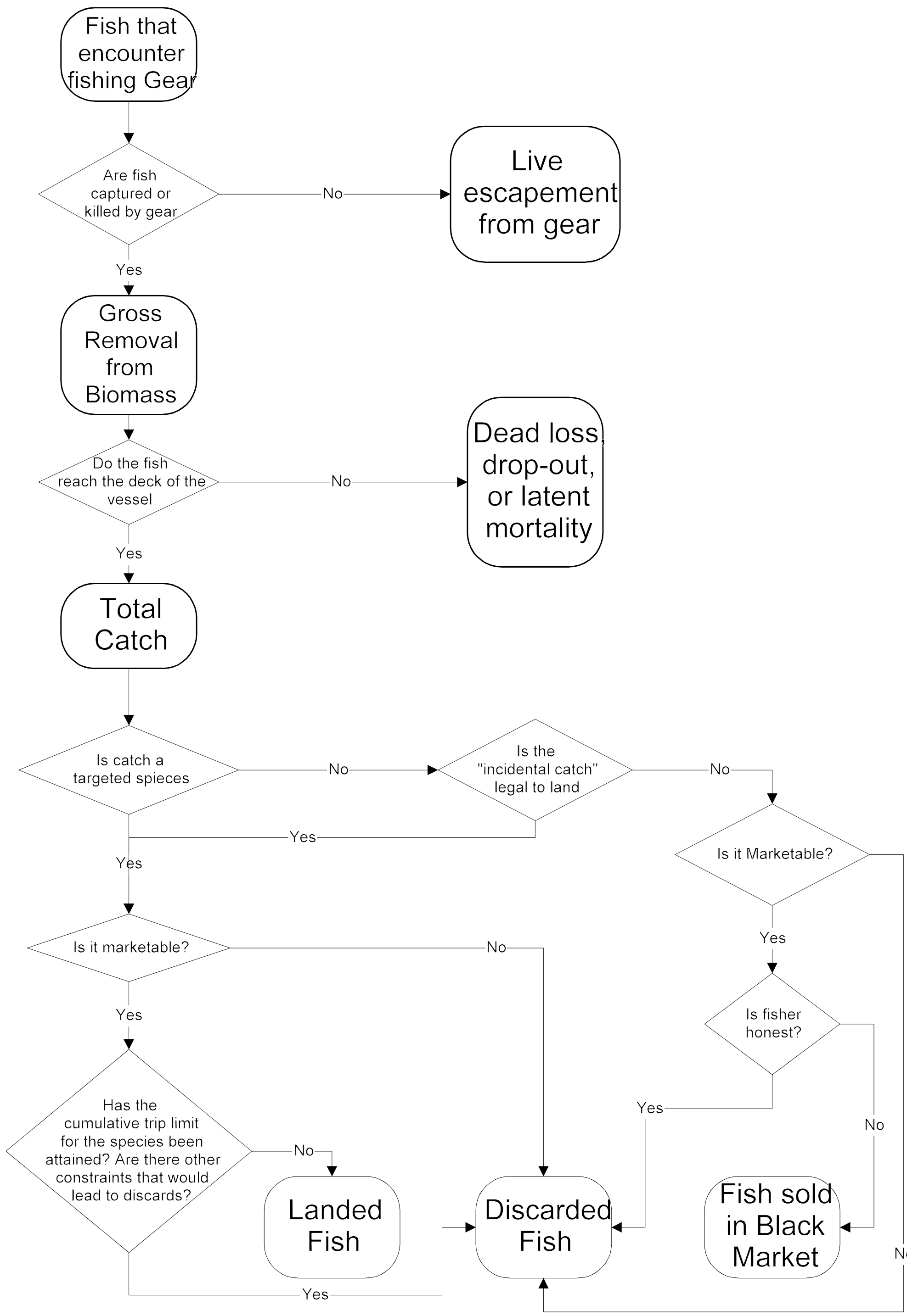
Figure ES.1 illustrates the meaning of bycatch and other catch-related terms as they are defined and used in the Magnuson-Stevens Act and Groundfish FMP. Some fish encounter fishing gear but escape alive. However, there will almost always be some unobserved mortality resulting from injury when fish encounter fishing gear, especially mass-contact types of gear, such as trawl gear. The latent or "pass-through" mortality of fish escaping from a trawl net may be quite high, depending on the design and manner in which the gear is fished as well as its mesh size. Additional delayed mortality may occur after fish escape gear. This type of morality may be related to the stress of capture and physiological injuries which subsequently turn out to be fatal. There may also be mortality associated with gear that is lost or abandoned — the bycatch resulting from this "ghost fishing." NMFS considers this unobserved fishing-related mortality included in the definition of bycatch because it constitutes a harvest of fish that are not sold or kept for personal use (63 FR 24235 May 1, 1998).

ES.2 Measuring Environmental Consequences

Short-term effects are mortalities resulting from fisheries, including harvest and incidental mortality that occurs when fishers capture and then release groundfish and other species. Long-term effects are changes in the abundance of successive generations of the affected stock that may occur as a result of reductions in short-term impacts and the consequent increase in the species' populations. These effects are qualitatively described.

Cumulative effects are changes to groundfish stocks and other marine animal populations that may result from a combination of short- and long-term effects of the actions in the groundfish fisheries, along with the effects of other past, present, or foreseeable future actions. Changes to the human environment stem from modifying management measures and the conduct of fisheries. These are described in terms of bycatch mitigation tools: changes in harvest specifications, season duration and structure, harvest, fishing effort, commercial fisheries, and angler benefits. Social and cultural effects are qualitatively described for the communities of commercial and recreational fishers and for coastal communities and Tribes.

Figure ES.1. Diagrammatic representation of bycatch and other catch-related terms.



ES.3 The Alternatives

The Council's ad hoc EIS Committee developed five alternatives to the current bycatch management program. Each of these alternatives would use many of the current mitigation tools, but may use different combinations or may apply some differently. Alternative 1 is the no action/status quo. It describes the current bycatch program. Alternative 2 would emphasize capacity reduction, which means reducing the size of the commercial groundfish fleet. Specifically, it would reduce the trawl fleet by half (50%) from the number permitted to fish in 2002-2003. Since this alternative was proposed, a federal buyback program was approved, resulting in 91 trawl vessels being permanently eliminated. That buyback program "watered down" the effects of Alternative 2. Alternative 3 would reduce fishing effort by reducing the amount of groundfish fishing time for every commercial vessel. This might be through shorter seasons, establishing fishing "platoons," or other methods to limit fishing. Alternative 4 would revise the definition of the term "trip limit" to include a requirement that vessel stop fishing when the limit is reached. Specifically, it would use a combination of catch limits and trip limits, and each fishing sector would be held to a specified limit or cap of overfished species. If vessels in a sector reached the limit, all vessels in the sector would be closed. Alternative 5 would replace trip limits with individual fishing quotas, which would be defined as catch or mortality limits. Quota holders would be allowed to buy and sell shares. Discard caps for overfished species would be established also. Alternative 6 would focus on reducing bycatch to near zero by establishing no-take marine reserves, individual vessel catch quotas, and prohibiting discard of most groundfish. The details of these alternatives are spelled out in Chapter 2 and further described in Chapter 4.

Table ES.1. Bycatch reduction methods (bycatch mitigation tools) included in the alternatives.

Goals and Objectives	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	No action: Control bycatch by trip (retention) limits that vary by gear, depth, area; long season. Use marine protected areas (RCAs)	Same as Alt. 1 but reduce trawl fleet and increase trip limits to match smaller fleet.	Same as Alt 1 but reduce commercial fishing time by seasons or other method, and increase trip limits.	Similar to Alt 1, but establish vessel and sector catch limits for overfished groundfish. Trip limits for other groundfish.	Establish individual catch limits (individual quotas) for groundfish species. Set discard caps for overfished species.	Establish no-take reserves, individual vessel catch limits (individual quotas). Prohibit all groundfish discards.
FISHERY MANAGEMENT TOOLS						
Harvest Levels						
ABC/OY	Y	Y	Y	Y	Y	Y
Set **overfished groundfish catch caps**	N	N	N	Y	N	Y
Use **trip limits**	Y	Y	Y	Y	N	N
Use **catch limits**	N	N	N	Y	Y	Y
Set individual vessel/permit catch	N	N	N	Y	Y	Y
Set groundfish **discard caps**	N	N	N	N	Y	Y
Establish **IQs**	N	N	N	N	Y	Y
Establish bycatch **performance standards**	N	N	N	N	Y	Y
Establish a reserve	N	N	N	Y	N/Y	Y
Gear Restrictions						
Rely on **gear restrictions**	Y	Y	Y	Y	N	Y
Time/Area Restrictions	Y	Y	Y	Y	Y	Y
Establish **long term closures for all groundfish fishing**	N	N	N	N	N/Y	Y
Establish **long term closures for on-bottom fishing**	N	N	N	N	N/Y	Y
Capacity reduction (mandatory)	Y	Y(50%)	Y	Y	Y	Y
Monitoring/Reporting						
Trawl logbooks	Y	Y	100%	Y		
Fixed-gear logbooks	N	N	100%	Y		
CPFV logbooks	N	N	N	Y		
Commercial **port sampling**	Y	Y	Y	>Y	N/Y	Y
Recreational	Y	Y	Y	>Y	Y	>>x
Observer coverage (commercial)	10%	10%	10%+logbook verification	increased, by sector	100%	100%
CPFV observers	N	N	N	Y	Y	100%
VMS	Y	Y	Y	Y	Y	Y
Post-season observer data OK	Y	Y	Y	N	N	N
Inseason observer data required	N	N	N	Y	Y	Y
Rely on fish tickets as the primary monitoring device for groundfish landings	Y	Y	Y	N	N	N

ES.4 Environmental Impacts of the Alternatives

Chapter 4 describes numerous environmental impacts that may occur if no action is taken or if any of the alternatives is adopted. No regulations would be imposed by any of the alternatives. However, if the Council adopts one of the alternative bycatch mitigation programs, an amendment to the FMP and implementing regulations would be prepared. Further, more detailed environmental analysis might be required at that time. The results of the analyses of impacts are summarized in Tables ES.2 through ES.6 at the end of this section.

Each alternative substantially reduces bycatch compared to an unregulated groundfish fishery. The status quo minimizes bycatch by establishing large marine protected areas that greatly reduce the likelihood that fishers will catch any overfished species within the boundaries. Thus, these MPAs nearly eliminate encounter/bycatch of overfished species within the boundaries, and also bycatch of other fish. The use of trip (retention) limits outside the MPAs will continue to result in regulatory discard/bycatch of groundfish, both overfished and non-overfished species. Economic discard/bycatch of small or otherwise low-value groundfish will continue. The groundfish observer program will monitor a fraction of active commercial fishing vessels.

Alternative 2 would be expected to reduce regulatory bycatch of groundfish. The degree of reduction depends on how constraining current trip limits are; bycatch of species that are typically discarded for economic (non-regulatory) reasons would not be reduced significantly. Bycatch of non-groundfish would not be directly affected. However, reduced commercial trawl fishing effort would be expected to reduce fishing impacts. Because the groundfish trawl fleet has recently been reduced by 91 vessels, the amount of change from Alternative 2 would be substantially less than originally expected. The level of observer coverage would be increased, resulting in a larger fraction of active commercial fishing vessels being observed. This would improve bycatch information.

Alternative 3 would be expected to reduce regulatory bycatch of groundfish to a similar degree as Alternative 2. Groundfish regulatory bycatch would be reduced as a result of larger trip limits. However, shorter fishing periods could result in different bycatch patterns, and could also increase a "race for fish" as fishers would fish harder at the beginning of the season in case of premature season closure. Predicting fishing effort, which is required for developing trip limits, would be severely compromised. While it may be possible to maintain some groundfish product flow to markets over much of the year, no vessels would be permitted to operate for more than a few months.

Alternative 4 would substantially reduce groundfish regulatory discard/bycatch (compared to the status quo) by assigning every commercial limited entry vessel to one or more sectors. Annual catch limits for each overfished species would be established for each sector. All vessels in a sector would be required to stop fishing for the remainder of the year if any of its caps was reached. In addition, individual vessel fishing mortality caps would be established to prevent premature closure due to a few "dirty" vessels with high bycatch rates. These catch limits would be similar to trip limits, except that a vessel reaching any cap must stop fishing for the remainder of the cumulative period. The observer program would be restructured to monitor bycatch in each sector, with data available inseason. Vessels carrying observers would have larger trip limits for non-overfished groundfish; vessels could provide an observer at their expense to gain access to the larger limits. Non-regulatory bycatch of groundfish and other species would not be significantly affected by this alternative unless all trip limits were defined as catch limits. In that case, vessels would retain a larger proportion of groundfish because all catch would apply towards the vessel limits.

Alternative 5 would establish a "rights-based" program of individual fishing quotas. These would be annual catch limit shares that could be traded or sold. Reaching any quota would require the vessel to stop fishing until it obtained additional quota. The observer program would be expanded to cover all commercial vessels participating in the quota program. The value of restricted species quota (RSQ) shares (for overfished species) would increase; initial shares for some severely depleted species (such as canary and yelloweye rockfish) would be less than 100 pounds. All catch of overfished species must be retained. This alternative would substantially reduce groundfish both regulatory and economic bycatch; encounter/bycatch and discard/bycatch would be reduced. The pace of fishing would likely slow substantially, providing greater opportunity to avoid bycatch of other species also. Catch and bycatch data on all species would be improved substantially. Gear regulations would be relaxed to allow and encourage experimentation and development of gear and techniques that would eventually reduce bycatch as much as technically feasible. Administration costs related to the observer and quota monitoring programs would increase substantially. This would be partially offset by a reduced pre-season process for developing trip limits and other management measures; the process of inseason trip limit adjustments would no longer be needed. Adverse impacts to the marine biological environment would be significantly reduced compared to Alternatives 1, 2, 3 and 4. Social and economic conditions would be significantly affected; some changes would be beneficial, some would be adverse, depending on the individual and the quota program design.

Alternative 6 would establish large no-take marine reserves that would eliminate encounter/ bycatch of all species (both groundfish and non-groundfish) within the boundaries. Individual catch quotas, similar to those of Alternative 5, would be established. Groundfish discard caps would nearly eliminate groundfish discard/bycatch. However, unless exceptions were established, these discard caps would increase the mortality of bycatch that could not be avoided. In addition, disposal of unusable fish on land would increase. Observers would monitor catch and bycatch of all commercial vessels (except those without adequate space or facilities). Monitoring of recreational fisheries would also be increased. Commercial vessels would be required to use only gears that had been certified as "low bycatch." This would substantially reduce bycatch in the short term compared to all other alternatives. However, Alternative 5 would be expected to develop more effective bycatch avoidance gears and methods over time because innovation would be allowed. Adverse impacts to the marine biological environment would be significantly reduced compared to Alternatives 1, 2, 3 and 4. Adverse impacts may or may not be reduced compared to Alternative 5. Social and economic conditions would be significantly affected, especially short-term adverse impacts resulting from no-take reserves, gear restrictions and discard prohibitions. Long-term beneficial effects would be faster rebuilding of overfished gr stocks, fish habitat renewal and growth, larger and more numerous fish near reserve boundaries, and areas where relatively un-fished ecosystems can develop.

ES.5 Practicability of Bycatch Minimization Methods

The Council must determine which bycatch mitigation program is environmentally preferred. That alternative may or may not be the one the Council chooses as its preferred (adopted) alternative. Part of the decision will be based on a determination of what management tools are "practicable." The information and analysis provided in Chapters 3 and 4 of this draft EIS will help the Council make that determination.

Table ES.2. Summary of how well alternatives achieve the stated purposes for the proposed action.

Purpose of Proposed Action	Alt 1 (no action)	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Account for total fishing mortality by species	The current observer program provides statistically reliable estimations of groundfish mortalities.	I+	I+	S+	S+	S+
Establish monitoring and accounting mechanisms to keep total catch of each groundfish stock from exceeding the specified limits	Trip and bag limits, application of the "bycatch model" and inseason tracking of landings are moderately effective but less than 100% successful.	I+	I+	S+	S+	S+
Reduce unwanted incidental catch and bycatch of groundfish and other species	Area closures (Rockfish Conservation Areas), seasons and gear restrictions reduce unwanted catch. Trip limits create regulatory bycatch (discard).	I	I	S+	S+	S+
Reduce the mortality of animals taken as bycatch	Prohibited species must be returned to the sea as quickly as possible with minimum of injury.	U	U	U	U	S-
Provide incentives for fishers to reduce bycatch and flexibility/opportunity to develop bycatch reduction methods	Trip limits reduce the "race for fish" and provide some minimal opportunity and incentives to avoid bycatch.	I+	I-	CS+	S+	CS+
Monitor incidental catch and bycatch in a manner that is accurate, timely, and not excessively costly	The current program minimizes user and agency costs of monitoring catch and bycatch at the expense of precision and timeliness.	I	I	S+/S-	S+/S-	S+/S-
Reduce unobserved fishing-caused mortalities of all fish	Area closures (RCAs), gear definitions and seasons mitigate potential mortalities.	I	I	CS+	S+	S+
Gather information on unassessed and/or non-commercial species to aid in development of ecosystem management approaches.	Over a period of years, information on non-commercial and unassessed stocks will improve.	I	I	CS+	S+	S+

Performance Ratings, compared to status quo/no action alternative:

Substantial Beneficial (S+): Substantial improvement from status quo expected.

Substantially Adverse (S-): Substantially increased costs or reduced effectiveness expected.

Conditionally Substantial Beneficial (CS+): Substantial improvement expected if certain conditions are met or events occur, or the probability of improvement is unknown.

Conditionally Substantial Adverse (CS-): Substantially increased costs expected if certain conditions met, or the probability of occurrence is unknown.

Insubstantial Beneficial (I+)/Insubstantial Adverse (I-): Changes are anticipated but not expected to be major.

Unknown (U): This determination is characterized by the absence of information sufficient to adequately assess the direction or magnitude of the impacts.

Table ES.3. Significance of effects on the biological environment.

Resource	Alt 1 (no action)	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
Groundfish	The current bycatch program provides statistically reliable estimations of groundfish bycatch and bycatch mortalities and mitigates many potential impacts. Trip and bag limits, application of the "bycatch model" and inseason tracking of landings are moderately effective but less than 100% successful in preventing overfishing. Trip limits create regulatory bycatch of groundfish.	I+	I+	S+	S+	S+
Other Relevant Fish, Shellfish and Squid	Impacts on species such as Pacific halibut are reduced from recent years due to large area closures to protect overfished groundfish (primarily rockfish).	U	U	S+	S+	S+
Protected Species	Area closures (Rockfish Conservation Areas), seasons and gear restrictions reduce potential catches. Protected species must be returned to the sea as quickly as possible with minimum of injury.	I+	I-	CS+	CS+	CS+
Salmon	Salmon bycatch in the Pacific whiting fisheries is closely monitored. Voluntary bycatch avoidance methods have proven effective, especially in the at-sea sectors	U	U	I+	I+	CS+
Seabirds	Few seabird interactions have been documented; seasons and area closures could increase or decrease interactions.	I+	I-	CS+	CS+	CS+
Marine Mammals	Few marine mammal takings have been documented, and all are within current standards.	I+	I-	S+/ S-	CS+	CS+
Sea Turtles	No sea turtle interactions have been observed in the groundfish fisheries.					
Miscellaneous Species	Area closures (RCAs), gear definitions and seasons mitigate potential mortalities. Little information is available.	U	U	CS+	CS+	S+
Biological Associations	Over a period of years, information on non-commercial and unassessed stocks will improve. Little information is available at this time.	U	U	CS+	S+	S+

Significance Ratings, compared to status quo/no action alternative:

Significant Beneficial (S+): Significant improvement from status quo expected.
Significant Adverse (S-): Significantly increased adverse impacts or reduced effectiveness expected.
Conditionally Significant Beneficial (CS+): Significant beneficial impacts expected if certain conditions are met or events occur (such as full observer coverage), or the probability of impacts is unknown.
Conditionally Significant Adverse (CS-): Significantly increased adverse impacts expected if certain conditions met, or the probability of occurrence is unknown.
Insignificant Beneficial (I+)/Insignificant Adverse (I-): Minor impacts, if any, are anticipated.
Unknown (U): This determination is characterized by the absence of information sufficient to adequately assess the significance of the impacts.

Table ES.4(a). Summary of effects of Alternatives 1, 2 and 3 on the social and economic environment. (Alternatives 4, 5 and 6 are addressed in the following table.)

	Alternative 1	Alternative 2	Alternative 3
Incentives to Reduce Bycatch	Quota-induced discards can occur when fishers continue to harvest other species when the harvest guideline of a single species is reached and further landings of that species are prohibited. As trip limits become more restrictive and as more species come under trip-limit management, discards are expected to increase. In addition, discretionary discards of unmarketable species or sizes are thought to occur widely. However, in comparison to a "race for fish" allocation system, the current management regime provides harvesters a considerable amount of flexibility to reduce unwanted catch and discards.	Reducing the level of effort in the groundfish fisheries and increasing trip limits would likely reduce the level of groundfish bycatch (discard).	If trip limits increase, the level of groundfish bycatch (discard) would be expected to decline.
Commercial Harvesters	By spreading out fishing more evenly over the year, the current management regime helps maintain traditional fishing patterns. However, landings of major target species (other than Pacific whiting) are expected to continue to decline as OYs are reduced to protect overfished species. Declining harvests lead to significant decreases in total groundfish ex-vessel value.	Further fleet reduction would be expected to reduce (but not eliminate) extra capacity in the fishery and to restore the fleet to some minimum level of profitability.	A combination of higher trip limits and a reduction in the length of the fishing season would be expected to lead to an overall reduction in variable fishing costs. With larger trip limits, revenues per trip are expected to increase. However, the overall impact of this alternative on costs and revenues would depend on when individual participants were allowed to fish. For example, fishers may be unable to fish for certain species at optimal times.
Recreational Fishery	Landings of major target species are not expected to increase and may decline further if OYs are reduced to protect overfished species. Decreased harvests lead to significant decreases in recreational value.	Changes in landings of major species targeted in the recreational fishery would be expected to be insignificant.	Effects as described in Alternative 2
Tribal Fishery	Changes in landings of major species targeted in tribal fisheries are expected to be insignificant.	Effects as described in Alternative 1	Effects as described in Alternative 1
Buyers and Processors	The current management regime reduces the likelihood that processing lines will be idle by fostering a regular flow of product to buyers and processors. However, decreased deliveries of groundfish to processors and buyers will result in significant decrease in groundfish product value.	No significant changes in the total amount of fish delivered to processors would be expected. Processors in ports that experience a reduction in fleet size may be negatively affected if they are unable to obtain supplies of fish from alternative sources	Larger trip limits would not be expected to affect the total amount of fish that harvesters deliver to processors. However, with vessels taking longer and potentially fewer trips, processors would have fewer boats to schedule for landings and unloading, reducing their average costs. On the other hand, costs could increase if processors were unable to control the flow of product throughout the year and capital is idle during closed periods.

Table ES.4(a). Summary of effects of Alternatives 1, 2 and 3 on the social and economic environment. (Alternatives 4, 5 and 6 are addressed in the following table.)

	Alternative 1	Alternative 2	Alternative 3
Communities	By maintaining year-round fishing and processing opportunities, the current management regime promotes year-round employment in communities. However, groundfish employment and labor income are expected to continue to decline, resulting in economic hardship for businesses involved in the groundfish fisheries. These businesses are expected continue to diversify to reduce dependence on groundfish fisheries.	The direction and magnitude of many of the economic effects on particular coastal communities are uncertain, as the distribution of the post-buyback fleet is uncertain. If further reduction in fleet capacity with higher trip limits were successful in increasing net revenues or profits to remaining commercial fishers, positive economic impacts on the communities where those fishers land their fish, home port and reside would be expected. On the other hand, some communities may experience a significant loss of vessels and a consequent decrease in income, jobs and taxes.	The impacts are uncertain, as community patterns of fishery participation vary seasonally based on species availability as well as the regulatory environment and oceanographic and weather conditions. If higher trip limits were successful in increasing net revenues or profits to fishers, positive economic impacts on the communities where those fishers land their fish, home port, and reside would be expected. On the other hand, seasonal closures could leave crew members at least temporarily unemployed.
Consumers	The current management regime allows buyers and processors to provide a continuous flow of fish to fresh fish markets, thereby benefitting consumers. Consumers of fresh or live groundfish may be adversely affected by reduced commercial landings. However, changes in benefits to most consumers of groundfish products would be expected to be insignificant due to availability of substitute products.	Effects as described in Alternative 1	Consumers of fresh or live groundfish could be unable to obtain fish from the same sources for half of the year unless the harvest sectors are split into two groups, with one group of vessels active at any given time.
Fishing Vessel Safety	Some gains in fishing vessel safety are at least partially realized under the current management regime, as fishers are able to fish at a more leisurely pace and avoid fishing in dangerous weather or locations. However, safety of human life at sea may decrease if reduced profits induce vessel owners to forgo maintenance, take higher risks or hire inexperienced crews.	Increases in net revenue to harvesters resulting from increases in trip limits may enhance their ability to take fewer risks and use their best judgment in times of uncertainty, thereby increasing vessel safety.	The effects on vessel safety may be mixed. Increases in net revenue to harvesters resulting from increases in trip limits may lead to reductions in injury and loss of life because of harvester's enhanced ability to take fewer risks and use their best judgment in times of uncertainty. However, set seasons make it more difficult for harvesters to make wise decisions as to when and where to fish.
Management and Enforcement Costs	The management regime is expected to continue to be contentious, difficult and expensive. Technological developments such as VMS may mitigate the rate at which management costs escalate.	Costs are expected to decrease, as fewer vessels are generally easier and less expensive to monitor.	Effects will vary depending on the way the seasonal closure is structured. Costs are expected to decline if there is no fishing activity to monitor for 6 months of the year. However, there will be increased costs if permit holders are divided into groups.

Table ES.4(b). Summary of effects of Alternatives 4, 5 and 6 on the social and economic environment. (Alternatives 1, 2 and 3 are addressed in the preceding table.)

	Alternative 4	Alternative 5	Alternative 6
Incentives to Reduce Bycatch	While it would be in the best interest of all vessels within a sector to reduce the catch of overfished species, a "race for fish" could develop in which individual vessels eschew fishing practices that reduce bycatch in order to attain their landing limits as quickly as possible. Setting individual catch limits would prevent that. In addition, if cooperative patterns of behavior emerge, decreases in bycatch would be expected.	The amount of fish discarded by each vessel would be counted against the vessel's limit. This measure provides strong economic incentives to reduce the catch of unwanted fish because it "internalizes" the costs of discarding fish.	MPAs would prohibit fishers from fishing in certain areas in order to reduce the probability that fish will be caught and discarded, while the 100% retention requirement would be the primary means of reducing groundfish bycatch (discard) outside of MPAs. Prohibiting discard would produce a strong incentive to avoid unwanted catch because the costs of sorting, storing, transporting and disposing of fish that cannot be sold may be substantial. If vessel groundfish quotas are transferable, Alternative 6 would be similar to Alternative 5; if not transferable, negative effects would be much more significant and more similar to Alternative 4.
Commercial Harvesters	A reduction in harvest and exvessel revenues could result from early attainment of overfished species sector caps. However, the total amount of fish available for retained harvest would be expected to increase, as vessels would increase retention of groundfish, and the level of bycatch would be measured more accurately through expanded observer coverage. The economic benefit of increased landings must be weighed against the additional operating costs that vessel owners would incur from the expanded observer coverage. The allocation of catch limits to individual sectors could lead to economic benefits if private agreements allocating transferable harvesting privileges were negotiated.	Current vessel owners as a group would likely benefit from a system that allocates freely transferable and leaseable quota shares to vessel owners on the basis of catch histories. Moreover, the total amount of fish available for harvest would increase, as bycatch would be measured more accurately through expanded observer coverage. Not all vessel owners would benefit equally, and the relative benefits would depend on the allocation formula. In addition, the economic benefits must be weighed against the additional operating costs that vessel owners would incur from the expanded observer coverage.	Some measures would significantly increase fishing costs, while other would reduce them. For example, 100% groundfish retention, full observer coverage, and establishment of MPAs would increase average costs, whereas the establishment of ITQs for groundfish species would reduce costs.
Recreational Fishery	This alternative may have a negative economic effect on recreational fishers if its sector catch limit were exceeded. The ability to detect excessive catches within the recreational sector would be enhanced by a CPFV observer program and expanded port/field sampling. The ability of the recreational sector to avoid a fishery closure by controlling catch of overfished species through an incentive program is likely to be limited, as there are many and diverse participants. Dividing the recreational sector into geographical (e.g., state-based) subsectors could mitigate some of the negative effects.	The creation of tradable quota shares for the commercial fishing/processing sectors is not expected to apply to the recreational fishery. The possibility of creating ITQs for recreational fishers may exist, but any discussion of how such a allocation would be achieved or its effects on recreational fishers would be speculative.	Rights-based system effects would be as described in Alternative 5. MPAs could benefit recreational fishers over the long term if local catch rates and fish size increased due to spillage of adults out of the MPAs. On the other hand, if MPAs resulted in geographic redistribution of the commercial and recreational fleets, the concentration of fishing effort in the areas that remain open could lead to localized stock depletion, reduced recreational catch per unit effort, and reduction in the quality of the fishing experience.

Table ES.4(b). Summary of effects of Alternatives 4, 5 and 6 on the social and economic environment. (Alternatives 1, 2 and 3 are addressed in the preceding table.)

	Alternative 4	Alternative 5	Alternative 6
Tribal Fishery	Changes in landings of major species targeted in tribal fisheries are expected to be insignificant.	Effects as described in Alternative 1	Effects as described in Alternative 1
Buyers and Processors	The economic effects on buyers and processing companies are uncertain because of the uncertainty as to how well vessel owners within sectors can successfully manage bycatch. To the extent that commercial harvesters adopt bycatch-reducing fishing tactics, processors and buyers would be expected to benefit from higher catches. On the other hand, if an entire fishing sector is shutdown, buyers and processors may experience significant shortages of fish.	Buyers and processors would be expected to benefit from the anticipated increases in fish landings. The overall level of benefits and the distribution of benefits across processors may depend largely on the formula for allocating quota shares. Arguments have been made that harvester-only ITQ programs may result in stranded capital in the processing sector and a shift in the balance of bargaining power toward harvesters. These potential adverse effects could be mitigated if processors were also allocated quota shares.	The net economic effect on buyers and processors is uncertain. In general, buyers and processors would be expected to benefit from the anticipated increases in fish landings that result from the implementation of a rights-based system. The 100% retention requirement could also result in a large increase in landings. However, it is uncertain how much of the additional fish retained would be marketable. Because of their lack of mobility, buyers and processors may be especially negatively affected by MPAs. However, the effects of MPAs on specific buyers and processing companies will depend in part on changes in local supply and how processors have adapted to current supply situations.
Communities	To the extent that harvesting sectors are not shut down, no significant economic impact on communities is likely. However, if sector closures occurred, there would likely be negative impacts in fishing communities, particularly if processing plants were also closed.	Consolidation of fishing and processing activities to fewer vessels and plants would likely result in reductions in the numbers of crew members and processing workers employed. Granting quota shares to community groups could help maintain existing harvesting and processing patterns and serve to meet concerns about employment in communities.	Effects of a right-based management system as described in Alternative 5. MPAs would be expected to help ensure harvests for future generations and the sustained participation of communities in groundfish fisheries. If, however, MPAs resulted in substantial decreases in groundfish catches over the short term, the economic hardships that fishing families and other members of communities are experiencing under Alternative 1 (no action) would be exacerbated.
Consumers	If no early closures of major harvesting sectors occur, the impact on consumers would be expected to be negligible. However, if major fishing sectors were shut down, consumers of fresh or live groundfish could be adversely affected.	Consumers would be expected to benefit from the anticipated increases in fish landings. There is some chance that consumers could be negatively affected, if a rights-based system leads to a decrease in the overall competitiveness of markets for certain groundfish products (e.g., live fish). The likelihood of this occurring would depend both on the level of consolidation that might occur and the elasticity of demand for particular products.	Consumers would benefit from the anticipated increased landings that result from a rights-based system. In addition, over the long term, MPAs that effectively increase the size and variety of seafood species could make consumers better off. On the other hand, large MPAs could substantially decrease seafood supply enough to make consumers worse off, at least in the short term. MPAs could have a positive effect on those consumers who derive non-consumptive benefits from marine ecosystems, including non-market benefits (e.g., existence value).
Fishing Vessel Safety	The effects on vessel safety are uncertain. Possible increases in the profitability of harvesting operations could lead to reductions in injury and loss of life because of harvesters' enhanced ability to maintain equipment, take fewer risks and use their best judgment in times of uncertainty. Without	Possible increases in the profitability of harvesting operations would likely lead to reductions in injury and loss of life because of harvesters' enhanced ability to maintain equipment, take fewer risks and use their best judgment in times of uncertainty.	The net effect of the various measures included in this alternative on fishing vessel safety is uncertain. The establishment of ITQs for groundfish species is expected to promote vessel safety by reducing the pressure to fish under dangerous conditions. On the other hand, the establishment of MPAs may result in a

Table ES.4(b). Summary of effects of Alternatives 4, 5 and 6 on the social and economic environment. (Alternatives 1, 2 and 3 are addressed in the preceding table.)

	Alternative 4	Alternative 5	Alternative 6
	individual vessel catch limits, if an intense "race for fish" could develop. The increased competition among fishers would likely increase the risks they would be willing take to harvest fish.		reduction in fishing vessel safety if the closure of fishing grounds results in vessels fishing farther from port and possibly in more hazardous areas.
Management and Enforcement Costs	Costs would be expected to increase as catch limits were allocated over an increasing number of sectors. It would be necessary to obtain precise and reliable estimates of the quantities of target and non-target catches within each sector. An expanded port/field sampling program to improve estimates of recreational catch would entail a larger budget for the state and federal agencies currently involved in data collection.	The costs of monitoring, enforcement and administration would be expected to increase significantly. Cost recovery measures such as a fee on quota holders would be expected.	Full (100%) observer coverage would be required, which would facilitate enforcement of a full retention regulation. The enforcement costs of establishing MPAs vary with several factors, including the location, number, size, and shape of the MPAs and types of activities restricted and allowed.

Table ES.5. Significance of effects on the social and economic environment.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Incentives to Reduce Bycatch	CS+/CS-	CS+	CS+	S+	S+	S+
Commercial Harvesters	S+	S+	CS+	CS+/CS-	S+/S-	S+/S-
Recreational Fishery	S-	I	I	CS-	I	S+/S-
Tribal Fishery	I	I	I	CS-	I	CS-
Buyers and Processors	S+/S-	I/CS-	I/CS-	CS+/CS-	CS+	CS+/CS-
Communities	S+/S-	CS+/CS-	CS+/CS-	CS-	CS+	CS+/CS-
Consumers	S+/S-	I	CS-	CS-	CS+	CS+/CS-
Fishing Vessel Safety	S+/S-	S+	S+/S-	CS-	S+	S+/S-
Management and Enforcement Costs	S-	S+	CS+/CS-	S-	S-	S-

Significance Ratings:

Significantly Adverse (S-): Significant adverse impact based on ample information and the professional judgment of the analysts.

Conditionally Significant Beneficial (CS+)/Conditionally Significant Adverse (CS-): Conditionally significant is assigned when there is some information that significant impacts could occur, but the intensity of the impacts and the probability of occurrence are unknown.

Insignificant Impact (I): No significant change based on information and the professional judgment of the analysts..

Unknown (U): This determination is characterized by the absence of information sufficient to adequately assess the significance of the impacts.

Table ES.6(a). Summary of direct, indirect and cumulative effects of Alternatives 1, 2 and 3.

Resource Issue or Category	Alternative 1	Alternative 2	Alternative 3
Habitat: Trawl and other gear contacting the bottom damage benthic organisms and physical structure			
Direct/Indirect	No change from baseline	No change from baseline	No change from baseline
Cumulative	No change from baseline	No change from baseline	No change from baseline
Ecosystem/Biodiversity: Lowered abundance of particular species changes ecosystem structure, stock declines lead to local/regional extinction.			
Direct/Indirect	No change from baseline	No change from baseline	No change from baseline
Cumulative	No change from baseline	No change from baseline	No change from baseline
Groundfish: Bycatch and bycatch mortality of overfished and other groundfish			
Direct/Indirect	Catch rates of overfished species such as canary and bocaccio rockfish may delay or prevent rebuilding. Discard/bycatch of other groundfish could remain high due to constraints for overfished species.	Reduced fishing effort expected to reduce bycatch and bycatch mortality of overfished and other groundfish. Latent capacity remains and could negate any savings.	Effects may be similar to Alternative 1 if shortened season does not result in larger trip limits.
Cumulative	Canary and bocaccio rockfish may not be sustainable.	Higher probability of rebuilding overfished species. Reduced bycatch and bycatch mortality of other groundfish may allow fuller resource utilization but not necessarily increased abundance.	Effects may be similar to Alternative 1 if shortened season does not result in larger trip limits.
Protected species: Bycatch and bycatch mortality of Pacific halibut, Pacific salmon, marine birds and mammals.			
Direct/Indirect	No change from baseline	No change from baseline	Interactions are thought to be low, but may be completely absent during seasonal closures. Halibut bycatch depends on timing of seasonal closures.
Cumulative	No change from baseline	No change from baseline	Interactions with birds depend on timing of seasonal closures.
Accountability: Increased monitoring bycatch and bycatch mortality improves accountability.			
Direct/Indirect	Provides for statistically reliable measures of bycatch on an annual basis, but not inseason.	Marginal improvement in monitoring coverage of trips.	Marginal improvement in monitoring coverage of trips
Cumulative	Lack of timely inseason data may lead to unsustainable fisheries for some overfished species.	Similar to Alternative 1 - data cannot be used in-season.	Similar to Alternative 1 - data cannot be used in-season

Table ES.6(b). Summary of direct, indirect and cumulative effects of Alternatives 4, 5, and 6 for West Coast groundfish fisheries.

Resource Issue or Category	Alternative 4	Alternative 5	Alternative 6
Habitat: Trawl and other gear contacting the bottom damage benthic organisms and physical structure			
Direct/Indirect	No change from baseline	Reduction in closed areas	Reduction in closed areas
Cumulative	No change from baseline	Increased growth of living benthic habitat (sponges and corals) in closed areas.	Increased growth of living benthic habitat (sponges and corals) in closed areas.
Ecosystem/Biodiversity: Lowered abundance of particular species changes ecosystem structure, stock declines lead to local/regional extinction.			
Direct/Indirect	No change from baseline	Increased growth and abundance of some species in closed areas	Increased growth and abundance of some species in closed areas
Cumulative	No change from baseline	Increased biodiversity in closed areas	Increased biodiversity in closed areas
Groundfish: Bycatch and bycatch mortality of overfished and other groundfish			
Direct/Indirect	Reduces bycatch and bycatch mortality of overfished species in particular - due to RSQ caps for overfished species.	Reduces bycatch and bycatch mortality of overfished and other groundfish through use of MPAs, RSQs and IFQs for overfished and other groundfish.	Reduces bycatch and bycatch mortality of all groundfish through use of no-take reserves, RSQs, IFQs, and 100% groundfish retention requirement.
Cumulative	Higher likelihood and rate of rebuilding, with possible exception of bocaccio rockfish.	Higher likelihood and rate of rebuilding of overfished groundfish, possible increases in other groundfish populations.	Highest likelihood and rate of rebuilding of overfished groundfish. Increased size and diversity of groundfish within closed areas.
Protected species: Bycatch and bycatch mortality of Pacific halibut, Pacific salmon, marine birds and mammals.			
Direct/Indirect	No change from baseline.	Small reductions in bycatch and bycatch morality within protected areas.	Small reductions in bycatch and bycatch morality within protected areas.
Cumulative	No change from baseline.	No change from baseline.	No change from baseline.
Accountability: Increased monitoring bycatch and bycatch mortality improves accountability.			
Direct/Indirect	Significantly improved monitoring coverage. In-season data can be used to make in-season adjustments. Accurate in-season accounting of overfished stocks of groundfish.	Significantly improved monitoring coverage with 100% observer coverage of commercial fleet. Real-time accounting of groundfish. Discard/ bycatch of overfished groundfish nearly eliminated.	Significantly improved monitoring coverage with 100% observer coverage of commercial fleet. Real-time accounting of all groundfish catch. No groundfish discard/bycatch.
Cumulative	Reduced risk and higher likelihood of rebuilding overfished stocks of groundfish.	Reduced risk and higher likelihood of rebuilding overfished groundfish stocks.	Reduced risk and higher likelihood of rebuilding overfished groundfish stocks.

Draft (4/7/04) Proposal for a Preferred Alternative for the Groundfish Programmatic Bycatch Environmental Impact Statement – New Alternative 7

Create a new Alternative 7 that includes elements of Alternatives 1, 4, and 5. Elements from Alternatives 1 that would be included in Alternative 7 would be all current status quo programs for bycatch minimization and management including but not limited to: setting optimum yield specifications, gear restrictions, area closures, variable trip and bag limits, season closures, establishing landings limits for target species based on co-occurrence ratios with overfished stocks, etc. The FMP would be amended to more fully describe our standardized reporting methodology program and to require the use of bycatch management measures indicated under Alternative1 for protection of overfished and depleted Groundfish stocks and to reduce bycatch and to reduce bycatch mortality to the extent practicable. These would be used until replaced by better tools as they are developed. A baseline accounting of bycatch by sector shall be established for the purpose of establishing future bycatch program goals.

Elements from Alternative 4 that would be included in Alternative 7 would be the Development and adoption of vessel and sector-specific caps of overfished and depleted Groundfish species where practicable. We anticipate phasing in sector Bycatch caps that would include: monitoring standards, full retention programs, and individual vessel incentives for exemption from caps.

Elements from Alternatives 5 that would be included in Alternative 7 would be the support of future use of IFQ programs for appropriate sectors of the fishery. The FMP would incorporate the Strategic Plan’s goal of reducing overcapacity in all commercial fisheries.

West Coast Groundfish
Bycatch Management

Draft
Programmatic EIS

Summary

April 2004

What I am going to tell you

- The process and schedule
- The legal mandate
- Describe the draft PEIS
- Review the conclusions of the analysis
- The necessary Council actions.

The process and schedule

- Alternatives adopted September 2003
- Preliminary draft EIS reviewed November 2003
- Draft Programmatic EIS public comment period: Feb 27-April 27
- **Council final decision: today**
- Prepare Final PEIS and Record of Decision
- Project completed summer 2004

The Legal Mandate: Magnuson-Stevens Fishery Conservation and Management Act
(see page E.S.-1)

- National Standard 9 requires that “Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.”

- Section 303(a)(11) of the Magnuson-Stevens Act requires each FMP “establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority – (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided.”

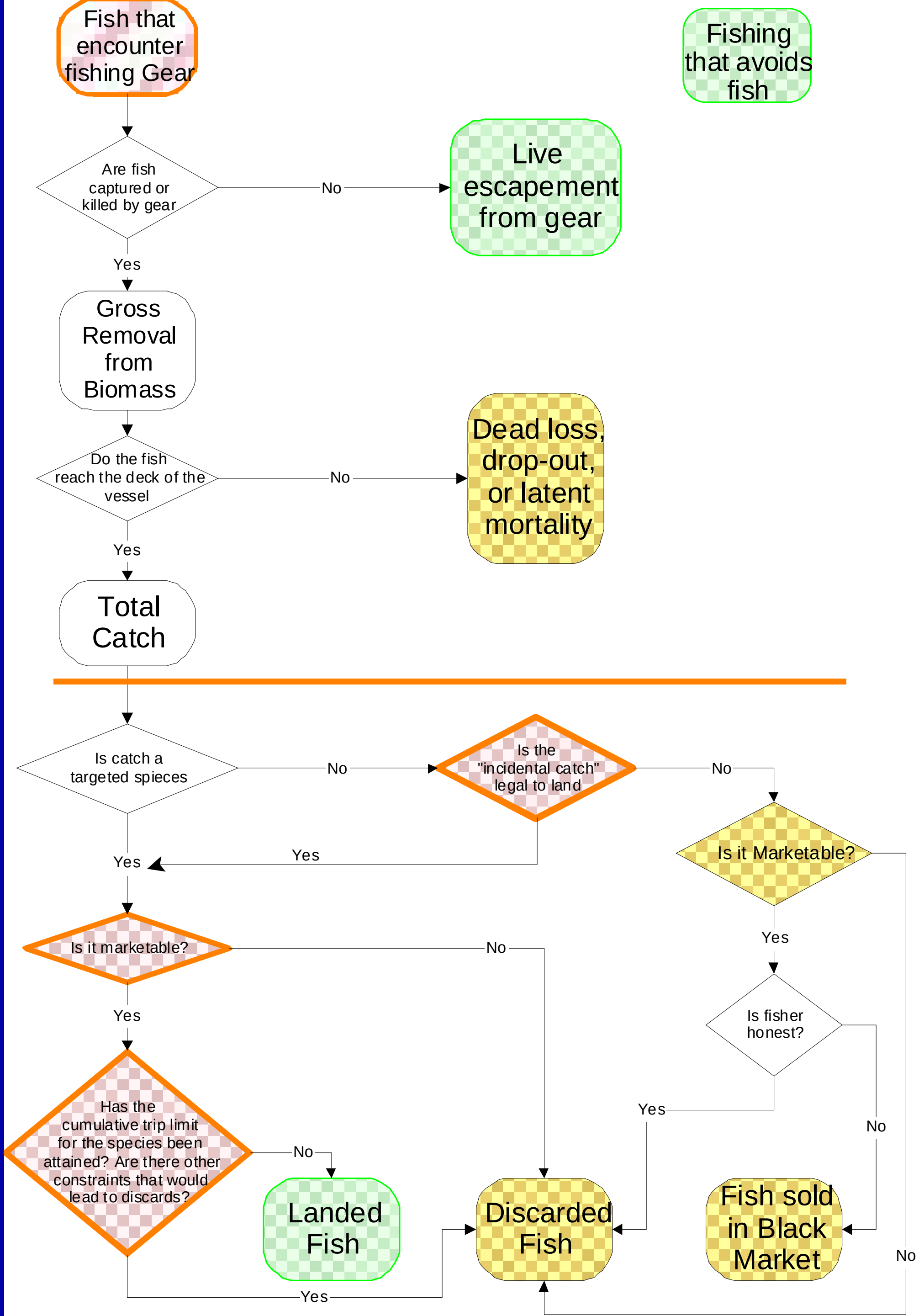
What is "Bycatch?"

- The Magnuson-Stevens Act defines the term "bycatch" to mean "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards." 16 U.S.C. § 1802(2).
- (Bycatch does not include fish released alive under a recreational catch and release fishery management program.)

- “Fish” means groundfish, other finfish, kelp, corals, sponges, jellyfish, and other marine invertebrates. Although the definition does not include seabirds and marine mammals, other federal laws require us to consider the impacts of fishing on those species.

- Sometimes when we say “bycatch” we don’t mean discard; what we really mean is “catching and killing something that should be avoided.”

Pre-catch: Avoidance, selectivity



Post-catch

Page ES-5

Bycatch Program Goals and Objectives
(see page E.S.-2)

- Account for total fishing mortality by species
- Establish monitoring and accounting mechanisms to keep total catch of each groundfish stock from exceeding the specified limits
- Reduce unwanted incidental catch and bycatch of groundfish and other species
- Reduce the mortality of animals taken as bycatch

- Provide incentives for fishers to reduce bycatch and flexibility/opportunity to develop bycatch reduction methods
- Monitor incidental catch and bycatch in manner that is accurate, timely, and not excessively costly
- Reduce unobserved fishing-caused mortalities of all fish
- Gather information on unassessed and/or non-commercial species to aid in development of ecosystem management approaches

The Alternatives

Alternative 1

Control bycatch by trip (retention) limits that vary by gear, depth, area; long season

Alternative 2

Same as Alternative 1 except reduce bycatch by decreasing effort and permitting larger or more flexible trip limits (reduce commercial trawl fleet)

Alternative 3

Same as Alternative 1 except reduce bycatch by reducing effort and permitting larger or more flexible trip limits (reduce commercial season)

Alternative 4

Same as Alternative 1 except reduce all groundfish bycatch by establishing vessel and sector catch/ mortality caps

Alternative 5

Reduce all groundfish bycatch by establishing individual catch limits (individual quotas) for groundfish species; require increased retention of overfished groundfish species

Alternative 6

Reduce all bycatch by large area closures and gear restrictions, individual bycatch caps, and require increased retention of all groundfish

Table 2.1. Bycatch Mitigation Tools

Harvest Levels

- ABC/OY
- sector allocations
- trip (landing) limits
- catch limits
- individual quotas
- **Discard Caps** (limits and prohibitions)
- **Gear Restrictions**
- **Trawl** mesh size
- footrope diameter/length
- net height
- codend mesh and dimensions
- design: on-bottom or pelagic
- bycatch reduction devices (BRDs)
- **Line** number of hooks
- hook size
- line length
- retrieval requirements
- **Pot/trap** number of pots
- pot size
- escape panel in net/pot
- retrieval requirements
- **Other** setnets (gill and trammel nets)

Table 2.1. Bycatch Mitigation Tools (cont)

- **Time/Area Restrictions**
  - seasons
  - area closures
  - depth closures
  - marine reserves
- **Capacity (number of participants)**
  - permits/licenses/endorsements
  - limited entry
- **Capacity (Vessel Restrictions)**
  - vessel size
  - engine power
  - vessel type
- **Monitoring/Reporting Requirements**
  - permits/licenses
  - registrations
  - Fish tickets (commercial landings/
  - sales receipts)
  - Vessel logbooks
  - Surveys
  - Punch cards/tags (recreational)
  - Port sampling/on-shore observers
  - On-board observers
  - Vessel monitoring systems (VMS)
  - Onboard video recording devices
  - Enforcement

Important Concepts and Definitions

- **Trip limits** restrict the amount of fish that may be **retained**; they do not directly restrict the amount of fish that may be caught.
- Trip limits apply only to groundfish species.
- As used in managing the commercial fishery, most trip limits expire at the end of the 2-month period (or other specified period).
- Trip limits cause regulatory bycatch/discard.

Concepts and Definitions

- **Catch limits** restrict the amount of fish that may be caught, regardless of whether all the fish are retained or discarded.
- Catch limits require vessels to stop fishing when a limit is reached.
- Catch limits were used to control foreign fisheries, but have not been used to manage domestic groundfish fisheries.

Concepts and Definitions

- Remember: sometimes “bycatch” means discard. Sometimes we really mean “catching” or “killing.” The first priority is to avoid catching anything you don’t want. The second priority is to avoid killing it if you don’t intend to keep it.

Summary of the Alternatives

- Alternatives 1, 2, and 3 continue the program of relying on groundfish retention limits.
- Alternatives 4, 5 and 6 would introduce catch limits that would require fishers to stop fishing. These could include catch limits on any species.

Summary of the Alternatives

- Under Alternative 4, sector caps could apply to 2-month periods, longer periods, or a year. Vessel caps, if used, would be similar to trip limits; at the beginning of each period, vessels would “start over.”

Summary of the Alternatives

- Alternative 5 would establish individual vessel caps for overfished and other designated species. These caps would be annual and transferable.

The Analysis

The analysis did not attempt to quantify the amounts of bycatch reduction that might result from the alternatives. When the Council develops regulations to implement its preferred alternatives, a quantitative analysis may be appropriate.

The Analysis

This is a program level EIS; it deals with concepts, policies, and overall program direction rather than specific regulations. In response to public comments during scoping, each type of mitigation tool was evaluated individually and in combination with other tools. The analysis was based on studies described in the literature, previous Council analyses, and professional experience and judgment.

The Analysis

The effects of alternatives on representative (indicator) species and species groups were identified. In most cases, data are not available to quantify potential effects. In some cases, even the direction of effects (positive or negative) are difficult to determine. In those cases, basic cause-effect relationships were identified.

Conclusions

- Catch limits can nearly eliminate regulatory discard if monitored adequately.
- Catch limits do not necessarily eliminate economic bycatch/discards. However, if all captured fish apply towards the catch limit, there is increased incentive to retain whatever is caught.
- There is also increased incentive to avoid catching fish that are less valuable.

Council Decisions Today

- Adopt preferred alternative, which could be a combination of more than one alternative.
- It may be appropriate to discuss "to the extent practicable."
- Discuss why the environmentally preferable alternative (Alternative 6) was not selected.

Exhibit C.13.c
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON BYCATCH MONITORING PROGRAM DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

The Groundfish Advisory Subpanel (GAP) held extensive discussions with NMFS contractors Mr. Jim Glock and Mr. Jim Golden. We appreciate the tremendous effort they have made to develop a draft Environmental Impact Statement.

Nevertheless, we are concerned the alternatives listed in Exhibit C.13.a, Attachment 1, will unnecessarily limit the flexibility of the Council to respond to legal requirements to minimize bycatch to the extent practicable. Each of the alternatives contains some of the management tools necessary to achieve the legal mandate. However, those tools do not cut across different fishery lines. For example, one alternative might be appropriate for the trawl fishery, another for recreational fisheries, but none encompass the wide variety of fisheries and bycatch problems that are found under the overall Pacific Coast Groundfish Fishery Management Plan.

The GAP suggests the Council adopt, as a preferred alternative, a new alternative which we have labeled 1A. This alternative should include all of the fishery management tools identified in the draft EIS. It should make clear that the Council's mandate is to minimize bycatch to the extent possible, as required by law, and regulations will be put in place to carry out that mandate. It should stipulate that the tools will be applied on a sector-by-sector basis, in each case using the tools that are most appropriate for the sector. It should stipulate that some tools - such as setting acceptable biological catches (ABCs) and optimum and yields (OYs) or establishing reserves - should be considered as applicable to all fishery sectors.

We cannot adopt a one-size-fits-all approach to bycatch minimization when the types of bycatch, their causes, and their prevention can be radically different among different fishery sectors. Nor do we believe the Council should arbitrarily handcuff itself by making only certain tools available. A flexible approach is the best way to ensure the Council is able to meet the requirements of law while allowing fisheries to continue.

PFMC
04/08/04

HABITAT COMMITTEE COMMENTS ON BYCATCH MONITORING PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Mr. Jim Glock made a presentation to the Habitat Committee (HC) summarizing the alternatives presented in the Bycatch Draft Programmatic Environmental Impact Statement (DPEIS). The HC appreciates the very substantial quantity and quality of work involved in preparing the DPEIS. The document is well organized, and the issues are clearly presented.

The DPEIS presents strategic alternatives for minimizing bycatch and meeting the Council's Magnuson-Stevens Act obligations, rather than a set of specific management measures.

From a purely habitat perspective, the HC notes that all gears contacting the bottom have some impacts; the most extensive impacts are associated with mobile, bottom-tending gear. The Council has already enacted measures including area closures and gear restrictions that reduce benthic habitat impacts. It is not possible to determine from the document which alternative would provide the greatest additional benefits in this specific context. Generic tools, such as further effort reduction, spatial management, and discard reduction, can also be beneficial in this respect. However, the HC is not able to offer a specific recommendation on any of the alternatives or a blend of alternatives based simply on habitat considerations.

Based on the management measures likely to be employed pursuant to each of the alternatives, Alternatives 4 through 6 offer the most significant benefits to Council-managed resources and the biological environment. The HC recognizes the implementation costs and challenges of these alternatives will be substantially greater than those associated with Alternatives 1 through 3.

PFMC
04/07/04

Exhibit C.13.c
Supplemental SSC Report
April 2004

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON THE GROUNDFISH BYCATCH PROGRAMATIC ENVIRONMENTAL IMPACT STATEMENT

Mr. Jim Glock presented alternatives and supporting analyses in the current draft of the Bycatch Programatic Environmental Impact Statement (PEIS, Exhibit C.13.a, Attachment 1) to the Scientific and Statistical Committee (SSC).

Four of the six alternatives in the PEIS deal primarily with regulatory bycatch. However, guidelines under National Standard 9 of the Sustainable Fisheries Act also require consideration of non-regulatory sources of bycatch. The SSC raised this issue in its statement from September 2003, but it is not clear how the issues of non-regulatory bycatch and discard are addressed in Alternatives 1-4.

Analyses currently in the PEIS are qualitative, which the SSC understands is customary. On the other hand, observer coverage, logbook, and other reporting requirements, as well as levels of enforcement, differ among the alternatives. Quantitative information about respective costs and other practicalities under each of the alternatives is needed for the Council to make an informed choice among alternatives. The qualitative analysis contained in the PEIS does not facilitate this type of choice.

The alternatives entail different levels of bycatch reduction relative to the status quo. However, the PEIS does not currently contain information on current bycatch and discard amounts, though such information is available (e.g., Table 5-5 in Amendment 16-3, Exhibit C.12.a, Attachment 1). The SSC recommends that future work estimate ranges of bycatch reduction, relative to the status quo, for each of the alternatives to better inform decision-making.

Finally, alternatives in the PEIS are combinations of bycatch reduction tools, and the six alternatives seem to be presented in order of increasing restrictiveness. For example, Alternative 6 includes individual quotas, marine reserves, and total retention of catch. The SSC does not see why these three particular management tools would necessarily need to be implemented simultaneously. More generally, it is not clear whether the Council’s choice of a preferred alternative would require the use of all tools specified under that alternative, or would merely give the Council flexibility to use any subset of these tools. Therefore, the SSC considers it important to maintain flexibility in developing a suite of management tools that would allow the Council to develop regulatory alternatives that best achieve the purpose of the PEIS (Section 1.3, pages 1-2).

PFMC
04/07/04

AD HOC GROUNDFISH TRAWL INDIVIDUAL QUOTA COMMITTEE REPORT ON BYCATCH MONITORING PROGRAM DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

The Ad Hoc Groundfish Trawl Individual Quota Committee (TIQC) met March 18-19, 2004 to continue work on developing alternatives for the TIQ program. Mr. Jim Glock provided a presentation on the programmatic bycatch environmental impact statement (PBEIS). TIQC members expressed concern that the adoption of certain alternatives in the PBEIS might prematurely constrain the range of alternatives being considered by the TIQC.The alternatives being considered by the TIQC include status quo (no individual fishing quota [IFQ] program) and IFQs to cover all groundfish species caught with trawl gear. However, within that range there are alternatives which would, for example, limit the IFQ program's coverage to those species that are of nearly exclusive interest to the trawl fishery or already allocated between the trawl and other sectors. Such mid-range alternatives would allow the IFQ program to proceed in the absence of Council action to explicitly allocate species not covered by the IFQ program. Trawl harvest of nonIFQ species (e.g., many of the overfished species) would be projected in a fashion similar to what is done for the current overfished species score card. For the nonwhiting fishery, harvest of nonIFQ species would be controlled through measures such as cumulative catch limits. The cumulative catch limit approach would differ from the current cumulative landing limits in that vessel operations would cease upon reaching a catch limit (the current cumulative limit system applies to landings, and catch is accounted for based on estimates of fleet incidental catch rates). The TIQC is considering an alternative under which these cumulative limits would be transferable within a period, except for those species with extremely low optimum yields (OYs) (e.g., overfished species). Species with extremely low OYs might also be managed with area-specific sector catch caps. Under sector catch caps, there may or may not be vessel cumulative catch limits, but a sector's operations would cease when the catch cap is reached. For the whiting fishery catch of nonwhiting species would be managed as a sector catch cap.

PFMC
04/05/04

** Natural Resources Defense Council ** The Ocean Conservancy **
** Oceana ** Pacific Marine Conservation Council **

April 2, 2004

Mr. Don Hansen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place NE, Suite 200
Portland, OR 97220-1384

Re: Agenda Item C.13: Bycatch Environmental Impact Statement (EIS)

Dear Mr. Hansen:

Please find enclosed a draft proposal for counting and minimizing bycatch in the Pacific groundfish fishery. This draft proposal is a modification of Alternative 4 in the Groundfish Bycatch Environmental Impact Statement (EIS) issued by NOAA Fisheries in February 2004. We ask that the Pacific Fishery Management Council (PFMC) recommend that NOAA Fisheries analyze this modification of Alternative 4 in the final EIS. Furthermore, we ask that the PFMC adopt this option as its preferred alternative.

This proposed alternative (we'll call it 4b) combines sector caps with continued use of spatial management to minimize bycatch. It provides incentives, in the form of a higher trip limit provided from a reserved portion of the optimum yield, to fishermen who want individual caps and will fund their own observer coverage. Furthermore, the proposal details a standardized reporting methodology to assess the amount and type of bycatch in the fishery.

Our proposal focuses on an effective alternative that provides accountability and that can be readily implemented. We thank the PFMC for considering our request and would be happy to answer any questions about our proposal.

Sincerely,

Chris Dorsett
The Ocean Conservancy

Peter Huhtala CD
Pacific Marine Conservation Council

Karen Garrison CD
Karen Garrison
Natural Resources Defense Council

Phil Kline CD
Phil Kline
Oceana

Attachment

Draft Proposal for Counting and Minimizing Bycatch in the West Coast Groundfish Fishery

March 31, 2004

This proposal to count and minimize bycatch relies on enhanced bycatch observation in the groundfish fishery, the use of bycatch caps for sectors of the groundfish fishery, and the continued use of spatial management to reduce bycatch. The sectors referred to in this document match those currently used in the Council's "bycatch scorecard" and can be further subdivided by area. We propose that a statistically adequate reporting methodology to assess the amount and type of bycatch occurring in each fishery be established using the criteria contained in "Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs" (Powers Report) and "How Much Observer Coverage is Enough to Adequately Estimate Bycatch" (Pikitch report). Implementation will be phased in over time based on a ranking of need and feasibility consistent with these reports.

Proposed Alternative to Minimize Bycatch in the Groundfish Fishery

The proposed alternative is a modification of Alternative 4 in the Bycatch EIS. This proposed alternative would combine sector caps with continued use of spatial management to minimize bycatch. The groundfish fishery will initially be subdivided into the sectors defined by gear type (limited entry trawl, fixed gear, etc), as used in the bycatch scorecard (attached). These sectors may be further subdivided by the Cape Mendocino line (40-10) into North and South components and by the RCA, into fishing zones seaward and landward of the RCA. Vessel operators who want to fish both seaward and landward of the RCA must provide proof of past fishing in both of these areas using catch history for that vessel over the past three years. Upon further analysis, these sectors may be further subdivided into geographical areas to fit area-based management initiatives.

Caps on total mortality of each overfished species will be established for each sector, and a sector will be closed to fishing upon attainment of any of theses caps. Additional management measures will be employed to ensure that the total mortality of every managed species stays within its OY.

Boats from within a sector can opt out of the sector cap, thereby preserving the opportunity to continue fishing if their sector is shut down, by meeting some established criteria such as funding 100% observer coverage for one's vessel. Upon opting out, a commercial vessel would get individual bycatch caps and incentives such as higher trip limits from a reserved portion of target species OY. This cap would be deducted from that of the vessel's sector. Vessels that opt out of sector allocations can form collectives to pool bycatch quotas amongst collective members. The entire collective is prohibited from further fishing once a collective bycatch cap is met.

Furthermore, vessels are permitted to switch to another sector by changing gear type. Similar to those vessels that opt for individual bycatch caps, bycatch cap amounts will transfer with the vessel to the new sector.

The initial bycatch caps will be for those species identified on the bycatch scorecard (bocaccio, canary rockfish, etc.), and the most current bycatch scorecard will be used to apportion the OY of each species among the sectors. The Council will review bycatch rates for other managed species not contained on the bycatch scorecard. If bycatch rates for these species are higher than an established threshold, a bycatch cap will be set for those species, and gradually reduced over time. As OY levels increase for the capped species, the increase beyond what may be needed as a buffer will be allocated to operators with the lowest bycatch rates among those with individual caps, and through other means that provide incentives for bycatch reduction individually, by sector and within collectives.

For species without set OYs (for example, unassessed species), information will be collected through a standardized reporting methodology for bycatch. After a to-be-determined time period of data collection, a bycatch cap will be established for individual species or species groups if bycatch of any unmanaged species is found to increase or decrease by 10% or more relative to the previous year. After a set number of years (e.g. five) after establishment of a bycatch cap, bycatch would be reduced by some set percentage (10%, for example) per time period through reductions in the caps, while providing incentives for those most successful at avoiding bycatch. In the interim, bycatch of unassessed and other species will be minimized by use of the RCA and additional spatial management measures as needed (for example, on the slope).

Establishing a Standardized Reporting Methodology for Bycatch

A bycatch reporting methodology will be established consistent with the criteria in the Powers and Pikitch reports. Groundfish fishing sectors will be analyzed consistent with these reports within the following categories: status of current reporting methodologies and bycatch interaction (fish, endangered animals and marine mammals). The sectors will then be ranked within the two categories. After consultation with appropriate NMFS and PSMFC staff, decisions will be made as to which sectors should be considered priorities for an enhanced reporting methodology. A timeline will be developed for establishment of this reporting methodology for each sector.

Reference Documents

Powers report: http://www.nmfs.noaa.gov/by_catch/EvalBycatch.pdf
Bycatch EIS: http://www.pcouncil.org/groundfish/gfbdpeis.html
Pikitch report: http://www.oceana.org/uploads/BabcockPikitchGray2003FinalReport.pdf

Exhibit C.13.d
Supplemental Public Comment
April 2004

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Compiled by Geoff Shester
Stanford University

Submitted to the Pacific Fisheries Management Council April 8, 2004

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A Cost Effective Approach to Protecting Deep Sea Coral and Sponge Ecosystems with an Application to Alaska's Aleutian Islands Region

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Abstract

There is much debate about how to protect deep sea coral and sponge ecosystems using the data currently available. The Aleutian Islands in Alaska contain some of the most abundant, diverse, and pristine deep sea coral and sponge ecosystems on Earth. From 1990 to 2002, U.S. federal fishery observer data indicates approximately 2,176,648 kg of coral and sponge bycatch occurred in the Aleutian Islands, equaling 52% of all coral and sponge bycatch in Alaska. Coral and sponge bycatch rates in the Aleutians were over 12 times the rate in the Bering Sea or Gulf of Alaska. The National Marine Fisheries Service (NMFS) estimates that 87% of coral bycatch and 91% of sponge bycatch in Alaska is caused by bottom trawling in the Bering Sea/Aleutian Islands management areas. The conservation organization Oceana developed an interdisciplinary fishery management approach to mitigating adverse impacts of fishing on deep sea coral and sponge ecosystems, which has been used by NMFS to formulate a habitat protection alternative for the Aleutian Islands that is being considered in an Environmental Impact Statement. The Oceana Approach is offered as a cost effective model for reducing the adverse effects of fishing on deep sea coral and sponge ecosystems. The approach uses observer data to identify areas of high coral and sponge bycatch rates to develop a comprehensive management policy that allows bottom trawling only in specific designated areas with high fish harvest and low habitat impacts. All areas not specified as open would be closed to bottom trawling. To prevent effort displacement, bottom trawl effort is reduced by the amount that historically occurred in areas that would become closed. The Oceana Approach also includes coral and sponge bycatch limits and a plan for comprehensive seafloor research, mapping, and monitoring. An enforcement strategy for these management measures is developed based on agency capabilities, and includes increased observer coverage, vessel monitoring systems, and electronic logbooks. This approach allows for maximum catch of target species with minimal adverse impacts on coral and sponge habitat. Successful implementation of the Oceana Approach will protect areas of high known trawl impacts to deep sea coral and sponge ecosystems and prevent trawl effort from moving into new, unexplored areas. The methodology is recommended for application to other regions and should be adjusted based on the available fishery and biological data for each region.

Introduction

Advances in technology have enabled fishermen to harvest biomass from the ocean more effectively than ever before. The world's demand for fish has created economic incentives for fishermen to build bigger boats with higher horsepower and use fishing gears that can be used in deeper and harder to reach areas, and catch high quantities of fish very quickly. Industrial bottom trawling is one such gear type that has enabled more effective harvest of fish stocks by towing large nets and cables over the seafloor. However, these hard on bottom fishing activities can alter and damage seafloor ecosystems, which may impose serious adverse impacts on the features of the ocean that make it so productive. These incidental externalities of increased harvesting ability have prompted serious concerns in the scientific and conservation communities about the effects of bottom trawling on seafloor habitat (Dayton et al. 1995; Watling and Norse 1998; NRC 2002; Roberts and Hirshfield 2003). Deep sea corals and sponges are living animals that can provide three dimensional structures that form habitat for commercial groundfish, shellfish, and other marine life (Husebo et al. 2002; Krieger and Wing 2002; Malecha et al. 2002; Heifetz 2002). They are found at depths from 30 meters to over 3000 meters (Krieger and Wing 2002). Because these long-lived filter feeders are attached to the seafloor, they may be important indicators of areas in the ocean that have consistently favorable ecological conditions worth protecting for other reasons as well.

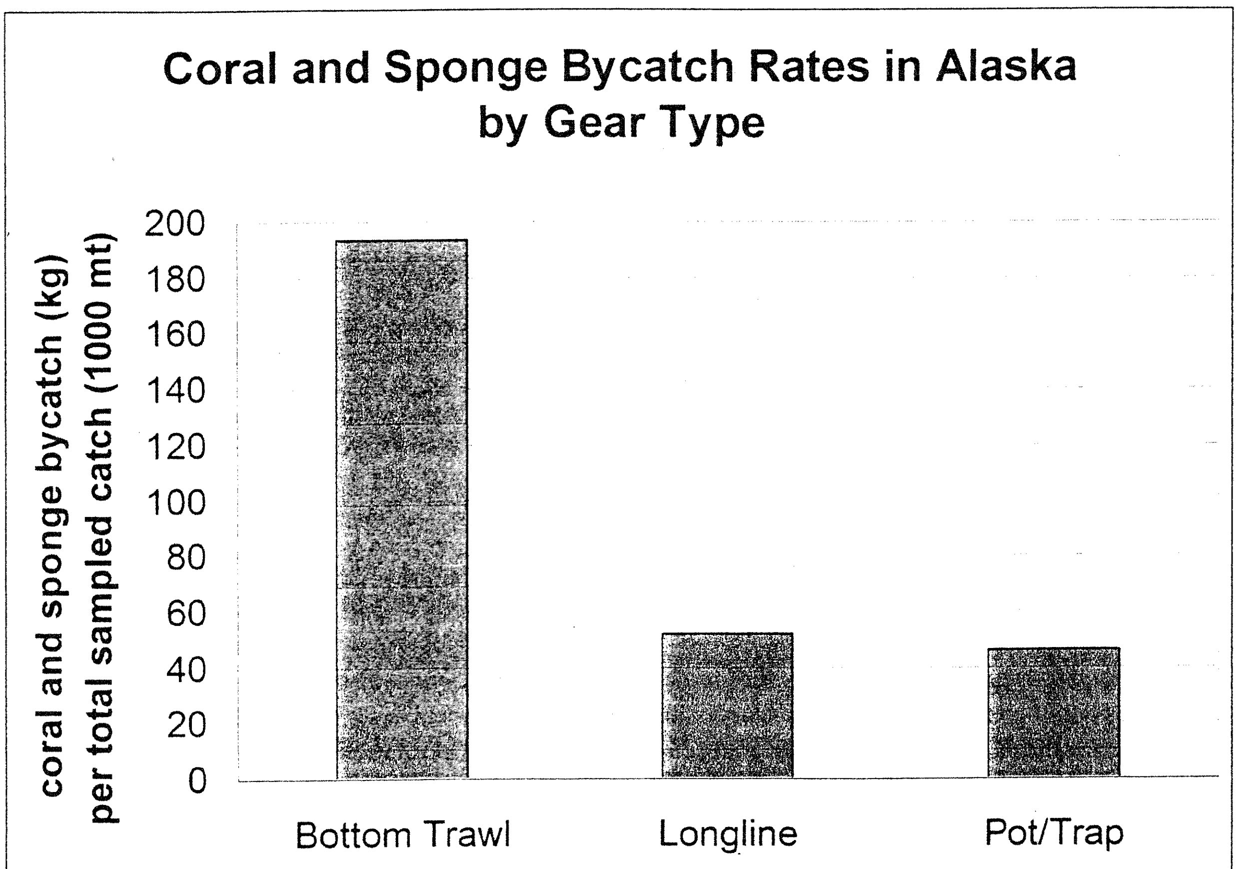

Figure 1: Bycatch rates for groundfish fishing gears in Alaska, based on data from 1990-2002. Bycatch rates are defined as the weight of reported bycatch divided by the weight of total sampled catch. These rates may not reflect actual damage to seafloor since fishing gears may not retain all corals and sponges that are impacted. Data source: NMFS 2002b.

Bottom trawling is known to decrease the quality of these habitats because they are vulnerable to damage and may take decades to centuries to recover (Cimberg et al. 1981; Freese et al. 1999; Freese 2001; Hall-Spencer et al. 2001; Krieger 2001; Andrews et al. 2002; Fossa et al. 2002; NRC 2002). Figure 1 shows that the rate of coral and sponge bycatch per metric ton of total catch is roughly four times greater for bottom trawls than for longline or pot gear types in Alaska. Because of their importance as habitat and vulnerability to human impacts, all corals and sponges have already been designated as Habitat Areas of Particular Concern (HAPCs) deserving of special protection by the National Marine Fisheries Service (NMFS) and the North Pacific Fishery Management Council (NPFMC 1998; Hogarth, Assistant Administrator for Fisheries, personal communication). HAPCs are a subset of Essential Fish Habitat (EFH) defined in U.S. law that are especially vulnerable to fishing (NMFS 2002a). Under the Magnuson-Stevens Fishery Conservation and Management Act of 1996 which governs federal fishery management in the U.S., NMFS is required to take actions that minimize the adverse impacts of fishing on EFH to the maximum extent practicable (16 U.S.C. 1863(a)(7)). However, no additional management measures have been implemented to date to protect these HAPCs.

	Coral Bycatch (kg)	Sponge Bycatch (kg)	Coral & Sponge Bycatch (kg)	Total Catch (mt)
Aleutian Islands (sampled)	201,472	1,376,074	1,577,546	1,307,144
Aleutian Islands (extrapolated)	277,985 (52% of Alaska)	1,898,663 (52% of Alaska)	2,176,648 (52% of Alaska)	1,803,556 (8% of Alaska)
All Alaska (sampled)	388,627	2,628,855	3,017,482	16,460,425
All Alaska (extrapolated)	537,063	3,632,945	4,170,008	22,747,477

Table 1: Summary of coral and sponge bycatch data for Alaska groundfish fisheries from 1990-2002 as of 9/25/02. Official total catch values are listed in the extrapolated rows in the total catch column. Sampled data represents the amounts reported by observers. Extrapolated data represents the sampled bycatch multiplied by the ratio of Official Total Catch to total sampled catch. Bycatch values are in kilograms (kg); total catch values are in metric tons (mt). "Coral Bycatch" includes bryozoans. Confidential data excluded. Data source: NMFS (2002b).

The Aleutian Islands contain some of the most abundant, diverse, and pristine deep sea coral and sponge ecosystems known on Earth. Stone (personal communication) estimates that this region easily contains over 100 species of corals and sponges. Table 1 shows observer bycatch data for corals and sponges and total catch data for the Aleutian Islands as well as Alaska-wide totals. The spatial distribution of this bycatch is depicted in Figure 2. Observer bycatch records are perhaps the best indicator of damage to deep sea coral and sponge ecosystems because they reflect the spatial heterogeneity of coral and sponge distribution and they directly measure relative removals of these habitat features from different areas. However, bycatch figures underestimate total damage because they do not count damaged corals and sponges that remain on the seafloor (trawl gear is not designed to retain corals and sponges). Total coral and sponge bycatch in the Aleutian Islands region accounts for 52% of all coral and sponge bycatch in Alaska, despite the fact that only 8% of Alaska's groundfish catch occurs in this region (NMFS 2002b). Coral and sponge bycatch rates in the Aleutian Islands were over 12 times the rate in the Bering Sea or Gulf of Alaska (NMFS 2002b). Though much damage is not reflected in reported bycatch, these numbers provide quantitative evidence of adverse impacts to habitats currently designated as HAPCs. NMFS (2002b) estimates that 87% of coral bycatch and 91% of sponge bycatch in Alaska is caused by bottom trawling. Legally, NMFS is required to take action if the adverse impacts of fishing on EFH are more than minimal and not temporary (NMFS 2002a).

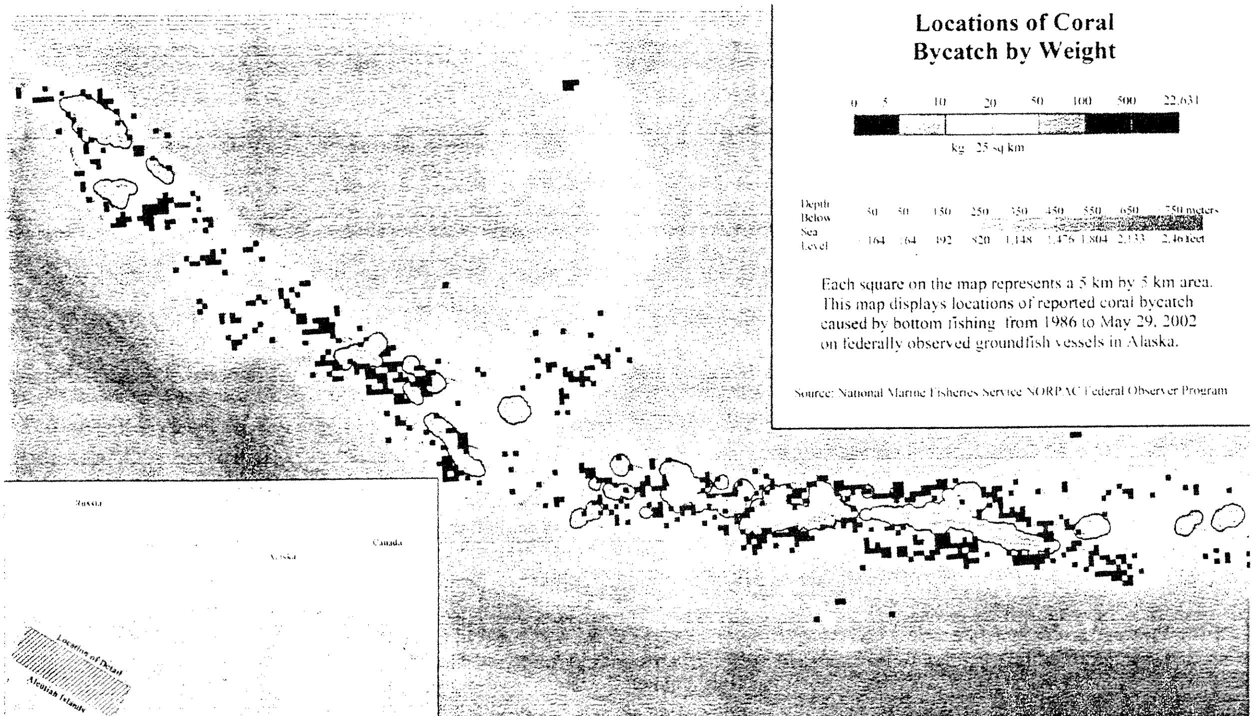

Figure 2. Coral bycatch in the Aleutian Islands reported by weight aggregated from 1986-2002. Data provided by NMFS NORPAC Federal Observer Program. Map produced by Conservation GIS Support Center, Anchorage, AK.

The three major trawl fisheries in the Aleutian Islands target Atka mackerel, Pacific cod, and rockfish (including Pacific Ocean perch, northern rockfish, and other rockfish). Estimated gross product revenue for trawl fisheries in the Aleutian Islands was $51.9 million in 2000 (J. Terry, NMFS economist, personal communication). The Aleutian Islands are split into three management areas roughly equivalent in size (Areas 541, 542, and 543) and totaling 1,004,130 km^2. In Alaska, the following species are known to associate with corals and sponges: rougheye rockfish, redbanded rockfish, shortraker rockfish, sharpchin rockfish, Pacific Ocean perch, dusky rockfish, yelloweye rockfish, northern rockfish, shortspine thornyhead, several species of flatfish, Atka mackerel, golden king crab, shrimp, Pacific cod, walleye pollock, greenling, Greenland turbot, sablefish, and various non-commercial marine species (Freese 2000; Krieger and Wing 2002; Heifetz 1999; Else et al. 2002; Heifetz 2002). Deep sea corals are known to provide protection from predators, shelter, feeding areas, spawning habitat, and breeding areas (Krieger and Wing 2002). Most corals caught in the Aleutian Islands region are gorgonian corals and hydrocorals, some of which are known to live for hundreds of years (Heifetz 2002; Andrews et al. 2002; Stone, personal communication).

It is well documented that the first pass of a trawl over sensitive habitat does far greater damage than subsequent passes (Moran and Stephenson 2000; NMFS 2004a). For this reason, the trawl industry has been quick to assert that current trawl effort is very patchy, and thus has a smaller impact on habitat because the same areas are trawled repeatedly. If this is indeed true, management measures that reduce the 'footprint' of trawl effort by maintaining the same patchy distribution over time are an effective way to prevent further damage to sensitive areas that have not yet been trawled. Therefore, management measures that identify specific open areas to trawling while closing other areas to trawling have the potential to maintain profitable fishing opportunities while protecting remaining pristine coral and sponge ecosystems. This 'open area' spatial management strategy for bottom trawling attains a high level of precaution when the complete distribution of coral and sponge ecosystems is not yet known, as is the case in most areas of the world. Figure 2 indicates that high amounts of coral and sponge bycatch in discrete areas (see areas in red and orange). In many cases, these "bycatch hotspots" do not occur in areas with high groundfish catch, indicating spatial heterogeneity in coral and sponge bycatch rates. These differences in bycatch rates are the basis for our hypothesis that it is possible to greatly reduce coral and sponge bycatch (and hence mitigate adverse effects on EFH) without major reductions in groundfish catch. The differences in bycatch rates between different areas likely reflect the heterogeneity in the spatial distribution of seafloor habitat types as well as commercial fish population densities.

The NMFS Alaska Region is currently in the process of completing an Environmental Impact Statement on Essential Fish Habitat Identification and Conservation in Alaska. This process, which is scheduled to be completed in 2006, will result in a document (EIS) containing a range of several alternatives, or policy options, for identifying EFH and HAPCs and minimizing adverse effects of fishing on EFH as required by law. The preliminary steps of the process included several stakeholder meetings and opportunities for public comment, with participation from the fishing industry, scientists, fishery managers, and conservation organizations including Oceana. Through an iterative process of acquiring data on trawl impacts and the known information about coral and sponge ecosystems in Alaska, Oceana advanced a policy proposal for protecting coral and sponge ecosystems from bottom trawling in the Aleutian Islands. The policy proposal model was developed with input from other scientists, fishing industry representatives, agency staff, and conservation organizations throughout the Essential Fish Habitat stakeholder process. We refer to the Oceana Approach as the principles and concepts contained in this proposal.

One of the alternatives being considered in the document (EFH mitigation Alternative 5B) incorporated the principles of the Oceana Approach in developing management measures for the Aleutian Islands. While the specific application of the Oceana Approach to this region was ultimately developed by NMFS, the authors believe it is an example of model habitat protection policy. By developing a habitat protection model for such a biologically exceptional area, we hoped to provide a model for protecting ocean habitat throughout the world. The Oceana Approach is offered as a general methodology for minimizing adverse impacts of fishing on EFH to the extent practicable, while Alternative 5B is a concrete example of how the Oceana Approach can be applied to a region that is currently experiencing major habitat impacts from bottom trawling.

Management components of the Oceana Approach

The Oceana Approach shifts fishery management to better reflect and coincide with the productive ecosystems that produce commercial fisheries. The approach is considered a first step in an effort to protect vulnerable EFH, such as deep sea coral and sponge ecosystems in the Aleutian Islands, from fishing gears known to be destructive to structural habitat features. The basic idea behind the Oceana Approach is to protect as much deep sea coral and sponge habitat as possible at the lowest cost to the fishing industry, including locations of these habitats that have not been discovered yet. Using available data to identify areas of high coral and sponge bycatch, Oceana developed a comprehensive management policy for deep sea coral and sponge protection. The Oceana Approach is a methodology for developing a comprehensive suite of management measures that reduce adverse impacts to EFH while maintaining vibrant fisheries. The five components of the Oceana Approach are:

1. Designated open areas to bottom trawling;
2. Trawl effort reduction to prevent increased trawl effort in remaining open areas;
3. Coral and sponge bycatch limits;
4. Additional monitoring and enforcement requirements including vessel monitoring systems (VMS), increased observer coverage, and electronic logbooks; and
5. A comprehensive research and mapping program to inform adaptive management efforts.

Detailed descriptions and methodologies of each policy component can be found below. While Oceana developed the concept for this approach, the details contained in the methodology used to formulate Alternative 5B were developed by NMFS (2004b) as noted.

1. Designated open areas to bottom trawling

The objectives of the spatial management components of the Oceana Approach are to mitigate adverse impacts on EFH from fishing by permitting destructive fishing practices only in designated open areas with high historic target species catch where bottom contact will do the least damage to habitat.

Identifying the potential capabilities of enforcement agencies are an essential first step in the process of considering the options for spatial management. If enforcement capabilities are strong and can be done at small spatial scales, it is possible to design management measures that reflect the resolution of spatial heterogeneity of seafloor habitats. However, if enforcement cannot be done at small spatial scales, it is necessary to design open and closed areas to different fishing gears with larger grid cells. There is a tradeoff in this policy choice. Enforcement of a complex system of small-scale open and closed areas may be very expensive, but may be better able to protect sensitive areas without major impacts on fishing opportunities. However, enforcement of broad-scale open and closed areas is easier and less costly, but removes many potential opportunities to protect sensitive habitat without closing major fishing grounds. We considered these costs and benefits and took into account the specific ecological and enforcement situation in the Aleutian Islands. Ultimately, the resolution of the spatial components of Alternative 5B were selected based on advice from the US Coast Guard, which recommended a Latitude/Longitude grid based on 3 minutes of latitude by 6 minutes of longitude (NPFMC 2003). This aligns with and subdivides existing ½ by 1 degree Alaska Department of Fish & Game statistical areas in the geo-reference system familiar to the fishing fleets, and is roughly equivalent to a 5 by 5 km block. This resolution is a compromise between cost of enforcement and the ability to capitalize on the spatial heterogeneity of seafloor habitat features.

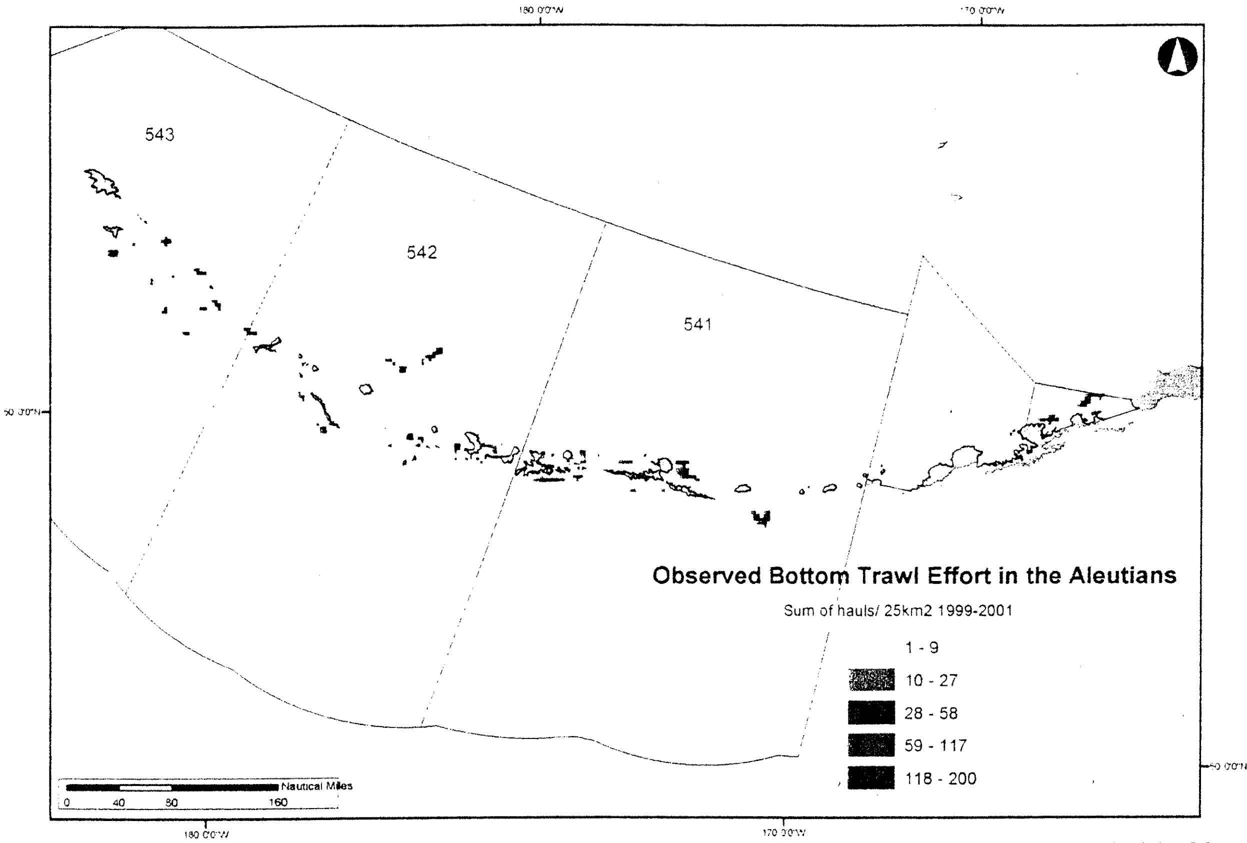

Figure 3. Observed bottom trawl effort in the Aleutian Islands management region from 1999-2001. Map provided by C. Coon, North Pacific Fishery Management Council.

The first objective of analysis is to identify areas of high and low relative economic importance to the trawl fleet. Two methods for identifying these areas are to determine the gross dollar value of fish caught annually or total number of tows over the period being analyzed. We obtained data on historic trawl effort from the Aleutian Islands to identify all grid blocks with less than a specified threshold level of fishing effort. The choice of years to use for the analysis should be broad enough to predict where the fleet is likely to be in the future and incorporate variation in fish locations over time. This increases the likelihood that the resulting policy will still work even if the fish move. Figure 3 shows an example map of trawl effort data for the Aleutian Islands region from 1999-2001 at a resolution of 5 by 5 km blocks. In areas where fishing locations are relatively static, such as continental slope areas, a shorter time series is likely encompass this variation, while on shelf habitats where fish may move over greater distances, a longer time series is more appropriate. However, it is important to note that more recent data may better reflect current fishing activity and areas where habitat interaction is greatest. Once the fishing effort time series has been selected and obtained, a threshold effort level must be selected.

This threshold specifies the level of effort in the block that is considered low enough that there will be minimal impact on the trawl fleet if the block is closed. For example, this threshold might be selected so that if closed may represent less than 1% of the historic effort, depending on what is considered minimal. Since the complete distribution of coral and sponge habitats in the Aleutian Islands and most other locations are not yet known, these areas are closed to bottom trawling in the Oceana Approach on the precautionary basis that they may contain important and sensitive habitat without representing a major loss to the trawl fleet. The idea is that some of these areas may be reopened in the future as additional research and mapping identifies areas that are not sensitive to trawl impacts (see Component 5 below). This approach will close extensive areas for fisheries that occur in specific concentrated locations, while it will close less area in fisheries that are prosecuted over a more widespread area. In the creation of Alternative 5B, NMFS kept all areas open that had greater than 10 trawl tows per grid cell over the years 1990-2001 and attempted to make these areas as linear as possible (least number of sides) (NMFS 2004b). Note that this threshold level chosen can dramatically influence the extent of closures and the associated reductions in groundfish catch. For a detailed description of the analysis and results of the spatial management components used in Alternative 5B, refer to NMFS (2004b). See Figure 4 for the version of a map of the resulting open and closed areas to bottom trawling being analyzed in Alternative 5B (NMFS 2004b).

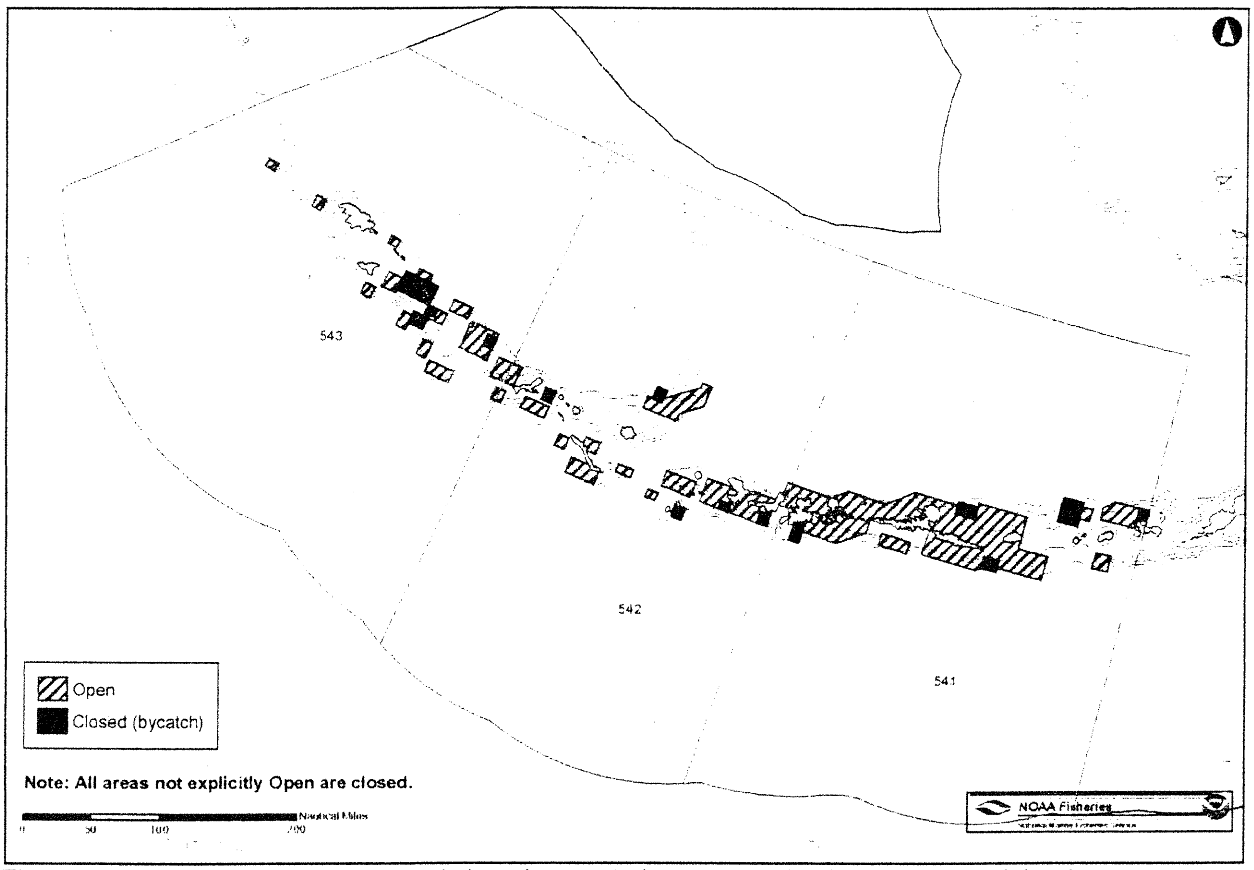

Figure. 4. Map of proposed open and closed areas to bottom trawling in the Aleutian Islands management areas in Alternative 5B, which was developed by NMFS using the Oceana Approach. Areas in white would be closed to bottom trawling on the precautionary basis that they contain less than one trawl tow per year, while potentially containing pristine deep sea coral and sponge ecosystems. Red areas would be closed to bottom trawling on the basis that the rate of coral or sponge bycatch per metric ton of groundfish catch exceeds a threshold set by NMFS. The blue striped areas are the areas that would remain open to bottom trawling on the basis that they have coral and sponge bycatch rates below the threshold set by NMFS, while incorporating most of the historic trawl effort in the region. Figure from January 2004 Draft Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska, NMFS. Figure 2-50, Chapter 2.

Careful examination of the differences in bycatch rates allows an informed selection of area closures that will provides the greatest mitigation of coral and sponge bycatch with the lowest impacts on trawl catch. To accomplish this objective, we developed two indices of habitat impact rates for each block that remains open. The first was the ratio of observed coral bycatch to observed total groundfish catch from 1990-2001. The second was the ratio of observed sponge bycatch to observed total groundfish catch from 1990-2001. These ratios represent a way to measure how much impact to EFH is caused per economic benefit gained by fishing. NMFS (2004b) used natural breaks in the data to determine a threshold value for each of the two indices. Note that the method employed by NMFS may be considered arbitrary since a desired level of bycatch reduction was not selected as a basis for the threshold. Ideally, threshold values should be selected based on a thorough examination of the costs and benefits associated with different threshold values. Blocks with an impact rate above the threshold for either index become closed to bottom trawling under this approach to ensure that bycatch reduction is cost effective. These closures are considered to be the areas where the adverse impacts of bottom trawling on EFH are truly mitigated. These areas are represented as the solid red areas in Figure 4. Note that the threshold level chosen can dramatically influence the extent of closures and the associated reductions in groundfish catch. The selection of this threshold value should reflect the extent to which mitigation is warranted as well as different economic costs associated with different potential threshold values. The essence of this approach is that for any specific level of bycatch reduction desired, this approach minimizes the necessary reduction in groundfish catch.

All remaining grid blocks (those that contained more than a minimum level of historic fishing effort and were below the threshold value for the coral and sponge impact indices) remain open to bottom trawling. These areas are represented by the striped blue areas in Figure 4. It is important to note that the open areas encompass areas where some coral and sponge bycatch has occurred. Ultimately, catching targeted species without contacting these habitats is the only way to protect the remaining deep sea coral and sponge ecosystems. The coral and sponge bycatch limits described below provide a mechanism to protect corals and sponges in remaining open areas. All existing closures and management measures remain in effect and should not be altered by this methodology.

2. Effort reduction

It is well established that area closures to protect habitat must be paired with effort reduction to offset the effects of displaced effort into the areas that remain open (NRC 2002). This objective can be accomplished in several ways, such as reducing the Total Allowable Catch (TAC) allocated to the bottom trawl fleet and/or by reallocating a percentage of the bottom trawl quota to less destructive gear types. Due to the controversial nature of the latter option, we recommended reducing bottom trawl effort in the Aleutian Islands through reductions in Total Allowable Catch (TAC) equal to the proportion of total catch that occurred in areas that would become closed to bottom trawling. For a detailed description of the analysis and results of the TAC reductions used in Alternative 5B, refer to NMFS (2004b). In summary, observer data from 1998-2002 were queried to estimate the percent of bottom trawl target species catch taken from areas that would be closed to bottom trawling under Alternative 5B. For each trawl fishery in the Aleutian Islands, trawl allocation of TACs was reduced proportionally to the historic catch that was caught in areas that would become closed.

This was straightforward for the Atka mackerel and rockfish fisheries, which have TACs specifically allocated in the Aleutian Islands. However, for Pacific cod, the TAC is currently allocated for the Bering Sea and Aleutian Islands areas combined. For this reason, we recommended splitting the TAC into two separate allocations (one for Bering Sea management areas and one for the Aleutian Islands management areas) and implementing the TAC reduction in the Aleutian Islands only. To meet the objective of preventing increased trawl effort in areas that remain open, TAC reductions are necessary only in regions where closures encompass historic fishing effort. Therefore, for TAC reductions to be cost effective, TACs must be allocated at the same regional scale to which the Oceana Approach is applied.

3. Coral and sponge bycatch limits

Currently there are no limits on the bycatch of corals and sponges anywhere in North America. As of May 2002, observer bycatch records from Alaska documented 535 instances since 1990 where an observer reported bycatch of over one metric ton of corals or sponges from a single trawl tow (J. Heifetz pers. comm. 2002). Since there are no bycatch limits or penalties for this bycatch, there is currently little economic incentive to avoid this unreasonably high bycatch particularly if the catch per unit effort of target species is relatively high. Though coral and sponge bycatch limits may appear to continue destruction of habitat, we offer this tool as one component of the first step in a comprehensive strategy to reduce and eventually eliminate damage to deep sea coral and sponge ecosystems while maintaining fisheries. The three main objectives of coral and sponge bycatch limits are to:

I. Create an incentive for trawlers to avoid setting their nets in coral and sponge habitat;
II. Ensure that the bycatch mitigated through area closures does not simply shift to areas that remain open; and
III. Provide a mechanism for future habitat protection and controls on habitat impacts by fishery managers through further reductions in bycatch limits in remaining open areas.

Essentially, bycatch limits set an incidental catch allowance while fishermen pursue commercial target species. In Alaska, groundfish fishery management already uses bycatch limits for other valuable species such as halibut, salmon, and crabs. Therefore, this management component of the Oceana Approach is merely an extension of a management tool already in place. In general, bycatch limits can be applied at a fleetwide, sector, co-operative, or individual vessel basis, and result in in-season and/or post-season consequences depending on observer coverage and enforcement capabilities.

Without estimates of the total biomass of corals and sponges or the amount of actual damage reflected in observed bycatch, it may be necessary to establish the limits based on historical bycatch data. We assumed that the bycatch that occurred in areas that would become closed (red areas in Figure 4) would be mitigated by the closures. Therefore, we recommend that only bycatch that historically occurred in remaining open areas should be used to determine initial bycatch limits.

For a detailed account of the development and results of the coral and sponge bycatch limits developed by NMFS in Alternative 5B, see NMFS (2004b). In the development of Alternative 5B, NMFS determined the limits by counting all historic coral and sponge bycatch, which results in substantially higher limits than if they were determined solely from areas that remain open (NMFS 2004b). Observed bycatch numbers were expanded relative to the proportion of observed to unobserved hauls to account for unobserved bycatch. Bycatch limits were set at or near the upper end of the observed annual bycatch levels. In some cases, the bycatch limits were reduced if there appeared to be outliers, defined as an annual bycatch estimate over 2 metric tons that was more than twice the amount estimated for any of the other years examined (NMFS 2004b).

One of the most important components of a successful bycatch limit strategy for corals and sponges is determining appropriate consequences for exceeding the cap, or incentives to keep bycatch below the cap. We considered in-season area or fishery closures, further TAC reductions in subsequent fishing seasons, and/or fines on individual vessels. Consequences applied at an individual vessel level may require 100% observer coverage and be more difficult to enforce, but ensure individual accountability. Conversely, fleetwide or sectorwide consequences may not provide proper incentives. NMFS (2004b) analyzed Alternative 5B by applying the bycatch limits by fishery and management area, using in-season closures of management areas to trawl fisheries that exceed the bycatch limit for either corals or sponges.

One potential unintended consequence of coral and sponge bycatch caps is that they may create an incentive for gear modifications that retain less bycatch without reducing habitat impacts (e.g., increased roller sizes that crush corals rather than catch them in trawl nets). For this reason, it is necessary to impose gear restrictions that prevent these types of modifications and consider gear conversion to off-bottom fishing. In simmary, the application of bycatch limits should be tailored to the particular circumstances of each fishery.

4. Monitoring and enforcement

Obtaining data on interactions with corals and sponges is essential to designing effective management measures, evaluating those measures, and improving the system over time. We recommend increasing observer coverage to the extent practicable, particularly for fisheries with high gear interactions with habitat. Increased observer coverage also has wide ranging benefits for overall fisheries and ecosystem-based management, particularly because it provides more statistical power in catch and bycatch estimates so managers have a better idea of what is actually happening in the water. Current requirements for observer coverage are based on vessel size, where 100% is required for vessels over 125 feet, 30% is required for vessels 60-125 feet, and 0% is required for vessels less than 60 feet (in addition, some fisheries are required to carry two observers due to Steller sea lion protection measures, which is considered 200% coverage). In Alternative 5B, observer coverage is increased to at least 100% for all trawl fisheries. Because it may be more costly for smaller vessels to carry observers, some compensation to vessels affected by this management measure should be considered.

Vessel monitoring systems (VMS) are a new technology that tracks the location and speed of fishing vessels over time. Requiring this technology for fishing fleets that interact with habitat serves two purposes. First, it allows another mechanism for enforcing open and closed areas by displaying the real time locations of vessels and whether the vessels have deployed their gear based on their speed. Second, it enables fishery managers to observe the precise tow locations fishermen are using. Combined with observer coverage, these data can show which tows are most successful for catching target species and the average level of coral and sponge bycatch associated with each tow. These data will also be invaluable for the adaptive management component described below.

Electronic logbooks can be used to augment observer and VMS data. It allows fishing captains to display the activities and catch associated with each location in real time, allowing more accurate monitoring and enforcement. This technology also provides data with greater spatial resolution, so managers can see more detailed trawl tow paths.

Use of these three management tools are key components of a comprehensive approach to habitat management and the benefits of their implementation are widespread to all components of fishery and oceans management. Strong monitoring and enforcement capabilities are crucial to the success of all other components of the Oceana Approach.

5. Research, seafloor mapping, and adaptive management

Research and mapping play an integral role in the Oceana Approach and provide a mechanism for the management measures to become more cost effective over time. It is imperative that we invest in research and mapping if we are to maintain and restore the health of ocean ecosystems. Several specific information-gathering objectives will increase the efficacy of the Oceana Approach in each application. Seafloor mapping that identifies living substrate habitat types is critical. This type of mapping may be done with sidescan sonar and multibeam scanning (see several other papers in this volume). Combined with ground-truthing activities such as submersible or remotely operated vehicle dives, this technology can reveal areas on the seafloor that may warrant additional protections as well as areas where bottom trawling may not have destructive impacts.

Examining habitat-specific gear impacts and potential gear modifications to mitigate these impacts will provide cost-effective solutions to the problem of habitat destruction. Understanding the impacts, severity, and effectiveness of various gear types may identify preferred gear types for each fishery and habitat type. Though the Oceana Approach is focused on reducing the impacts of bottom trawling on coral and sponge ecosystems, the principles can also be applied to other gear types if they are found to be destructive to seafloor habitat. Research may also inform decisions regarding the level of mitigation necessary for applying the Oceana Approach to other gear types in the future.

Research should also explore the community ecology of coral and sponge habitats, particularly the production functions between these biogenic habitat features and commercial fish species. Once the relationship between the productive capacity of commercial fisheries and the quality and quantity of vulnerable habitat features is better understood, management measures can be better designed to maintain and potentially enhance fisheries productivity. Basic biology and life history information is lacking for many deep sea coral and sponge species. Understanding growth rates, reproduction, dispersal, and ages of deep sea corals and sponges will provide estimates of recovery time for different habitat types. In summary, the Oceana Approach includes research and mapping on coral and sponge ecosystems that is focused on where it is, what it does, what damages it, and how long it takes to grow back.

In the long term, an adaptive management approach will improve the cost effectiveness of management measures described thus far. Adaptive management is the concept that management measures should be designed using whatever data are available and improved over time by collecting data to address remaining policy questions and scientific uncertainties (see Holling 1978; Walters 1986). The monitoring and enforcement components described above can be used to identify areas where bycatch rates are highest within areas that remain open. Additionally, they may also reveal more spatially explicit information on which areas have more and less relative effort. These data should be used to develop additional closed areas based on areas of higher bycatch rates and areas that become not as important to the fishery. Research and mapping components may be used to identify coral and sponge gardens within open areas that should become closed. As enforcement and monitoring capabilities improve with technological innovations, the scale of management, or the size of the grid blocks, should decrease so that management can take place at a resolution that better fits the patchiness of the seafloor habitat types and the spatial resolution of fishing effort.

In addition, the research and mapping components can be designed to provide opportunity for re-opening areas previously closed. Criteria for opening areas could be that they have either been mapped or thoroughly observed in situ and do not contain sensitive habitats such as corals and sponges. When research identifies gear modifications that reduce impacts on habitats while still catching fish, these modifications can be incorporated into the management regime.

Expected results of implementing the Oceana Approach

NMFS (2004c) conducted significant analysis of Alternative 5B, which they developed based on the Oceana Approach described above. In addition, specific numerical statistics regarding the analysis were provided to the authors (J. Kurland, Director, NMFS Alaska Region Habitat Conservation Division, personal communication). While these numbers may change with additional analysis, they provide an example of the results that can be expected of a habitat protection policy formulated using the Oceana Approach.

Alternative 5B would reduce the impact of bottom trawling over 82,023 km^2 of Aleutian Island seafloor habitat or 77.9 percent of the current fishable area of 105,243 km^2 (NMFS 2004c). If implemented, Alternative 5B would significantly reduce coral and sponge bycatch in trawl fisheries in the Aleutian Islands. NMFS estimates that 36% of the historic coral bycatch and 24% of the historic sponge bycatch from 1990-2001 occurred in areas that would become closed to bottom trawling under this alternative (J. Kurland, Director, Habitat Division, NMFS Alaska Region, personal communication). Since these areas as well as previously untrawled areas would become closed, these values represent the minimum level of bycatch reduction can be expected if this alternative is implemented. Bycatch caps based on historical levels from remaining open areas will provide insurance that this mitigation will actually occur. NMFS (2004b) calculated that the TAC reductions based on the average percentage of catch that occurred in closed areas from 1998 to 2001 would be:

- 6.0% for the Atka mackerel trawl fishery,
- 10.0% for the Pacific cod trawl fishery, and
- 12.0% for the rockfish trawl fisheries.

Therefore, the scale of coral and sponge bycatch reduction accomplished through the Aleutian Islands model is roughly three-fold greater than the reductions in groundfish catch imposed on the bottom trawl industry. The above results confirm our hypothesis that it is possible to design cost effective habitat protection measures by taking advantage of the fact that bycatch rates are spatially heterogeneous. This shows that it is possible to substantially mitigate the adverse impacts of fishing on Essential Fish Habitat while maintaining vibrant fisheries, assuming all other things being equal. These results would be expected to further improve through the adaptive management strategy described above.

Discussion

The Oceana Approach effectively reduces adverse impacts of bottom trawling on EFH at minimum cost to the bottom trawl industry, but is only a first step. As mentioned, some areas known to contain corals and sponges remain open to bottom trawling under this approach. To maintain the full productive capacity of fish habitat, fishermen must continue to reduce the ecosystem impacts of harvesting fish. Several scientists and managers have commented that it may be more appropriate to consider total coral and sponge bycatch rather than bycatch rates. While this may afford substantial protection to deep sea coral and sponge ecosystems, this will necessitate a greater reduction in TAC than would be necessary for the same reduction in bycatch using a rate threshold.

This approach contrasts approaches that apply random closures or closures in areas of highest trawl effort, while leaving all remaining areas open. For random closures, such as strip closures across depth strata, it is most likely that the percentage of TAC reduction and bycatch reduction are roughly equivalent to the percentage of area closed. For closures in areas of high trawl effort, it is likely that the economic costs will be high with small habitat benefit and possibly increased habitat impacts in remaining open areas if fishing effort is not reduced.

In contrast to the status quo fishing regime in the Aleutian Islands, Alternative 5B embodies a more precautionary approach that errs on the side of conservation particularly with regard to rare species and habitat types. Due to the patchiness of deep sea coral and sponge habitats and the high species richness observed at many sites, these ecosystems likely contain rare or endemic species that may be found no where else in the world. The recent discovery of several new species and even a new genus of corals from recent submersible expeditions in the Aleutian Islands shows this is not merely postulation (R. Stone, personal communication). Many of these species may also produce valuable cures to human diseases, climate change data, and genetic information (Witherell and Coon 2000). There also may be unique assemblages of deep sea coral and sponge species resulting in rare habitat types yet to be discovered. Protecting these unexplored, untrawled sites ensures that these unique, undiscovered species and habitat types will exist for the benefit of future generations. With recovery times in the hundreds to thousands of years, damage to these habitats is for all practical purposes irreversible on a management time scale. Therefore, although the full value to society of protecting coral and sponge ecosystems is not yet understood, the option value of protecting these vulnerable ecosystems may be far greater than the short-term costs imposed on the industry. If a less precautionary approach is taken, such as the status quo, it is likely that many of these rare habitats and unique ecological linkages will be gone before they are discovered.

Successful implementation of the Oceana Approach requires an investment in better fisheries management. Enforcement must be able to enforce open and closed areas at a high level of spatial resolution. Observer coverage must increase and training must include identification of invertebrates. Managers and fishermen must use the latest technologies, including vessel monitoring systems, electronic logbooks, and state of the art sounders. Incentives must be enforceable and significant. Management must be flexible enough to incorporate new information to improve the various policy components. There must be a commitment to research and seafloor mapping to guide the adaptive management process. This investment will ensure that we have productive fisheries and healthy ocean ecosystems for generations to come.

The Oceana Approach is recommended for application to other regions and should be adjusted based on available fishery and biological data for each region. For example, thresholds selected for defining open areas should be selected relative to the data for each region, rather than a specific number. It is useful to view the results using different threshold values to compare the costs and benefits. The essence of this threshold rate approach is that it optimizes bycatch reduction subject to any chosen economic cost constraint. In other words, for any level of economic costs fishery managers are willing to impose on the trawl industry, it is possible to choose specific maximize the protection of deep sea coral ecosystems.

Management measures designed using the Oceana Approach will be most effective in regions with accurate spatial records of coral and sponge bycatch, but the approach can also be applied at a coarser scale based on any level of available data. For example, if observer data are not available, trawl survey data may be used to determine the relative ratio of coral and sponge concentration to target species catch per unit effort. The approach works best in areas where fishery locations are relatively static, but can be tailored to more dynamic fisheries by incorporating longer time series in the determination of open areas. The methodologies described above could also potentially be applied to any gear type that may have adverse impacts to EFH. It can also be applied to other habitat features that are vulnerable to fishing activities. To do this, it is necessary to determine which features of EFH are vulnerable to disturbance, and the extent to which each gear type affects these features.

If there is indeed a positive functional relationship between deep sea coral and sponge ecosystems and commercial fish populations as suggested by the documented species associations, it is clear that the adverse impacts from bottom trawling are continuing to reduce the productivity of their own fisheries as well as fisheries prosecuted with other gear types. In the end, a sustainable groundfish fishery in the Aleutian Islands will require developing new fishing techniques that effectively harvest the fish without destroying the habitat the fish need to survive, reproduce, and grow to maturity. Considering the current political strength of the trawl industry in Alaska's fishery management context, the only way to stop bottom trawling on corals, sponges and seamounts may be to simply buy out the capacity. As in other resource conflicts such as groundfish collapses on the U.S. west coast and New England, federal buyouts are often the inevitable results of unsustainable resource management. The paradox is that while there may be economic incentives encouraging bottom trawling in deep sea coral and sponge habitats, the irreversible consequences of this destructive activity will ultimately hurt the economy. A truly sustainable human existence on this planet requires that we actively develop new policy approaches and technologies that provide opportunities to maintain the economy and catch fish without destroying natural habitats and ecosystems.

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Exhibit C.14
Situation Summary
April 2004

CLARIFY COUNCIL DIRECTION ON 2005-06 MANAGEMENT ALTERNATIVES (*IF NECESSARY*)

Situation: This is the second opportunity for the GMT and GAP to address the Council as they develop management alternatives for 2005-2006 groundfish fisheries. The Council will provide initial guidance on analyses needed to adopt a final range of 2005-2006 management measure alternatives under agendum C.10. This agendum provides an opportunity for the GMT and GAP to check in with the Council, if necessary, to complete needed analyses and address policy issues before recommending a final range of management measures under agendum C.15 on Friday. The Council task is to provide the GMT and GAP guidance and direction as they work through their analyses of 2005-2006 management alternatives.

Council Action:

1. **Provide guidance to the GMT and GAP as they work through their analyses of 2005-2006 management alternatives.**

References:

None.

Agenda Order:

a. Agendum Overview — John DeVore
b. GMT Report — Michele Robinson
c. Reports and Comments of Advisory Bodies
d. Council Guidance and Direction

PFMC
03/22/04

PRELIMINARY
GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON
2005-06 GROUNDFISH MANAGEMENT MEASURES

Based on the range of ABCs and OYs that the Council adopted, the GMT developed and discussed management measures for the 2005-06 commercial and recreational groundfish fisheries with the Groundfish Advisory Panel (GAP), and recommends the following:

CREATION OF NEW MANAGEMENT LINES

The GMT recommends that a new depth management line be created for the area south of 42° N. latitude (OR/CA border) at 40 fms.

CATCH SHARING AND HARVEST GUIDELINES

Based on the guidance provided by the Council and contained in the Allocation Committee report, the GMT has the following recommendations:

Black Rockfish Sharing Between Oregon and California
As in 2004, the GMT recommends carrying forward the black rockfish catch sharing recommendation of 58% to Oregon and 42% to California within the southern OY, and specifying those values as harvest guidelines in the federal regulations for the respective states. It is our understanding that the states of California and Oregon have factored in precautionary approaches in managing to these black rockfish targets.

Harvest Guidelines for Canary Rockfish
The GMT recommends that the Council set separate harvest guidelines for canary rockfish for the recreational fisheries, by state, which would be divided at the state borders (42° N latitude between CA and OR and at 46°16' N latitude between OR and WA). The understanding would be for the states to manage their respective recreational fisheries to stay within those harvest guidelines specified. The management response expected to be taken when the state recreational canary harvest guideline is projected to be exceeded is described under the recreational fisheries section of this report.

Harvest Guidelines for Lingcod
The GMT recommends that the Council set separate harvest guidelines for lingcod for the state recreational fisheries for 2005-06, by dividing the harvest guidelines into North (OR & WA) and South (CA) areas. These harvest guidelines would be divided at the CA and OR border. The understanding would be for the states to manage their respective recreational fisheries to stay within those harvest guidelines specified.

AREA-SPECIFIC MANAGEMENT MEASURES (i.e., "hotspots")

The GMT believes that more refined area-specific management should be considered for 2005-2006. Information collected through the federal observer program, state-sponsored EFPs, and data collected through other fishery dependent and independent sources continue to further define the locations of both target species and species of concern. Focusing fisheries in areas of high abundance of target species with relatively lower incidence of overfished species may provide both better fishing opportunity as well as conservation benefits than coordinates approximating broad depth strata. Additionally, the implementation of VMS provides us with a tool to accurately manage where fishing occurs.

The GMT plans to include a qualitative discussion of the use of "hotspots" for management in the 2005-06 Specifications Environmental Impact Statement (EIS). This analysis would include current descriptions of "hotspots," such as the Yelloweye Rockfish Conservation Area in Washington and the Cordell Banks and Cowcod Conservation Area in California. The potential use of "hotspots" could also be considered as inseason measures during the 2005 and 2006 fishing periods. One inseason implementation of "hotspots" could include closing areas of higher widow rockfish encounters in the shoreside whiting fishery.

COMMERCIAL MANAGEMENT MEASURES

The GMT recommends that the commercial trawl trip limits described in Attachment 1 be approved for review. The GMT also recommends status quo trip limits and management measures for the limited entry fixed gear and open access fisheries coastwide for 2005-06 (with the exception of Oregon nearshore management).

Conversion of Exempted Fishing Provisions into Federal Regulations

During its meetings in September and October 2003, and in February 2004, the GMT discussed the conversion of fisheries conducted under past exempted fishing permits (EFPs) into federal regulations that would apply fleetwide. The GMT focused its discussion primarily on the former Oregon Selective Flatfish Trawl EFP and the current Washington Arrowtooth Flounder Trawl EFP. The GMT recommends that the provisions and allowances provided for under these EFPs be adopted in federal regulations for the 2005-06 management period. The GMT has received presentations and written reports on the results from both of these EFPs and, because the data demonstrate that use of these gear configurations result in lower bycatch of overfished rockfish (particularly canary), the GMT believes these data should be used for management purposes.

The application of the new EFP bycatch rates, which are significantly lower in some cases than what is currently used in the bycatch model, will likely result in allowing higher trip limits for targeted flatfish species. The Oregon Selective Flatfish Trawl EFP results rely heavily on the use of the prescribed selective flatfish trawl gear used both in research activities and by EFP participants. The Washington Arrowtooth Flounder EFP also experimented with rockfish excluder devices with demonstrated success. Both of these EFPs allowed fishing in the trawl rockfish conservation area (RCA) using bycatch caps for overfished rockfish, 100% observer coverage, and mandatory rockfish retention as additional tools to ensure that the rockfish bycatch was measured and accounted for. The GMT recommends that, if fishing with these selective gears and/or excluders were provided for within the RCA, the Council adopt measures similar to the EFP provisions for bycatch caps, observer coverage and rockfish retention.

If fishing were confined to the area outside the RCA (shoreward and/or seaward), then the GMT does not recommend additional observer coverage above what is provided by the NMFS West Coast Groundfish Observer Program. The GMT believes that monitoring of bycatch caps is not accomplishable without 100% observer coverage and therefore should also not apply while fishing outside the RCA. Mandatory rockfish retention could still be required, however, monitoring of rockfish retention would be limited. The GMT believes that fishing outside the RCA may work for the Selective Flatfish Trawl as some flatfish are available nearshore, however, this option is likely not feasible for targeted arrowtooth flounder fishing which occurs in deeper waters. The GMT also notes that providing a Selective Flatfish Trawl and an Arrowooth Trawl fishery will require additional gear strata to be added to the NMFS Observer Program data analysis.

The GMT proposes that the shallow management line for the trawl RCA be moved seaward in 2005 and 2006 to 100 fms north of 40°10'. The only gears that would be permitted shoreward of the 100-fm boundary would be the Selective Flatfish Trawl and the Arrowtooth Trawl (i.e., small footrope trawl as currently defined would not be allowed shoreward of the RCA). The GMT recommends maintaining differential trip limits (principally for DTS species) between Selective Flatfish Trawl and other trawl gear because canary rockfish impact modeling suggests this is needed to allow fishing with the Selective Flatfish Trawl out to depths where flatfish stocks are most abundant (100 fathoms in some periods). Further, fishers using the Arrowtooth Trawl could access the trawl RCA provided that the provisions of the Arrowtooth Trawl proposal are met (including mandatory observer coverage, bycatch caps, and rockfish retention). A full detailed description of the Arrowtooth Trawl proposal is captured in Exhibit C.10.a., Attachment 2.

The California Selective Flatfish EFP was conducted in 2003 and is planned for 2004; pending review of the results of the data collected, the GMT recommends that consideration be given to apply the Selective Flatfish Trawl provisions off California south of 40°10' inseason in 2005 or 2006.

Oregon DTS EFP Results

Oregon's Trawl Discard Reduction EFP for the DTS fishery is being conducted in 2004. Pending review of the results of the data collected, the GMT recommends that consideration be given to the potential for converting this EFP into regulation inseason for 2006.

OREGON NEARSHORE MANAGEMENT

During 2005-06, the potential exists for major increases in nearshore commercial lingcod harvest, primarily with hook and line gear. Excessive lingcod harvest in this area could result in localized reef depletions, undesirable sport and commercial fishery conflicts, and undesirable bycatch impacts. Allowing too much harvest too quickly might also jeopardize the currently healthy stock status in the northern portion of the stock. The Oregon Department of Fish and Wildlife proposes the use of open access trip limits, differential lingcod size limits, or both, to limit increases in commercial lingcod harvest in nearshore rocky areas. In addition, ODFW will continue with the nearshore management strategies previously established for black rockfish, blue rockfish, other nearshore rockfish, cabezon and greenling for 2005 and 2006.

CALIFORNIA NEARSHORE MANAGEMENT

To simplify nearshore management and provide for a more stable fishery in 2005, it may be worthwhile to consider combining components of the shallow nearshore, deeper nearshore and CA scorpionfish complexes into a single nearshore rockfish complex. However, certain key species, such as black rockfish or black/blue rockfish may be considered for separate management. This would allow the nearshore fisheries to be managed on a finer geographic scale without creating an excessive number of harvest guidelines to track and manage.

Nearshore recreational fisheries in California have proved difficult to forecast in recent years, resulting in emergency actions by both state and federal jurisdictions. This has created a large workload for staff and has resulted in considerable confusion among the angling public. Inseason recreational management changes are difficult to convey to the public, resulting in low compliance with the modified regulations. Consequently, it may be advantageous to consider a season where the last 2 to 4 months of the year are closed. This could create a "buffer" against unexpectedly high inseason catches, provided that the open season was constructed so that the entire OY or HG was not expected to be taken within the proposed season. In this approach, if the fishery behaved as anticipated and did not exceed expected catches, then an in-season action would be taken to open the year-end months. This helps eliminate the problem with non-compliance in regard to inseason closures and other actions, and reduces staff workload compared to a closure.

RECREATIONAL MANAGEMENT MEASURES

As in 2004, the GMT believes that recreational fisheries measures for 2005 and 2006 should be intended to reduce take of overfished species, primarily bocaccio in the southern area, yelloweye rockfish in the northern area, and canary rockfish coastwide. Following advice received from the Council, the GMT recommends prohibiting retention of both canary and yelloweye rockfish. This prohibition is intended to discourage any targeting by recreational fisheries to reduce the potential of additional targeted catch of those species beyond true unavoidable catch, some of which would be expected to survive if encountered in shallow water. These prohibitions are recommended even in light of the fact that they result in creating some limited discard. This unavoidable discard mortality should be weighed against the benefit of removing incentives to target these species. The prohibitions are recommended to address the low and uncertain stock status of those species, the uncertainty in our ability to track actual removals in all fisheries and the disproportionate effects of recreational removals on rebuilding trajectories. Retention prohibitions for cowcod would also continue in 2005 and 2006.

Specific state recreational management measures include:

<u>Washington</u>
The Washington Department of Fish and Wildlife is proposing status quo regulations for its recreational fisheries in 2005 and 2006. These regulations are:

- 15 aggregate bottomfish bag limit
- 10 rockfish sublimit with no retention of canary or yelloweye rockfish

- 2 lingcod sublimit, with a minimum size limit of 24" and a status quo season
- Continuation of "C-Shaped" Yelloweye Rockfish Conservation Area off North Coast

If the harvest guidelines specified for Washington are projected to be exceeded, the Washington Department of Fish and Wildlife would take action inseason to close all or portions of the recreational fishery deeper than 30 fms.

<u>Oregon</u>
The Oregon Department of Fish & Wildlife is proposing status quo regulations for its recreational fisheries in 2005 and 2006. These regulations are:

<u>Status quo season:</u> Open all year at all-depths except closed outside of the 40-fathom curve from June 1 through September 30. Pacific halibut will be open at all-depths during authorized seasons. Possession of groundfish prohibited in waters deeper than the 40-fathom curve during the June through September offshore closure period.

If canary rockfish or yelloweye rockfish harvest guidelines are projected to be attained inseason, the fishery will close to inside the 30-fathom line to reduce impacts on these species.

<u>Daily Bag Limit:</u> 10 marine fish including rockfish, greenling, cabezon, Pacific halibut and other species, not including salmon species, lingcod, perch species, sturgeon, sand dabs, striped bass, tuna, and bait fish (herring, smelt anchovies and sardines). No retention of yelloweye rockfish and canary rockfish.

* Two lingcod daily bag limit

<u>Minimum Length Limits:</u>

* Lingcod: 24-inches
* Cabezon: 16-inches
* Greenling species: 10-inches

<u>Potential Inseason Changes</u>: The effect of changes in the structuring of the recreational fishery for the 2004 fishery (offshore closures, harvest guidelines, etc.) will not be known at the time of adopting 2005-06 management measures. The following are suggested management measures that could be implemented inseason if the 2005 (or 2006) fishery does not proceed as expected.

1. Reduce the period of closure periods outside of 40-fathoms if duration of total season is reduced from 12 months due to management of nearshore species. Impacts not to exceed harvest guidelines on overfished species.

2. Implement gear restrictions and/or release techniques to reduce the impact of overfished rockfish species if successful techniques are developed, researched, reviewed, and accepted. Impacts not to exceed harvest guidelines on overfished species.

3. If information is available, move from large offshore RCA closures to closing hot spots of

known canary rockfish and yelloweye concentrations OR open cold spots of areas known to have no or low concentrations of canary rockfish and yelloweye rockfish. Impacts not to exceed harvest guidelines on overfished species.

California

The California Department of Fish and Game is proposing options for the recreational structure for 2005-06 in relation to concerns for staying within harvest targets or harvest guidelines (HGs), particularly for species under rebuilding plans. This includes continued non-retention of canary and yelloweye rockfish statewide. In addition, the CDFG is considering the following:

- Manage recreational fisheries through a regional managment approach to address specific management and fishery needs in each of three Rockfish and Lingcod Management Areas (RLMAs) in the north (42° to 40°10'), central (40°10' to Pt. Conception), and South (Pt. Conception to Mexico border).
- Recombine the nearshore species groups of shallow NS, deeper NS, and California scorpionfish south of 40° 10' as follows:
    - Central RLMA: Black + blue RF; Other minor NS RF
    - Southern RLMA: Shallow + deeper NS RF, CA scorpionfish

- Designate recreational HGs for the nearshore species above for each of the three state management areas (may not be implemented until 2006)
- Consider managing on state-level cabezon and greenlings under one OY
- Lingcod: Consider establishing state harvest targets for the three state management areas within the CA lingcod HG
- Use conservative approach in constructing management options
- Build around a primary fishing season for each management area with more conservative regulations prior to and after the primary season
- Consider changes to lingcod size limit and remain with one fish bag limit

GMT Recommendations

1. Approve the GMT recommended recreational harvest guidelines for canary rockfish, black rockfish, and lingcod, and the boundaries for the regions.
2. Approve the GMT–proposed commercial management measure alternatives for public review.
3. Approve the alternatives to convert the Selective Flatfish Trawl and the Arrowtooth Trawl EFPs into federal regulations for public review.
4. Include an alternative that moves the shallow trawl RCA boundary to 100 fms north of 40°10', with the Selective Flatfish Trawl and the Arrowtooth Trawl as the only gears that are allowed shoreward of the RCA.
5. Approve the inclusion of the concept of "hotspot" area management as an alternative for possible inseason action for public review.
6. Approve the proposed state recreational management measure alternatives for public review.

7. Approve the proposed Oregon and California Nearshore management approaches for public review.
8. Identify Council-preferred management measures to help focus the analyses in the EIS.

Attachment 1, Table 1.--2005 trawl limits, regular trawl bycatch rates, High OYs

	bimo	inline	outline	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish
N. of 40°10'	1	75	150	11,000	15,000	3,600	63,000	No limit	No limit	100,000	8,000
	2	60	150	11,000	15,000	3,600	63,000	150,000	100,000	100,000	8,000
	3	60	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	4	75	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	5	75	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	6	75	150	11,000	15,000	3,600	63,000	No limit	No limit	100,000	8,000
small footrope				2,000	1,000	1,000	10,000	4,000	10,000	30,000	
				2,000	1,000	1,000	10,000	4,000	10,000	30,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				5,000	1,000	1,000	18,000	8,000	20,000	70,000	
38°-40°10	1	75	150	15,500	19,000	4,300	63,000	No limit	No limit	100,000	40,000
	2	75	150	15,500	19,000	4,300	63,000	10,000	20,000	100,000	40,000
	3	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	4	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	5	75	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	6	75	150	15,500	19,000	4,300	46,000	No limit	No limit	120,000	40,000
S. of 38°	1	75	150	15,500	19,000	4,300	63,000	No limit	No limit	100,000	40,000
	2	75	150	15,500	19,000	4,300	63,000	10,000	20,000	100,000	40,000
	3	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	4	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	5	75	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	6	75	150	15,500	19,000	4,300	46,000	No limit	No limit	120,000	40,000
Total catch											
N. of 40°10'				2,884	590	626	5,128	1,724	2,155	3,768	441
38°-40°10'				418	169	170	1,409	200	210	1,910	343
S. of 38°				293	116	112	775	12	26	216	57
Total				3,596	875	908	7,312	1,936	2,392	5,893	841
Landed catch											
N. of 40°10'				1,948	483	375	4,562	960	2,065	2,661	203
38°-40°10'				262	145	118	1,041	7	203	1,421	284
S. of 38°				209	101	78	641	1	26	152	48
Total				2,419	729	571	6,244	967	2,294	4,234	536

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	71	10	98	65	3	0	0	0
S. of 40°10'	36	1	0	13	0	0	16	0
Total	106	10	98	79	3	0	51	0

Attachment 1, Table 2.--2005 trawl limits, regular trawl bycatch rates, High OYs

	bimo	inline	outline	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish
N. of 40°10'	1	75	150	11,000	15,000	3,600	63,000	No limit	No limit	100,000	8,000
	2	60	150	11,000	15,000	3,600	63,000	150,000	100,000	100,000	8,000
	3	60	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	4	75	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	5	75	150	20,000	23,000	5,000	40,000	150,000	100,000	100,000	8,000
	6	75	150	11,000	15,000	3,600	63,000	No limit	No limit	100,000	8,000
small footrope				2,000	1,000	1,000	10,000	4,000	10,000	30,000	
				2,000	1,000	1,000	10,000	4,000	10,000	30,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				10,000	1,000	3,000	27,000	11,000	30,000	80,000	
				5,000	1,000	1,000	18,000	8,000	20,000	70,000	
38°-40°10	1	75	150	15,500	19,000	4,300	63,000	No limit	No limit	100,000	40,000
	2	75	150	15,500	19,000	4,300	63,000	10,000	20,000	100,000	40,000
	3	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	4	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	5	75	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	6	75	150	15,500	19,000	4,300	46,000	No limit	No limit	120,000	40,000
S. of 38°	1	75	150	15,500	19,000	4,300	63,000	No limit	No limit	100,000	40,000
	2	75	150	15,500	19,000	4,300	63,000	10,000	20,000	100,000	40,000
	3	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	4	100	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	5	75	150	15,500	19,000	4,300	46,000	10,000	20,000	120,000	40,000
	6	75	150	15,500	19,000	4,300	46,000	No limit	No limit	120,000	40,000
Total catch											
N. of 40°10'				2,884	590	626	5,128	1,724	2,155	3,768	441
38°-40°10'				418	169	170	1,409	200	210	1,910	343
S. of 38°				293	116	112	775	12	26	216	57
Total				3,596	875	908	7,312	1,936	2,392	5,893	841
Landed catch											
N. of 40°10'				1,948	483	375	4,562	960	2,065	2,661	203
38°-40°10'				262	145	118	1,041	7	203	1,421	284
S. of 38°				209	101	78	641	1	26	152	48
Total				2,419	729	571	6,244	967	2,294	4,234	536

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	71	10	98	65	3	0	0	0
S. of 40°10'	36	1	0	13	0	0	16	0
Total	106	10	98	79	3	0	51	0

2

Attachment 1, Table 3.--2005 trawl limits, selective trawl bycatch rates, Low OYs

Estimated Mortality by Species under the low option

	Species	North	South	Total
Rebuilding Species	Lingcod	45.9	25.9	71.8
	Canary	5.8	0.5	6.3
	POP	90.6	0.0	90.6
	Darkblotched	65.3	10.9	76.1
	Widow	2.2	0.1	2.3
	Bocaccio	0.0	13.6	13.6
	Y'eye	0.1	0.1	0.2
	Cowcod	0.0	0.4	0.4
Target Species	Sablefish	2,000	613	2,613
	Longspine	608	297	904
	Shortspine	632	277	909
	Dover	5,054	2,091	7,145
	Arrowtth	1,336	210	1,546
	Petrale	2,289	261	2,550
	Othr Flat	2,199	1,225	3,423
	Slope Rock	102	178	280

Bi-Monthly Limits and RCA Boundaries Under the Low Flatfish Option

SUBAREA	BIMO	INLINE	OUTLINE	Sablefish	Longspine	Shortspine	Dover	Othr Flat	Petrale	Arrowtooth	Slope Rock
N. 40o10	1	75	150	6,500	14,000	3,200	62,000	61,000	No Limit	100,000	4,000
	2	100	150	6,500	14,000	3,200	62,000	61,000	60,000	60,000	4,000
	3	100	150	16,000	23,000	5,000	35,000	61,000	60,000	60,000	4,000
	4	100	150	16,000	23,000	5,000	35,000	61,000	60,000	60,000	4,000
	5	100	150	16,000	23,000	5,000	35,000	61,000	60,000	60,000	4,000
	6	75	150	6,500	14,000	3,200	62,000	61,000	No Limit	100,000	4,000
Northern Small Footrope Limit	1	75	150	2,500	2,800	1,000	15,000	15,000	12,000	2,500	
	2	100	150	2,500	2,800	1,000	15,000	30,000	25,000	3,000	
	3	100	150	2,500	2,800	1,000	15,000	30,000	25,000	3,000	
	4	100	150	2,500	2,800	1,000	15,000	30,000	25,000	3,000	
	5	100	150	2,500	2,800	1,000	15,000	30,000	25,000	3,000	
	6	75	150	2,500	2,800	1,000	15,000	15,000	12,000	2,500	
38 - 40o10	1	75	150	6,500	14,000	3,200	49,000	61,000	No Limit	100,000	40,000
	2	100	150	6,500	14,000	3,200	49,000	61,000	60,000	60,000	40,000
	3	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	4	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	5	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	6	75	150	6,500	14,000	3,200	49,000	61,000	No Limit	100,000	40,000
S. 38	1	75	150	6,500	14,000	3,200	49,000	61,000	No Limit	100,000	40,000
	2	100	150	6,500	14,000	3,200	49,000	61,000	60,000	60,000	40,000
	3	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	4	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	5	100	150	16,000	23,000	5,000	49,000	61,000	60,000	60,000	40,000
	6	75	150	6,500	14,000	3,200	49,000	61,000	No Limit	100,000	40,000

Attachment 1, Table 4.--2005 trawl limits, selective trawl bycatch rates, High OYs

Estimated Mortality by Species under the High option

	Species	North	South	Total
Rebuilding Species	Lingcod	73.7	34.5	108.2
	Canary	9.0	0.7	9.7
	POP	99.4	0.0	99.5
	Darkblotched	76.1	12.0	88.0
	Widow	2.6	0.1	2.7
	Bocaccio	0.0	17.9	17.9
	Y'eye	0.2	0.1	0.4
	Cowcod	0.0	0.5	0.5
Target Species	Sablefish	2,537	771	3,308
	Longspine	601	297	898
	Shortspine	644	289	932
	Dover	5,032	2,091	7,124
	Arrowtth	1,655	210	1,865
	Petrale	2,413	261	2,674
	Othr Flat	4,172	1,910	6,082
	Slope Rock	102	178	280

Bi-Monthly Limits and RCA Boundaries Under the High Flatfish Option

SUBAREA	BIMO	INLINE	OUTLINE	Sablefish	Longspine	Shortspine	Dover	Othr Flat	Petrale	Arrowtooth	Slope Rock
N. 40o10	1	75	150	9,200	14,000	3,500	62,000	100,000	No Limit	No Limit	4,000
	2	100	150	9,200	14,000	3,500	62,000	100,000	100,000	100,000	4,000
	3	100	150	19,500	23,000	5,000	35,000	100,000	100,000	100,000	4,000
	4	100	150	19,500	23,000	5,000	35,000	100,000	100,000	100,000	4,000
	5	100	150	19,500	23,000	5,000	35,000	100,000	100,000	100,000	4,000
	6	75	150	9,200	14,000	3,500	62,000	100,000	No Limit	No Limit	4,000
Northern Small Footrope Limit	1	75	150	3,700	3,000	1,000	15,000	50,000	20,000	5,000	
	2	100	150	3,700	3,000	1,000	15,000	55,000	35,000	6,000	
	3	100	150	3,700	3,000	1,000	15,000	70,000	35,000	8,000	
	4	100	150	3,700	3,000	1,000	15,000	70,000	35,000	8,000	
	5	100	150	3,700	3,000	1,000	15,000	70,000	35,000	8,000	
	6	75	150	3,700	3,000	1,000	15,000	50,000	20,000	7,000	
38 - 40o10	1	75	150	9,200	14,000	3,500	49,000	100,000	No Limit	No Limit	40,000
	2	100	150	9,200	14,000	3,500	49,000	100,000	100,000	100,000	40,000
	3	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	4	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	5	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	6	75	150	9,200	14,000	3,500	49,000	100,000	No Limit	No Limit	40,000
S. 38	1	75	150	9,200	14,000	3,500	49,000	100,000	No Limit	No Limit	40,000
	2	100	150	9,200	14,000	3,500	49,000	100,000	100,000	100,000	40,000
	3	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	4	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	5	100	150	19,500	23,000	5,000	49,000	100,000	100,000	100,000	40,000
	6	75	150	9,200	14,000	3,500	49,000	100,000	No Limit	No Limit	40,000

4

California 2005-2006 Management Options

Northern Rockfish and Lingcod Management Area (NRLMA)

Commercial and Recreational

Black rockfish - catch sharing % of black rockfish with Oregon (status quo)
Minor Nearshore Rockfish

- Keep current management groups –OR-
- Manage as above plus establish NRLMA recreational harvest guidelines for each of the management groups

Cabezon and Greenlings

- Status quo -OR-
- Manage cabezon and greenlings on a state-level under one OY –OR-
- Manage cabezon and greenlings under one NRLMA OY

Recreational

Lingcod

- Manage as part of the regional recreational HG for CA and coastwide commercial OY –OR-
- Manage as above plus establish a NRLMA recreational harvest guideline

Canary and Yelloweye Rockfish

- Manage as part of the coastwide OY (status quo) -OR-
- Manage as part of the coastwide OY with catch sharing % between CA, OR, & WA

Depth Restrictions
Status Quo
No restrictions
Range from 0-20 fms to 0-60 fms

Seasons
Status Quo
Build to give the most fishing opportunity
Build around a primary fishing season (end of May – early September)

Central Rockfish and Lingcod Management Area (CRLMA)

Commercial and Recreational

Minor Nearshore Rockfish

- Keep current management groups -OR-

- Recombine shallow nearshore rockfish, deeper nearshore rockfish, and CA scorpionfish into two groups: black + blue rockfish and other minor nearshore rockfish –OR-
- Recombine shallow nearshore rockfish, deeper nearshore rockfish, and CA scorpionfish into one group –OR-
- Manage for one of the above plus establish CRLMA recreational harvest guidelines for each of the management groups

Cabezon and Greenlings
- Status quo -OR-
- Manage cabezon and greenlings on a state-level under one OY –OR-
- Manage cabezon and greenlings under one CRLMA OY

<u>Recreational</u>

Lingcod
- Manage as part of the regional recreational HG for CA and coastwide commercial OY –OR-
- Manage as above plus establish a CRLMA recreational harvest guideline

Canary and Yelloweye Rockfish
- Manage as part of the coastwide OY (status quo) -OR-
- Manage as part of the coastwide OY with catch sharing % between CA, OR, & WA

<u>Depth Restrictions</u>
Status Quo
No restrictions
Range from 0-20 fms to 0-60 fms

<u>Seasons</u>
Status Quo
Build to give the most fishing opportunity
Build around a primary fishing season (May – November)

<u>Southern Rockfish and Lingcod Management Area (SRLMA)</u>

<u>Commercial and Recreational</u>
Minor Nearshore Rockfish
- Keep current management groups -OR-
- Recombine shallow nearshore rockfish, deeper nearshore rockfish, and CA scorpionfish into two groups: shallow nearshore + deeper nearshore and California scorpionfish –OR-
- Recombine shallow nearshore rockfish, deeper nearshore rockfish, and CA scorpionfish into one group –OR-

- Manage for one of the above plus establish SRLMA recreational harvest guidelines for each of the management groups

Cabezon and Greenlings

- Status quo -OR-
- Manage cabezon and greenlings on a state-level under one OY –OR-
- Manage cabezon and greenlings under one SRLMA OY

<u>Recreational</u>

Lingcod

- Manage as part of the regional recreational HG for CA and coastwide commercial OY –OR-
- Manage as above plus establish a SRLMA recreational harvest guideline

Canary Rockfish

- Manage as part of the coastwide OY (status quo) -OR-
- Manage as part of the coastwide OY with catch sharing % between CA, OR, & WA

<u>Depth Restrictions</u>
Status Quo
No restrictions
Range from 0-20 fms to 0-60 fms

<u>Seasons</u>
Status Quo
Build to give the most fishing opportunity
Build around a primary fishing season (Nov-Feb: primarily rockfish; Mar-Apr, Nov-Dec: CA Scorpionfish)

Statewide Options

Cabezon

- Status quo OR
- Commercial slot limit
- Consider close during spawning season

Lingcod

- Close during spawning season for lingcod
    - Commercial line gear spawn season closure Nov 1 – May 1 (status quo)
    - Set different recreational spawning season (Nov 1 – Apr 1) OR
    - Align rec/com spawn closure by expanding rec to May 1 or reduce commercial to Apr 1)

Greenlings

- Close during spawning season

Tools - General

Seasons

- Status quo (match recreational and commercial seasons by area)
- Decouple recreational and commercial seasons and depths
- Use conservative approach in constructing season options
    - Build around a primary fishing season for each management area with more conservative regulations prior to and after the primary season

Bag Limits

- Status Quo
- Range: 4-10
- Consider CPFV differential bag limits (e.g. for CPFVs)

Attachment 1, Table 1.--2005 trawl limits, regular trawl bycatch rates, Low OYs

	bimo	inline	outline	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish
N. of 40°10'	1	75	150	8,000	15,000	3,600	63,000	No limit	No limit	57,000	8,000
	2	60	150	8,000	15,000	3,600	63,000	150,000	100,000	57,000	8,000
	3	60	150	15,000	23,000	5,000	33,000	150,000	100,000	57,000	8,000
	4	75	150	15,000	23,000	5,000	33,000	150,000	100,000	57,000	8,000
	5	75	150	15,000	23,000	5,000	33,000	150,000	100,000	57,000	8,000
	6	75	150	8,000	15,000	3,600	63,000	No limit	No limit	57,000	8,000
small footrope				4,000	1,000	1,000	20,000	4,000	15,000	57,000	
				4,000	1,000	1,000	20,000	4,000	15,000	57,000	
				6,500	1,000	1,500	33,000	6,000	20,000	57,000	
				6,500	1,000	1,500	33,000	6,000	20,000	57,000	
				6,500	1,000	1,500	33,000	6,000	20,000	57,000	
				4,000	1,000	1,000	20,000	4,000	15,000	57,000	
38°-40°10	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	57,000	40,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	57,000	40,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	5	75	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	57,000	40,000
S. of 38°	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	57,000	40,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	57,000	40,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	5	75	150	11,500	19,000	4,300	40,000	10,000	20,000	57,000	40,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	57,000	40,000
Total catch											
N. of 40°10'				2,129	590	622	4,810	1,649	2,136	2,311	441
38°-40°10				310	169	170	1,295	200	210	1,043	423
S. of 38°				218	116	112	709	12	26	127	51
Total				2,658	875	904	6,814	1,860	2,373	3,481	915
Landed catch											
N. of 40°10'				1,440	483	371	4,273	939	2,051	1,637	203
38°-40°10				194	145	118	959	7	203	774	346
S. of 38°				155	101	78	587	1	26	89	42
Total				1,789	729	567	5,818	946	2,280	2,499	592

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	57.1	8.0	86.4	2.2	57.4	0.1	0.0	0.0
S. of 40°10'	23.8	0.5	0.0	0.1	11.7	0.1	11.0	0.3
Total	80.9	8.5	86.4	2.3	69.1	0.2	42.0	0.3

ADOPTION OF 2005-06 MANAGEMENT ALTERNATIVES FOR PUBLIC REVIEW

Situation: This is the final step of three at this meeting (C.10 and C.14 being the other two) in the process to adopt a range of 2005-2006 groundfish management measure alternatives that will be fully analyzed in a Draft Environmental Impact Statement (DEIS). The adopted process and schedule for finalizing 2005-2006 management recommendations calls for a draft DEIS to be distributed in late May for public review and used to base final Council decision-making at the June Council meeting. The GMT and GAP are expected to recommend management measure alternatives with accompanying analyses intended to estimate resulting mortalities of groundfish stocks and complexes. The objective of these management measure alternatives is to meet, but not exceed the alternative harvest levels decided under agendum C.8. The Council task under this agendum is to adopt 2005-2006 management measure alternatives for formal analysis and public review.

Council Action:

1. Adopt 2005-2006 management measure alternatives for public review.

References:

None.

Agenda Order:

a.	Agendum Overview	John DeVore
b.	GMT Analysis of Impacts	Michele Robinson
c.	Reports and Comments of Advisory Bodies	
d.	Public Comments	
e.	**Council Action:** Adopt Management Alternatives for Public Review	

PFMC
03/22/04

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON 2005-06 GROUNDFISH MANAGEMENT MEASURES

Based on the range of ABCs and OYs that the Council adopted, the GMT developed and discussed management measures for the 2005-06 commercial and recreational groundfish fisheries with the Groundfish Advisory Panel (GAP), and recommends the following:

CREATION OF NEW MANAGEMENT LINES

The GMT recommends that a new depth management line be created for the area south of 42° N. latitude (OR/CA border) at 40 fms. The GMT also recommends a new latitudinal management line be specified at Pigeon Point (37°11'N lat.).

CATCH SHARING AND HARVEST GUIDELINES

Based on the guidance provided by the Council and contained in the Allocation Committee report, the GMT has the following recommendations:

Black Rockfish Sharing Between Oregon and California

As in 2004, the GMT recommends carrying forward the black rockfish catch sharing recommendation of 58% to Oregon and 42% to California within the southern OY, and specifying those values as harvest guidelines in the federal regulations for the respective states. It is our understanding that the states of California and Oregon have factored in precautionary approaches in managing to these black rockfish targets.

Harvest Guidelines for Canary Rockfish

The GMT recommends that the Council set separate harvest guidelines for canary rockfish for the recreational fisheries, by state, which would be divided at the state borders (42° N latitude between CA and OR and at 46°16' N latitude between OR and WA). The harvest guidelines would be:

WA = 1.7 mt
OR = 6.8 mt
CA = 9.3 mt

These values would remain constant across all canary rockfish OY alternatives. The understanding would be for the states to manage their respective recreational fisheries to stay within those harvest guidelines specified. The management response expected to be taken when the state recreational canary harvest guideline is projected to be exceeded is described under the recreational fisheries section of this report.

Harvest Guidelines for Lingcod

The GMT recommends that the Council set separate harvest guidelines for lingcod for the state recreational fisheries for 2005-06, by dividing the harvest guidelines into North (OR & WA) and South (CA) areas. These harvest guidelines would be divided at the CA and OR border. The GMT notes that the stock assessment area was divided at Cape Blanco, Oregon (43° N. latitude) and the OR/CA border is at 42° N. latitude. The

GMT developed and recommends a formula based on the CPUE data from the Resource Assessment and Conservation Engineering (RACE) survey from 1995-2001 to account for the amount of lingcod that should be transferred from the southern area to the northern area to account for the line shift. Applying this calculation to the Council's preferred OY for lingcod, results in the following base harvest targets:

Council OY = 2,414 mt
North of 43° (1,142) + amount for 42°-43° (107) = 1,801 mt (OR and WA)
South of 42° (719) - amount for 42°-43° (107) = 612 mt (CA)

From these base values, the recreational harvest guidelines would be specified and subtracted from the respective areas and the understanding would be for the states to manage their respective recreational fisheries to stay within those harvest guidelines specified. The remaining amounts from the two areas would then be pooled. The catch projections to accommodate the limited entry trawl, fixed gear, and open access fisheries at 2004 levels, and tribal fisheries would then be removed from the combined pool and managed on a coastwide basis. The GMT notes that the trawl fishery would be constrained by canary rockfish bycatch impacts and the fixed gear and open access fisheries would be constrained by yelloweye rockfish bycatch impacts; therefore, the amount of lingcod needed to accommodate those fisheries would be less than the amount that could be taken without those constraints. This will likely result in a substantial difference between the overall total of catch projections and the Council OY.

Harvest Guidelines for Yelloweye Rockfish

In response to the Council guidance, the GMT does not recommend using the values in the September 2003 scorecard for yelloweye rockfish as these amounts have not been updated would not accommodate status quo fisheries. Current estimated impacts are roughly equivalent for the three states. The GMT believes that the catch projections for state recreational fisheries, which would continue to have no retention allowances for yelloweye rockfish, could be accommodated under the OY alternatives for 2005 (26 mt) and 2006 (27 mt) approved by the Council under Amendment 16-3. Under this approach, the GMT workload would not be increased by having state-specific harvest guidelines. The GMT would appreciate clarification on the range of options to be analyzed relative to state recreational harvest guidelines among: 1) no harvest guidelines (consistent with the Allocation Committee report); 2) dividing the catch shares north (OR and WA) and south (CA); and 3) among all three states for public review.

AREA-SPECIFIC MANAGEMENT MEASURES (i.e., "hotspots")

The GMT believes that more refined area-specific management should be considered for 2005-2006. Information collected through the federal observer program, state-sponsored EFPs, and data collected through other fishery dependent and independent sources continue to further define the locations of both target species and species of concern. Focusing fisheries in areas of high abundance of target species with relatively lower incidence of overfished species may provide both better fishing opportunity as well as conservation benefits than coordinates approximating broad depth strata. Additionally, the implementation of VMS provides us with a tool to accurately manage where fishing occurs.

The GMT plans to include a qualitative discussion of the use of “hotspots” for management in the 2005-06 Specifications Environmental Impact Statement (EIS). This analysis would include current descriptions of “hotspots,” such as the Yelloweye Rockfish Conservation Area in Washington and the Cordell Banks and Cowcod Conservation Area in California. The potential use of “hotspots” could also be considered as inseason measures during the 2005 and 2006 fishing periods. One inseason implementation of “hotspots” could include closing areas of higher widow rockfish encounters for the whiting fishery during the primary season.

COMMERCIAL MANAGEMENT MEASURES

Limited Entry Trawl

The GMT recommends that the commercial trawl trip limits described in Attachment 1 be approved for review. The GMT also plans to consider increasing incidental catch allowances for rebuilding species as a result of the effort reduction from the buyback program as a potential management approach for 2005-06. The GMT will explore setting trip limits that would accommodate incidental catch levels without encouraging targeted fisheries in an effort to reduce bycatch while meeting rebuilding needs.

Limited Entry Fixed Gear and Open Access

The GMT recommends status quo trip limits and management measures for the limited entry fixed gear and open access fisheries coastwide for 2005-06 with the exception of state-specific nearshore and shelf management measures (see Attachment 2).

Tribal Fisheries

The GMT requests the flexibility to analyze options for the tribal fisheries consistent with the Council guidance provided for 2005-06 management measures, to include managing for status quo harvest levels for lingcod, canary rockfish, and yelloweye rockfish.

Conversion of Exempted Fishing Provisions into Federal Regulations

During its meetings in September and October 2003, and in February 2004, the GMT discussed the conversion of fisheries conducted under past exempted fishing permits (EFPs) into federal regulations that would apply fleetwide. The GMT focused its discussion primarily on the former Oregon Selective Flatfish Trawl EFP and the current Washington Arrowtooth Flounder Trawl EFP. The GMT recommends that the provisions and allowances provided for under these EFPs be analyzed for the 2005-06 management period. The GMT has received presentations and written reports on the results from both of these EFPs and, because the data demonstrate that use of these gear configurations result in lower bycatch of overfished rockfish (particularly canary), the GMT believes these data should be used for management purposes.

The application of the new EFP bycatch rates, which are significantly lower in some cases than what is currently used in the bycatch model, will likely result in allowing higher trip limits for targeted flatfish species. The Oregon Selective Flatfish Trawl EFP results rely heavily on the use of the prescribed selective flatfish trawl gear used both in research activities and by EFP participants. The Washington Arrowtooth Flounder EFP also experimented with rockfish excluder devices with demonstrated success. Both of these EFPs allowed fishing in the trawl rockfish conservation area (RCA) using bycatch caps for overfished rockfish, 100% observer coverage, and mandatory rockfish retention as additional tools to ensure that the rockfish bycatch was measured and accounted for. The GMT recommends that, if fishing with these selective gears and/or excluders were provided for within the RCA, the Council adopt measures similar to the EFP provisions for bycatch caps, observer coverage and rockfish retention.

If fishing were confined to the area outside the RCA (shoreward and/or seaward), then the GMT does not recommend additional observer coverage above what is provided by the NMFS West Coast Groundfish Observer Program. The GMT believes that monitoring of bycatch caps is not accomplishable without 100% observer coverage and therefore should also not apply while fishing outside the RCA. Mandatory rockfish retention could still be required, however, monitoring of rockfish retention would be limited. The GMT believes that fishing outside the RCA may work for the Selective Flatfish Trawl as some flatfish are available nearshore, however, this option is likely not feasible for targeted arrowtooth flounder fishing which occurs in deeper waters. The GMT also notes that providing a Selective Flatfish Trawl and an Arrowtooth Trawl fishery will require additional gear strata to be added to the NMFS Observer Program data analysis.

The GMT proposes that the shallow management line for the trawl RCA be moved seaward in 2005 and 2006 to 100 fms north of 40°10'. The only gears that would be permitted shoreward of the 100-fm boundary would be the Selective Flatfish Trawl (i.e., small footrope trawl as currently defined would not be allowed shoreward of the RCA). The GMT recommends maintaining differential trip limits (principally for DTS species) between Selective Flatfish Trawl and other trawl gear because canary rockfish impact modeling suggests this is needed to allow fishing with the Selective Flatfish Trawl out to depths where flatfish stocks are most abundant (100 fathoms in some periods). Further, fishers using the Arrowtooth Trawl could access the trawl RCA provided that the provisions of the Arrowtooth Trawl proposal are met (including mandatory observer coverage, bycatch caps, and rockfish retention). A full detailed description of the Selective Flatfish Trawl and the Arrowtooth Trawl proposals is captured in Exhibit C.10.a., Attachment 2.

The California Selective Flatfish EFP was conducted in 2003 and is planned for 2004; pending review of the results of the data collected, the GMT recommends that consideration be given to apply the Selective Flatfish Trawl provisions off California south of 40°10' inseason in 2005 or 2006.

<u>Oregon DTS EFP Results</u>

Oregon’s Trawl Discard Reduction EFP for the DTS fishery is being conducted in 2004. Pending review of the results of the data collected, the GMT recommends that consideration be given to the potential for converting this EFP into regulation inseason for 2006.

OREGON NEARSHORE MANAGEMENT

During 2005-06, the potential exists for major increases in nearshore commercial lingcod harvest, primarily with hook and line gear. Excessive lingcod harvest in this area could result in localized reef depletions, undesirable sport and commercial fishery conflicts, and undesirable bycatch impacts. Allowing too much harvest too quickly might also jeopardize the currently healthy stock status in the northern portion of the stock. The Oregon Department of Fish and Wildlife proposes the use of open access trip limits, differential lingcod size limits, or both, to limit increases in commercial lingcod harvest in nearshore rocky areas. In addition, ODFW will continue with the nearshore management strategies previously established for black rockfish, blue rockfish, other nearshore rockfish, cabezon and greenling for 2005 and 2006.

CALIFORNIA NEARSHORE MANAGEMENT

To simplify nearshore management and provide for a more stable fishery in 2005, it may be worthwhile to consider combining components of the shallow nearshore, deeper nearshore and CA scorpionfish complexes into a single nearshore rockfish complex. However, certain key species, such as black rockfish or black/blue rockfish may be considered for separate management. This would allow the nearshore fisheries to be managed on a finer geographic scale without creating an excessive number of harvest guidelines to track and manage.

Nearshore recreational fisheries in California have proved difficult to forecast in recent years, resulting in emergency actions by both state and federal jurisdictions. This has created a large workload for staff and has resulted in considerable confusion among the angling public. Inseason recreational management changes are difficult to convey to the public, resulting in low compliance with the modified regulations. Consequently, it may be advantageous to consider a season where the last 2 to 4 months of the year are closed. This could create a “buffer” against unexpectedly high inseason catches, provided that the open season was constructed so that the entire OY or HG was not expected to be taken within the proposed season. In this approach, if the fishery behaved as anticipated and did not exceed expected catches, then an in-season action would be taken to open the year-end months. This helps eliminate the problem with non-compliance in regard to inseason closures and other actions, and reduces staff workload compared to a closure.

RECREATIONAL MANAGEMENT MEASURES

As in 2004, the GMT believes that recreational fisheries measures for 2005 and 2006 should be intended to reduce take of overfished species, primarily bocaccio in the southern area, yelloweye rockfish in the northern area, and canary rockfish coastwide. Following advice received from the Council, the GMT recommends prohibiting retention of both canary and yelloweye rockfish. This prohibition is intended to discourage any targeting by recreational fisheries to reduce the potential of additional targeted catch of those species beyond true unavoidable catch, some of which would be expected to survive if encountered in shallow water. These prohibitions are recommended even in light of the fact that they result in creating some limited discard. This unavoidable discard mortality should be weighed against the benefit of removing incentives to target these species. The prohibitions are recommended to address the low and uncertain stock status of those species, the uncertainty in our ability to track actual removals in all fisheries and the disproportionate effects of recreational removals on rebuilding trajectories. Retention prohibitions for cowcod would also continue in 2005 and 2006.

Specific state recreational management measures include:

Washington

The Washington Department of Fish and Wildlife is proposing status quo regulations for its recreational fisheries in 2005 and 2006. These regulations are:

- 15 aggregate bottomfish bag limit
- 10 rockfish sublimit with no retention of canary or yelloweye rockfish
- 2 lingcod sublimit, with a minimum size limit of 24" and a status quo season
- Continuation of "C-Shaped" Yelloweye Rockfish Conservation Area off North Coast

If the harvest targets for canary and yelloweye specified for Washington are projected to be exceeded, the Washington Department of Fish and Wildlife would take action inseason to close all or portions of the recreational fishery deeper than 30 fms.

Oregon

The Oregon Department of Fish & Wildlife is proposing status quo regulations for its recreational fisheries in 2005 and 2006. These regulations are:

Status quo season: Open all year at all-depths except closed outside of the 40-fathom curve from June 1 through September 30. Pacific halibut will be open at all-depths during authorized seasons. Possession of groundfish prohibited in waters deeper than the 40-fathom curve during the June through September offshore closure period.

If canary rockfish or yelloweye rockfish harvest guidelines are projected to be attained inseason, the fishery will close to inside the 30-fathom line to reduce impacts on these species.

Daily Bag Limit: 10 marine fish including rockfish, greenling, cabezon, Pacific halibut and other species, not including salmon species, lingcod, perch species, sturgeon, sand dabs, striped bass, tuna, and bait fish (herring, smelt anchovies and sardines). No retention of yelloweye rockfish and canary rockfish.

* Two lingcod daily bag limit

Minimum Length Limits:

* Lingcod: 24-inches
* Cabezon: 16-inches
* Greenling species: 10-inches

Potential Inseason Changes: The effect of changes in the structuring of the recreational fishery for the 2004 fishery (offshore closures, harvest guidelines, etc.) will not be known at the time of adopting 2005-06 management measures. The following are suggested management measures that could be implemented inseason if the 2005 (or 2006) fishery does not proceed as expected.

1. Reduce the period of closure periods outside of 40-fathoms if duration of total season is reduced from 12 months due to management of nearshore species. Impacts not to exceed harvest guidelines on overfished species.
2. Implement gear restrictions and/or release techniques to reduce the impact of overfished rockfish species if successful techniques are developed, researched, reviewed, and accepted. Impacts not to exceed harvest guidelines on overfished species.

3. If information is available, move from large offshore RCA closures to closing hot spots of known canary rockfish and yelloweye concentrations OR open cold spots of areas known to have no or low concentrations of canary rockfish and yelloweye rockfish. Impacts not to exceed harvest guidelines on overfished species.

<u>California</u>
The California Department of Fish and Game is proposing options for structuring the 2005-2006 recreational groundfish fisheries in relation to concerns for staying within harvest guidelines (HGs), particularly for species under rebuilding plans. The range of options includes the following:

- Manage recreational fisheries through a regional management approach to address specific management and fishery needs in each of three Rockfish and Lingcod Management Areas (RLMAs): North (42° N. lat to 40°10' N. lat.); Central (40°10' N. lat to Pt. Conception); and South (Pt. Conception to Mexico border)
- In each management area, compose management groups from different combinations of nearshore species
- -Continued non-retention of cowcod, canary and yelloweye rockfish statewide
- Use a conservative management approach that incorporates preferred groundfish seasons, conservative regulations during non-preferred fishing time, and triggers within the regulations.
    - Establish triggers that are less than the harvest guideline that initiates a specified management response
- Establish regional regional harvest guidelines for the three management areas
- Within three RLMAs, use closed seasons, depth restrictions, bag limits, and size limits to manage recreational catch to specified harvest limits. Options to be considered include:
    - Some or all of spawning period closed for nesting species (lingcod, cabezon, greenlings (all species of the genus *Hexagrammos*)
    - For season and depth options, see Attachment x
        - Option 1: Divers and shore based fishing would be allowed during season closures
        - Option 2: Divers and shore based fishing would not be allowed during season closures
    - For bag limits:
        - Option 1: 20 finfish with 1 lingcod, 5 California scorpionfish, and 10 RCG (rockfish, cabezon, and greenling bag limit with sub-bag limit of 1 (south of 40° 10') - 2 (north of 40° 10') bocaccio, 3 cabezon, and 2 greenlings

- Option 2: Lingcod bag limit of 0 (low) to 2 (high), California scorpionfish bag limit of 5 (low) to 10 (high), and a RCG bag limit from 5 (low) to 10 (high) with sub-bag limit of 2 bocaccio, 3 cabezon and 2 greenlings
- Sub-option 2a: In addition to Option 2, explore possibility of including a sub-bag limit or separate bag limit for black rockfish
- Sub-option 2b: In addition to Sub-option 2a, explore possibility of including differential bag limits between recreational fishing sectors (shore based, private and rental boats, and party/charter boats)
  - For size limits:
    - Lingcod
      - Option 1: Status Quo (30 inches)
      - Option 2: 24-30 inches

Seasons

Option 1: Status Quo
Option 2: Range of from 2 months (low) to 10 months (high)
Sub-option 2a: structured to provide the most fishing opportunity
Sub-option 2b: structured around a preferred fishing season

Depth Restrictions

Option 1: Status Quo (0-30 fms)
Option 2: Within selected season structure, model fishing in 0-20 fms, 0-30 fms, 0-40 fms, 0-50 fms, or 0-60 fms

GMT Recommendations

1. Approve the new depth management line at 40 fms south of 42° N. latitude and the latitudinal line at Pigeon Point (37°11'N. lat.), California, for review.
2. Approve the GMT recommended recreational harvest guidelines for canary rockfish:
   WA = 1.7 mt
   OR = 6.8 mt
   CA = 9.3 mt
3. Approve the GMT recommended catch sharing for the southern black rockfish OY of 58% to Oregon and 42% to California for review.
4. Approve the GMT recommended catch sharing formula based on the Allocation Committee guidance for lingcod between the north (OR and WA) and the south (CA) with a management line at 42° N. latitude.
5. Approve the GMT recommended formula for accounting for the line shift for lingcod from Cape Blanco, Oregon (43° N. latitude) to the OR/CA border (42° N. latitude) based on the RACE survey data.
6. Approve the GMT recommendations for catch sharing of yelloweye

rockfish and specify the options for the state recreational fisheries for public review.

7. Approve the GMT–proposed limited entry trawl, limited entry fixed gear, tribal, and groundfish-directed open access management measure alternatives for public review.
8. Approve the alternative to convert the Selective Flatfish Trawl EFP for public review.
9. Approve the alternative to convert the Arrowtooth Trawl EFP into federal regulations for public review, with the assumption that it would require a separate rule-making process.
10. Include an alternative that moves the shallow trawl RCA boundary to 100 fms north of 40°10', with the Selective Flatfish Trawl as the only gear that is allowed shoreward of the trawl RCA.
11. Approve the inclusion of the concept of "hotspot" area management as an alternative for possible inseason action for public review.
12. Approve the proposed state recreational management measure alternatives for public review.
13. Approve the proposed Oregon and California Nearshore management approaches for public review.
14. Identify Council-preferred management measures to help focus the analyses in the EIS.

Attachment 1, Table 1.--2005 trawl limits and catch projections, using regular trawl bycatch rates and the **Low OYs**

	2-month period	RCA boundaries shallow	deep	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish	Chilipepper Lg. footrope
Trip limits												
N. of 40°10'	1	75	150	8,000	15,000	3,600	63,000	No limit	No limit	69,000	8,000	
	2	75	150	8,000	15,000	3,600	63,000	150,000	100,000	69,000	8,000	
	3	60	150	15,000	23,000	5,000	33,000	150,000	100,000	69,000	8,000	
	4	75	150	15,000	23,000	5,000	33,000	150,000	100,000	69,000	8,000	
	5	75	150	15,000	23,000	5,000	33,000	150,000	100,000	69,000	8,000	
	6	75	150	8,000	15,000	3,600	63,000	No limit	No limit	69,000	8,000	
small footrope	1	75	150	4,000	1,000	1,000	20,000	5,000	15,000	30,000		
	2	75	150	4,000	1,000	1,000	20,000	8,000	15,000	40,000		
	3	60	150	6,500	1,000	1,500	33,000	10,000	25,000	69,000		
	4	75	150	6,500	1,000	1,500	33,000	10,000	25,000	69,000		
	5	75	150	6,500	1,000	1,500	33,000	8,000	25,000	69,000		
	6	75	150	4,000	1,000	1,000	20,000	5,000	15,000	30,000		
38°-40°10	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	69,000	40,000	10,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	69,000	40,000	10,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	5	75	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	10,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	69,000	40,000	10,000
S. of 38°	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	69,000	40,000	10,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	69,000	40,000	10,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	5	75	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	10,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	69,000	40,000	10,000
Total catch												
N. of 40°10'				2,129	590	622	4,810	1,712	2,170	2,442	441	
38°-40°10				310	169	170	1,295	200	210	712	423	
S. of 38°				218	116	112	709	12	26	71	51	
Total				2,658	875	904	6,814	1,923	2,406	3,225	915	
Landed catch												
N. of 40°10'				1,440	483	371	4,273	958	2,080	1,724	203	
38°-40°10				194	145	118	959	7	203	530	346	
S. of 38°				155	101	78	587	1	26	50	42	
Total				1,789	729	567	5,818	965	2,308	2,305	592	

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	59.2	8.3	86.7	2.2	57.7	0.1	0.0	0.0
S. of 40°10'	19.9	0.4	0.0	0.1	11.2	0.1	38.7	0.3
Total	79.1	8.6	86.7	2.3	68.9	0.2	38.7	0.3

Attachment 1, Table 2.--2005 trawl limits and catch projections, using regular trawl bycatch rates and the **High OYs**

	2-month period	RCA boundaries shallow	deep	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish	Chilipepper Lg. footrope
Trip limits												
N. of 40°10'	1	75	150	11,000	15,000	3,600	62,000	No limit	No limit	110,000	8,000	
	2	60	150	10,000	15,000	3,600	62,000	150,000	100,000	110,000	8,000	
	3	60	150	18,000	23,000	5,000	39,000	150,000	100,000	110,000	8,000	
	4	75	150	18,000	23,000	5,000	39,000	150,000	100,000	110,000	8,000	
	5	75	150	18,000	23,000	5,000	39,000	150,000	100,000	110,000	8,000	
	6	75	150	10,000	15,000	3,600	62,000	No limit	No limit	110,000	8,000	
small footrope	1	75	150	2,000	1,000	1,000	10,000	5,000	10,000	40,000		
	2	60	150	2,000	1,000	1,000	10,000	8,000	15,000	60,000		
	3	60	150	10,000	1,000	3,000	27,000	10,000	20,000	70,000		
	4	75	150	10,000	1,000	3,000	27,000	10,000	15,000	60,000		
	5	75	150	10,000	1,000	3,000	27,000	8,000	15,000	70,000		
	6	75	150	5,000	1,000	1,000	18,000	5,000	10,000	70,000		
38°-40°10	1	75	150	14,000	19,000	4,300	62,000	No limit	No limit	120,000	40,000	10,000
	2	75	150	14,000	19,000	4,300	62,000	10,000	35,000	120,000	40,000	10,000
	3	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	4	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	5	75	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	10,000
	6	75	150	14,000	19,000	4,300	45,000	No limit	No limit	120,000	40,000	10,000
S. of 38°	1	75	150	14,000	19,000	4,300	62,000	No limit	No limit	120,000	40,000	10,000
	2	75	150	14,000	19,000	4,300	62,000	10,000	35,000	120,000	40,000	10,000
	3	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	4	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	5	75	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	10,000
	6	75	150	14,000	19,000	4,300	45,000	No limit	No limit	120,000	40,000	10,000
Total catch												
N. of 40°10'				2,650	590	626	5,031	1,712	2,066	4,106	441	
38°-40°10				378	169	170	1,382	200	220	2,016	343	
S. of 38°				265	116	112	760	12	26	235	57	
Total				3,293	875	908	7,172	1,923	2,312	6,357	841	
Landed catch												
N. of 40°10'				1,781	483	375	4,476	956	1,989	2,897	203	
38°-40°10				236	145	118	1,021	7	212	1,498	284	
S. of 38°				189	101	78	628	1	26	165	48	
Total				2,207	729	571	6,125	964	2,227	4,560	536	

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	69.0	9.3	97.1	2.5	64.7	0.1	0.0	0.0
S. of 40°10'	36.7	0.8	0.0	0.1	13.3	0.1	52.0	0.5
Total	105.6	10.1	97.1	2.6	77.9	0.3	52.0	0.5

Attachment 1, Table 3.--2005 trawl limits and catch projections, using selective flatfish trawl bycatch rates and the **Low OYs**

	2-month period	RCA boundaries shallow	RCA boundaries deep	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish	Chilipepper Lg. footrope
Trip limits												
N. of 40°10'	1	75	150	8,000	15,000	3,600	63,000	No limit	No limit	69,000	8,000	
	2	75	150	8,000	15,000	3,600	63,000	150,000	69,000	69,000	8,000	
	3	100	150	15,000	23,000	5,000	33,000	150,000	69,000	69,000	8,000	
	4	100	150	15,000	23,000	5,000	33,000	150,000	69,000	69,000	8,000	
	5	100	150	15,000	23,000	5,000	33,000	150,000	69,000	69,000	8,000	
	6	75	150	8,000	15,000	3,600	63,000	No limit	No limit	69,000	8,000	
small footrope	1			4,000	1,000	1,000	20,000	5,000	15,000	30,000		
	2			4,000	1,000	1,000	20,000	5,000	17,000	40,000		
	3			6,500	1,000	1,000	33,000	6,500	27,000	69,000		
	4			6,500	1,000	1,000	33,000	6,500	27,000	69,000		
	5			6,500	1,000	1,000	33,000	6,500	27,000	69,000		
	6			4,000	1,000	1,000	20,000	5,000	17,000	69,000		
38°-40°10	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	69,000	40,000	10,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	69,000	40,000	10,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	5	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	10,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	69,000	40,000	10,000
S. of 38°	1	75	150	11,500	19,000	4,300	63,000	No limit	No limit	69,000	40,000	10,000
	2	75	150	11,500	19,000	4,300	63,000	10,000	20,000	69,000	40,000	10,000
	3	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	4	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	12,000
	5	100	150	11,500	19,000	4,300	40,000	10,000	20,000	69,000	40,000	10,000
	6	75	150	11,500	19,000	4,300	40,000	No limit	No limit	69,000	40,000	10,000
Total catch												
N. of 40°10'				2,182	594	631	5,051	1,791	2,340	2,571	441	
38°-40°10				318	169	170	1,294	199	214	724	423	
S. of 38°				224	116	112	709	12	27	72	51	
Total				2,724	879	913	7,054	2,001	2,580	3,366	915	
Landed catch												
N. of 40°10'				1,501	485	375	4,474	1,023	2,237	1,798	203	
38°-40°10				195	145	118	959	7	206	538	346	
S. of 38°				156	101	78	587	1	26	50	42	
Total				1,852	731	571	6,020	1,031	2,469	2,387	592	

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	58.7	6.3	92.9	2.3	69.3	0.2	41 0.0	0.0
S. of 40°10'	20.5	0.4	0.0	0.1	11.2	0.1	10.6	0.3
Total	79.2537	6.6	92.9	2.4	80.6	0.2	10.6	0.3

Attachment 1, Table 4.--2005 trawl limits and catch projections, using selective flatfish trawl bycatch rates and the **High OYs**

	2-month period	RCA boundaries shallow	RCA boundaries deep	Sablefish	Longspine	Shortspine	Dover	Arrowtooth	Petrale	Other flatfish	Slope rockfish	Chilipepper Lg. footrope
Trip limits												
N. of 40°10'	1	100	150	10,000	15,000	3,600	62,000	No limit	No limit	100,000	8,000	
	2	75	150	10,000	15,000	3,600	62,000	150,000	100,000	100,000	8,000	
	3	75	150	20,000	23,000	5,000	39,000	150,000	100,000	100,000	8,000	
	4	75	150	20,000	23,000	5,000	39,000	150,000	100,000	100,000	8,000	
	5	75	150	20,000	23,000	5,000	39,000	150,000	100,000	100,000	8,000	
	6	100	150	10,000	15,000	3,600	62,000	No limit	No limit	100,000	8,000	
small footrope	1			2,000	1,000	1,000	10,000	6,000	15,000	50,000		
	2			2,000	1,000	1,000	10,000	8,000	20,000	60,000		
	3			10,000	1,000	3,000	27,000	11,000	20,000	75,000		
	4			10,000	1,000	3,000	27,000	11,000	20,000	75,000		
	5			10,000	1,000	3,000	27,000	11,000	17,000	75,000		
	6			5,000	1,000	1,000	10,000	8,000	15,000	75,000		
38°-40°10	1	75	150	14,000	19,000	4,300	62,000	No limit	No limit	120,000	40,000	10,000
	2	75	150	14,000	19,000	4,300	62,000	10,000	35,000	120,000	40,000	10,000
	3	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	4	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	5	75	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	10,000
	6	75	150	14,000	19,000	4,300	45,000	No limit	No limit	120,000	40,000	10,000
S. of 38°	1	75	150	14,000	19,000	4,300	62,000	No limit	No limit	120,000	40,000	10,000
	2	75	150	14,000	19,000	4,300	62,000	10,000	35,000	120,000	40,000	10,000
	3	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	4	100	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	12,000
	5	75	150	14,000	19,000	4,300	45,000	10,000	35,000	120,000	40,000	10,000
	6	75	150	14,000	19,000	4,300	45,000	No limit	No limit	120,000	40,000	10,000
Total catch												
N. of 40°10'				2,905	584	620	5,133	1,521	2,139	3,676	441	
38°-40°10				378	169	170	1,382	200	220	1,219	423	
S. of 38°				265	116	112	760	12	26	119	51	
Total				3,548	869	901	7,274	1,733	2,385	5,014	915	
Landed catch												
N. of 40°10'				1,893	478	376	4,569	782	2,044	2,605	203	
38°-40°10				236	145	118	1,021	7	212	909	346	
S. of 38°				189	101	78	628	1	26	84	42	
Total				2,318	724	572	6,218	789	2,282	3,598	592	

	Lingcod	Canary	POP	Widow	Darkblotched	Yelloweye	Bocaccio	Cowcod
Bycatch								
N. of 40°10'	88.8	9.8	93.5	2.6	74.4	0.3	44 ~~0.0~~	0.0
S. of 40°10'	27.2	0.6	0.0	0.1	12.4	0.1	12.3	0.4
Total	116.0	10.3	93.5	2.7	86.8	0.4	12.3	0.4

Attachment 2, Table 1.--Proposed 2005 sablefish primary fishery tier limits and projected bycatch of depleted species associated with all sablefish catch in the limited entry fixed-gear fishery: **Low Sablefish OY**.

	2120.050196	2494.36772	2664.574316						
	Seaward boundary of the RCA at 150 fm (South of 40°10')				Seaward boundary of the RCA at 100 fm (North of 40°10')				
	Coastwide summary	Gear rates and bycatch Longline	Pot	Combined bycatch	Coastwide summary	Gear rates and bycatch Longline	Pot	Combined bycatch	Coastwide bycatch
Total catch allocated (mt)	**2,120**				**2,120**				
Observed sablefish discard rate	18.49%	19.24%	17.82%		15.6%	14.12%	18.01%		
Discard mortality percentage of landed mt + discarded mt	**4.3%**	**4.5%**	**4.2%**		**3.6%**	**3.2%**	**4.2%**		
Assumed discard mortality (mt)	92				76				
Landed catch target (mt)	**2,028**				**2,044**				
Amount allocated to:									
DTL (mt)	304				307				
Primary fishery (mt)	**1,724**				**1,738**				
Primary fishery tier limits (lb)									
Tier 1	53,147				53,576				
Tier 2	24,158				24,353				
Tier 3	13,804				13,916				
Percent of total catch, by area	10.5%				89.5%				
Percent of area catch, by gear		90%	10%			60%	40%		
Estimated distribution of total catch, by area	222.61	200.34	22.26		1,897.44	1,138.47	758.98		
Bycatch ratios [2]									
Lingcod		0.391%	0.159%			0.400%	0.151%		
Widow rockfish		0.001%	0.000%			0.001%	0.000%		
Canary rockfish		0.041%	0.000%			0.042%	0.000%		
Yelloweye rockfish		0.087%	0.000%			0.089%	0.000%		
Bocaccio rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Cowcod rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Pacific ocean perch		0.017%	0.000%			0.017%	0.000%		
Darkblotched rockfish		0.041%	0.009%			0.041%	0.009%		
Projected bycatch impacts (mt)									
Lingcod		0.8	0.0	**0.8**		4.6	1.1	5.7	**6.5**
Widow rockfish		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Canary rockfish		0.1	0.0	**0.1**		0.5	0.0	0.5	**0.6**
Yelloweye rockfish		0.2	0.0	**0.2**		1.0	0.0	1.0	**1.2**
Bocaccio rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Cowcod rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Pacific ocean perch		0.0	0.0	**0.0**		0.2	0.0	0.2	**0.2**
Darkblotched rockfish		0.1	0.0	**0.1**		0.5	0.1	0.5	**0.6**

[1] As in previous years, the rate of mortality for discarded sablefish in the fixed-gear fishery is assumed to be 20%.
[2] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.
[3] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.2.
[4] Please note that the observer data on which these rates are based include no observations from south of Ft. Bragg, CA, so these are likely underestimates of true bycatch.

Attachment 2, Table 2.--Proposed 2005 sablefish primary fishery tier limits and projected bycatch of depleted species associated with all sablefish catch in the limited entry fixed-gear fishery: **Medium Sablefish OY**.

	Seaward boundary of the RCA at 150 fm (South of 40°10')				Seaward boundary of the RCA at 100 fm (North of 40°10')				
	Coastwide summary	Gear rates and bycatch Longline	Gear rates and bycatch Pot	Combined bycatch	Coastwide summary	Gear rates and bycatch Longline	Gear rates and bycatch Pot	Combined bycatch	Coastwide bycatch
Total catch allocated (mt)	**2,494**				**2,494**				
Observed sablefish discard rate	18.49%	19.24%	17.82%		15.6%	14.12%	18.01%		
Discard mortality percentage of landed mt + discarded mt	**4.3%**	**4.5%**	**4.2%**		**3.6%**	**3.2%**	**4.2%**		
Assumed discard mortality (mt)	108				89				
Landed catch target (mt)	**2,386**				**2,405**				
Amount allocated to:									
DTL (mt)	358				361				
Primary fishery (mt)	**2,028**				**2,045**				
Primary fishery tier limits (lb)									
Tier 1	62,531				63,035				
Tier 2	28,423				28,652				
Tier 3	16,242				16,373				
Percent of total catch, by area	10.5%				89.5%				
Percent of area catch, by gear		90%	10%			60%	40%		
Estimated distribution of total catch, by area	261.91	235.72	26.19		2,232.46	1,339.48	892.98		
Bycatch ratios [2]									
Lingcod		0.391%	0.159%			0.400%	0.151%		
Widow rockfish		0.001%	0.000%			0.001%	0.000%		
Canary rockfish		0.041%	0.000%			0.042%	0.000%		
Yelloweye rockfish		0.087%	0.000%			0.089%	0.000%		
Bocaccio rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Cowcod rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Pacific ocean perch		0.017%	0.000%			0.017%	0.000%		
Darkblotched rockfish		0.041%	0.009%			0.041%	0.009%		
Projected bycatch impacts (mt)									
Lingcod		0.9	0.0	**1.0**		5.4	1.3	6.7	**7.7**
Widow rockfish		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Canary rockfish		0.1	0.0	**0.1**		0.6	0.0	0.6	**0.7**
Yelloweye rockfish		0.2	0.0	**0.2**		1.2	0.0	1.2	**1.4**
Bocaccio rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Cowcod rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Pacific ocean perch		0.0	0.0	**0.0**		0.2	0.0	0.2	**0.3**
Darkblotched rockfish		0.1	0.0	**0.1**		0.6	0.1	0.6	**0.7**

[1] As in previous years, the rate of mortality for discarded sablefish in the fixed-gear fishery is assumed to be 20%.
[2] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.
[3] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.2.
[4] Please note that the observer data on which these rates are based include no observations from south of Ft. Bragg, CA, so these are likely underestimates of true bycatch.

Attachment 2, Table 3.--Proposed 2005 sablefish primary fishery tier limits and projected bycatch of depleted species associated with all sablefish catch in the limited entry fixed-gear fishery: **High Sablefish OY.**

	Seaward boundary of the RCA at 150 fm (South of 40°10')				Seaward boundary of the RCA at 100 fm (North of 40°10')				
	Coastwide summary	Gear rates and bycatch Longline	Gear rates and bycatch Pot	Combined bycatch	Coastwide summary	Gear rates and bycatch Longline	Gear rates and bycatch Pot	Combined bycatch	Coastwide bycatch
Total catch allocated (mt)	**2,665**				**2,665**				
Observed sablefish discard rate	18.49%	19.24%	17.82%		15.6%	14.12%	18.01%		
Discard mortality percentage of landed mt + discarded mt	**4.3%**	**4.5%**	**4.2%**		**3.6%**	**3.2%**	**4.2%**		
Assumed discard mortality (mt)	116				95				
Landed catch target (mt)	**2,549**				**2,569**				
Amount allocated to:									
DTL (mt)	382				385				
Primary fishery (mt)	**2,167**				**2,184**				
Primary fishery tier limits (lb)									
Tier 1	66,798				67,337				
Tier 2	30,363				30,608				
Tier 3	17,350				17,490				
Percent of total catch, by area	10.5%				89.5%				
Percent of area catch, by gear		90%	10%			60%	40%		
Estimated distribution of total catch, by area	279.78	251.80	27.98		2,384.79	1,430.88	953.92		
Bycatch ratios [2]									
Lingcod		0.391%	0.159%			0.400%	0.151%		
Widow rockfish		0.001%	0.000%			0.001%	0.000%		
Canary rockfish		0.041%	0.000%			0.042%	0.000%		
Yelloweye rockfish		0.087%	0.000%			0.089%	0.000%		
Bocaccio rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Cowcod rockfish [4]		0.000%	0.000%			0.000%	0.000%		
Pacific ocean perch		0.017%	0.000%			0.017%	0.000%		
Darkblotched rockfish		0.041%	0.009%			0.041%	0.009%		
Projected bycatch impacts (mt)									
Lingcod		1.0	0.0	**1.0**		5.7	1.4	7.2	**8.2**
Widow rockfish		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Canary rockfish		0.1	0.0	**0.1**		0.6	0.0	0.6	**0.7**
Yelloweye rockfish		0.2	0.0	**0.2**		1.3	0.0	1.3	**1.5**
Bocaccio rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Cowcod rockfish [4]		0.0	0.0	**0.0**		0.0	0.0	0.0	**0.0**
Pacific ocean perch		0.0	0.0	**0.0**		0.2	0.0	0.3	**0.3**
Darkblotched rockfish		0.1	0.0	**0.1**		0.6	0.1	0.7	**0.8**

[1] As in previous years, the rate of mortality for discarded sablefish in the fixed-gear fishery is assumed to be 20%.
[2] The bycatch ratios are calculated by dividing the total catch of each species by the total poundage of sablefish that was caught.
[3] Year specific tonnages combined using the following weights: 2003: 0.45, 2002: 0.35, 2001: 0.2.
[4] Please note that the observer data on which these rates are based include no observations from south of Ft. Bragg, CA, so these are likely underestimates of true bycatch.

Exhibit C.15.c
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON ADOPTION OF 2005-2006 MANAGEMENT ALTERNATIVES FOR PUBLIC REVIEW

The Groundfish Advisory Subpanel (GAP), after receiving guidance from the Council and discussing various options with the Groundfish Management Team (GMT), offers the following sets of options for 2005 - 2006 groundfish management. The GAP recommends adopting these along with the options presented by the GMT in order to have an appropriate range for public review.

LIMITED ENTRY TRAWL (non-whiting)

1. In general, specify trawl bimonthly trip limits reflecting low, medium, and high OY's that seek to minimize the area of the Rockfish Conservation Area (RCA), while maximizing the opportunity to harvest those species of groundfish that are available to be harvested and minimizing the take of those species that are considered to have low levels of abundance.
2. Examine use of the selective flatfish trawl (now known as the "butterfly trawl") shoreward of the RCA north of 40°10'.
3. Examine opportunities to eliminate any trip limit differentials for areas shoreward and seaward of the RCA.
4. Examine the option of converting the the Oregon Trawl Discard Reduction Exempted Fishing Permit (EFP) into regulations as an inseason adjustment for 2006.
5. Examine the option of converting the Washington arrowtooth flounder EFP into regulations.

LIMITED ENTRY TRAWL (whiting)

For 2005 and 2006, the whiting fishery will continue to be managed under the provisions of the Pacific groundfish fishery management plan, with allocations between three sectors (on-shore, catcher-processor, mothership) and a tribal set-aside. In the on-shore sector, an early season opportunity will be available for whiting harvest in northern California. The GAP notes that the regulatory regime for Pacific whiting may change substantially once the U.S./Canada Treaty on Pacific Hake/Whiting is implemented by the U.S. The U.S. will be allowed to harvest up to 73.88% of the coastwide acceptable biological catch (ABC), as provided by the Treaty.

In order to minimize interception of widow rockfish in the whiting fishery, two options should be examined:

A) continue existing management measures involving use of observers on catcher-processors and motherships, private services that monitor bycatch, and voluntary arrangements among shore plants and boats;

B) use the measures described above but add a series of closure areas which can be identified on the basis of latitude / longitude way points connected by straight lines and which encompass areas of high historical widow rockfish bycatch;

The GAP examined and rejected the idea of reducing widow rockfish bycatch by limiting fishing to certain hours. The periods when higher bycatch occurs are not uniform and cannot easily be identified or enforced. In order to ensure adequate enforcement, productive fishing times with low bycatch will have to be closed off. Interrupting product flow to at-sea processors will impose a significant economic impact.

LIMITED ENTRY FIXED GEAR, north of 40°10'

In general, the limited entry fixed gear fishery will continue to be managed through a combination of depth and gear restrictions, harvest limits, trip limits, size limits, and closures designed to prevent overfishing, while achieving the optimum yield.

1. Examine Rockfish Conservation Area boundaries identical to the range of options in 2004, plus 150 fathoms.
2. Set cumulative limits for all species identical to trawl limits, with the following exceptions:
   A) nearshore rockfish identical to open access limits;
   B) examine alternatives for longspine and shortspine thornyheads -
      1. limits identical to trawl limits
      2. limits reduced from trawl limits by the proportion of the trawl limit increase due to trawl buyback

LIMITED ENTRY FIXED GEAR, between 40°10' and 34°27'

1. Examine EFP opportunities to fish for chilipepper deeper than lines of 75, 100, and 125 fathoms in the area of 38° to 34°27'.
2. Set cumulative limits for all species identical to trawl limits, with the following exceptions:
   A) for minor shelf species, limits of 300 lbs / 2 mos with closures consistent with nearshore open access;
   B) examine alternatives for longspine and shortspine thornyheads -
      1. limits identical to trawl limits
      2. limits reduced from trawl limits by the proportion of the trawl limit increase due to trawl buyback

   C) examine harvest alternatives for chilipepper rockfish with closures consistent with nearshore open access. Since canary rockfish move into shallow water (less than 75 fathoms) in this area, data from fisheries that were allowed prior to canary rockfish being designated overfished can be instructive.

   D) examine harvest alternatives for bocaccio rockfish with closures consistent with nearshore open access. Canary rockfish are not generally present deeper than 75 fathoms; the RCA boundary in the south was constructed primarily for bocaccio savings. South of 40/10

LIMITED ENTRY FIXED GEAR, south of 34°27'

1. Examine a high OY option which would involve a year-round fishery out to 60 fathoms, closures of historic canary hot spots, and reduction in harvest limits or time closures when harvest limits are approached.

2. Examine a medium OY option which is the same as the high OY option, except with a 10 month fishery.
3. Examine a ~~medium~~ low OY option which is the same as the high OY option, except with a ~~10~~ 8 month fishery.

OPEN ACCESS, north of 40°10'

In general, the open access fishery will continue to be managed through a combination of depth and gear restrictions, harvest limits, size limits, trip limits, and closures designed to prevent overfishing while achieving the optimum yield.

1. Provide no retention of canary or yelloweye rockfish.
2. Provide no retention of lingcod in periods 1, and 6, with an option of a period 2 closure.

OPEN ACCESS, 40°10' TO 34°27'

1. Provide closures as appropriate for minor shelf rockfish, bocaccio, and lingcod
2. For minor slope rockfish, remove the landing cap of 25% of the weight of sablefish landed in the area between 40° 10' and 38°.

OPEN ACCESS, south of 34°27'

Option 1: establish the same range of trip limits and closures as provided for the limited entry fixed gear fishery in this area.
Option 2: establish differential trip limits for limited entry fixed gear and open access fisheries in this area.

WASHINGTON RECREATIONAL FISHERY

1. Lingcod, canary rockfish, and yelloweye to be managed on a state harvest guideline basis.
2. Black rockfish be managed on a status quo basis.

OREGON RECREATIONAL FISHERY

1. Implement gear restrictions and/or release techniques to reduce the impact of overfished rockfish species if successful techniques are developed, researched, reviewed, and accepted. Impacts not to exceed harvest guidelines on overfished species.

2. If information is available, move from large offshore RCA closures to closing "hot spots" of known canary rockfish and yelloweye concentrations or open "cold spots" of areas known to have no or low concentrations of canary rockfish and yelloweye rockfish impacts not to exceed harvest guidelines on overfished species.

CALIFORNIA RECREATIONAL FISHERY, IN GENERAL

If information is available, move from large offshore RCA closures to closing "hot spots" of known canary rockfish, yelloweye rockfish, and scorpionfish concentrations or open "cold spots" of areas known to have no or low concentrations of canary rockfish, yelloweye rockfish, and scorpionfish impacts, not to exceed harvest guidelines on overfished species.

CALIFORNIA RECREATIONAL FISHERY, 40°10' TO OREGON BORDER

1. High OY Option: Open all year, 10 rockfish bag limit of 5 black, 3 cabezon or greenling in any combination, two other species. Additional bag limit of 2 lingcod.

2. Medium OY option: Open May through September each year, same bag limit as High OY option.

3. Low OY option: Same as Medium OY, with an additional closure during any of the months of June, July, and August.

4. Under all options, no retention of canary or yelloweye rockfish will be allowed. Fishing will be contained inside 30 fathoms, with the option to move the fishery to inside 20 fathoms if canary rockfish catch approaches limits by midseason. Retention of ling cod to be banned if the harvest limit is near attainment.

MANAGEMENT OPTIONS FOR CENTRAL ROCKFISH AND LINGCOD MANAGEMENT AREA

1. Under all options, no retention of canary, cowcod, or yelloweye allowed.

2. In general, the fishery will be managed with a combination of season closures, bag limits, length limits, and depth restrictions. In order of priority, the months for openings are:

   A) July through October top priority.
   B) Add additional months in this order: November, June, December, January, February, May, March, and April.

HIGH OPTION:

Months	Bag Limit RF	Lingcod	Depths
12	10	2/24"	20/30/40/50 fm

MEDIUM OPTION:

Months	Bag Limit RF	Lingcod	Depths
8	10	2/24"	20/30/40 fm

LOW OPTION:

Months	Bag Limits RF	Lingcod	Depths
6	10	2/24"	20/30/40 fm

All options will include sand dab and flatfish (using same restricted gear) during closures.

Sub-option A: Allow shore and diver fishing during offshore closure.

Sub-option B: Close shore and diver fishing during offshore closure.

MANAGEMENT OPTIONS FOR SOUTHERN ROCKFISH AND LINGCOD MANAGEMENT AREA

1. Under all options, no retention of canary, cowcod, or yelloweye allowed.

2. In general, the fishery will be managed with a combination of season closures, bag limits, length limits, and depth restrictions. In order of priority, the months for openings are:

   A) March through August top priority.
   B) September and October second priority.
   C) Add additional months in this order: November then December

HIGH OPTION:

Months	Bag Limits RF	Lingcod	Depths
12	10	2/24"	20/30/40/50/60 fm

MEDIUM OPTION:

Months	Bag Limit RF	Lingcod	Depths
10 (March-Dec)	10	2/24"	20/30/40/50/60 fm

LOW OPTION:

Months	Bag Limits RF	Lingcod	Depths
8 (March-Oct)	10	2/24"	20/30/40/50/60 fm

All options will include sand dab and flatfish (using same restricted gear) during closures.

Sub-option A: Allow dive and shore fishing during offshore closures.
Sub-option B: Close dive and shore fishing during offshore closures.

Scorpionfish

Option 1: Open 6 months, July through December. 10 fish bag limit, 10" min size limit.
Option 2: Open 4 months, March-April, Nov-Dec, 5 fish bag limit, 10" min size limit.

Potential for Reduction in Widow Rockfish Bycatch in the Pacific Hake Fishery Using Bycatch Avoidance Areas

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Situation

The bycatch of widow rockfish in all sectors of the Pacific hake fishery has been significant in scale but variable among sectors (Table 1). However, there has also been a dramatic time trend of significant reduction in widow rockfish bycatch since 1999, likely due to a combination of factors including lower hake OYs, lower widow rockfish relative abundance, outreach by managers to inform fishers of rationale for bycatch reduction, and active avoidance of widow rockfish habitat by the fleet. Indeed, each sector has shown dramatic and consecutive reductions to the all-time low catches that occurred in 2003.

Table 1. Summary of the of the US Pacific hake fishery through 2003. Weights are in metric tons.

Year	Hake US optimum yield (mt)	Widow RF US optimum yield (mt)	Mothership Widow RF bycatch (mt)	Catcher/ Processor Widow RF bycatch (mt)	Shoreside Widow RF bycatch (mt)
1999	232,000	4,981	48.00	101.00	191.74
2000	232,000	4,291	151.00	70.00	82.54
2001	190,400	2,260	29.19	139.71	43.60
2002	129,600	853	20.50	115.10	5.32
2003	148,200	832	0.69	11.56	8.97

In spite of these reductions, the overfished status of widow rockfish and associated low OYs have placed the PFMC in the position of restricting the hake harvest in an effort to constrain the potential for high bycatch of widow rockfish for all sectors. Analysis by the Oregon Department of Fish and Wildlife may aid in this discussion by providing an alternative to reducing the hake OY by focusing on minimizing the bycatch of widow rockfish more directly.

We believe that reducing hake OY is an inefficient and ineffective method for reducing widow bycatch for the following reasons. Widow rockfish bycatch is rare, with almost all of the widow rockfish captured occurring in only a handful of tows. These high-bycatch tows are essentially random, so within a season there is no relationship between the amount of hake caught and the amount of widow rockfish encountered. Although the probability of a high-bycatch tow increases as more tows are conducted, only a few high-bycatch tows could easily exceed the expected catches for the fishery. One of the only predictable aspects of widow rockfish bycatch is where it occurs. On a gross scale, it occurs within the RCA, namely along rocky areas of the shelf break. We propose to use this geographic pattern in bycatch to predictably minimize bycatch in the future hake fishery.

Approach

We have taken a GIS approach to identifying locations along the coast in each sector that tend to show high bycatch rates. We used data from 1999-2003 from each sector. For each sector, catch of hake and widow rockfish from each tow plotted as low, med and high bycatch rates using logbook tow locations. Tows with zero bycatch are also shown so that the total distribution of fishing effort is visible. For shoreside sector trips with multiple tows, the bycatch rate was calculated for the trip and then indicated as low, med, and high for every tow of the trip from logbook data. This procedure was conducted for catcher processors (CP), mothership (MS) and shoreside (SS) sectors. Note however that because bycatch has decreased dramatically, most of the high-density areas (areas with yellow and red symbols) are made mainly tows from earlier years. None-the-less, these represent areas that show high bycatch rates through multiple years, and so are useful in defining areas where widow rockfish bycatch is more probable.

Several fishery characteristics are obvious in the GIS plot (Figure 1). First, the SS sector typically fishes shallower than the CP sector, but overlaps well with the MS sector. All sectors overlap almost completely in areas where the shelf or shelf break is especially narrow (*e.g.* Heceta Bank). Secondly, the CP fishery tends to fish the full latitudinal range from 42°N to 48°N, though the focus of their effort was to the north in 99-01 and to the south in 02-03.

We identified areas where widow bycatch was likely regardless of sector, and created boxes surrounding them for each of enforcement and compliance. We identified 4 boxes coastwide (red boxes in Figure 1). We then eliminated the tows within a given box, recalculated the mean annual bycatch rate for each sector and expanded for a simulated hake allocation of 91,350 mt SS, 73,950 mt CP and 52,500 mt MS (based on 2004 allocation). The bycatch rate was determined using the same methodology developed by the GMT in March for the 2004 hake allocation (40%: '03, 30%: '02, 20%: '01, 10%: '00).

Results show that much of the widow bycatch can be isolated in these areas (Table 2-attached). The locations of high bycatch were different for each sector, but significant reductions could be made with any box. Because little difference in bycatch would be expected if vessels from any sector fished in these areas, we recommend that these areas be considered high bycatch areas for the fishery, not for any specific sector. The resulting decrease in widow rockfish bycatch is shown in Table 3. Of course, closing the entire RCA

Table 3. Estimated bycatch of widow rockfish (mt) in the Pacific hake fishery in 2004 after closure of areas with historically high bycatch rates.

Option	Shoreside	Mothership	Catcher-Processor	Total Estimated Widow	% Reduction
No Closure	25.90	55.07	391.41	472.38	
Box 1 Only	24.96	10.06	130.82	165.84	65%
Box 2 Only	24.21	19.87	74.59	118.67	75%
Box 3 Only	29.60	20.55	62.62	112.77	76%
Box 4 Only	25.81	18.54	148.20	192.55	59%
Entire RCA	6.77	10.20	27.58	44.55	91%

to midwater fishing had the largest impact, similar to the results in the poster presentation by Wiedoff and Parker (2004). Also note the relatively minor differences in hake bycatch rate expected after exclusion of any area. Therefore, the relative effectiveness of the closure areas is due mainly to the avoidance of widow rockfish bycatch, not to changes in the hake catch rate.

Risks

One potential risk for closing some areas to fishing is that of increasing bycatch of some other species as the fishing effort shifts to other areas. Bycatch of other species is also patchy in time and space (Figure 2). Although not analyzed here, bycatch of yellowtail rockfish occurs in similar areas with widow rockfish, so some overall decrease in yellowtail rockfish bycatch would be expected. Bycatch of young sablefish is more dependent on large year classes which analysis suggests is predictable a year in advance and can be addressed in that way.

Our work indicates that the mean rate of hake catch/h is the same inside and outside bycatch avoidance areas and so no increase in fishing time should result from closing any or all bycatch avoidance areas. Aside from changes in where they can fish and changes in travel time, we do not see a pronounced effect of this approach on fishing efficiency.

Of course there is always the risk of encountering high bycatch of widow rockfish even when fishing outside the bycatch avoidance areas. However, this risk is less when fishing outside bycatch avoidance areas than if fishing anywhere with a lower hake OY.

The bycatch rates presented do not incorporate the variation in bycatch for each sector. Therefore, small changes in the rate, or estimated catch should not be viewed as significant. Also, in 2002 the CP sector experienced one large tow that accounts for almost 80 of its bycatch. The presence of this tow dramatically changes the bycatch rates for that year and the corresponding predicted rate. We excluded that tow, but show what the average 2002 rate would have been in the margin with an asterisk.

Recommendations

- Identification and avoidance of bycatch avoidance areas allows the fishery to avoid known areas of high widow bycatch using midwater trawl gear. The resulting decrease in widow rockfish bycatch is fairly predictable and should not be impacted by the scale of the hake OY.
- We recommend that the number of closure areas be the minimal number needed. The number of bycatch avoidance areas chosen is up to the council process, but because of enforcement issues and the likelihood that the time-trend in bycatch is a major factor influencing bycatch.
- Bycatch avoidance areas chosen should apply to all hake sectors because fishing in an identified zone by any sector is likely to produce higher bycatch.

Table 2.

Calculations of estimated widow bycatch for the Pacific hake fishery in 2004 based on a weighted widow bycatch rate (kg/h) and weighted hake bycatch rate (mt/h). Note one large (80 mt) CP tow in 2002 severely changes bycatch rates, this tow is exluded from analysis, though the real average is given as a note.

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
NO CLOSURES	2004 Allocation (mt)	N=1598		91,350	N=4290		52,500	N=3626		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	31.167	42.489	10%	93.283	26.926	10%	49.103	25.639	
	2001	20%	35.528	35.547	20%	40.805	29.277	20%	636.273	50.079	
	2002	30%	3.712	47.187	30%	84.855	38.161	30%	560.982	55.77	
	2003	40%	7.781	63.625	40%	17.768	69.307	40%	47.552	77.622	
	Total catch rate		14.45	50.96		50.05	47.72		319.48	60.36	
	Hours fishing needed			1792.43			1100.19			1225.16	
	Estimated Widow (mt)		25.90			55.07			391.41		472.38

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
CLOSE BOX 1	2004 Allocation (mt)	N=1569		91,350	N=3512		52,500	N=3296		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	26.623	41.591	10%	13.19	25.627	10%	13.474	27.056	
	2001	20%	36.018	35.182	20%	15.731	28.969	20%	156.359	48.323	
	2002	30%	3.03	47.269	30%	12.658	36.802	30%	236.791	56.071	
	2003	40%	7.781	63.625	40%	2.421	71.937	40%	7.822	77.928	
	Total catch rate		13.89	50.83		9.23	48.17		106.79	60.36	
	Hours fishing needed			1797.30			1089.85			1225.09	
	Estimated Widow (mt)		24.96			10.06			130.82		165.84

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
CLOSE BOX 2	2004 Allocation (mt)	N=1535		91,350	N=4212		52,500	N=3471		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	32.166	43.212	10%	51.874	26.867	10%	20.99	25.646	
	2001	20%	31.644	35.147	20%	16.096	29.277	20%	197.543	41.338	
	2002	30%	3.844	47.699	30%	27.695	38.161	30%	47.953	55.705	*238.784
	2003	40%	7.607	65.458	40%	3.356	69.307	40%	7.76	77.622	
	Total catch rate		13.74	51.84		18.06	47.71		59.10	58.59	
	Hours fishing needed			1762.03			1100.32			1262.11	
	Estimated Widow (mt)		24.21			19.87			74.59		118.67

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
CLOSE BOX 3	2004 Allocation (mt)	N=1189		91,350	N=4068		52,500	N=3207		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	27.929	40.419	10%	49.108	26.854	10%	16.772	23.533	
	2001	20%	35.298	37.78	20%	15.828	29.322	20%	192.689	49.669	
	2002	30%	4.598	43.345	30%	25.514	37.214	30%	25.239	55.666	*229.824
	2003	40%	10.98	59.03	40%	2.876	58.541	40%	7.618	77.606	
	Total catch rate		15.62	48.21		16.88	43.13		50.83	60.03	
	Hours fishing needed			1894.70			1217.24			1231.90	
	Estimated Widow (mt)		29.60			20.55			62.62		112.77

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
CLOSE BOX 4	2004 Allocation (mt)	N=1539		91,350	N=3804		52,500	N=3249		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	31.537	42.811	10%	50.404	26.669	10%	20.838	25.639	
	2001	20%	37.311	36.502	20%	9.208	30.369	20%	217.762	55.605	
	2002	30%	2.81	47.652	30%	27.695	38.161	30%	245.919	56.645	
	2003	40%	8.061	65.248	40%	3.658	67.41	40%	9.416	76.967	
	Total catch rate		14.68	51.98		16.65	47.15		123.18	61.47	
	Hours fishing needed			1757.53			1113.40			1203.12	
	Estimated Widow (mt)		25.81			18.54			148.20		192.55

Option		Shoreside			Mothership			Catcher-Processor			Total Widow
CLOSE RCA	2004 Allocation (mt)	N=802		91,350	N=1432		52,500	N=1693		73,950	
	Year	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	Weighting	Widow (kg/h)	Hake (mt/h)	
	2000	10%	31.304	42.292	10%	43.22	22.451	10%	15.759	25.99	
	2001	20%	4.446	35.534	20%	7.045	30.064	20%	60.575	43.957	
	2002	30%	0.14	53.898	30%	7.089	34.415	30%	23.075	40.895	*998.662
	2003	40%	0.236	71.378	40%	1.423	62.028	40%	5.228	93.061	
	Total catch rate		4.16	56.06		8.43	43.39		22.70	60.88	
	Hours fishing needed			1629.60			1209.86			1214.62	
	Estimated Widow (mt)		6.77			10.20			27.58		44.55

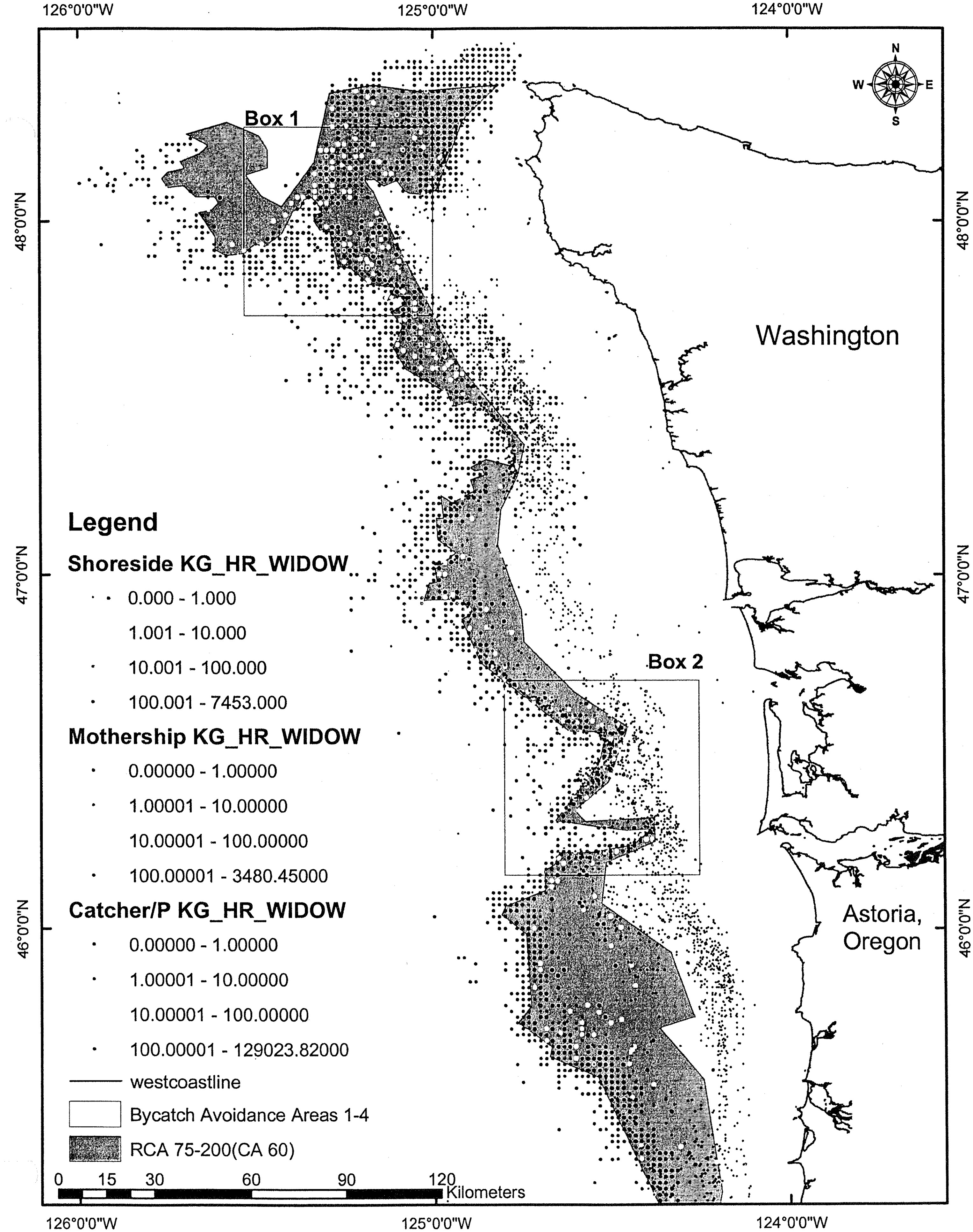


Figure 1. Tow distribution for Pacific Hake Fishery 1999-2003. Rates are kg of widow rockfish/hr towed.

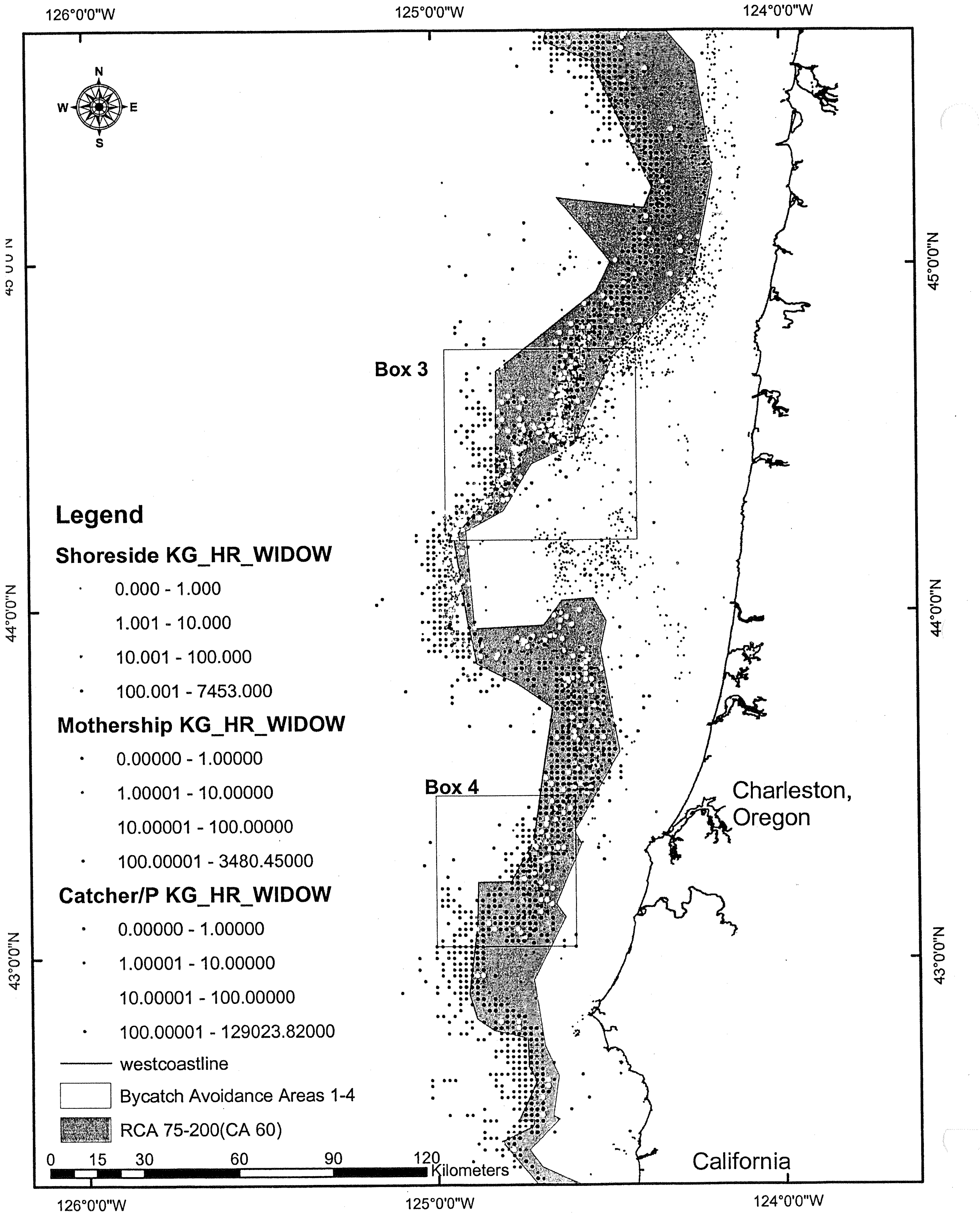
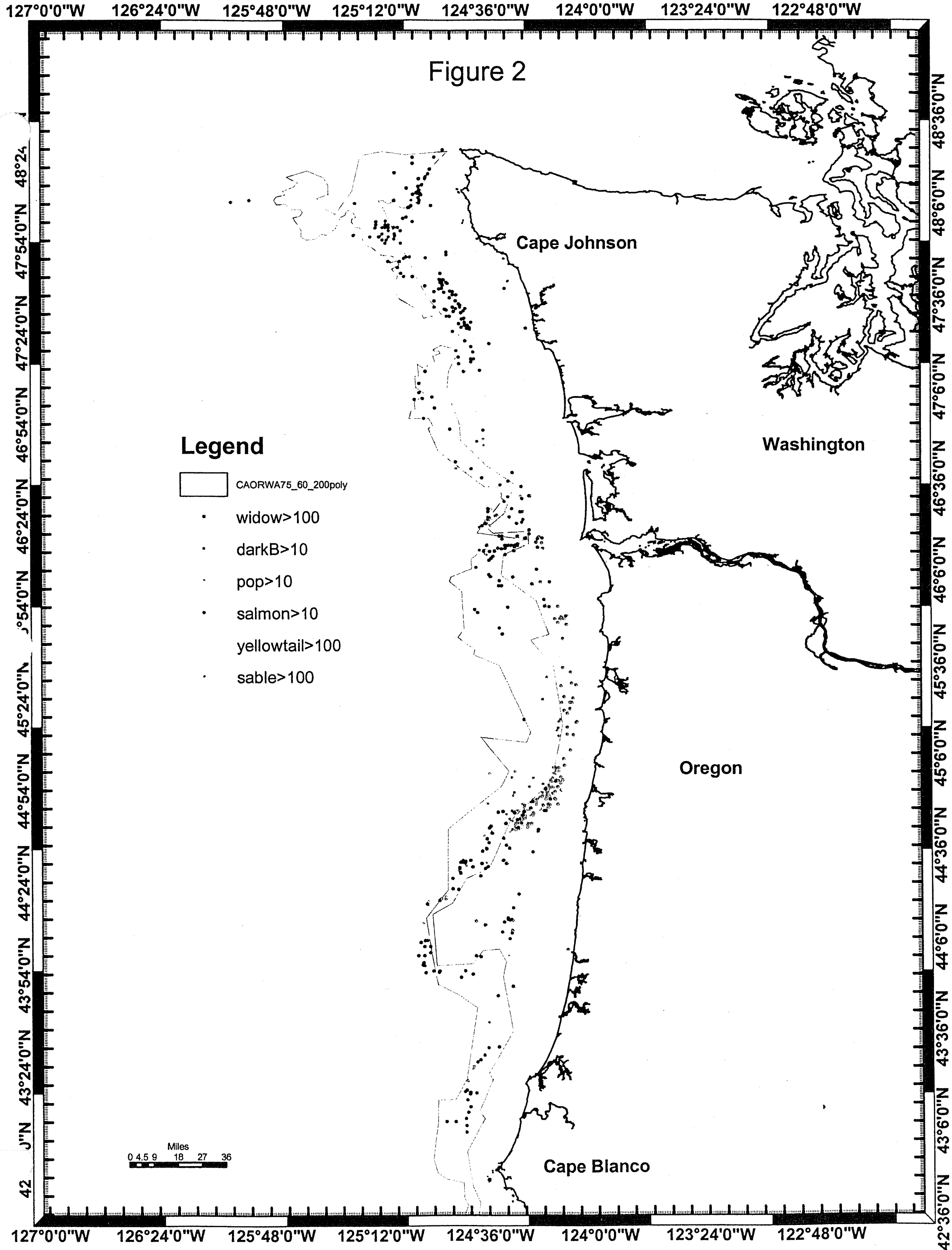


Figure 1a. Tow distribution for Pacific Hake Fishery 1999-2003. Rates are kg of widow rockfish/hr towed. 6

Figure 2



Cape Johnson
Washington
Oregon
Cape Blanco
Legend
CAORWA75_60_200poly
widow>100
darkB>10
pop>10
salmon>10
yellowtail>100
sable>100
Miles
0 4.5 9 18 27 36
127°0'0"W
126°24'0"W
125°48'0"W
125°12'0"W
124°36'0"W
124°0'0"W
123°24'0"W
122°48'0"W
48°36'0"N
48°6'0"N
47°36'0"N
47°6'0"N
46°36'0"N
46°6'0"N
45°36'0"N
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44°36'0"N
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Exhibit C.16
Situation Summary
April 2004

UPDATE ON TRAWL INDIVIDUAL QUOTAS PROGRAM (IF NECESSARY)

Situation: The Ad Hoc TIQ Committee met March 18-19 to continue its work on developing options and the Ad Hoc Allocation Committee briefly considered related allocation issues at its March 25-26 meeting. A draft plan for moving forward on consideration of the Trawl Individual Quotas (TIQ) program is provided (Exhibit C.16.a, Draft Workplan). This agenda item has been contingently scheduled should significant questions on program development arise and require Council guidance. A decision will be made under Agendum A.4 (Approval of Agenda) as to whether this agendum will be taken up by the Council as tentatively scheduled.

Council Action:

1. Provide Guidance on the Next Steps in the Groundfish Trawl IQ Process

Reference Materials:

1. Exhibit C.16.a, Draft Workplan: Phase I Work Plan for Consideration of a Trawl Individual Quota (IQ) Program.
2. Exhibit C.16.d, Public Comment.

Agenda Order:

a.	Agendum Overview	Jim Seger
b.	Report of the Ad Hoc TIQ Committee	Dave Hanson
c.	Reports and Comments of Advisory Bodies	
d.	Public Comment	
e.	Council Discussion and Guidance	

PFMC
03/23/04

PHASE I WORK PLAN FOR CONSIDERATION OF A TRAWL INDIVIDUAL QUOTA (IQ) PROGRAM

The trawl IQ program entails two major decision issues for the Council: (1) design of the elements of the trawl IQ program, (2) consideration of allocation between trawl and other sectors of the industry. Four phases have been identified for the development of the program. With regards to these two decision issues the objectives for Phase I[1/] are:

(1) develop trawl IQ program alternatives to be analyzed in an EIS through a NEPA compliant scoping process;
(2) determine the breadth of allocation issues which may need to be addressed to support the trawl IQ program.

The attached table and corresponding figure provides a step-by-step workplan for the portion of Phase I related to development of trawl IQ program alternatives. A time frame for action is provide through July. Progress after July will depend on other workload and resources available to support the process. Some key elements of the process include:

- Appointment of an analytical team (likely understaffed based on current agency commitments).
- Contracting for support for the analytical team.
- Development of a workplan for the enforcement tracking and monitoring group and formation of the group.
- Enlistment of assistance from independent economic reviewers[2/].
- Initiation of a public scoping process including release of a detailed scoping document and scoping hearings in each state.

1/ Phase II will entail development of the trawl IQ program EIS and a NEPA scoping process for allocation alternatives. The two processes are staggered to reduce delays from bottlenecks in the process. Phase III involves final NMFS action on the trawl IQ program and development of an allocation EIS (if necessary). Phase IV entails implementation of the trawl IQ program (if necessary) and final NMFS action on and implementation of the allocation EIS (if necessary).

2/ The initial budget for this project included travel money for economists to attend TIQC meetings and provide advice on development of alternatives. After additional discussions with potential participants in this group it was decided that a more effective way for them to participate would be to provide independent review and comment on the options and analytical approaches developed during the scoping process.

Table: Phase I of plan for developing trawl IQ alternatives (excluding allocation issues).

Council	Scoping and Alternative Development	Analytical Team and Independent Economists	ETM
March-April			
Council decision on appointment of teams (Analytical Team, Enforcement/Tracking/Monitoring Team)	TIQC meeting to complete informal scoping of strawman options for public scoping.	Contract help for analytical team. Identify independent economists to advise on analysis and option development.	Establish a workplan for ETM
	Announce start of formal scoping.		
May-June			
		Analytical team meets with contractor and independent economists to scope analytical issues.	. . . tasks dependent on workplan . . .
Release Public Scoping Document (options and scope for analysis) (after review at June meeting?)		Analytical team and contractor assembles background data and begins analysis of some central IQ program issues (e.g. concentration limits).	
July - ???			
	Public Scoping Hearings	Analytical team and contractor continue work	
	End scoping		
	Summary of public comments TIQC reviews public scoping comments, comments of independent economists and background data from analytical team. Develops recommendations.	Independent economists review results of scoping and provide other options for consideration.	
Council reviews: • public comments • TIQC recommendations • independent economist comments • analytical team initial work product. Specifies initial options for preliminary analysis.			

Table: Phase I of plan for developing trawl IQ alternatives (excluding allocation issues).

Council	Scoping and Alternative Development	Analytical Team and Independent Economists	ETM
		Analytical team completes preliminary analysis.	Report from tracking and monitoring group.
	TIQC reviews preliminary analysis, report from tracking and monitoring group and develops recommendations		
Council adopts options for draft EIS			

Possible Pathway for Phase I TIQ Scoping

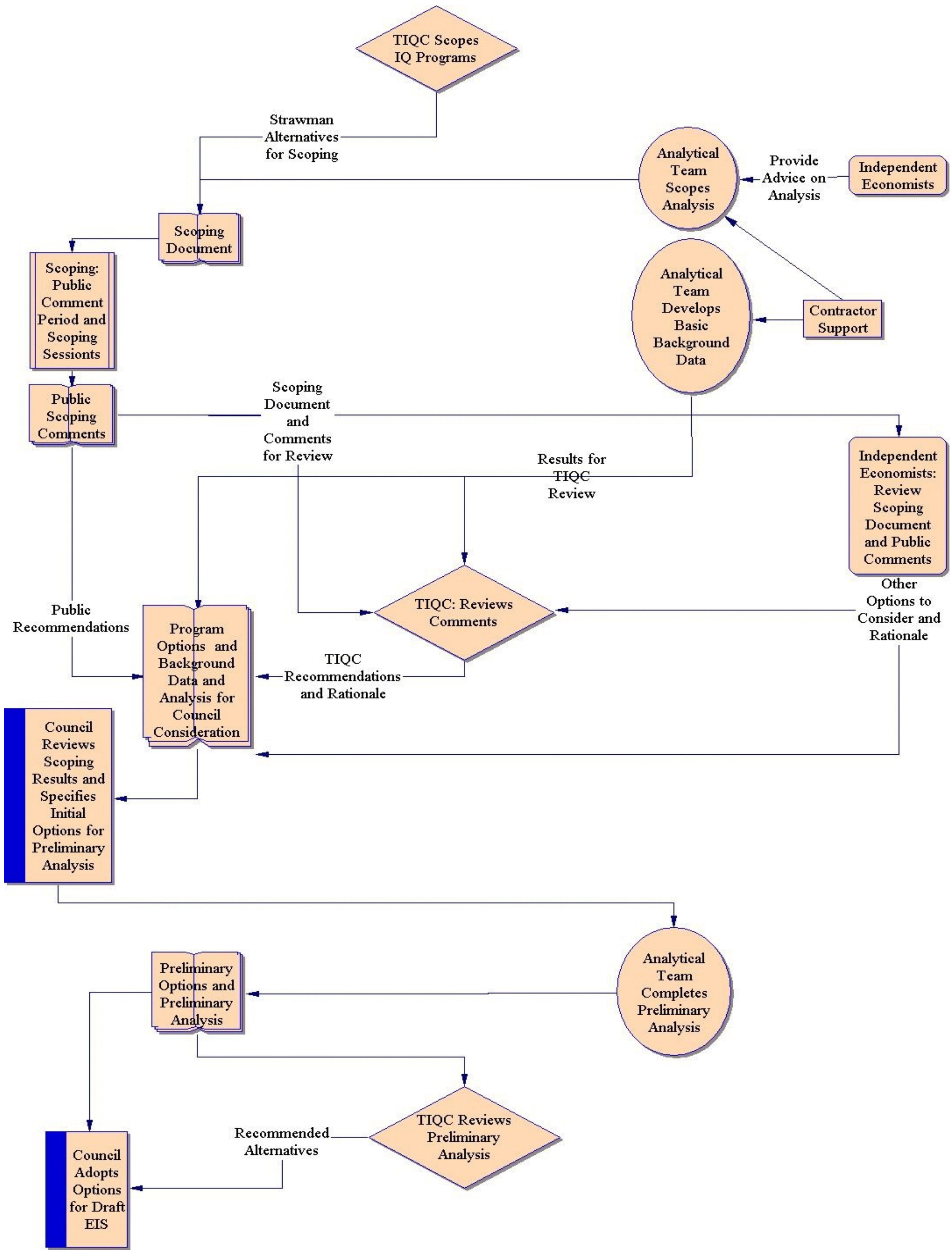

Exhibit C.16.b
Supplemental TIQC Report
April 2004

STATUS OF TRAWL INDIVIDUAL QUOTA CONSIDERATION
STAFF REPORT TO THE COUNCIL

Trawl Individual Quota Committee

- Met in March, no report on this agenda item.

The Trawl Individual Quota Committee (TIQC) met following the March Council meeting and continued work on developing their proposal. The only report from them to the Council at the April meeting will be presented under agenda item C.13 on the bycatch programmatic Environmental Impact Statement (EIS). Some of their work is reflected in the staff report to the Ad Hoc Allocation Committee (attached).

Phase I Work Plan

- Add reports on the enforcement tracking and monitoring system and scope of allocation decision to the first box with a bold bar on page 4 of Exhibit C.16.a, Draft Workplan

Council consideration of individual quotas for the trawl fishery has been divided into four phases. The four phases of this effort are in the staff update provided at the March meeting of the allocation committee (attached). The first phase involves scoping and development of trawl IQ alternatives and the scoping of allocation issues. The Phase I work plan for the trawl IQ program (excluding the sector allocation issue) is provided as a separate attachment under this agendum (Exhibit C.16.a, Draft Workplan). The table on pages two and three of that document show that the enforcement tracking and monitoring (ETM) work plan has yet to be developed. The information in the table is presented as a flow chart on the fourth page. The allocation committee reviewed this chart at their March 24-25 meeting. Members of the committee recommended that when the scoping results, options and background data are first presented to the Council for review, the Council should also receive reports on the ETM system design and the apparent scope of the allocation tasks.

Time Line

- First Council action on alternatives is not likely to occur until November 2004.
- Lack of analytical support is a major constraint on the process.

The Phase I workplan provides a time frame for activity up through July 2004 . Progress after July will depend on the availability of resources. One of the primary limiting factors at this time appears to be the availability of people to participate on the analytical team. The Trawl IQ Committee will not likely meet again until significant analytical information is available for review. At this time, the best estimate is that the committee will not meet again until the fall and the Council will receive results from the scoping process in November 2004. Preliminary options and analysis would then be available sometime in the spring of 2005.

Public Scoping

- Scoping documents will be distributed just after the June Council meeting. If the Council wishes to review these documents prior to their release, this issue should be included on its June, 2004 meeting agenda.. (Table of Contents for scoping document attached.)
- Public scoping sessions may be held in each state in late June or July.

Detailed scoping documents are being developed for public scoping. These documents will present the problem statement and purpose and need, solicit comments on alternatives that should be considered, and solicit comments on impacts that should be included in the analysis. To help focus public comment, the documents will include initial recommendations of the Trawl IQ Committee, as developed at their first two meetings.

Public scoping sessions are not a required part of the scoping process, however, because of the controversial nature of individual quotas and the scoping effort that has already occurred through the Trawl IQ Committee meetings, such sessions may be warranted. An open process that "invites broad participation by stakeholders" is one of the recommendations contained in the National Research Council report produced pursuant to the Sustainable Fisheries Act.

Organizational Issues

The following are the planned changes and augmentations to the original staff plan.

- Ms. Patty Burke will be part of the Oversight Group.
- Rather than convening a tracking and monitoring committee, development of a detailed tracking and monitoring system will be deferred until a contractor can be hired to work with the states on system design issues. Consideration of an electronic fish ticket system for the states should proceed outside the trawl IQ program process.
- Rather than creating a separate Enforcement Team, the standing Enforcement Consultants committee will be tasked with specifying their needs with respect to ETM system.
- The lack of personnel available for the analytical team necessitate help from an outside contractor. Available funds are sufficient to cover only a portion of this need. This team will be convened as a Council committee.
- The independent economists originally slated to attend trawl IQ Committee meetings will instead be asked to meet with analysts to help develop the draft scoping document and to review and comment on results of the scoping process.

The Council staff originally identified nine groups that would work on this project. That list will be modified as indicated by the above.

Oversight Group	NOAA Fisheries and GC Staff	~~Data Tracking and Monitoring Team~~
Coordination Team (NMFS and Council Staff)	Ad Hoc TIQ Committee	~~Enforcement Team~~ Enforcement Consultants
Committee Support and Coordination (Staff)	IQ Analytical Team	Allocation Committee

UPDATE ON TRAWL IQ PROGRAM
FOR ALLOCATION COMMITTEE MEETING (03/2004)
Staff Report

Contents of this report:

TIQ Program Planning Phases and Allocation Tasks

	Allocation Task	IQ Design Task
Phase I	Scope Allocation Issue - Given the main IQ alternatives how extensive an allocation is needed (which sectors)? Review and make recommendations on provisions pertaining to the scope of the IQ program that affect the open access sector.	Scope and Develop Alternatives
Phase II	Develop Alternatives	Publish Draft EIS and Final Council Recommendation
Phase III	Publish Draft EIS and Final Council Recommendation	NMFS Decision and Initial Implementation Steps (e.g. develop PRA documents)
Phase IV	NMFS Decision and Sector Allocation Implementation	Initial IQ Allocation and Implement IQ Program Infrastructure

Our intent is to include scoping of the allocation issue as part of the IQ scoping process but development of the main intersector allocation alternatives will not proceed until Phase II. The

purpose of this staggered approach is to avoid bottlenecks in policy development and optimize use of available technical support.
Initial question for the Allocation Committee. "What information which may be useful in determining the breadth of allocations that will need to be addressed?" Another way to look at this is: "What criteria should be used to determine the breadth of the allocations required?"

IFQs and Other Management Tools (Preliminary Recommendations from TIQC)

The IQ program options consist of mixes trawl management measures that may be used for various groundfish species and species groups. Under the status quo alternative (Alternative 1), a mix of cumulative limits and season closures would be used to manage the fishery. Under the full IFQ alternative (Alternative 4), all species would be managed under IFQs (Table 1). Between these alternatives is a range. Under Alternative 2, species that are primarily targeted by trawl gear or already allocated between trawl and other gears would be managed under IFQs and under Alternative 3, all species with OYs would be managed under IFQs. Harvest of all other species would be controlled using other types of management measures. The following tables identify the IFQ management measures that would be used for alternatives to status quo.

Nonwhiting Fishery

Option	Management Tools
Alt 2 Target and Allocated Species Alt 3 OY Species Alt 4 All Groundfish Species	IFQ
NonIFQ Species (during initial allocation calculate an IFQ s available for future use)	Cumulative catch limit Transferable cumulative catch limit *within period*. Trawl share based on biennial council decision. Any transfers between vessels are temporary.
NonIFQ Species with Extremely Low OYs (establish a threshold at which point a spe would switch from incidental catch manag to "Low OY" management) (during initial allocation, calculate an IFQ available for future use)	Manage as a pool. When pool is exhausted fishery shuts down. 100% mty accounting. Retention allowances may vary based on annual management measure decisions. Harvest rate control measures: · Cumulative limit, when a vessel reaches its limit that vessel's operations down. · Sector/area caps, when sector reaches cap it shuts down. Other measures to keep bycatch rates low may stay in place (e.g. RCAs).

Whiting Fisheries

Option	Management Tools
Target Species	IFQ
Incidental Catch	Option 1: Allocate and manage bycatch as a pool, shut down sector when bycatch limit is reached, roll-over any excess from one sector to the next as the year progresses. Buy from nonwhiting sector and put into a pool. Buy from other whiting sector (requires a coop). Option 2: Allocate and manage bycatch as IFQs (individuals could pool). (Allocated equally among vessels, see Section A.13).

	Option 2a Allow transfer between whiting and nonwhiting sectors. Option 2b. Restrict IFQ to whiting sector.

Allocation Issues

Allocation: Trawl - Other Sector (Various Divisions of Other Sectors)

Under this issue, the Council will need to:

- determine the sectors for which allocations will be developed,
- determine the approach by which it will make allocations to the trawl IFQ fishery (a formula or a determination for each management cycle), and
- if allocations are to be determined for each management cycle, consider whether or not to establish criteria or guidelines to be used in such determinations.

Sectors for Which Allocation Is Needed to Support the Trawl IQ Program

Allocations needed to implement the trawl IQ program could range from a single split between the trawl sector and all other sectors or it could be part of an allocation formula that covers all major sectors and geographic regions (limited entry trawl, limited entry fixed gear, groundfish open access, tribal, recreational, Washington, Oregon, and California). Currently, only sablefish is specifically allocated to the limited entry trawl sector. There are other species that are primarily taken by the limited entry trawl sector, such as Pacific whiting and Dover sole. Some species, such as rockfish are allocated between the limited entry and open access fisheries, but within the limited entry sector there is not an allocation between fixed gear and trawl gears. While there may be allocation between the limited entry and open access fisheries, in some cases there is not an allocation between commercial gears and the recreational fishery. The tribal fishery is another sector for which explicit allocations have been established for only a few species.

Allocation Approach (“Hard” or “Soft” Allocation)

Two main approaches have been identified.

- Allocation based on fixed shares, formula, or schedule/table, modified through regulatory or FMP amendment (“Hard” Allocation).
- Ad hoc allocation based on circumstances entering each management cycle (“Soft” Allocation).

Existing hard allocations are provided in Table 2. The following discussion covers (1) the methods by which “soft” allocation of overfished species to the trawl sector is currently achieved and changes in the utility of that approach with implementation of an IQ program, (2) some of the advantages and disadvantages of “hard” and “soft” allocation approaches.

EXCERPT FROM DRAFT SCOPING DOCUMENT:

> Under the current bimonthly trip limit system, the needed amounts of overfished species are determined based on target species cumulative limits which are specific to time of year and

depth strata of harvest. Absent these restrictions, there is a less firm basis for determining the amount of overfished species needed by trawl vessels to access their primary target species. If all depth and season restrictions are removed, current fishery participation models are not adequate to predict likely bycatch rates, nor are such models likely to be developed absent a number of years of experience managing under the IQ program. Thus, absent the season and cumulative limit regulatory framework used in previous years to determine need for access to overfished species there would be more latitude for specifying a basis for the trawl allocation of overfished species. A conservative approach to estimating the overfished species incidental catch rates would be to apply the highest incidental catch rates associated with each target species. This would result in the estimation of a trawl fishery need for allocation of overfished species much greater than in previous years. Alternatively, a lower amount of overfished species might be provided, and a high quality monitoring program relied on to ensure that overfished species catch (retained and discarded) does not exceed the IFQ issued. Too low of an allocation could result in unintentionally constraining target species harvest due to a shortfall in overfished species IFQ. If there is no established allocation, it is likely that there would be greater difficulty and controversy in justifying an appropriate annual allocation levels.

An established allocation might also result in an undesirable allocation. Too little of an overfished species may be allocated if the amount of target species available increases dramatically as a result of a stock assessment change, bycatch rates remain stable, and there is no increase in the amounts of overfished species made available to the trawl fishery because of the application of a fixed formula. In such circumstances, target species catch might be constrained and incentive created for unmonitored discards. To reduce the chances of such circumstances occurring, established allocations may need to include sliding scales based on abundance of target species. Such formulas might need to be fairly complex in order to avoid a circumstance such that a nontrawl sector might be severely constrained due to increases in abundance of trawl target species.

Thus, two situations are identified under which the trawl fishery access to target species might be unintentionally constrained by an under allocation of overfished species (1) a bad guess at the start of the management cycle on the IFQ trawl fishery need for access to overfished species, or (2) an allocation formula that does not adequately adjust for changing relative stock abundances and encounter rates in the trawl fishery. Under either scenario, one of the advantages of the IQ program is that fishers can be expected to optimize use of whatever allocation they are provided.

Support Needed to Determine Breadth of Intersector Allocation

The following are the types of information that the Allocation Committee and Council will have to develop recommendations on the breadth of intersector allocation required to support a trawl IQ program.

- Scoping comments from Summer 2004.
- Preliminary provisions of the IQ program.
- Lists of species that have constrained harvest regulations in recent years.

- Historic catch information for each sector.

Attached are examples of tables produced previously to develop allocation alternatives. What other information may be helpful to the allocation committee in determining the breadth of coverage of the intersector allocation alternatives?

LE Trawl with Trawl - LE Trawl with OA Gear (Handle as Part of TIQ Program)

The Council may need to consider the separation and possible reallocation of the portion of the limited entry (LE) allocation taken by limited entry vessels using open access gears. Such consideration will be needed if the scope of the IQ program will not include catch by limited entry trawl vessels using directed or incidental open access gears (such catch is currently counted against the limited entry gear allocation).

This allocation issue primarily affects the trawl sector but under some circumstances may affect the open access fishery. The issue is integral to the design of the IQ program because it interacts with the scope of the IQ program. Therefore, it is slated to be handled as part of the IQ EIS process rather than the allocation EIS process. Because more than just the trawl sector is affected, the TIQC may not have adequate representation to fully develop the relevant options. It therefore appears appropriate that the allocation committee serve as the forum for committee level discussions of options that affect the open access fishery. The following is a discussion of this allocation issue.

Under the allocation accounting system of the license limitation program, all groundfish taken by vessels with LE permits count against the LE groundfish quota, regardless of the gear used. LE vessels may use open access gears in fisheries that target groundfish or harvest groundfish incidental to the harvest of nongroundfish species. For example, directed groundfish catch by LE vessels using longline and fishpot gear under open access regulations counts against the LE allocation. Additionally, if a vessel with a LE trawl permit participates in nongroundfish fisheries, such as pink shrimp or California halibut, and lands groundfish as incidental catch, the landed incidental groundfish catch counts against the LE allocation.

The coverage of the IQ program needs to be reconciled with the current allocation accounting rules. If the current accounting rules are used and the IQ program is to cover all of the LE trawl vessel allocation, LE trawl vessels making groundfish landings in nongroundfish fisheries would have to make those landings in compliance with tracking and monitoring rules for the IQ program. The possibility might be explored for having somewhat different tracking and monitoring rules when a vessel is using an open access gear.

EXCERPT FROM DRAFT SCOPING DOCUMENT:

> Ensuring LE trawl vessel compliance with IFQ tracking and monitoring rules while fishing with open access gear will inflict additional costs for vessels and the tracking and monitoring system. Therefore consideration needs to be given to options that would not require IFQs when LE trawl vessels use open access gears. Options include subdividing the trawl allocation and/or of changing the LE catch accounting system. In the following table, the two

IFQ program scope options are provided along with suboptions. Three suboptions are outlined for a system in which IFQ is not required for groundfish catch by LE trawl vessels using open access gears (Option 2). Changing the accounting system for LE trawl vessels would also bring up the issue of considering such a change for LE fixed gear vessels and treatment of vessels with LE permits for both trawl and fixed gears.

IFQ Program Scope - Option 1: Require IFQ for all Catch by LE Trawl Vessels	
	Require LE Trawl vessels to make landings in compliance with IFQ tracking and monitoring rules, even when using nontrawl open access gears (examples of directed and incidental gears that may take groundfish include longline, fishpot, shrimp trawl, California halibut trawl, and crab pots).
SubOption A	Require that landings be made in compliance with open access fishery cumulative limit and other harvest regulations.
SubOption B	Allow landings in excess of open access fishery cumulative limits, so long as landings are completely covered by IFQ.
IFQ Program Scope - Option 2: Require IFQ Only for Groundfish Trawl Catch by LE Trawl Vessels	
SubOption A	· Split the trawl allocation between IFQ and nonIFQ harvest · Manage groundfish harvest by trawl vessels using open access gears to stay within the suballocation.
SubOption B	· Maintain the same LE allocation · Change the accounting system such that catch of LE trawl vessel's using open access gears counts against the open access allocation. · Determine whether or not to make similar changes with respect to LE longline and fishpot vessels.
SubOption C	· Reallocate a portion of the LE allocation · Change the accounting system such that catch of LE trawl vessel's using open access gears counts against the open access allocation. · Determine whether or not to make similar changes with respect to LE longline and fishpot vessels.

Subdividing the trawl allocation brings up issues of: how to divide the allocation, the need to modify the catch accounting system to track progress toward harvest of the allocation, difficulties in managing what may be very small quotas and management responses when such nonIFQ LE trawl quotas are exceeded by LE trawl vessels participating in directed or incidental open access fisheries.

Allocation of Incidental Catch among Whiting Sectors (Handle as Part of TIQ Program)

Allocation of incidental catch among trawl sectors will likely need to be addressed for some of the IFQ alternatives. This allocation issue may best be handled by the TIQC.

TABLE 1. Trawl catch, management regime alternatives (INITIAL/ PRELIMINARY TIQC RECOMMENDATIONS) and acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for 2003 and 2004. (Overfished stocks in CAPS) (page 7 of 2).

Stock	2004 ABCs/OYs (mt)		Alternative Management Regimes				At-Sea Deliveries (NOTES 1&2)		
	ABC	**OY**	**Alt 1 - Status Quo**	**Alt 2**	**Alt 3**	**Alt 4**	Alt2	Alt 3	Alt 4
LINGCOD	1,385	735	CL	CL/ICA	IFQ	IFQ			IFQ
Pacific Cod (Vanc-Col OY, Eur-Mont-Conc catch counts toward the "Other Fish" OY)	3,200	3,200	No Lim	IFQ	IFQ	IFQ			
PACIFIC WHITING (Coastwide)	188,000	250							
Shoreside			Season & CL	IFQ	IFQ	IFQ	IFQ	IFQ	IFQ
Mothership			Season	IFQ	IFQ	IFQ	IFQ	IFQ	IFQ
Catcher/processor			Season	IFQ	IFQ	IFQ	IFQ	IFQ	IFQ
Sablefish (Coastwide) b/	8,487	7,786	CL						
North of Conception	8,185	7,510	CL	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Conception area	302	276	CL	IFQ	IFQ	IFQ			
PACIFIC OCEAN PERCH	980	444	N-CL; S-CLgr	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Shortbelly Rockfish	13,900	13,900	No Lim	IFQ	IFQ	IFQ	ICA	ICA	IFQ
WIDOW ROCKFISH	3,460	284	Closure & CL	IFQ	IFQ	IFQ	ICA	ICA	IFQ
CANARY ROCKFISH c/	256	47	CL	CL/ICA	IFQ	IFQ	ICA	ICA	IFQ
Chilipepper Rockfish	2,700	2,000	N-CLgr; S-CLgr	IFQ	IFQ	IFQ	ICA	ICA	IFQ
BOCACCIO	400	250	S-Closure	CL/ICA	IFQ	IFQ	ICA	ICA	IFQ
Splitnose Rockfish	615	461	S-CL	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Yellowtail Rockfish (north)	4,320	4,320	N-CL; S-CLgr	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Shortspine Thornyhead	1,030	983	CL	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Longspine Thornyhead	2,461	2,443	CL	IFQ	IFQ	IFQ			
S. of Pt. Conception	390	195	CL	IFQ	IFQ	IFQ			
COWCOD N. Concep & Monterey)	5	2.4	Closure	CL/ICA	IFQ	IFQ			
S. Concep	19	2.4	Closure	CL/ICA	IFQ	IFQ			
DARKBLOTCHED	240	240	N-CLgr; S-CLgr	IFQ	IFQ	IFQ	ICA	ICA	IFQ
YELLOWEYE	53	22	N-CL, CLgr; S-CLgr	CL/ICA	IFQ	IFQ	ICA	ICA	IFQ
Nearshore Species									
Black WA	540	540	N-CLgr; S-CLgr	CL/ICA	IFQ	IFQ	ICA	ICA	IFQ
Black OR-CA	775	775	N-CLgr; S-CLgr	CL/ICA	IFQ	IFQ	ICA	ICA	IFQ
Minor Rockfish North (for management purposes split: nearshore, shelf and slope)	4,795	2,250 (ns=122, shlf=968, slp=1,160)		ns -CL/ICA shlf-IFQ slp-IFQ	IFQ-grp	IFQ or IFQ-grp (depending on spp)	ICA	ICA	IFQ-grp
Remaining Rockfish North	1,612	-							
Bocaccio	318	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Chilipepper - Eureka	32	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Redstripe	576	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			

TABLE 1. Trawl catch, management regime alternatives (INITIAL/ PRELIMINARY TIQC RECOMMENDATIONS) and acceptable biological catches (ABCs) and total catch optimum yields (OYs) (mt) for 2003 and 2004. (Overfished stocks in CAPS) (page 7 of 2).

Sharpchin	307	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Silvergrey	38	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Splitnose	242	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Yellowmouth	99	-	N-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Other Rockfish North	2,068	-	N-CLgr by depth	IFQ-grp	IFQ-grp	IFQ-grp			
Minor Rockfish South (for management purposes split: nearshore, shelf and slope)	3,506	1,968 (ns=615, shlf=714, slp=639)		ns -CL/ICA shlf-IFQ slp-IFQ	IFQ	IFQ or IFQ-grp (depending on spp)			IFQ??
Remaining Rockfish South	854	-							
Bank	350	-	S-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Blackgill	343	-	S-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Sharpchin	45	-	S-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Yellowtail	116	-	S-CLgr	IFQ-grp	IFQ-grp	IFQ or IFQ-grp			
Other Rockfish South	2,558	-	S-CLgr by depth	IFQ-grp	IFQ-grp	IFQ-grp			
Dover Sole	8,510	7,440	CL	IFQ	IFQ	IFQ			
English Sole	3,100	na	CLgr	IFQ	IFQ	IFQ			
Petrale Sole	2,762	na	CL	IFQ	IFQ	IFQ			
Arrowtooth Flounder	5,800	na	CL	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Other Flatfish	7,700	na	CLgr	IFQ	IFQ	IFQ	ICA	ICA	IFQ
Other Fish	14,700	na	No Lim	**??**	**CL/ICA**	**IFQ**			
Halibut NOTE3			Prohib	Prohib	Prohib	IBQ	Prohib	Prohib	IBQ
Salmon NOTE3			Prohib	Prohib	Prohib	Prohib??	Prohib	Prohib	Prohib??
Crab NOTE3			Prohib	Prohib	Prohib	Prohib??	Prohib	Prohib	Prohib??

KEY TO CODES FOR ALTERNATIVE MANAGEMENT REGIMES
Prefix N or S = measures used north or south of Cape Mendocino.
CL = species specific cumulative trip limits
CLgr = harvest controlled under the cumulative limit for a species group.
Season = opening with no cumulative limits
Closure = no retention allowed (any catch must be discarded)
Prohib = no retention every allowed in the groundfish fishery.
No Lim = harvest monitoring only, other limits have not been necessary to control harvest.

NOTE1: Substantial dog shark are caught in the whiting fishery (2,269 mt in the at-sea portion from 1992-2002)
NOTE2: At-sea species for management has not been discussed by the TIQC. The list of potential species provided here is based on a threshold of at-least 3 mt in the estimated at-sea deliveries for 1992-2002.
NOTE3: TIQC has not reviewed management options for prohibited species under Alternative 4.

TABLE 2. Existing allocations for groundfish species and species groups. (Overfished stocks in CAPS) (page 9 of 2).

				Commercial Fishery OY		
Stock	Tribal	Sport	Other	Open Access	Limited Entry (LE)	Trawl Portion of LE
LINGCOD (coastwide)	Estimated Need	Estimated Need		19%	81%	Not Specified
Pacific Cod (Vanc & Col OY; southern harvest is under "Other Fish" - NOTE: EUREKA IS COUNTED SOUTH)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
PACIFIC WHITING (Coastwide)	Sliding Scale					
Shoreside						
Mothership						
Catcherprocessor						
Sablefish						
North of Conception	10%			9.4%	90.6%	58%
Conception area	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
PACIFIC OCEAN PERCH (north of Cape Mendocino)	Not Specified	Not Specified		Suspended for Rebuilding		Not Specified
Shortbelly Rockfish (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
WIDOW ROCKFISH (coastwide)	Estimated Need	Not Specified	Set Aside of LE for At-Sea	Suspended for Rebuilding (3%/97%)		Not Specified
CANARY ROCKFISH (coastwide)	Estimated Need	35.5%		Suspended for Rebuilding (12.3%/87.7%)		Not Specified
Chilipepper Rockfish (Mont and Conception area OY, northern harvest is under "Other Fish")	None	Estimated Need		44.3%	55.7%	Not Specified
BOCACCIO (Mont and Conception area OY, northern harvest is under "Other Fish")	None	56%		Suspended for Rebuilding (44.3%/52.7%)		Not Specified
Splitnose Rockfish (Mont and Conception area OY, northern harvest is under "Other Fish")	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
Yellowtail Rockfish (Vanc, Col and Eureka OY; southern harvest is under "Other Fish")	Estimated Need	Estimated Need	Set Aside of LE for At-Sea	8.3%	91.7%	
Shortspine Thornyhead (coastwide)	Estimated Need	Not Specified		0.27%	99.73%	
Longspine Thornyhead (north)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
S. of Pt. Conception	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
COWCOD (S. Concep)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
N. Concep & Monterey (Vanc, Col and Eureka harvest is under "Other Fish")	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
DARKBLOTCHED (coastwide)	Not Specified	Not Specified	Set Aside of LE for At-Sea	Not Specified	Not Specified	Not Specified
YELLOWEYE (coastwide)	Estimated Need	Estimated Need		Not Specified	Not Specified	Not Specified
Nearshore Species						
Black WA	Not Specified	Not Specified	Geographic Allocations	Not Specified	Not Specified	Not Specified
Black OR-CA	Not Specified	Not Specified	Geographic Allocations	Not Specified	Not Specified	Not Specified
Minor Rockfish North (total of following)	Estimated Need	Estimated Need (2004: nearshore = 68 mt shelf = 10 mt, slope = 0 mt)		8.3%	91.7%	Not Specified
Remaining Rockfish North						
Bocaccio						
Chilipepper - Eureka						

TABLE 2. Existing allocations for groundfish species and species groups. (Overfished stocks in CAPS) (page 9 of 2).

Stock	Tribal	Sport	Other	Open Access	Limited Entry (LE)	Trawl Portion of LE
				Commercial Fishery OY		
Redstripe						
Sharpchin						
Silvergrey						
Splitnose						
Yellowmouth						
Other Rockfish North						
Minor Rockfish South (total of following)	Estimated Need	Estimated Need (2004: nearshore = 375 mt shelf = 60 mt, slope = 0 mt)		44.3%	55.7%	Not Specified
Remaining Rockfish South						
Bank						
Blackgill						
Sharpchin						
Yellowtail						
Other Rockfish South						
Dover Sole (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
English Sole (coastwide, ABC split between Col and Eur areas)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
Petrale Sole (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
Arrowtooth Flounder (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
Other Flatfish (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified
Other Fish (coastwide)	Not Specified	Not Specified		Not Specified	Not Specified	Not Specified

Fish is also set aside for resource survey vessel compensation, research fishing, and nongroundfish fisheries and precautionary buffers.
"Estimated Need" indicates an allocation, set aside, or anticipated catch which is taken into account in determining the commercial fishery OY.

Comparison of commercial and recreational rockfish landings, by species and year.

Rec updated 7-20-99

	Common name	PacFIN Code	All Commercial 1995	1996	1997	1998 *	All recreational 1995	1996	1997	1998 *	Percentage commercial 1995	1996	1997	1998 *
1	PACIFIC OCEAN PERCH	POP	887.7	870.3	689.3	627.4			0.5		100%	100%	100%	100%
2	WIDOW ROCKFISH	WDOW	6,707.2	6,047.0	6,453.0	3,643.8	4.3	26.3	42.0	61.8	100%	100%	99%	98%
3	YELLOWTAIL ROCKFISH	YTRK	4,839.7	5,202.8	2,165.4	2,782.2	94.1	139.2	374.4	225.8	98%	97%	85%	92%
4	CANARY ROCKFISH	CNRY	890.5	1,206.9	1,095.4	1,136.6	124.9	91.5	140.9	88.7	88%	93%	89%	93%
5	BOCACCIO	BCAC	925.8	596.6	440.9	399.9	30.9	98.8	107.3	67.0	97%	86%	80%	86%
6	CHILIPEPPER	CLPR	1,978.1	1,817.6	2,039.4	1,233.2	7.3	33.8	73.5	10.1	100%	98%	97%	99%
7	BLACK ROCKFISH	BLCK	222.0	275.7	332.9	287.7	710.3	710.8	707.4	916.0	24%	28%	32%	24%
8	BLACKGILL ROCKFISH	BLGL	354.8	378.2	273.4	213.4	0.9				100%	100%	100%	100%
9	SPLITNOSE ROCKFISH	SNOS	428.8	478.6	561.1	1,291.9					100%	100%	100%	100%
10														
11	AURORA ROCKFISH	ARRA	64.8	47.9	48.3	40.5					100%	100%	100%	100%
12	BANK ROCKFISH	BANK	436.5	550.4	414.5	452.1	0.2	11.0	11.7	2.4	100%	98%	97%	99%
13	BLUE ROCKFISH	BLUR	52.4	28.8	56.5	55.3	164.6	296.8	447.5	433.7	24%	9%	11%	11%
14	BRONZESPOTTED ROCKFISH	BRNZ	1.2	18.3	0.5	0.6				1.4	100%	100%	100%	30%
15	BROWN ROCKFISH	BRWN	19.8	43.7	58.0	7.5	41.2	38.0	54.7	47.4	32%	53%	51%	14%
16	BLACK-AND-YELLOW ROCKFISH	BYEL	16.7	18.2	13.9	10.1	10.3	4.2	3.2	6.5	62%	81%	81%	61%
17	CHINA ROCKFISH	CHNA	27.8	26.7	40.2	11.3	25.5	21.0	17.8	17.8	52%	56%	69%	39%
18	CHAMELEON ROCKFISH	CMEL												
19	COPPER ROCKFISH	COPP	50.0	50.6	65.4	32.5	50.7	95.3	45.6	54.3	50%	35%	59%	37%
20	COWCOD ROCKFISH	CWCD	65.6	36.9	49.9	18.4	2.2	5.4	1.9	2.7	97%	87%	96%	87%
21	DARKBLOTCHED ROCKFISH	DBRK	720.9	707.0	798.6	713.3					100%	100%	100%	100%
22	FLAG ROCKFISH	FLAG	3.6	2.5	2.0	0.5	5.6	16.2	8.5	9.7	39%	13%	19%	5%
23	GREENBLOTCHED ROCKFISH	GBLC	14.4	12.0	1.6	2.6	2.7	8.0	1.0	1.4	84%	60%	62%	65%
24	GOPHER ROCKFISH	GPHR	61.0	58.8	30.1	21.1	37.4	37.9	37.1	38.5	62%	61%	45%	35%
25	GRASS ROCKFISH	GRAS	52.1	63.6	43.2	40.6	6.7	8.4	8.1	8.7	89%	88%	84%	82%
26	GREENSPOTTED ROCKFISH	GSPT	91.7	131.8	56.0	22.2	71.6	37.3	23.3	13.1	56%	78%	71%	63%
27	GREENSTRIPED ROCKFISH	GSRK	146.9	223.1	152.4	180.1	6.6	4.4	4.1	3.8	96%	98%	97%	98%
28	KELP ROCKFISH	KLPR	4.8	3.1	2.8	1.8	23.0	12.0	12.5	5.9	17%	21%	18%	23%
29	MEXICAN ROCKFISH	MXRF		0.1	2.5			1.4		0.1		7%	100%	0%
30	OLIVE ROCKFISH	OLVE	9.8	17.2	0.2	1.2	36.0	41.9	67.8	66.3	21%	29%	0%	2%
31	PYGMY ROCKFISH	PGMY	3.3		49.1	1.4					100%		100%	100%
32	PINK ROCKFISH	PNKR	4.7								100%			
33	PINKROSE ROCKFISH	PRRK		7.1	8.5	1.7						100%	100%	100%
34	QUILLBACK ROCKFISH	QLBK	9.2	6.9	19.7	12.7	4.2	4.0	8.6	9.9	69%	63%	70%	56%
35	REDBANDED ROCKFISH	RDBD	61.2	64.8	32.9	45.2					100%	100%	100%	100%

Comparison of commercial and recreational rockfish landings, by species and year.

	PacFIN	All Commercial				All recreational				Percentage commercial			
Common name	Code	1995	1996	1997	1998 *	1995	1996	1997	1998 *	1995	1996	1997	1998 *
REDSTRIPE ROCKFISH	REDS	271.7	200.7	155.6	101.6	1.3	0.1	0.3	0.1	100%	100%	100%	100%
ROUGHEYE ROCKFISH	REYE	266.4	177.1	139.8	175.8				0.6	100%	100%	100%	100%
ROSY ROCKFISH	ROSY	2.4	12.4	4.7	1.4	4.5	17.1	12.3	7.1	35%	42%	28%	16%
ROSETHORN ROCKFISH	RSTN	25.2	23.1	21.1	23.9	1.8	1.5	1.2	2.0	93%	94%	95%	92%
SHORTBELLY ROCKFISH	SBLY	30.7	35.8	78.0	19.2					100%	100%	100%	100%
SHARPCHIN ROCKFISH	SHRP	242.8	229.4	322.6	113.8					100%	100%	100%	100%
SILVERGREY ROCKFISH	SLGR	96.6	238.5	83.5	275.0	0.4	0.6	0.2	1.4	100%	100%	100%	99%
SPECKLED ROCKFISH	SPKL	14.4	9.2	16.7	4.2	4.9	13.2	9.8	11	75%	41%	63%	28%
SQUARESPOT ROCKFISH	SQRS	0.1	70.6	0.1	0.3	0.7	20.2	13.7	5.2	13%	78%	1%	5%
SHORTRAKER ROCKFISH	SRKR	37.3	9.9	92.5	58.5					100%	100%	100%	100%
STARRY ROCKFISH	STAR	19.7	16.6	22.6	6.5	19.0	58.4	29.5	21.6	51%	22%	43%	23%
STRIPETAIL ROCKFISH	STRK	49.4	0.3	20.6	19.9					100%	100%	100%	100%
SWORDSPINE ROCKFISH	SWSP					0.7				0%			
TIGER ROCKFISH	TIGR	0.9	1.1	3.5	1.0	0.1	0.3	0.8	0.4	90%	79%	81%	71%
TREEFISH	TREE	0.4	6.6	27.6	0.2	17.7	20.6	5.8	9.4	2%	24%	83%	2%
VERMILION ROCKFISH	VRML	125.9	157.8	106.3	27.2	181.9	204.1	85.5	136.3	41%	44%	55%	17%
YELLOWEYE ROCKFISH	YEYE	199.8	181.7	194.1	109.4	31.9	24.4	36.8	29.8	86%	88%	84%	79%
YELLOWMOUTH ROCKFISH	YMTH	110.6	112.9	75.4	53.7	0.0				100%	100%	100%	100%
BOCACCIO+CHILIPEPPER RCKFSH	RCK1			0.2									
UNSP. BOLINA RCKFSH	RCK2	8.7	10.6	13.6	52.7								
UNSP. DPWTR REDS RCKFSH	RCK3	16.6	0.3	0.2	0.2								
UNSP. REDS RCKFSH	RCK4	196.6	103.8	92.8	268.0								
UNSP. SMALL REDS RCKFSH	RCK5	36.4	15.3	8.6	185.1								
UNSP. ROSEFISH RCKFSH	RCK6	1.7	2.4		145.8								
UNSP. GOPHER RCKFSH	RCK7	42.5	38.2	26.2	38.3								
BLACK+BLUE ROCKFISH	RCK9	0.2	0.9	2.4	1.2								
OTHER ROCKFISH	ORCK	63.3	48.2	0.7	58.8								
UNSP. ROCKFISH	URCK	916.3	962.5	736.8	812.9								
Total of remaining nominal categories		1,282.3	1,182.2	881.5	1,563.0	55.6	67.6	55.3	15.9	96%	95%	94%	99%

Notes: Commercial landings reflect the application of species composition information from state port sampling programs to fishticket data in the PacFIN data base. For the 9 species at the top of each states table (from POP to splitnose) fishticket data include nominal market categories, which may not be fully distributed to individual species following application of species composition data. For these table, all landings remaining in a species' nominal category following application of species composition data are assumed to be entirely that species. Data for 1998 should be regarded as preliminary, with no recreational data for Washington.

Distribution of coastwide rockfish landings between limited entry and open access, by species and year

Common name	PacFIN Code	Open-Access Landings 1995	Open-Access Landings 1996	Open-Access Landings 1997	Open-Access Landings 1998	Limited Entry Landings 1995	Limited Entry Landings 1996	Limited Entry Landings 1997	Limited Entry Landings 1998	Percent Limited Entry 1995	Percent Limited Entry 1996	Percent Limited Entry 1997	Percent Limited Entry 1998
PACIFIC OCEAN PERCH	POP	11.1	4.8	4.7	15.6	876.6	865.7	684.5	611.9	99%	99%	99%	98%
WIDOW ROCKFISH	WDOW	182.8	91.1	88.9	244.1	6,524.4	5,955.9	6,364.1	3,399.7	97%	98%	99%	93%
YELLOWTAIL ROCKFISH	YTRK	419.0	423.3	344.4	470.7	4,420.7	4,779.4	1,821.0	2,311.5	91%	92%	84%	83%
CANARY ROCKFISH	CNRY	129.7	164.6	214.7	175.7	760.7	1,042.3	880.6	960.9	85%	86%	80%	85%
BOCACCIO	BCAC	401.2	196.6	90.3	65.0	524.7	400.0	350.6	335.0	57%	67%	80%	84%
CHILIPEPPER	CLPR	388.4	476.0	557.1	261.3	1,589.7	1,341.6	1,482.2	972.0	80%	74%	73%	79%
BLACK ROCKFISH	BLCK	192.7	235.7	243.3	174.0	29.3	40.0	89.6	113.8	13%	15%	27%	40%
BLACKGILL ROCKFISH	BLGL	153.7	105.6	63.1	17.7	201.1	272.5	210.3	195.5	57%	72%	77%	92%
SPLITNOSE ROCKFISH	SNOS	40.0	76.5	26.2	16.2	388.8	402.1	535.0	1,275.8	91%	84%	95%	99%
AURORA ROCKFISH	ARRA	1.2	0.5	1.7	0.3	63.7	47.5	46.6	40.2	98%	99%	96%	99%
BANK ROCKFISH	BANK	73.3	55.3	34.6	56.8	363.2	495.1	379.9	395.2	83%	90%	92%	87%
BLUE ROCKFISH	BLUR	43.4	18.6	48.1	48.4	9.0	10.2	8.4	7.0	17%	35%	15%	13%
BRONZESPOTTED ROCKFISH	BRNZ	1.2	0.3	0.4	0.3	0.0	18.0	0.0	0.3	0%	98%	0%	50%
BROWN ROCKFISH	BRWN	16.2	35.8	35.6	6.6	3.6	7.9	22.4	0.9	18%	18%	39%	12%
BLACK-AND-YELLOW ROCKFISH	BYEL	16.7	18.1	13.8	9.5	0.0	0.1	0.0	0.6	0%	1%	0%	6%
CHINA ROCKFISH	CHNA	23.1	20.6	35.2	8.2	4.7	6.1	5.0	3.1	17%	23%	12%	27%
CHAMELEON ROCKFISH	CMEL			0.0	0.0			0.0	0.0				
COPPER ROCKFISH	COPP	42.4	36.5	42.5	17.7	7.6	14.0	22.9	14.8	15%	28%	35%	46%
COWCOD ROCKFISH	CWCD	25.5	16.4	13.2	8.5	40.0	20.6	36.7	9.9	61%	56%	74%	54%
DARKBLOTCHED ROCKFISH	DBRK	10.6	6.4	1.6	9.5	710.3	700.6	797.1	703.7	99%	99%	100%	99%
FLAG ROCKFISH	FLAG	3.5	1.3	1.2	0.2	0.1	1.2	0.8	0.2	3%	48%	40%	50%
GREENBLOTCHED ROCKFISH	GBLC	0.1	0.3	0.1	0.1	14.3	11.7	1.5	2.5	99%	98%	94%	96%
GOPHER ROCKFISH	GPHR	57.8	54.3	28.8	21.0	3.1	4.5	1.3	0.1	5%	8%	4%	0%
GRASS ROCKFISH	GRAS	51.8	63.5	43.0	39.5	0.3	0.0	0.2	1.1	1%	0%	0%	3%
GREENSPOTTED ROCKFISH	GSPT	38.4	24.9	19.7	9.7	53.3	107.0	36.3	12.5	58%	81%	65%	56%
GREENSTRIPED ROCKFISH	GSRK	5.4	78.1	2.5	4.1	141.5	145.0	149.8	176.0	96%	65%	98%	98%
KELP ROCKFISH	KLPR	4.5	3.1	0.0	1.7	0.2	0.0	2.8	0.1	4%	0%	100%	6%
MEXICAN ROCKFISH	MXRF		0.1	2.4			0.0	0.1			0%	4%	
OLIVE ROCKFISH	OLVE	8.4	5.3	0.2	1.0	1.3	11.9	0.1	0.1	13%	69%	33%	9%
PYGMY ROCKFISH	PGMY	0.1	0.0	37.1	0.0	3.2	0.0	12.1	1.4	97%		25%	100%
PINK ROCKFISH	PNKR	4.3	0.0	0.0		0.3	0.0	0.0		7%			
PINKROSE ROCKFISH	PRRK		1.0	4.0	1.7		6.2	4.5	0.0		86%	53%	0%
QUILLBACK ROCKFISH	QLBK	6.6	3.9	11.8	7.6	2.6	3.0	7.9	5.1	28%	43%	40%	40%
REDBANDED ROCKFISH	RDBD	1.6	11.7	0.5	0.6	59.6	53.1	32.4	44.6	97%	82%	98%	99%

Distribution of coastwide rockfish landings between limited entry and open access, by species and year

Common name	PacFIN Code	Open-Access Landings				Limited Entry Landings				Percent Limited Entry			
		1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
REDSTRIPE ROCKFISH	REDS	4.3	0.8	0.1	1.2	267.4	199.9	155.5	100.4	98%	100%	100%	99%
ROUGHEYE ROCKFISH	REYE	1.6	6.7	0.9	2.4	264.8	170.4	138.9	173.4	99%	96%	99%	99%
ROSY ROCKFISH	ROSY	1.5	5.5	2.9	0.0	0.9	6.9	1.9	1.4	38%	56%	40%	100%
ROSETHORN ROCKFISH	RSTN	1.2	0.5	1.3	2.3	24.0	22.6	19.8	21.6	95%	98%	94%	90%
SHORTBELLY ROCKFISH	SBLY	0.8	0.0	0.0	0.0	29.8	35.8	78.0	19.2	97%	100%	100%	100%
SHARPCHIN ROCKFISH	SHRP	3.6	0.3	1.3	0.4	239.3	229.2	321.3	113.4	99%	100%	100%	100%
SILVERGREY ROCKFISH	SLGR	4.1	1.5	2.9	2.0	92.5	237.0	80.6	273.1	96%	99%	97%	99%
SPECKLED ROCKFISH	SPKL	7.1	3.8	4.3	2.1	7.3	5.4	12.4	2.1	51%	59%	74%	50%
SQUARESPOT ROCKFISH	SQRS	0.0	1.5	0.0	0.0	0.1	69.1	0.0	0.3	100%	98%		100%
SHORTRAKER ROCKFISH	SRKR	0.1	8.0	0.5	0.3	37.1	1.8	91.9	58.2	100%	18%	99%	99%
STARRY ROCKFISH	STAR	16.4	0.0	17.1	4.1	3.3	16.6	5.5	2.4	17%	100%	24%	37%
STRIPETAIL ROCKFISH	STRK	0.2	0.0	0.4	0.0	49.2	0.3	20.2	19.9	100%	100%	98%	100%
SWORDSPINE ROCKFISH	SWSP			0.0				0.0					
TIGER ROCKFISH	TIGR	0.1	0.5	0.7	0.0	0.9	0.6	2.8	1.0	90%	55%	80%	100%
TREEFISH	TREE	0.4	6.6	27.6	0.1	0.0	0.0	0.0	0.0	0%	0%	0%	0%
VERMILION ROCKFISH	VRML	99.8	131.7	74.4	15.3	26.0	26.1	31.9	11.9	21%	17%	30%	44%
YELLOWEYE ROCKFISH	YEYE	36.6	33.0	52.7	23.9	163.1	148.7	141.4	85.5	82%	82%	73%	78%
YELLOWMOUTH ROCKFISH	YMTH	2.9	0.2	0.0	2.2	107.7	112.8	75.3	51.5	97%	100%	100%	96%
BOCACCIO+CHILIPEPPER RCKFSH	RCK1			0.2				0.0				0%	
UNSP. BOLINA RCKFSH	RCK2	6.3	10.5	13.4	44.6	2.5	0.2	0.2	8.1	28%	2%	1%	15%
UNSP. DPWTR REDS RCKFSH	RCK3	0.0	0.1	0.0	0.0	16.6	0.2	0.1	0.2	100%	67%	100%	100%
UNSP. REDS RCKFSH	RCK4	174.2	87.6	70.7	128.3	22.5	16.2	22.1	139.8	11%	16%	24%	52%
UNSP. SMALL REDS RCKFSH	RCK5	25.7	6.8	7.1	16.4	10.6	8.6	1.5	168.8	29%	56%	17%	91%
UNSP. ROSEFISH RCKFSH	RCK6	0.4	0.0	0.0	25.3	1.4	2.4	0.0	120.6	78%	100%		83%
UNSP. GOPHER RCKFSH	RCK7	41.5	37.9	25.9	31.5	1.0	0.3	0.3	6.8	2%	1%	1%	18%
BLACK+BLUE ROCKFISH	RCK9	0.2	0.9	2.3	1.2	0.0	0.0	0.1	0.0	0%	0%	4%	0%
OTHER ROCKFISH	ORCK	39.8	32.6	0.7	46.9	23.5	15.6	0.1	11.9	37%	32%	13%	20%
UNSP. ROCKFISH	URCK	369.5	403.5	254.9	263.1	546.9	559.0	481.9	549.9	60%	58%	65%	68%

Distribution of coastwide **limited-entry** rockfish landings between permits endorsed for trawl gear and those endorsed for fixed-gears, by species and year

Common name	PacFIN Code	Non-trawl endorsed landings				Trawl-endorsed landings				Percent non-trawl			
		1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
PACIFIC OCEAN PERCH	POP	4.4	9.8	2.1	3.9	872.1	856.0	682.4	607.9	1%	1%	0%	1%
WIDOW ROCKFISH	WDOW	15.0	7.0	27.5	14.4	6,509.4	5,948.9	6,336.6	3,385.3	0%	0%	0%	0%
YELLOWTAIL ROCKFISH	YTRK	55.1	48.6	100.6	71.8	4,365.6	4,730.8	1,720.5	2,239.6	1%	1%	6%	3%
CANARY ROCKFISH	CNRY	63.5	71.1	77.0	105.3	697.1	971.1	803.5	855.6	8%	7%	9%	11%
BOCACCIO	BCAC	14.9	17.9	15.1	11.2	509.7	382.1	335.5	323.8	3%	4%	4%	3%
CHILIPEPPER	CLPR	33.6	34.2	28.6	15.7	1,556.1	1,307.4	1,453.5	956.3	2%	3%	2%	2%
BLACK ROCKFISH	BLCK	19.7	21.9	44.6	32.3	9.6	18.1	45.0	81.4	67%	55%	50%	28%
BLACKGILL ROCKFISH	BLGL	60.3	114.8	65.9	79.8	140.9	157.9	144.4	115.8	30%	42%	31%	41%
SPLITNOSE ROCKFISH	SNOS	1.3	0.7	0.4	0.5	387.5	401.4	534.6	1,275.3	0%	0%	0%	0%
AURORA ROCKFISH	ARRA	0.3	0.5	1.1	0.0	63.4	46.9	45.5	40.2	0%	1%	2%	0%
BANK ROCKFISH	BANK	10.6	1.0	0.3	8.7	352.6	494.1	379.6	386.5	3%	0%	0%	2%
BLUE ROCKFISH	BLUR	7.4	10.2	8.3	7.0	1.5	0.0	0.1	0.0	83%	100%	99%	100%
BRONZESPOTTED ROCKFISH	BRNZ	0.0	0.0	0.0	0.3	0.0	18.0	0.0	0.0		0%		100%
BROWN ROCKFISH	BRWN	3.1	6.9	9.6	0.8	0.6	1.0	12.7	0.1	84%	87%	43%	89%
BLACK-AND-YELLOW ROCKFISH	BYEL	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0		100%		100%
CHINA ROCKFISH	CHNA	4.7	6.1	4.9	2.9	0.0	0.0	0.0	0.2	100%	100%	100%	94%
CHAMELEON ROCKFISH	CMEL			0.0	0.0			0.0	0.0				
COPPER ROCKFISH	COPP	7.1	13.9	22.6	11.6	0.5	0.1	0.3	3.2	93%	99%	99%	78%
COWCOD ROCKFISH	CWCD	3.2	2.1	2.5	1.5	36.9	18.5	34.2	8.4	8%	10%	7%	15%
DARKBLOTCHED ROCKFISH	DBRK	0.9	1.6	0.4	1.7	709.4	699.0	796.7	702.0	0%	0%	0%	0%
FLAG ROCKFISH	FLAG	0.1	0.2	0.4	0.2	0.0	1.0	0.4	0.0	100%	17%	50%	100%
GREENBLOTCHED ROCKFISH	GBLC	0.0	0.1	0.4	0.0	14.3	11.6	1.2	2.4	0%	1%	25%	0%
GOPHER ROCKFISH	GPHR	3.1	1.3	1.2	0.1	0.0	3.2	0.0	0.0	100%	29%	100%	100%
GRASS ROCKFISH	GRAS	0.2	0.0	0.2	1.1	0.1	0.0	0.0	0.0	67%		100%	100%
GREENSPOTTED ROCKFISH	GSPT	16.7	25.6	14.3	6.1	36.5	81.4	22.1	6.4	31%	24%	39%	49%
GREENSTRIPED ROCKFISH	GSRK	1.8	1.3	2.8	0.3	139.7	143.7	147.1	175.7	1%	1%	2%	0%
KELP ROCKFISH	KLPR	0.2	0.0	0.0	0.1	0.0	0.0	2.8	0.0	100%		0%	100%
MEXICAN ROCKFISH	MXRF		0.0	0.1			0.0	0.0				100%	
OLIVE ROCKFISH	OLVE	1.3	0.1	0.1	0.1	0.1	11.9	0.0	0.0	93%	1%	100%	100%
PYGMY ROCKFISH	PGMY	0.0	0.0	2.0	0.0	3.2	0.0	10.1	1.4	0%		17%	0%
PINK ROCKFISH	PNKR	0.2	0.0	0.0		0.1	0.0	0.0		67%			
PINKROSE ROCKFISH	PRRK		6.1	4.5	0.0		0.1	0.0	0.0		98%	100%	
QUILLBACK ROCKFISH	QLBK	2.6	3.0	7.9	3.0	0.0	0.0	0.0	2.1	100%	100%	100%	59%
REDBANDED ROCKFISH	RDBD	12.6	3.4	1.6	0.5	47.0	49.7	30.9	44.2	21%	6%	5%	1%

Distribution of coastwide **limited-entry** rockfish landings between permits endorsed for trawl gear and those endorsed for fixed-gears, by species and year

Common name	PacFIN Code	Non-trawl endorsed landings				Trawl-endorsed landings				Percent non-trawl			
		1995	1996	1997	1998	1995	1996	1997	1998	1995	1996	1997	1998
REDSTRIPE ROCKFISH	REDS	0.0	0.0	0.0	0.0	267.4	199.9	155.5	100.4	0%	0%	0%	0%
ROUGHEYE ROCKFISH	REYE	122.7	64.4	12.4	76.9	142.2	106.0	126.4	96.5	46%	38%	9%	44%
ROSY ROCKFISH	ROSY	0.8	1.9	1.9	0.7	0.0	5.0	0.0	0.6	100%	28%	100%	54%
ROSETHORN ROCKFISH	RSTN	3.9	2.4	2.0	0.2	20.0	20.1	17.8	21.4	16%	11%	10%	1%
SHORTBELLY ROCKFISH	SBLY	0.0	0.0	0.0	0.0	29.8	35.8	78.0	19.2	0%	0%	0%	0%
SHARPCHIN ROCKFISH	SHRP	0.2	0.0	0.0	0.0	239.1	229.2	321.3	113.4	0%	0%	0%	0%
SILVERGREY ROCKFISH	SLGR	0.0	0.3	1.8	0.1	92.5	236.7	78.9	273.0	0%	0%	2%	0%
SPECKLED ROCKFISH	SPKL	2.6	0.3	2.9	1.9	4.7	5.1	9.5	0.2	36%	6%	23%	90%
SQUARESPOT ROCKFISH	SQRS	0.0	7.3	0.0	0.0	0.0	61.8	0.0	0.3		11%		0%
SHORTRAKER ROCKFISH	SRKR	0.8	1.8	0.7	0.0	36.3	0.0	91.2	58.2	2%	100%	1%	0%
STARRY ROCKFISH	STAR	3.3	0.0	5.0	2.4	0.0	16.6	0.6	0.0	100%	0%	89%	100%
STRIPETAIL ROCKFISH	STRK	0.0	0.0	0.0	0.0	49.2	0.3	20.2	19.9	0%	0%	0%	0%
SWORDSPINE ROCKFISH	SWSP			0.0				0.0					
TIGER ROCKFISH	TIGR	0.0	0.4	0.3	0.1	0.8	0.2	2.5	0.9	0%	67%	11%	10%
TREEFISH	TREE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
VERMILION ROCKFISH	VRML	11.6	18.7	22.1	10.4	14.4	7.4	9.8	1.5	45%	72%	69%	87%
YELLOWEYE ROCKFISH	YEYE	27.2	37.6	47.7	20.1	136.0	111.0	93.8	65.4	17%	25%	34%	24%
YELLOWMOUTH ROCKFISH	YMTH	1.8	0.8	0.0	0.0	105.9	112.0	75.3	51.5	2%	1%	0%	0%
BOCACCIO+CHILIPEPPER RCKFSH	RCK1			0.0				0.0					
UNSP. BOLINA RCKFSH	RCK2	0.7	0.2	0.2	7.8	1.8	0.0	0.0	0.3	28%	100%	100%	96%
UNSP. DPWTR REDS RCKFSH	RCK3	0.0	0.2	0.1	0.0	16.6	0.0	0.0	0.2	0%	100%	100%	0%
UNSP. REDS RCKFSH	RCK4	10.6	11.9	17.9	34.2	11.8	4.3	4.2	105.6	47%	73%	81%	24%
UNSP. SMALL REDS RCKFSH	RCK5	6.4	0.8	0.0	3.6	4.2	7.8	1.5	165.1	60%	9%	0%	2%
UNSP. ROSEFISH RCKFSH	RCK6	1.0	0.0	0.0	0.4	0.4	2.4	0.0	120.2	71%	0%		0%
UNSP. GOPHER RCKFSH	RCK7	0.1	0.3	0.3	6.8	1.0	0.0	0.0	0.0	9%	100%	100%	100%
BLACK+BLUE ROCKFISH	RCK9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0			0%	
OTHER ROCKFISH	ORCK	5.8	7.7	0.1	1.7	17.7	7.8	0.0	10.3	25%	50%	100%	14%
UNSP. ROCKFISH	URCK	408.3	349.2	248.6	281.1	138.5	209.8	233.3	268.8	75%	62%	52%	51%

Public Scoping Document for Trawl IQs (IFQs and IPQs)
and Intersector Allocations:
MS-Act and NEPA SCOPING

Exhibit C.16.d
Public Comment
April 2004

Pacific Marine Conservation Council

March 17, 2004

Don McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384

Re: Item for Inclusion in April 2004 Briefing Book, Agenda Item C.16

Dear Dr. McIsaac:

Please accept the following new publication for inclusion in the April 2004 Briefing Book, Agenda Item C.16. The publication is entitled "Individual Fishing Quotas: Environmental, Public Policy and Socioeconomic Impacts." This brief paper documents the hypothetical and observed negative impacts (often unintended) of IFQ programs on family fishermen, coastal communities, the public trust and marine resources. The National Research Council's 1999 study *Sharing the Fish* recognized the paucity of consideration of socioeconomic impacts and the lack of clear-cut evidence of the conservation benefits of IFQ programs. This paper is a step towards a broader public deliberation about the potential costs and benefits an IFQ program can have on a fishery.

As the Council considers moving forward with an IFQ program for the limited-entry groundfish trawl fleet, thoughtful consideration of the variety of impacts detailed in this report should be made.

Sincerely,

Peter Huhtala
Senior Policy Director

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Individual Fishing Quotas:

Environmental, Public Policy, and Socioeconomic Impacts

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Front cover photograph
Kodiak Town Harbor with fishing boats
Kodiak, AK

Published March 2004

Individual Fishing Quotas

Environmental, Public Trust, and Socioeconomic Impacts

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I. Executive Summary

Recent scientific reports have detailed declines in various indicators of ocean health, and ocean fisheries in particular have received much attention. One study found that 90 percent of large, predatory ocean fish have disappeared from the world's oceans in the last 50 years[1]. These declines have had considerable impact both on marine ecosystems and on fishermen[2] and consumers who rely on those ecosystems for economic benefit and sustenance. Overfishing and mismanagement of U.S. fisheries have left many federally-managed fish populations depleted. The fishing industry is struggling, coastal fishing communities are struggling, and there is growing evidence about the broader adverse impacts to marine ecosystems.

One system that is increasingly being promoted in fishery management as the preferred means to restore profitability to fishing and health to ocean fisheries is the use of Individual Fishing Quota programs or IFQs[3]. IFQs grant an opportunity to fish for a fixed percentage of the total annual quota of a fish species to individual fishermen or fishing businesses. Proponents claim that IFQs reduce overcapitalization (the number of fishing vessels in a fishery), promote conservation, improve market conditions, and promote safety. Critics charge that IFQs create disincentives for conservation, consolidate ownership, limit new entrants into the fishery due to the high cost of quota shares, increase management costs, and create a range of negative socioeconomic impacts including loss of employment in coastal communities and inequitable distribution of initial allocation of quotas.

IFQs are currently used in four U.S. fisheries and in several fisheries in other countries. Research into these programs reveals both positive and negative impacts. Experience suggests that IFQs reduce overcapitalization, for example, but often do so at a cost to small family fishermen and coastal communities. Likewise, the evidence is mixed on conservation benefits. A recent General Accounting Office study details the "delicate balancing act" that managers must walk between economic, environmental, and social costs and benefits in implementing IFQs[4]. For precisely this reason, Congress enacted a moratorium on new IFQ programs from 1996-2002 and mandated further study of IFQs before new IFQ programs could be enacted in the U.S..

The purpose of this paper is not intended to set out arguments for or against IFQs. Nor is it intended to compare IFQ programs with existing management schemes. The purpose is to identify the negative impacts associated with current IFQ programs that have been identified by researchers in U.S. and foreign IFQ-managed fisheries, learn from those mistakes, and make recommendations to avoid them if such programs are to be implemented in the future.

Many of these findings were noted by the National Research Council's (NRC) Congressionally-mandated review of IFQs[5]. The NRC found many positive features of IFQs as well. It is certainly possible for these issues to be dealt with by the regional fishery management councils in designing programs, as suggested by NRC. However, empirical evidence of significant conflicts of interest on the councils raises serious questions about the councils' ability to make the hard choices necessary to satisfy the competing criteria of IFQs[6]. Instead, given the breadth and depth of potential problems associated with IFQs, Congress should enact national standards governing IFQs to prevent these problems. Such standards would preclude IFQs from becoming property rights, ensure conservation is enhanced through strict standards and regular independent review, and protect family fishermen and fishing communities.

The numerous and significant impacts detailed in this paper can be reduced or eliminated by enactment of federal legislation containing national standards for IFQ programs. Here are some impacts highlighted in the review:

Public Trust Impacts

- IFQs can be used to privatize publicly-owned fishery resources.
- IFQs create wealth before fish are caught, making it more difficult to incorporate management changes because of the additional money involved.
- Under IFQs, management costs increase and are often not fully recovered.

Environmental Impacts

- Overfishing in the form of exceeding the total allowable catch can still occur under IFQs.
- IFQs can increase bycatch because fishermen often keep only the most economically valuable fish (this is known as highgrading).
- Because quota shares are allocated for individual species, IFQs can be inconsistent with ecosystem-based management.

Socioeconomic Impacts

- IFQs tend to consolidate quota into the hands of larger fishing firms often to the detriment of small family fishermen.
- Because of consolidation of quota, IFQs eliminate jobs, disrupt fishing communities, and eliminate fishing traditions.
- IFQs generate windfall profits and increase profitability for a select few "winners;" the resultant re-distribution of wealth is often inequitable.

II. Introduction to IFQs

Ocean fisheries face enormous problems with declining catches, habitat destruction, overfishing, overcapacity, and wasteful practices. For example, in the west coast groundfish fishery, the capacity to catch fish outpaced the reproductive capacity of the fish. To address this situation, the federal government in 2000 declared the west coast groundfish fishery a "disaster," and as a result, large area closures were instituted and hundreds of fishermen were put out of work. The problems continue: Nine groundfish species are listed as overfished and scientists estimate that it will take decades for their populations to recover. Industrial-scale fishing trawlers have destroyed an unknown amount of ocean-floor fish habitat. Individual fishermen have lost jobs, and revenues to coastal communities have declined precipitously. The cumulative impacts to marine ecosystems are unknown.

Some have posited that this "tragedy of the commons" is reversible through privatization of ocean resources[7]. Others have shown that mismanagement of ocean resources by the regional fishery management councils is at fault[8,9]. Still others blame poor scientific data for poor management.

In response to these problems, Congress passed amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) in 1996 to end overfishing, rebuild overfished stocks, minimize wasteful fishing practices that catch and kill non-target ocean wildlife, and identify and protect important ocean and coastal fish habitats. The 1996 amendments, called the Sustainable Fisheries Act, provided the regional fishery management councils and federal managers in the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries) with specific guidance to accomplish these goals. The Sustainable Fisheries Act also placed a moratorium on new individual fishing quota (IFQ) programs because of concerns with the impact of such programs on both fishermen and the marine environment. IFQs, Congress dictated, required further study to determine their potential costs and benefits.

IFQs grant exclusive access to fish a certain percentage of the total allowed catch of a species of fish or shellfish in a specific area within a specified time. IFQs reduce competition between fishermen for fish (the so-called "race for fish") because each fisherman in an IFQ program is apportioned a certain percentage of fish that can be caught at any time during the fishing season[10]. This is a change from current fisheries management, which prescribes specific fishing seasons and vessel limits. This flexibility is cited as critical to improving safety (fishermen do not have to fish in bad weather or overload their vessels to maximize landings), creating more revenue for fishermen, and delivering fresh fish to markets and restaurants for longer periods of time.

IFQs are generally transferable, that is, fishermen or fishing businesses can buy, lease, or sell their shares. For example, a fisherman could purchase additional quota of a particular fish and catch more fish during that season. Such transferability is cited by proponents as critical for ensuring that market forces eliminate inefficiencies in any particular fishery. The theory is that by allowing individuals and firms to transfer quota in this manner, inefficient operators will increase their efficiency or sell their quota[7]. Proponents claim that through the combination of exclusive access and transferability, fishermen and fishing businesses will become more economically viable. In addition, proponents claim that because the value of quota shares is linked to the environmental health of the fish resource, fishermen will become better stewards of those resources.

IFQ programs have been implemented in only four U.S. fisheries: in 1990 for the surf clam/ocean quahog shellfish fishery in the mid-Atlantic, in 1992 for the wreckfish fishery off the south Atlantic, and in 1995 for the halibut and sablefish fisheries in Alaska. New Zealand and Iceland use IFQs in nearly all of their fisheries, Canada and Australia use IFQs in several fisheries, and Greenland and the Netherlands use IFQs in some fisheries.

From October 1996 until October 2002, Congress placed a moratorium on the establishment of new IFQ programs due to concerns with the impact of such programs on both fishermen and the marine environment. It also mandated a rigorous review of IFQs by the National Research Council (NRC). After extensive research on IFQs, including public hearings in the eight fishery management regions of the U.S., the NRC published *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas* in 1999. The NRC recommended lifting the moratorium on IFQs, but also identified a number of significant negative impacts of IFQs found in fisheries in the U.S. and around the world. While the NRC recommended giving latitude to the regional fishery management councils to address some of these issues, it also recommended that Congress act to address other issues through amendments to the MSA. Many fishing and conservation groups called on Congress to adopt national standards to address negative impacts. Congress did not act to pass such legislation and, at the behest of one of the original authors of the MSA, the moratorium was extended until October 2002. That moratorium has expired, no national standards have been passed, IFQ programs are under development in the Gulf of Mexico red snapper fishery, and talks are underway in the Pacific for a groundfish IFQ program.

Examinations demonstrate that IFQs reduce capacity and unrestricted quota trading helps promote economic efficiency as less efficient fishermen either improve efficiency or sell their quota[5]. Yet, this efficiency can come at a cost to small family fishermen and coastal communities, in both inequitable initial distribution as well as overconsolidation. IFQs also push the envelope of privatizing public resources. IFQ proponents claim that by giving fishermen a long-term interest in fishery resources, they will be better stewards of the resource. Examinations of IFQs, however, demonstrate both positive and negative impacts to marine resources. The following examination of the literature is intended to outline the negative impacts of IFQs that have been identified by researchers in U.S. and foreign IFQ-managed fisheries so that we can avoid them in the U.S.. For a closer look at the mixed results of IFQs, see the box "Alaska's Halibut IFQ Fishery" below.

Alaska's Halibut IFQ Fishery

Initial quota allocation sought to maintain a heterogeneous fishing fleet:

- Quota shares were granted based on participation in the fishery over three years, not just one, allowing various interests to be considered in the fishery[11].
- Allocation limits exist across vessel type and size categories and the shares may only be traded within their respective categories. Furthermore, an amendment to the program allows small-boat operations to fish with large-boat quotas[5], making it easier for small boats to persist in the fishery.
- Shares are further subdivided among geographic regions[5], allowing all coastal communities the ability to reap the economic benefits of IFQs.
- In the Aleutian Islands and Bering Sea, between 20% and 100% of shares in specific regions were set aside for rural native communities in the form of Community Development Quotas[11].
- However, quotas were only granted to boat owners, not crew members, a contentious issue that still riles fishery managers and coastal communities[5].

Some conservation benefits developed:

- A study by the International Pacific Halibut Commission estimates that fishing mortality from lost and abandoned gear dropped from 554.1 metric tons in 1994 to 125.9 metric tons in 1995[5].
- The total allowable catch, which was frequently exceeded before the implementation of the IFQ program, has not been exceeded since[5].
- Because shares are subdivided among regions, it follows that area-specific stock depletions will not occur. However, there have been no biological studies to confirm this hypothesis[5].

Fleet safety increased:

- The IFQ program allowed the fishing season to extend to 245 days from under 5 days. The extension allows fishermen the liberty of choosing when to fish so they do not have to fish in bad weather or compete in derby-style races. Since the implementation of the program, the longline vessel accident rate has fallen[12].

Economic benefits may have increased:

- The extended fishing season may also account for the rise in ex-vessel halibut prices. However, this has not been effectively proven[5].
- For seven years, taxpayers paid for the administrative costs of the program while NOAA fisheries developed a shareholder cost-recovery system. In 2002, the government was able to implement the new system and start collecting fees from quota holders.

III. Public Trust Impacts

Property Rights?
In the MSA, the U.S. claims "sovereign rights and exclusive fishery management authority over all fish and all continental shelf fishery resources, within the exclusive economic zone[13]." The central concept in fisheries management is that the living and non-living resources of the ocean belong to all U.S. citizens. Like the national forests and parks, the ocean and its resources are managed for the public by a federal agency, in this case NOAA Fisheries and the regional fishery management councils. Like those other resources, the oceans, especially its fisheries, have tremendous value. In 2002, total commercial fisheries landings were valued at $3.1 billion[14]. The American Sportfishing Association set the total 2001 economic output of saltwater sportfisheries at $31 billion[15].

In fisheries management, IFQs are commonly referred to as "rights-based management" regimes because they assign exclusive access to a portion of the overall catch to an individual fisherman or business. This exclusive access has been claimed by proponents to represent a "property right[7]." Others refute this claim, noting that the MSA specifically negates any potential ownership of publicly-owned ocean resources[16,17,18].

One of the central arguments of rights-based management proponents is that such management will set up an efficient market where costs will be minimized and economic benefits maximized[7]. Furthermore, proponents claim privatization leads to better stewardship of resources and helps to sustain fish species in the long run[7]. However, many economists agree that the arguments wielded by these proponents are based on arbitrary assumptions and theories that may prove false in real world scenarios[5,19,20]. Moreover, the claims surrounding enhanced stewardship of resources are widely questioned[5,16,21,22]. As the NRC observed, "Much of the political support for IFQs is … driven by faith in the assumption that privatization will foster ecological sensibility[5]."

While it is clear that the MSA prohibits IFQs from becoming private property[17], there is ample evidence asserting that IFQs, as they have been implemented, take on the appearance of private property rights[5,19,20]. Indeed, many IFQ proponents argue that such rights are necessary for full realization of the benefits of IFQs[23]. Copes (2000) notes that "a fishery committed to an IFQ program is a fishery whose fish stocks are unlikely to return to publicly-owned resource status[24]." Squires *et al.* (1995) envision an even more permanent status: "[t]he inherent permanency of perpetual property rights and the difficulties of revoking them due to vested interests probably insures the permanency of ITQs [individual transferable quotas] when they have been implemented[25]." In Iceland, for example, quota shares in the groundfish fishery, while theoretically the property of the nation, "are acquiring the characteristics of private property, *despite legal clauses to the contrary*[5]." (emphasis added) In New Zealand, quota shares are held to be property rights by owners. Only with a Court of Appeal decision in 1997 did the court invalidate the claim that quota represented an "absolute" property right[22].

> *"Is it necessary to convert public assets into private assets in order to solve current fisheries management problems? The experience of the U.S. suggests that the answer is an emphatic no."*
>
> Seth Macinko and Tim Hennessey
> *Managing Marine Fisheries in the U.S., 2002*

Macinko and Hennessey (2002) raise the question regarding the "appropriate public policy process for making a decision on such a conversion in ownership[18]." In detailing the history of privatized natural resources in the U.S., researchers have found that such a transfer of ownership is not necessary to solve current fisheries management problems[16,18].

One area of speculation surrounding the implementation of IFQs has to do with the potential for quota holders to bring legal action against the government for compensation should the value of quota decline after management action. In New Zealand, for example, the fishing industry filed suit following the government's reduction of the total catch[22]. The NRC put it plainly: "… although IFQs are limited privileges and may be legally revocable, political pressure from permit and quota shareholders concerned about protecting their investments will resist revocation … this is evidenced in other natural resource sectors, such as mining and ranching, when reduction in privileges of access to public resources are challenged by those who benefit from them[5]." Whether or not the MSA can withstand such challenges remains to be seen (especially in fisheries that become overfished and quota reductions are required). The NRC determined that additional amendments were necessary to the MSA in order to prevent such claims: "The Magnuson-Stevens Act should be amended to make it clear that the nature of the privilege embodied in an IFQ … does not authorize actions by IFQ shareholders against federal, state, or local governments for actions designed to protect marine resources and the environment…[5]."

In the words of McCay (1995), "tradable, exclusive rights to take a proportion of a defined quota are quite clearly property, as underscored in their treatment as such for tax purposes in Iceland, the U.S. and other countries. Whether *de jure* or *de facto*, something like private property emerges in ITQ systems [where quota is granted in perpetuity][21]."

One final aspect of the debate around property rights, and perhaps the most troubling to taxpayers, involves the issue of "gifting." In all existing IFQ programs, the initial allocation of quota has been awarded without charging the recipient for the use of public resources[5,21]. Such "gifting" of public resources in the U.S. "has not been seen since the Homestead Act of 1872, and flies in the face of existing U.S. policy on a host of other natural resource issues[26]." This initial allocation of free quota shares creates a windfall to the initial recipients. Later entrants have to pay to gain quota and have to pay those from whom they buy quota, not the government. Such an arrangement lends to the conclusion that IFQs "amount to a giveaway of public resources[21]." Copes (1997) adds: "[Windfall gains] have often caused discontent not only among subsequent holders of purchased licenses and quotas, but also among the general public, scandalized by the inequitable disposition of benefits from a public resource. To many, this gift may seem particularly inappropriate in the case of large and financially sound fishing corporations[19]." While windfall gains represent troubling public policy, this has not prevented American and foreign countries' employment of them. Researchers have noted that windfall gains are needed to ensure the cooperation of current participants[19,20].

Impacts to Fishery Management

IFQ proponents claim that IFQs ameliorate several challenges facing fishery managers, including adherence to the total allowable catch (TAC). The theory holds that since each fisherman is guaranteed a fixed share, fishermen will only catch their share, thus eliminating overages. Once an IFQ program is established, however, adapting to changing conditions and incorporating management changes are often more difficult because IFQ programs often treat fish as private property. For example, reductions to allowable catches will likely be highly contested by quota owners because such reductions diminish not only the value of the current season's catch but also a loss of asset value for loans[22,25]. Quota owners also have an increased economic incentive to exert pressure on managers to ensure that the TAC is maintained or increased even when managers may be lowering the TAC for long-term public interest[22,27]. As Wallace (1998) notes: "TAC … setting is prone to strong industry pressure for the elevation of catch limits or resistance to catch reductions[22]." Furthermore, add Monk and Hewison (1994), "Political pressure has led to the setting of TACs at levels beyond maximum sustainable yield[28]." In New Zealand, for example, the government tried in successive years to reduce the TAC for the northern red snapper stock to allow it to rebuild. "Industry responded with a series of legal injunctions to prevent TAC reductions and to gain compensation from the government should reductions be allowed[22]." The Court of Appeal eventually dismissed industry's claims that their property rights were absolute and that the government had no ability to change the TAC.

> *"ITQ management appears to have been assessed by economists primarily interested in terms of increased gross resource rents, with insufficient weight or attention given to the economic costs of monitoring, enforcement, resource assessment, discards, and social costs to form a measure of net social benefit."*
>
> Dale Squires, James Kirkley,
> and Clement A. Tisdell
> *Reviews in Fishery Science, 1995*

Another researcher makes a simple analogy: "[m]anagers should consider Murphy's Law: Anything that can go wrong will. Issuing perpetual rights makes things hard to fix[29]." IFQ programs can also be extremely costly to change once they are in place[27]. In New Zealand, for example, early revenues from ITQ programs often went to compensate ITQ holders when the TAC was lowered[28]. The implication of compensating quota owners is sobering: Such costs can effectively prohibit managers from adjusting TACs downward because the potential compensation to quotas holders would be high. In reviewing New Zealand's Quota Management System (QMS) after eight years, Monk and Hewison (1994) found that "the threat of large compensation claims by quota holders against the New Zealand government has acted as an impediment to reductions in TACs in some major fisheries. There appears to be a clear example of this occurring in the orange roughy fishery on the Chatham Rise, where the government has continued to set a TAC at nearly three times the scientifically recommended MSY (maximum sustainable yield)[28]."

In addition to making management adjustments more difficult, IFQs significantly increase the costs of management. IFQs are often more expensive than alternative management systems due to their dependence on highly accurate stock assessments, extensive enforcement, and more highly trained staff[5,25,30]. Many IFQ systems have failed to either recover fees adequate to cover management and research costs[5,25], and most fee collections provide minimal cost recovery[5].

New Zealand's history is instructive. First, the government tried to recover the costs of management and research through "resource rents" applied to users. According to Wallace (1998), "The resource rental revenue … always returned less than fishery management and research costs[22]." Second, at industry's request, the government implemented a cost-recovery system where industry would pay 70% of management and research costs. In 1992, the government expected to generate "NZ$53 million annually … [yet] only levied about NZ$33-36 million in cost recovery charges[22]." Industry pressure to reduce contributed costs in New Zealand has hit research budgets especially hard[22]. The potential downside of cost recovery systems in New Zealand, and elsewhere, is the "capture by the industry of fisheries management at the expense of other users[22]." Furthermore, in New Zealand, "Industry has tended to consider its rights as pre-eminent in any dispute with other stakeholders such as recreationalists or environmental organizations … [C]ost recovery has strongly reinforced this view…[22]."

In addition, researchers have observed that the more complex the fishery, the higher the costs of an IFQ system[24,29]. Seasonal changes, different vessel quotas, and overlapping jurisdictional boundaries all lead to higher management, monitoring, and enforcement costs[25]. In order for appropriate TACs to be set at the beginning of each season, IFQ systems require increasingly accurate and frequent stock assessments[25]. IFQs move fishery managers to focus almost exclusively on stock assessments, to the exclusion of broader environmental assessments[22]. For example, in New Zealand, "environmental organizations' attempts to widen the research agenda from fisheries stock assessment to environmental assessment … have had very limited success[22]."

> *"Since quotas are fixed and excessive catch is a violation of the law and subject to prosecution, a quota shareholder tends to land only the portion of the catch that generates the highest income."*
>
> National Research Council
> *Sharing the Fish, 1999*

Monitoring and enforcement are critical in IFQ systems: only with full compliance does industry reap expected benefits[5,25,26,31]. In addition, IFQs potentially create incentives to cheat by underreporting catches and highgrading by keeping only the most economically valuable part of catches[5,20,32,33,34], increasing enforcement costs. The basic reason: fishermen and fishing businesses will seek to get the most value for their quota. McCay (1995) cites the changeover to a non-competitive system as the reason for these incentives: "[U]nable to compete for an undetermined amount under a generalized quota or other regulatory system, the ITQ holders have incentives to try to get more than allowed[21]." Thus, monitoring and enforcement costs are driven up to ensure the efficacy of IFQ programs.

In the Netherlands, the government is moving away from IFQs due to high management costs[12]. In Alaska's halibut and sablefish fisheries, increased dockside monitoring and enforcement requirements have increased management costs[12]. For example, Buck (1995) observed: "NMFS estimated that increased monitoring and enforcement costs to cover additional landing ports and vessel observers for the halibut and sablefish IFQ program would be approximately $2 million annually, to counter high-grading and bycatch concerns, and deal with the large fleet and area covered[12]." Monk and Hewison noted that New Zealand's "system is difficult to enforce and monitor[28]." Buck (1995) also noted on a broader level that "larger ITQ programs will likely require an extensive enforcement effort and the number of violations could be substantial[12]." Given the limits in the MSA to cost-recovery (3% of the ex-vessel value of landed fish), such issues are highly germane. In its recommendations on this issue, the NRC suggests that this "may well be too low for some IFQ programs and should be increased[5]."

IV. Environmental Impacts

IFQ proponents argue that as resource rights move from public to private hands, better stewardship of the resource follows. This is based on the theory that when no one owns the fish there is motivation for each fisherman to fish as much as possible, as quickly as possible, so he or she can catch the maximum amount before the fishery limit is reached each season. Proponents argue that once fishermen own the fish they are catching, they will not need to race their peers in order to catch the most fish. Instead, they will reap the benefits of fishing over a longer period of time if the fish resources remain healthy, which will create an incentive for them to maintain the fish populations' health. Even though traditional economic thought followed this line of thinking for decades, many economists have seen little empirical evidence of an improved conservation ethic in IFQ fisheries[26,28,36].

> *"ITQs give rights to one fish, forcing fishermen to devalue other parts of the ecosystem. No 'direct' value means it is not valued."*
>
> Allison Rieser
> *Harvard Environmental Law Review, 1999*

IFQs = Enhanced Stewardship?
IFQ supporters can point to some successes of IFQ programs: namely more efficient fish markets. An efficient market exists when a fisherman is making the most money for the smallest effort put into catching the fish. Nonetheless, Squires *et al*. (1998) note, "Simply instituting an ITQ program will not, however, ensure that potential gains in efficiency will arise[20]." The theoretical case for IFQs is "highly dependent on gross simplifications imbedded in the implicit or explicit assumptions which remove the ITQ model from the real world of fisheries[19]."

For example, proponents claim that implementing ownership rights will lead fishermen to maintain the health of the resource for years to come. The assumption that fishermen will fish at a sustainable rate runs contrary to what is called "the iron law of the discount rate." If a fishermen can earn more money by selling a fish today than by allowing it to stay in the ocean another week, he or she will catch it and sell it today[36].

In such situations, as the history of U.S. natural resources depletion has shown, it is optimal for the individual owner to exploit the resource as quickly as possible and invest the proceeds where they will grow faster than the regeneration rate of the exploited stock[36]. In the U.S. wreckfish fishery, Gauvin (1994) found that "the hoped for market incentive that would induce stock conservation had less impact than originally expected" because the discount rate – the desire to earn more money faster – outstripped the conservation incentives[34].

IFQs are Inconsistent with Ecosystem-based Management
IFQ programs work by dividing up percentages of the total annual quota of a single-species of fish among the fishermen in a fishery. IFQs, like existing single species management, apportion these quotas without regard to how catching those fish will affect the rest of the ecosystem. Unlike existing single-species models, however, re-configuring quota allocations to account for such ecosystem impacts will be harder to do as quota value increases. Recent reviews of the U.S. fishery management system, like that of the Pew Oceans Commission, call for ecosystem-based management because it is the only way to maintain healthy oceans, fish populations, and fishing communities[37,38,39]. Rieser (1999) notes the difficulty of managing "a large number of individuals with the same incentives" to ensure that "all of the interconnecting components of a functioning ecosystem remain intact[27]."

In New Zealand and Nova Scotia the single-species IFQ programs fail to address broader ecosystem considerations[28,40]. Wallace (1998) points out that IFQ management "…has intensified the stratification of fisheries management into single stock management[22]." Monk and Hewison (1994) note that New Zealand's system "focuses primarily on single-species management and largely fails to address broader ecosystem considerations[28]." In both, a fish quota of one species is traded to cover the bycatch of another species. Although this may help limit bycatch, it does not take into consideration the health of the population of the bycatch species. Thus, the overall balance of the species in the ecosystem is disregarded[26].

Furthermore, the challenge to ecosystem-based management increases because the only products in the ecosystem that have economic value are the fish sold at market. Some economists find that there is no incentive to protect the ocean habitat because no one, including the fishermen, has to pay for destruction that has no dollar value assigned to it[20,27,41]. When a factory worker accidentally breaks a machine, the factory owner has to pay for a new machine or the factory will not be able to continue producing at the same pace. In contrast, if a trawl runs over a coral bed and destroys the spawning ground of a grouper, no one pays for the destruction of the spawning ground even though the grouper's production level drops over time.

An IFQ program requires that the health of a fish population must be determined before the start of the season so each fisherman's quota can be set for the year. However, ocean conditions and fish populations are always in flux. Even the best scientific population predictions may change during a fishing season. IFQ researchers note that fishery management lacks the ability to adjust the TAC downward once it has been set in place[19] (see Public Trust Impacts section). Such inflexibility prohibits managers from acting with precaution in situations where the TAC may not represent adequate protection for specific fish populations.

"IFQs are not a conservation tool, they're mainly an economic tool to control overcapitalization and 'the race for fish'. The TAC and other management measures are the main conservation tools in IFQ systems."

National Research Council
Sharing the Fish, 1999

Bycatch, Discarding, & Highgrading

All fishery management schemes suffer from the ecological and economic problems created by bycatch, which is the catching of unwanted fish and other ocean wildlife that leads to overexploitation and ecosystem damage. Scholars who support IFQs argue that quotas, which create incentives to maintain fish populations, help alleviate these problems. However, not only does bycatch remain a problem in IFQ programs, but also it can be intensified or new problems can be created by the incentives formed in quota programs[20,21]. In New Zealand, for example, Monk & Hewison note that, "Bycatch and underreporting continue to be major problems[28]."

"The original theorists of ITQs probably did not envision the degree to which incentives to cheat, discard, or highgrade catch might influence the behavior of fishermen."

John Gauvin, John M. Ward, and Edward E. Burgess
Marine Resource Economics, 1994

Highgrading, price dumping, and underreporting are all outcomes of quota systems and not of traditional management systems. In fact, because quotas grant fishermen the privilege to catch the fish and not ownership rights to the fish themselves, the conservation benefits may not exist at all[5,20,25]. The privilege to catch fish will motivate fishermen to maximize the value of their quota, not to maintain the sustainability of the fish population that they do not own.

In order to maximize the quota value and each catch associated with it, fishermen may be motivated to throw back lower-value fish. Bycatch known as highgrading occurs when higher-value fish are kept for sale while the lower-value fish are thrown back to sea, often dead[5,19,26,35,42,43,44]. Through highgrading a fisherman can maximize the dollar value of his or her catch while disregarding the adverse effects of this bycatch to the overall ecosystem. The NRC reported that "[d]iscarding of small and immature fish during fishing operations and highgrading the catch seem … to continue to be serious problems in the Icelandic fishery and these problems may have been escalated with ITQs[5]." In addition, highgrading has been documented in fisheries for Atlantic Canadian groundfish[45], inshore Newfoundland cod[45], northern New Zealand snapper[46], Australian southern bluefin tuna[47], and the New Zealand multi-species ITQ program[20,48,49]. Dewees (1990) observed that "New Zealand's … ITQ experience reveals multispecies fisheries problems with high grading, discards, total allowable catch overruns, and total allowable catch underruns[48]." McCay (1990) additionally notes that "ITQs do not solve the problems [bycatch, joint catch] of multispecies fisheries management and may intensify some of them[49]."

Similar to highgrading, quotas create an incentive for price dumping, which is the discarding of fish due to changes in ex-vessel price. If a fisherman is on his or her way back to dock and hears that the price of the fish has dropped, he or she may throw the fish overboard in order to fish the allowable quota on another day when prices may be higher[19]. In management schemes where fishermen can fish without a quota, there is no incentive for them to throw back fish they could otherwise sell, even if the price drops. In this way, the limits imposed by quota shares encourage increased bycatch mortality.

Furthermore, underreporting of catch, known as data fouling and quota busting (exceeding quota share) may be more prevalent in IFQ systems[20,25]. Gimbel (1994) notes that quotas create an incentive for fishermen to underreport so they can maximize their quota value[26]. In detailing the data fouling associated with Iceland's IFQ program, the NRC noted that fishermen who accidentally land cod while fishing for haddock "must acquire an equivalent amount of cod ITQs to cover their catch to prevent loss of their fishing licenses. … this results in considerable amounts of dead fish being thrown back to sea, especially toward the end of the fishing year when ITQs are scarce and the lease price is inordinately high. ITQs may, therefore, contribute to the waste of living resources, resulting in the erosion of ecological responsibility[5]." Underreporting, like the type that occurs in Iceland, undermines catch calculations and can cause TACs to be set too high[26]. Muse and Schelle (1989) note that data fouling is one of the main problems in the Ontario freshwater ITQ program[45], and it is also observed in the U.S. IFQ wreckfish fishery[34].

"The way in which an IQ system works gives fishermen a clear incentive to high-grade their catches leading to unreliable fishing mortality data."

Stephen Cunningham
The Use of Individual Quotas in Fisheries Management, 1993

Examples of IFQ Fishery Failures

Contrary to economic efficiency and biological conservation arguments that proponents wield, fishery collapses have taken place in IFQ systems. The New Zealand snapper fishery suffered depletion due to overfishing through highgrading, misreporting, and increases in quota shares over the initial allocation[28,46]. Wallace's (1998) examination of all the New Zealand fisheries under IFQ management found them lacking: "In 1998, of the 187 stocks managed under the quota system, 25 had stock assessments. Of these, 13 were below the biomass that would support maximum sustainable yield[22]."

"Much of the political support for ITQs is … driven by faith … that privatization will foster ecological sustainability."

National Research Council
Sharing the Fish, 1999

After surveying the collapse of multiple New Zealand fisheries, Monk and Hewison (1994) warn fishery managers to "critically examine its [ITQs] present deficiencies" before implementing future programs. Their review of IFQ programs found fishery failures under IFQ management in the orange roughy, rock lobster, and snapper fisheries in New Zealand[28].

Back on this side of the globe, Canada's east coast cod and groundfish populations suffered similar declines. After 10 years under IFQ management, the fisheries collapsed. For five years the Canadian government closed down the fishery. Copes (2000) notes that this was the first ever "massive and multiple collapse" along Canada's Atlantic coast[24].

In sum, IFQs do not eliminate existing environmental problems and can actually exacerbate them. Reviewing 11 years of IFQ management in New Zealand, Wallace (1998) concludes: "The capacity of the New Zealand quota management systems to achieve environmental goals has not been demonstrated[22]." Monk and Hewison (1994) speak more broadly to the environmental impacts of IFQs: "… IFQs are not a panacea for long-term conservation of fisheries."

V. Socioeconomic Impacts to Fishermen and Fishing Communities

The objectives of IFQ programs focus on conservation, economic efficiency, and safety. Proponents generally fail to address socioeconomic impacts: the impacts to fishermen and fishing communities. Squires *et al*. (1995) note that "there are real social costs of ITQ management that must be factored into evaluations, although these are inevitable costs whenever market economies widen and deepen to incorporate sectors not formerly and predominately governed by markets[25]." Yet, the NRC notes that "the extensive literature and testimony received indicate that insufficient attention and resources have been devoted to socioeconomic impact assessments prior to decisions about IFQs[5]." The following discussion outlines some of the real social costs.

Consolidation of Quota – Disenfranchisement of Small Family Fishermen

The starting point for many of the social and economic problems associated with IFQs is the tendency for IFQ systems to allow for a concentration of quota shares[21,24]. Additionally, IFQs tend to encourage large-scale interests to dominate a fishery and for small family fishermen to be bought out of the fishery[31,50,51]. Hand in hand with concentration of quota is the transfer of market power to those fishermen with large quota shares and the resultant ability to then manipulate quota and product prices to the detriment of others[31,52]. McCay (1995) adds that, "Generally, in ITQ systems, power will be transferred to ITQ holders, reducing the negotiating power of those who work for them[21]."

Numerous examples of quota consolidation exist in IFQ programs. A 1999 study of the surf clam and ocean quahog fishery showed that many small firms sold out in the first two years after implementation of the IFQ program and by the late 1990s significant consolidation had occurred[5]. A General Accounting Office (2002) review, however, found that an even greater consolidation had occurred: "Consolidation of surf clam and ocean quahog quota is greater than NMFS data indicate, because different quota holders of record are often part of a single corporation or family business that, in effect, controls many holdings. For example, for 2002, we determined that consolidation of quota in the surf clam program was about twice that indicated by NMFS data and that one entity alone controlled at least 27 percent of the quota[53]."

In the Icelandic fisheries, concentration of quota shares with fewer and bigger companies has accelerated where there are multiple fisheries under IFQ management. Twenty-four large firms own almost half the total quota; a decade earlier these same firms owned only a quarter of the total[5,54]. Survey research in New Zealand found a pronounced decrease in quota owners, suggesting a rise in quota held by remaining participants[51]. McCay (1995) also found a "rapid concentration of ownership in ITQs … the groundfish fisheries of the Scotia-Fundy district of Canada[21]." Even IFQ systems with ownership restrictions struggle with overconsolidation[21]. In New Zealand, limits on the amount of quota one fisherman or firm can own are 20 percent for inshore and 35 percent for offshore fisheries; nevertheless, the owned and leased quota-holdings of the 10 largest companies in New Zealand increased from 58 percent to 66 percent over a 10 year span (1986-1988)[31]. In the Alaskan halibut IFQ program, small family fishermen's quota holdings decreased through the 1995-2003 period, while larger vessel owners' quota holdings increased[55].

"From a social cost-benefit standpoint the question needs to be asked whether the improved private profitability of the enlarged company operations will be able to offset the diseconomies suffered in smaller communities with a shrunken economic base. The latter will include the effects of job losses, reduced aggregate incomes, shrunken business turnover, reduced scale economies and service levels, higher unemployment, outmigration, assets lying waste, requirement for additional infrastructure in receiving communities of migrants, etc."

Parzival Copes
Social Implications of Quota Systems in Fisheries, 1997

Impacts to Small Coastal Communities

The consolidating nature of IFQs affects family fishermen and fishing communities in numerous ways. The impacts of consolidation and concurrent disenfranchisement of small family fishermen are felt most strongly in coastal fishing communities. The National Research Council (1999) analyzed this impact: "To some extent, regional concentration of quota shares is unavoidable, a healthy sign of increased economic efficiency. The social costs, however, may outweigh the gains in economic efficiency. As was the case when agriculture became increasingly intensive and took advantage of gains to scale, negatively affecting traditional farming communities, some fishing communities will undoubtedly thrive, whereas others' valued life-styles and traditions will be threatened[5]."

Researchers have documented numerous adverse socioeconomic impacts: job losses, reduced aggregate incomes, higher unemployment, rupture of personal relations, loss of professional expertise and knowledge, loss of a traditional fishing culture, and wider income gap between quota "haves" and "have-nots[19,21]." In Iceland, municipal bankruptcy in fishing villages that have lost most, or all, of their quota along with massive unemployment and dissolution of communities is of great concern[5,54]. Another concern is the loss of fishing employment and decrease in revenues and the impact on coastal communities' economic and social stability.

IFQs have also initiated a geographical shift of power from rural to urban centers. McCay *et al*. (1995) reported a clear geographical shift in both the surf clam/ocean quahog fishery as well as the Canadian programs they examined[56]. In Iceland, the main accumulators of quota are companies in larger towns[5].

> *"The fact that an ITQ program will produce aggregate benefits means there is a potential to make everyone better off. In practice, it is difficult to attain such fine-tuned fairness."*
>
> Rögnvaldur Hannesson
> *Global Trends: Fisheries Management, 1997*

In reviewing a decade of IFQ management in the Icelandic fisheries, one researcher asked the following question: "[s]hould the closedown of whole communities, leaving the residents unemployed and with worthless houses be treated as an 'externality' of the ITQ-system, a part of the price to be paid for efficiency in the fisheries[54]?"

> *"IFQs as currently administered, do nothing to produce income for U.S. citizens, who are the owners of the wealth of ocean fisheries."*
>
> Daniel Bromley
> *Managing Marine Fisheries in the US, 2002*

Initial Allocation of Quota Shares

Initial allocation of quota shares is replete with problems. The process itself is lengthy and requires a substantial investment of management resources[25]. In the Alaska halibut and sablefish fisheries, for example, implementation of an IFQ system took eight years to complete[11]. The process is also likely to be contested by those excluded from the initial allocation[27]. This has been the case in the Alaska halibut and sablefish fishery as well as the New Zealand fisheries. A 1997 survey of quota holders in the Alaska halibut fishery found that nearly two-thirds thought that the IFQ systems did not allocate quota fairly[57].

A major issue associated with initial allocations is the determination of who is eligible to receive quota. Generally, vessel owners are eligible[5]. Yet, such a determination is widely criticized in the U.S. and elsewhere. The decision to allocate only to vessel owners in the Alaska halibut and sablefish fisheries sparked wide opposition from crew and skippers. In *Alliance Against IFQs v. Brown*, the Ninth Circuit Court found that the plaintiffs had valid concerns but the lack of a legal basis in the Magnuson-Stevens Act, and the limited review afforded under the arbitrary and capricious standard of the Administrative Procedures Act, foreclosed any opportunity for relief[27]. In Iceland, for example, prior to IFQ programs, fishing was typically regarded as a "co-venture" of vessel owners and crew, and many crewmembers now feel disenfranchised[5]. In 1998, the Iceland Supreme Court ruled that initial quota allocations deprived a majority of the population access to an equitable share in the publicly-owned resources of the ocean[58].

Crew and skippers who have as long a track record as boat owners themselves are generally left out of the initial allocations and many lose their jobs[19,27,59]. Conversely, those who remain may suffer reduced incomes, as was the case in the Nova Scotia small trawler fishery[56]. IFQs also create significant barriers to entry or upward mobility for fishermen, especially for crew, small-scale fishermen, or economically distressed fishermen due to the high cost of purchasing quota[60]. Additionally, because of the considerable cost of quota shares and reduced number of vessels, few crewmembers can expect to become vessel owners[19,21,25,51]. Copes (1997) posits that with IFQs, highly skilled skippers and crew (called highliners) "may remain at the top of the skill hierarchy, but with the lower demand for labor in the fishery and the smaller post-rationalization difference between highliners and marginal fishers, the highliners are likely to find the returns to their skills reduced. Highly skilled hired skippers and crew members are likely to lose income in the process[19]." Casey *et al.* (1995) noted that highliners in the British Columbia halibut fishery "tended to receive quota allocations significantly less than their previous derby landings and vessels with sporadic catch history received relatively more quota[61]."

> *"...limits on transferability can help maintain the viability of communities, regions, or ethnic groups by retaining asset ownership and employment within these social groupings."*
>
> Dale Squires, James Kirkley,
> and Clement A. Tisdell
> *Reviews in Fishery Science, 1995*

Another major issue with initial allocations has to do with the wealth created in the initial allocation. The windfall financial gains conferred upon the initial participants creates an immediate gap between quota "haves" and "have-nots[19]." Such a gap can significantly reorganize social relations in small communities[62]. The initial windfall gains can also create discontent in the public at large to the inequitable disposition of benefits from a public resource, especially if those gains initially or eventually end up in the hands of large and financially sound fishing or processing corporations[5,19,26]. Australia has attempted to curtail these effects, utilizing criteria to "avoid or minimize redistribution of wealth[63]."

A final problem with initial allocations is that they are generally based on recent catch history, i.e., the amount of fish a fisherman has caught during a specified period of time[5]. In systems where there are no limits, such allocations reward the biggest fishermen, those with the largest capacities in the selected years win. In some cases, these could be the very fishermen that caused environmental problems in the fishery in the first place.

In Australia, the courts found that such an allocation process was capricious and irrational[5]. In that program and others, initial inequities continue to provide major obstacles to establishing satisfactory management regimes[5,19]. A corollary issue is known as "fishing for quota," where speculation that an IFQ program is coming leads fishermen to fish hard to develop large catch histories, increasing pressure on fish populations.

VI. National Standards for IFQs

As noted earlier, the purpose of this paper was not to set out arguments for or against IFQs. The purpose was to highlight the negative impacts of IFQs that have been identified by researchers in U.S. and foreign IFQ-managed fisheries. The numerous and significant impacts detailed in this paper can be greatly reduced or eliminated by enactment of legislation containing national standards for IFQ programs.

The Marine Fish Conservation Network worked with conservation groups, commercial and recreational fishing associations, and marine science organizations over the past several years to develop a set of national legislative standards that will not prevent regional councils from enacting IFQs, but will work to prevent the worst aspects of IFQ programs from harming family fishermen, marine ecosystems, and the public trust.

The standards outlined below are spelled out in more detail in H.R. 2621, the "Fishing Quota Standards Act of 2003," introduced by Representatives Allen (ME), Delahunt (MA), and Simmons (CT).

Fishing Quota Standards Act of 2003 (H.R.2621)

Negative Impact	How H.R. 2621 Eliminates or Mitigates
IFQs take on the appearance of property rights	The bill retains current law stating that IFQs are not compensable property rights and are revocable. Additionally, the bill strengthens this principle by limiting IFQ programs and shares to a period not to exceed seven years, after which time they *may* be renewed subject to satisfying defined criteria.
Threatening the public trust	The bill requires Councils and the Secretary of Commerce in developing IFQ programs to take into account the fair and equitable distribution of a public resource. The bill requires IFQ programs and shareholders to return scientifically measurable improvements in avoiding bycatch, preventing highgrading, reducing overfishing, rebuilding overfished stocks, and protecting essential fish habitat. The bill requires independent review of IFQ programs and shareholders through a national IFQ review panel, consisting of individuals knowledgeable about fisheries management. In addition, each fishery management council will establish and maintain an IFQ review committee, consisting of individuals with knowledge in fisheries management to conduct reviews of IFQ shareholder performance.
IFQs increase management costs	The bill requires that the total amount collected from all quota shareholders is sufficient to recover direct costs related to administration and implementation, including enforcement, management, data collection, and scientific research.
IFQs consolidate quota	The bill generally limits quota shareholders to owning no more than one percent of the total allowable catch with an exception of five percent if a council can demonstrate that such an increase will not be detrimental to other shareholders. Exceptions for fisheries with a small number of participants are provided.

(Continued on next page)

Negative Impact	How H.R. 2621 Eliminates or Mitigates
IFQs do not eliminate bycatch, discarding, and highgrading	The bill rewards fishermen with past conservation-based performance by including conservation performance criteria for the initial allocation process. This criteria seeks to include fishermen who have used selective fishing practices that have minimal bycatch, prevent highgrading, and have minimal adverse impacts on essential fish habitat. The bill requires IFQ programs and shareholders to provide additional conservation benefits in the form of scientifically measurable improvements in avoiding bycatch, preventing highgrading, reducing overfishing, rebuilding overfished stocks, and protecting essential fish habitat. The bill creates incentives in successive allocations for fishermen who fish selectively and protect essential fish habitat to obtain increased allocations.
IFQ have numerous negative impacts on coastal communities	The bill contains language requiring any IFQ program to minimize, to the extent practicable, negative social and economic impacts of the program on local coastal communities.
IFQs allocate quota unfairly	The bill requires a fair and equitable allocation of quota shares among vessel categories and gear types. Additionally, preference in initial allocations is given to fishermen who are currently engaged in fishing and have long-term participation in the fishery. The bill also requires the approval of a two-thirds majority of the fishermen in the fishery to begin development of an IFQ program. Last, the bill requires a second referendum to approve a specific IFQ program, requiring a two-thirds majority of fishermen and crewmembers.
IFQs exclude crew and skippers	The bill requires that crew members who derive at least 75 percent of their income from the fishery be included in the referendum to approve a specific IFQ program.
IFQs eliminate new entrants	The bill requires that IFQ programs set aside a portion of each annual-allocation for new entrants, including entry-level fishermen, small vessel owners, and crew members.

While these standards cannot eliminate all problems associated with IFQs, they can reduce some of the worst effects of poorly regulated IFQs. The extensive literature detailed in this paper sets out concerns detailed by research completed on IFQs from Alaska to New Zealand. IFQs present significant threats to public ownership, the ocean environment, and the socioeconomic well being of fishing communities, and good government is needed to protect the taxpayer, marine ecosystems, and family fishermen and fishing communities. As Grafton (1996) notes, "ITQs are not … a panacea for all the problems that arise in fisheries[31]."

Recognition of the limitations of IFQs and proactive action on the part of Congress can ensure that IFQ programs promote conservation and protect small family fishermen and the coastal communities who depend on them.

Congress has the opportunity to address the problems identified in this paper; we can learn from the mistakes of others.

VII. Endnotes

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LATENT LIMITED ENTRY TRAWL PERMITS

Situation: A NMFS Northwest Region document was provided to the Council on this issue under the NMFS groundfish regulation status report at the March 2004 Council meeting. Dr. Steve Freese will present a summary of the report at this meeting. An updated version of the report, with some minor revisions, will be provided in your supplemental materials.

The issue of latent permits and the Council's consideration of trawl individual fishing quota (IFQ) interact. To the degree that initial allocation is based on permit catch history, the amount of IFQ issued for latent permits will be substantially less than more active permits. If a trawl IFQ system is eventually implemented, the IFQ issued will take on much of the value currently associated with trawl limited entry permits and the value of trawl limited entry permits will decline to minimal levels. Even though a control date of November 6, 2003 was adopted to limit economic speculation in the IFQ program, while the IFQ program is being considered, latent permits may become more active. If no trawl IFQ program is eventually adopted, latent permits may be transferred to more active vessels and fishing pressure in the fishery may increase.

Council Task:

1. Discussion of whether or not to consider taking steps to address the latent capacity issue.

Reference Materials:

1. Exhibit C.17.b, Supplemental NMFS Report: The Aftereffects of the Pacific Groundfish Limited Entry Trawl Buyback Program, A Preliminary Analysis.

Agenda Order:

a.	Agendum Overview	Jim Seger
b.	NMFS Report	Steve Freese
c.	Reports and Comments of Advisory Bodies	
d.	Public Comment	
e.	Council Guidance	

PFMC
03/23/04

The Aftereffects of the Pacific Groundfish Limited Entry Trawl Buyback Program

A Preliminary Analysis

Attachment
C.17.Supplemental NMFS

Goals

Reduce capacity in the groundfish fishery

Increase the remaining harvesters' productivity

Financially stabilize the fishery

Conserve and manage groundfish

Results

The number of permits has been reduced by 35%

Based on 2002 revenues, annual groundfish revenues per permit are expected to potentially increase by 53%

Annual non-whiting groundfish revenues per permit are expected to increase by at least 66 percent (tentative estimate).

Capacity in terms of endorsed permit length for the fleet has been reduced by 34%

The physical capacity rating of the fleet (points) has been reduced by 31%

Some trip limits have been increased

FISHERY	PERMITS IN EACH FISHERY		
	NUMBER	NUMBER RELINQUISHED	PERCENTAGE OF TOTAL EXISTING
Groundfish[1]	263	91	34.60%
CA crab	632	23	3.64%
CA shrimp	77	31	40.26%
OR crab	443	10	2.26%
OR shrimp	185	40	21.62%
WA crab	232	3	1.29%
WA shrimp	109	14	12.84%
Total	1,941	213	-

FISHERY	*AVERAGE* ANNUAL VALUE IN EACH FISHERY		
	VALUE REMOVED	**FISHERY'S TOTAL VALUE**	**PERCENTAGE OF TOTAL VALUE REMOVED**
Groundfish:			
• *Excluding* whiting	$15,561,899	$33,800,713	46.04%
• *Including* whiting	$15,972,354	$43,799,118	36.47%
CA crab	$1,302,847	$14,955,003	8.71%
CA shrimp	$376,288	$1,267,120	29.70%
OR crab	$763,259	$19,657,008	3.88%
OR shrimp	$1,243,970	$7,628,189	16.31%
WA crab	$206,185	$18,228,037	1.13%
WA shrimp	$144,777	$1,374,177	10.54%
Total	$20,009,680	-	-

FISHERY	LOAN PORTION	LANDING FEE PERCENTAGE
Groundfish	$28,538,743	5.00%
CA crab	$2,327,872	1.28%
CA shrimp	$672,336	4.35%
OR crab	$1,363,760	0.57%
OR shrimp	$2,222,675	2.39%
WA crab	$368,403	0.17%
WA shrimp	$258,682	1.54%
Total	$35,752,471	-

Some Immediate Effects

- Bellingham loses all of its 4 active vessels, Cresent City loses 14 of 16.
- Fishermen and Processors start buying permits
- Permit prices more than double-recent prices for permits have ranged from $100,000 to $250,000 depending on length endorsement and permit catch histories.

Concern Regarding “Latent” Permits

There is concern regarding permits remaining in the fishery that have remained idle in recent years

Concern has been raised that Buyback Participants are re-entering the fishery via “latent permits”

Others have asked NOAA Fisheries to set a control date and issue an advance notice of proposed rule making to address inactive or "lightly fished" latent permits to keep new capacity from reentering the fishery.

Effort Increases Through Latency

PFMC Scientific and Statistical Committee (SSC) believes that vessels are typically not interested in buying a permit unless they intend to use it. Latent permit holders are often the most willing sellers of permits given their lack of participation in the fishery, meaning the presence of significant latent capacity almost inevitably assures the increase in realized fishing effort when permits are transferred

THE SSC Recommends:

"Unless the Council takes deliberate action, a significant amount of capacity will remain in the groundfish fishery that can be mobilized at any sign of improved fishing opportunities. Given that fishing effort can easily outpace OYs even if the OYs were to increase to much higher levels, the current problems associated with low landings limits and short seasons will not go away unless latent capacity is permanently removed from the groundfish fishery."

Evidence of Latent Permits

Forty permits recorded no groundfish landings in 2002 or 2003

Remaining Limited Entry Trawl Permits

'ear	1998	1999	2000	2001	2002	2003
:ished	154	158	152	140	133	132
lot fished	18	14	20	32	40	40
'otal	172	172	172	172	172	172

Excludes 10 permits associated with Factory Trawlers)

Four permit owners did not fish at all from 1998 to 2003

Number of Unfished Permits by Consecutive Period

1998-2003	4
1999-2003	7
2000-2003	13
2001-2003	24
2002-2003	33
2003	40

The number of unfished permits has increased in conjunction with declines in groundfish harvest

Groundfish Harvests 1000 Tons

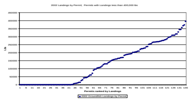
Buyback and Non-Buyback Trawlers

1000 metric Tons

	Non-Whiting Shore	Whiting Shore	Total Shore	Non-Tribal Whiting Mothership	Groundfish Total	Whiting Total
1994	46	80	126	93	219	173
1995	50	75	125	41	166	115
1996	52	85	137	47	184	132
1997	47	87	135	50	185	138
1998	34	91	125	50	175	140
1999	33	87	120	48	167	135
2000	29	89	117	47	164	136
2001	25	73	99	36	135	109
2002	25	46	71	27	98	72
2003	22	55	78	26	104	81

During 2002, 56 permits had harvest levels less than 50,000 lbs.

The graph below plots permits against landings. (To avoid the scale effects associated with Pacific whiting permits, the plot excludes permits with more than 400,000 lbs.)



Breakdown of 2002 Harvests-Remaining Permits

Range		**Number**	**Total Groundfish**			Average	Average	**Total All Species**
Lbs	Lbs	**of Permits**		Lbs	Revenue	lbs/permit	$/permit	Lbs
0	0	30		0	0	0	0	0
0	0	10		0	0	0	0	719,695
1	15,000	10		65,554	41,422	6,555	4,142	1,255,875
16,000	50,000	6		233,843	113,879	38,974	18,980	1,610,520
51,000	100,000	7		529,940	319,852	75,706	45,693	837,461
101,000	200,000	29		4,440,717	2,517,061	153,128	86,795	10,416,529
201,000	400,000	44		12,112,506	6,703,388	275,284	152,350	18,172,958
401,000	1,000,000	6		3,889,682	1,099,961	648,280	183,327	4,055,289
>1,000,000		30		152,446,116	8,548,965	5,081,537	284,966	154,794,826
Totals		172		173,718,358	19,344,528	1,009,990	112,468	191,863,153
		263		206,790,628	32,106,888	786,276	122,079	238,605,783
		91		33,072,270	12,762,360	363,432	140,246	46,742,630
		172		173,718,358	19,344,528	1,009,990	112,468	191,863,153
		172		206,790,628	32,106,888	1,202,271	186,668	

Mothership Operations						
# of Vessels	1998	1999	2000	2001	2002	2003
Arctic Fjord	7	3	5	4	5	4
Arctic Storm	7	5	5	5	5	4
Excellence	4	4	5	7	4	4
Golden Alaska	4	4	4	0	0	0
Ocean Phoenix	7	6	8	7	0	0
Ocean Rover	2	3	2	3	2	2
Unique JV	24	23	23	20	11	12
New vessels that did not fish previously		2	3	1	0	1
Deliveries (tons)	49705	47580	46710	35658	26106	26102

What is the Number of Latent Permits-Pre Buyback?

- Using “1 lb” rule
  - Only 4 permits not fished at all over 1998-2003
  - 24 permits not fished at all over 2001-2003
  - 40 permits not fished in 2002 and 2003
- Using “Less than 50,000 lbs in 2002” rule
  - 56 permits : 30 with no Coastwide landing of any species; 10 with no groundfish landings; 10 with less than 15,000 lbs of groundfish; 6 with more than 15,000 but less than 50,000 lbs

Events Acting to Curtail Latent Permits Sales

ITQ Control Date

Current permit holders will be reluctant to sell their permits as they would be offering up their access to an IQ share

Currently discussed in the Pacific Council's ITQ Committee are ITQ allocation alternatives that would limit potential catch history periods to all or part of the 1994-2003 time period

The Notice for the Pacific groundfish fishery (69FR1563), states the following:

"…The control date announces to the public that the Pacific Council may decide not to count activities occurring after the control date toward determining a person's qualification for an initial allocation or determining the amount of initial allocation of quota shares. Groundfish landed from limited entry trawl vessels after November 6, 2003 may not be included in the catch history used to qualify for initial allocation in the trawl IQ program."

Evidence of Rising Permit Prices Due to ITQ Control Date

"...The market for "A" trawl permits took off right after the buyback results were announced. Values have at least doubled, and prices are around $7000-$8000/pt." -December 2003 *Fishermen's News*

"Coastal "A" Trawl permits have become the hot item. With the buyback a done deal and participants set to receive funds any day now, there is all of a sudden a great deal of interest from people that are looking to get back in. There haven't been very many permits available, but some have sold. Prices have varied from around $7,000-$10,000/pt. The market is complicated somewhat by the potential for some sort of IFQ program in the future. Buyers want permits with history, but several of the permits that have been available have been inactive for the past few years." - January 2004 *Fishermen's News*

The average remaining permit has an endorsed length of 70 feet and a capacity rating of about 23 points. At current prices of $6,000 to $10,000 per point, the average permit is worth an estimated $138,000 to $230,000

Permit Endorsed Length (feet)	All Permits Number	Buyback Permits Number	Remaining Permits Number	% Reduction
33-40	5	0	5	0%
41-50	26	5	21	19%
51-60	73	32	41	44%
61-70	40	14	26	35%
71-80	71	33	38	46%
81-90	27	4	23	15%
91-100	7	1	6	14%
101-110	8	2	6	25%
111+	6	0	6	0%
Total	263	91	172	35%
Total Length Feet	18065	6089	11976	34%
Average	69	67	70	
Median	67	66	69	
Total "points"	6449	1984	4465	31%

20 permits have sold

- 14 had no landings in 2002; 3 had landings greater than 50,000 lbs
- 6 Buyback Participants have purchased a total of 11 permits with one resold to processor
- 2 processors have purchased a total of 8 permits
- 2 non-buyback fishermen have purchased one permit each, one of these permits is being combined with an existing permit

Some buyers may calculate that it's profitable to buy a permit and fish it during the three to five years it may take to implement ITQs

Reason for Permit Purchase in the Face of an ITQ Control Date

Processors who lost vessels may want to assure supply of fish to the processing plant

Processors may be buying permits to expand their market share

Permit holders who were ineligible to take part in the Buyback Program are willing to sell their permits because of increased prices

Some buyers may be speculating the Council will relax its rules on ITQs

Some buyers are buying permits to obtain potential ITQ history

Some buyers may calculate that it's profitable to buy a permit and fish it during the three to five years it may take to implement ITQs

What is the Number of Latent Permits-Post Buyback?

- 56 permits in 2002 with landing less than 50,000 lbs
- 17 of these permits purchased
- Expected 2004 increase in vessels that deliver to Motherships-12?
- 27?

Attachment C.17.b
Supplemental NMFS
Buyback Aftereffects
Report -April 2004 (v.2.)

The Aftereffects of the Pacific Groundfish Limited Entry Trawl Buyback Program
A Preliminary Analysis.
NMFS NWR (April 09, 2004 Draft)

Executive Summary

On December 4, 2003, under the Pacific Groundfish Limited Entry Trawl Buyback Program (Buyback Program) NOAA Fisheries permanently retired 91 trawl vessels and their Pacific Groundfish limited entry trawl permits. (NOAA Fisheries had previously announced the purchase of 92 vessels and federal groundfish permits, but at the last moment rejected one purchase due to an invalid bid package.) Designed under specific instructions from U.S. Congress (Attachment 1), the Buyback Program reduced the number of trawl permits to 172, excluding the ten associated with the catcher-processor fleet. The 91 buyback vessels cannot fish anywhere in the world ever again.

The Buyback Program was designed with the following goals:

* Reduce capacity in the groundfish fishery
* Increase the remaining harvesters' productivity
* Financially stabilize the fishery
* Conserve and manage groundfish

As a result of the Buyback Program:

* The number of permits has been reduced by 35%
* Based on 2002 revenues, annual groundfish revenues per permit are expected to potentially increase by 53%
* Annual non-whiting groundfish revenues per permit are expected to increase by at least 66 percent (tentative estimate)..
* Capacity in terms of endorsed permit length for the fleet has been reduced by 34%
* The physical capacity rating of the fleet (points) has been reduced by 31%
* Some trip limits have been increased

Since October 1, 2003, the NMFS NWR has transferred 20 trawl permits to new owners. The NWR has also received signals about the potential transfer of another permit. Some of these transfers are by Buyback Participants and others are by seafood processors. Many of these permits have been idle in recent years. Some reviewers of the Buyback Program have raised

concerns about Buyback Program participants reentering the fishery by buying such permits. Others have asked NOAA Fisheries to set a control date and issue an advance notice of proposed rule making to address inactive or "lightly fished" latent permits to keep new capacity from reentering the fishery.

The Buyback Program also bought 121 state crab and shrimp permits. This analysis does not describe the effects of the Buyback Program on these fisheries because of insufficient information. As a result this analysis is incomplete and preliminary. Some of this information will not be available until June 2004 after the California crab permit renewal cycle is completed. NOAA Fisheries is seeking information from the states on what actions they are taking to permanently revoke the state permits purchased. NOAA Fisheries is also now working with the states on how best to collect the fees needed to repay the $36 million loan portion of the Buyback Program's $46 million cost. (Attachment 2 provides information about the Buyback loan and state crab and shrimp fisheries.)

To help discussions concerns latent permits in the groundfish fishery, this analysis describes some of the results of the Buyback Program. In particular, this paper provides details on the 172 trawl permits that remain in the fishery. As a means of focusing discussion, this analysis sets up two alternative definitions of "latent." One definition defines an active permit as one that has landed at least one pound of fish, every year, over a number of consecutive years. A second definition is based on a review of 2002 harvests by permit and arbitrarily defines a latent permit as one that has less than 50,000 lbs. associated with it in a single year. Applying these definitions and comparing these alternatives produces a range of 24 to 32 latent permits. For discussion permits this range is collapsed into a single estimate of 30 permits.

However, defining "latent" and taking any action on "latent" permits will depend on discussions between NOAA Fisheries and the Pacific Fishery Management Council. The current Pacific Groundfish FMP does not contain provisions for removing "latent" permits. In developing Amendment 6 to the FMP, the Pacific Fishery Management Council rejected "Use It or Lose it" rules for removing "latent" permits.

> "These provisions result in expiration of a permit if the holder fails to make a certain minimum amount of landings in a fishing year. This type of measure is counter productive to effort reduction policies and its use was therefore minimized in development of the license limitation alternative." (Amendment six, page 4-81)

One way to frame future discussions on this issue is to address the following question:

> The Pacific Groundfish Buyback Program has reduced the available pool of limited entry permits for vessels that deliver to shore plants and motherships from 263 permits to 172 permits. Before carrying out a trawl ITQ program, should NMFS and the Council take action to reduce the number of inactive permits?

The next section of the analysis reviews various conclusions, findings, and other issues related to groundfish permits and the term "latent." These are:

* The term "latent" has no official definition.
* Forty permits had no recorded groundfish landings in 2002 and 2003.
* Four permit owners did not fish their permits at all during the 1998 to 2003 period.
* The number of unfished permits increased significantly after the year 2000 mirroring the decline in groundfish.
* During 2002, 56 permits had harvest levels less than 50,000 lbs.
* Some permits may not be fished because of strategic planning.
* The ITQ Control Date and rising permit prices are discouraging the sale of latent permits.
* Twenty trawl permits have changed hands since October 1, 2003. Six had 2002 harvests. Fourteen did not.
* Knowing there is a control date on ITQ's why buy a permit?
* Activating some permits may be helpful to some fishing communities. How has the Buyback Program affected fishing communities?

This section is then followed by final section whereby the two alternatives are described, applied, and compared. This section projects:

* For 2004, after considering recent permit transfers and the potential for increased harvests of whiting, about 30 "latent" permits remain in the fishery.

<u>Discussion and Findings</u>:

The term "latent" has no official definition

The Magnuson-Stevens Act, the Pacific Groundfish Fishery Management Plan (FMP), or the academic literature do not define the term "latent." As a result, there are no guidelines for the analyst to use for measuring latency. Defining the term "latent" will depend on available data and on the goals and objectives for the fishery.

In defining the term "latent" it will be important to distinguish between two interrelated concepts: "latent permits" and "latent capacity." Most discussions about "latent permits" concern minimum landing requirements that must be met for the permit to remain valid. Other discussions concern "latent" capacity which is about the amount of unutilized capacity exists in the fishery. This analysis is addressed to the "latent" permit issue.

Many of the issues surrounding the term "latent" are discussed in the March 16, 2000 draft Report on Overcapitalization in the West Coast Groundfish Fishery developed by the Economic Subcommittee of the Pacific Fisheries Management Council's Scientific and Statistical Committee:

> Under Amendment 6 to the Groundfish FMP (PMFC 1992a) the Council established a limited entry program whereby vessels meeting minimum landings requirements (MLRs) for trawl, longline or fishpot gear during the window period July 1, 1984-August 1, 1988 could qualify for a transferable limited entry permit. Permit holders were allowed to use only those gears endorsed on their permits (i.e., those gears for which they met the MLRs) while participating in the limited entry fishery. While permits must be renewed annually, permit holders are not required to land any groundfish in order for the permit to remain valid. To discourage increases in harvest capacity associated with the transfer of permits from smaller to larger boats, non-permitted vessels desiring to enter the fishery are required to either purchase a permit from a similar-sized or larger vessel or to purchase a combination of permits from smaller vessels according to a conversion formula based on vessel length. Trip limits and trip frequency limits, which were already being used to restrict harvest rates on the major groundfish complexes, were also expected to reduce the incentive for " capital stuffiing"

The SSC Report went on to define the MLRs for trawlers and "Capital stuffing"

> MLRs during the window period varied by gear type as follows: trawl-9 landings of at least 500 pounds of non-whiting groundfish or 450 mt of non-whiting groundfish or 17 landings of at least 500 pounds of whiting or 3,750 mt of whiting:...
>
> "Capital stuffing" pertains to the technological innovations and fishing practices that allow fishermen to increase their share of the allowable harvest in the race for fish. As these innovations and practices become more widespread, the competitive advantage they initially provided tends to dissipate, leading to additional rounds of innovation and higher costs for the fleet as a whole without a commensurate increase in harvest.

The SSC Report discussed the linkage between harvest capacity and permits:

> Potential harvest capacity includes both unutilized (i.e., latent) and utilized capacity. Although limited entry has likely had the effect of "freezing" potential harvest capacity in the fishery at its 1994 level, the low MLRs used to qualify a permit virtually assured that a significant proportion of the potential harvest capacity initially admitted into the fishery consisted of latent capacity. Furthermore, the amount of time elapsed between the window period (i.e., the 1984-1988 period during which vessels would had to fish to qualify for a limited entry permit) and the year when limited entry was actually implemented (1994) increased the likelihood of permits being issued to vessels whose

> Involvement in the groundfish fishery had waned by the time permits were actually issued.
>
> Permit transferability per se has the advantage of flexibility, in that it allows the composition of the fishing fleet to adapt to changes in environmental, biological and economic conditions, and allows individual vessels to enter and exit in response to changes in their personal circumstances. However, since vessels are typically not interested in buying a permit unless they intend to use it and since marginally involved fishery participants (i.e., vessels comprising the latent capacity in the fishery) are typically the most willing to sell their permits, the presence of significant latent capacity almost inevitably assures the increase in realized fishing effort when permits are transferred. The establishment of an active whiting catcher-processor sector resulting from the transfer of permits from trawlers to catcher-processors reduced the amount of latent capacity in the trawl sector and did little to curtail the actual amount of fishing effort expended by trawlers. Transfers involving fixed gear vessels have likely resulted in increased fishing effort as well.

The SSC concludes its report requesting that the Council take deliberate action:

> In other words, latent capacity is always available in the open access fishery and likely to remain high in the limited entry fishery, since permit holders are much more likely to retain their permits rather than allow them to lapse. Unless the Council takes deliberate action, a significant amount of capacity will remain in the groundfish fishery that can be mobilized at any sign of improved fishing opportunities. Given that fishing effort can easily outpace OYs even if the OYs were to increase to much higher levels, the current problems associated with low landings limits and short seasons will not go away unless latent capacity is permanently removed from the groundfish fishery.

In its Executive Memorandum to the Council, the SSC asserted that:

> The Council should take immediate action to develop stringent capacity reduction programs, for all sectors of the West Coast groundfish fishery. Given the current moratorium on IFQs and the complexities of designing an IFQ system, IFQs are best viewed as a long term management strategy for West Coast groundfish. Other potential solutions include limited entry for the open access fishery and buyouts and/or permit stacking for the limited entry fishery should be explored immediately.

Forty permits had no recorded groundfish landings in 2002 and 2003.

Vessels that deliver to shore or to non-tribal motherships use these permits. Sometimes within a year or across years, two or more vessels use a given permit. We added preliminary PacFIN data for January-September 2003 to the Buyback Program Database which contains 1998 -2002 fish ticket data. We then organized the data by permit and developed a simple rule to define a "fished" permit. A fished permit is one where at least one pound of groundfish landed or delivered during the time the permit was valid. Below, we analyze these permits based on total pounds landed or delivered in 2002. (This analysis describes the 172 trawl permits that remain in the fishery. It does not include permits combined with other permits in 1998 (5), 1999 (1) and in 2003 (1) or the 10 permits associated with the catcher-processor fleet.)

Remaining Limited Entry Trawl Permits

Year	1998	1999	2000	2001	2002	2003
Fished	154	158	152	140	133	132
Not fished	18	14	20	32	40	40
Total	172	172	172	172	172	172

(Excludes 10 permits associated with Factory Trawlers)

Four permit owners did not fish their permits at all during the 1998 to 2003 period.

Only four permits recorded no landings consecutively between 1998-2003.

Number of Unfished Permits by Consecutive Period

1998-2003	4
1999-2003	7
2000-2003	13
2001-2003	24
2002-2003	33
2003	40

The number of unfished permits increased significantly after the year 2000 mirroring the decline in groundfish harvests.

Harvests of all groundfish or whiting by the entire limited entry trawl fleet (excluding catcher processors and tribal trawlers) fell off significantly during the 2001-2003 period compared with the 1998-2000 period. Pacific whiting harvests have fallen off significantly in the last two years, matching the trends in unfished permits during these two years. During this later period, nine species of fish were declared overfished, including whiting. In response, the Pacific Council and NOAA Fisheries set up large area closures and other measures to protect these fish.

Groundfish Harvests 1000 Tons

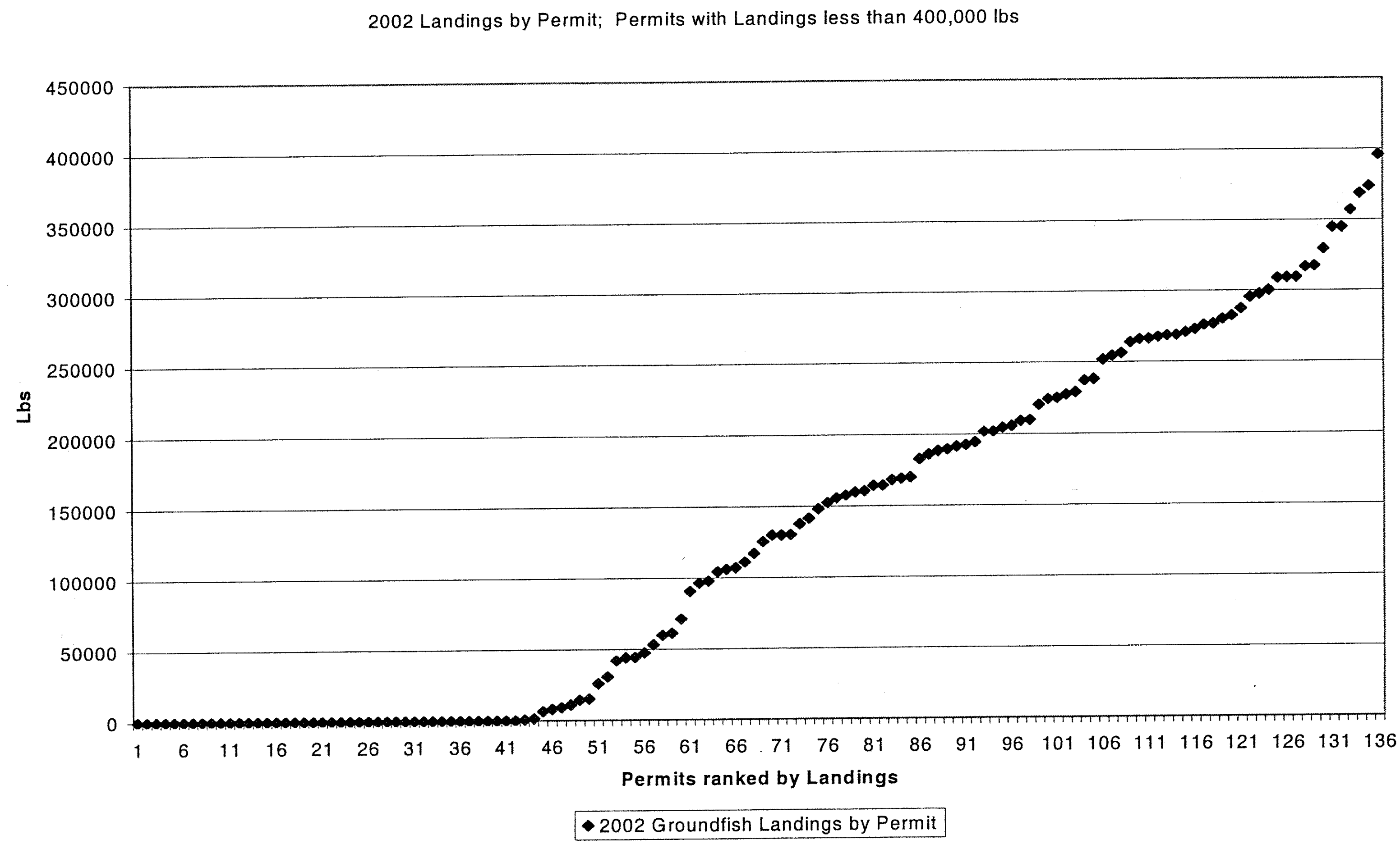
Buyback and Non-Buyback Trawlers

1000 metric Tons

	Non-Whiting Shore	Whiting Shore	Total Shore	Whiting Non-Tribal Mothership	Groundfish Total	Whiting Total
1994	46	80	126	93	219	173
1995	50	75	125	41	166	115
1996	52	85	137	47	184	132
1997	47	87	135	50	185	138
1998	34	91	125	50	175	140
1999	33	87	120	48	167	135
2000	29	89	117	47	164	136
2001	25	73	99	36	135	109
2002	25	46	71	27	98	72
2003	22	55	78	26	104	81

During 2002, 56 permits had harvest levels less than 50,000 lbs.

The graph below plots permits against landings. (To avoid the scale effects associated with Pacific whiting permits, the plot excludes permits with more than 400,000 lbs.) There are no obvious break points on which to base a definition of a latent permit.



The table below classifies permits by groundfish harvest combining shoreside landings with non-tribal mothership deliveries. The owners of forty permits did not fish their permits in 2002. Thirty permits were not fished at all, and 10 permit owners fished species other than groundfish during the year (mainly crab and shrimp). Of the permits that were fished, ten permits had harvests ranging from one to 15,000 lbs. Finally, six permits had landings between 16,000 and 50,000 lbs.

2002 Harvests and Revenues for Remaining 172 Permits

Groundfish Range Low lbs	Harvest High lbs	Number of Permits	Groundfish Total Lbs	Groundfish Total Revenue	Groundfish Average lbs/permit	Groundfish Average $/permit	All Species Total Lbs	All Species Total Revenue
0	**0**	30	0	$0	0	$0	0	$0
0	**0**	10	0	$0	0	$0	719,695	$1,090,574
1	**15,000**	10	65,554	$41,422	6,555	$4,142	1,255,875	$685,242
16,000	**50,000**	6	233,843	$113,879	38,974	$18,980	1,610,520	$815,505
51,000	**100,000**	7	529,940	$319,852	75,706	$45,693	837,461	$742,562
101,000	**200,000**	29	4,440,717	$2,517,061	153,128	$86,795	10,416,529	$5,369,242
201,000	**400,000**	44	12,112,506	$6,703,388	275,284	$152,350	18,172,958	$10,567,037
401,000	**1,000,000**	6	3,889,682	$1,099,961	648,280	$183,327	4,055,289	$1,147,221
>1,000,000		30	152,446,116	$8,548,965	5,081,537	$284,966	154,794,826	$10,373,211
Totals		172	173,718,358	$19,344,528	1,009,990	$112,468	191,863,153	$30,790,594
All 2002 Permits		263	206,790,628	$32,106,888	786,276	$122,079	238,605,783	$49,219,394
Buyback Permits		91	33,072,270	$12,762,360	363,432	$140,246	46,742,630	$18,428,800

Note that as a result of the buyback, there remain 172 permits. If upcoming years generate groundfish revenues similar to those of 2002 ($32 million); then the average groundfish revenue per permit would be about $187,000; 53 percent higher than $122,000 earned per permit in 2002.

(The following discussion is tentative and needs to be cross checked with others.) Many permit holders do not participate in the Pacific whiting fishery. Non-whiting groundfish revenues earned by the buyback fleet were almost exactly half of the estimated non-whiting revenues earned by the entire fleet in 2002--about $25 million. . About 32 permits may be deemed "Pacific whiting" permits. These are permits whose owners appear to earn more than 90% of their groundfish revenues from Pacific whiting (20 in 2002) or are permits that appear to be used solely in the non-tribal whiting mothership fishery (about 12-also see discussion below). The estimate of 32 "Pacific whiting" permits in 2002 would yield an estimate of 231 "non-whiting" groundfish permits in 2002 for an average revenue per permit of $108,000. None of the buyback permits were "Pacific whiting" permits. Therefore, an estimate of the number of post-buyback "non-whiting" permits is 231 minus 91 or 140. Sharing $25 million in non-whiting groundfish revenues by 140 permits would lead to an average revenue per permit of $179,000-an increase of 66 percent because of the Buyback. One industry analyst thinks the increase is more on the order of an 85% increase.

Some Permits may not be fished because of strategic planning.

Some of these permits may be unfished because of strategic planning by fishermen who keep their groundfish permits in case other fisheries they engage in decline. They may also be waiting for groundfish stocks to increase. For example, declining trends in the Pacific whiting fishery may account for 12 unfished permits used by the non-tribal mothership fleet. Projections for the 2004 whiting OY may return the whiting mothership to levels similar to those of 1998.

Motherships and their delivery vessels are typically closely tied. If the mothership chooses to remain in Alaska to process pollock, typically the allied delivery vessels do so too. Often, the delivery vessel fishes for Pacific groundfish using a permit owned by the mothership company.

Twenty-seven of the remaining 172 permits have been used as vessels engaging in the non-tribal mothership fishery over the period 1998 to 2003. Of these permits, eight were idle in 2003, 10 permits idle in 2002, and eight were idle in 2001. Over the period 1998 to 2003, annual non-tribal mothership harvests decreased from 50,000 tons to 26,000 tons. With the decline in harvests, the number of motherships taking part in the fishery also declined. In 1998, there were six motherships, whereas in 2003, there were only four. Starting in 2001, the mothership Golden Alaska stopped engaging in the fishery. Similarly, starting in 2002, the mothership Ocean Phoenix stopped taking part in the fishery.

In comparing the number of unique vessels (some vessels supply more than one mothership) over the period 1998 to 2003, it appears that 12 of the 40 unfished permits are unfished because of changes in the mothership whiting fishery. For perspective, during 1994, the first year of limited entry, there were nine major motherships employing 43 different delivery vessels to harvest 92,000 tons of Pacific whiting. Over the years 1998-2003, 31 different delivery vessels have participated in the fishery.

	Number of Delivery Vessels						
Motherships	1998	1999	2000	2001	2002	2003	
Arctic Fjord	7	3	5	4	5	4	
Arctic Storm	7	5	5	5	5	4	
Excellence	4	4	5	7	4	4	
Golden Alaska	4	4	4	0	0	0	
Ocean Phoenix	7	6	8	7	0	0	
Ocean Rover	2	3	2	3	2	2	
Unique JV	24	23	23	20	11	12	
New vessels that did not fish previously		2	3	1	0	1	31 different vessels
Mothership deliveries	49705	47580	46710	35658	26106	26102	

The ITQ Control Date and rising permit prices are discouraging the sale of latent permits.

On January 9, 2004, NOAA Fisheries published a November 6, 2003 control date notice for the Pacific groundfish fishery. The potential use of ITQ in the trawl fishery discourages the entry of new permit holders into the fishery and the sale of permits by existing permit holders. Current permit holders will be reluctant to sell their permits as they would be offering up their access to an IQ share. New permit holders that have entered the fishery may not see their new activities count toward the currently discussed trawl ITQ program. Currently discussed in the Pacific Council's ITQ Committee are ITQ allocation alternatives that would limit potential catch history periods to all or part of the 1994-2003 time period. Therefore any catch history developed after the November 6, 2003 ITQ Control Date will likely not count toward an ITQ share.

The Notice for the Pacific groundfish fishery (69FR1563), states the following:

> "The control date for the trawl IQ program is intended to discourage increased fishing effort in the limited entry trawl fishery based on economic speculation while the Pacific Council develops and considers a trawl IQ program. Persons potentially eligible for IQ shares may include vessel owners, permit owners, vessel operators and crew. The control date announces to the public that the Pacific Council may decide not to count activities occurring after the control date toward determining a person's qualification for an initial allocation or determining the amount of initial allocation of quota shares. Groundfish

landed from limited entry trawl vessels after November 6, 2003 may not be included in the catch history used to qualify for initial allocation in the trawl IQ program."

The following table shows how the Buyback Program has affected permit prices. According to the "Permit News" section of the December 2003 *Fishermen's News*;

> "...The market for "A" trawl permits took off right after the buyback results were announced. Values have at least doubled, and prices are around $7000-$8000/pt."

Permit Prices-As reported by Dock Street Broker's (Seattle, Washington) "Permit News" Report:

	$/Point
January 1998	$6,000-$7,000
January 1999	$6,000-$6,500
January 2000	$5,000-$6,000
January 2001	$3,000-$4,000
January 2002	$2,000-$3,000
January 2003	$2,000-$3,000
February 2003	$2,000-$3,000
March 2003	$3,000-$3,000
April 2003	$3,000-$3,000
May 2003	$3,000-$3,000
June 2003	$3,000-$3,000
July 2003	$3,000-$3,000
August 2003	$3,000-$3,000
September 2003	$3,000-$3,000
October 2003	$3,000-$3,000
November 2003	$3,000-$3,000
December 2003	$7,000-$8,000
January 2004	$7,000-$10,000
February 2004	$6,000-$10,000
March 2004	$6,000-$10,000
April 2003	$6,000-$10,000

(*Fishermen's News,* various issues-dates are publication dates)

The January 2004 issue of the *Fishermen's News* indicates how the control date on ITQ's is affecting the permit market:

> "Coastal "A" Trawl permits have become the hot item. With the buyback a done deal and participants set to receive funds any day now, there is all of a sudden a great deal of interest from people that are looking to get back in. There haven't been very many

permits available, but some have sold. Prices have varied from around $7,000-$10,000/pt. The market is complicated somewhat by the potential for some sort of IFQ program in the future. Buyers want permits with history, but several of the permits that have been available have been inactive for the past few years."

The February 2004 issue of the *Fishermen's News* continues to report increasing prices but the market may be cooling down:

> "Coastal "A" trawl permits are still in demand, but the post-buyback furor has settled somewhat. A few permits are available, and look to spend around $10,000/pt."

Since February 2004 and through April 2004, prices have stayed stable at $6,000 to $10,000 per point.

Listed as sold on the 02/02/04 edition of the www.permitmaster.com website was a 32-point trawl permit (80 feet) for $250,000 and on the www.dockstreetbrokers.com website a 10-point (50 feet) for $200,000. (This later offer appears contrary to the $7000-$8000 point estimate mentioned above.) Dockstreet Brokers sold a second permit for 52 feet (11 points) for $105,000 for an average of $9500 per point (02/11/2004 listing).

For someone to enter the fishery, he probably needs to buy a federal permit and a vessel. He probably also needs to buy some state permits to make the vessel profitable. The Buyback Program purchased 91 groundfish permits and vessels and 121 state permits for crab and shrimp. The median price paid out for a Buyback package was about $400,000. This implies that for a new entrant into the fishery, the costs of entering the fishery could be on the order of about $400,000.

The reference to "A" trawl is to distinguish the permit from a provisional "B" permit which no longer exists. The reference to points reflects the capacity rating scale associated with the permit. The capacity rating scale is a projection of capacity against vessel length. It is a nonlinear relationship :

Length in Feet	Capacity (points)
33	3.50
40	5.66
50	9.88
60	15.59
70	22.92
80	32.00
90	42.96
100	55.90
110	70.94
120	88.18

This capacity rating schedule controls capacity in the fleet. To enter a new vessel into the fishery, the owner needs to buy (take out) a sufficient number of "points" through the purchase of existing permits so overall capacity in the fleet is not increased. Currently the major use of this schedule is used by fishermen who wish to lengthen their vessel and need to combine permits. As it bears on the cost on entering the fishery, the following example is illustrative.

> A vessel owner wants to increase his vessel by 10 feet. His vessel and associated Pacific groundfish permit are now 70 feet. A limited entry trawl permit with a 70-foot endorsement has a capacity rating of 23; a limited entry trawl permit with an 80-foot endorsement has a rating of 32 points. Therefore, the vessel owner needs to buy a permit of enough length to cover the nine points needed. To get the added length, the vessel owner may first consider buying the smallest permit in the fleet-33 feet. He rejects this permit as it would only provide 3.5 points. To get nine points he must purchase a 48-foot permit or greater. At $7,000 per point, this would imply that to lengthen his vessel, he would need to spend at least $63,000.

The average remaining permit has an endorsed length of 70 feet and a capacity rating of about 23 points. At current prices of $6,000 to $10,000 per point, the average permit is worth an estimated $138,000 to $230,000.

Permit Data-Endorsed Length:

Permit Endorsed Length (feet)	All Permits Number	Buyback Permits Number	Remaining Permits Number	% Reduction
33-40	5	0	5	0%
41-50	26	5	21	19%
51-60	73	32	41	44%
61-70	40	14	26	35%
71-80	71	33	38	46%
81-90	27	4	23	15%
91-100	7	1	6	14%
101-110	8	2	6	25%
111+	6	0	6	0%
Total	263	91	172	35%
Total Length Feet	18065	6089	11976	34%
Average	69	67	70	
Median	67	66	69	
Total "points"	6449	1984	4465	31%

Twenty trawl permits have changed hands since October 1, 2003. Six had 2002 harvests. Fourteen did not.

Since October 1, 2003 and through April 7, 2004, the NMFS NWR transferred a net total 20 permits to new owners. (There were actually 21 permit transfers but one permit was transferred twice.). Not all of the these permits were inactive. They have the following characteristics:

* 14 had no landings in 2002
* 6 had landings in 2002
* 3 had landings greater than 50,000 lbs in 2002
* 6 Buyback participants purchased 11 permits with one being resold to a processor.
* 2 non-buyback fishermen purchased one permit each, with 1 permit being combined with an existing permit.
* 2 processors purchased a total of 8 permits.

A Buyback Program participant has recently indicated to the NMFS NWR Permits Office that he may buy another permit. If this transaction is completed, 21 permits will have changed hands.

Knowing there is a control date on ITQ's why buy a permit?

* Processors who lost vessels may want to assure supply of fish to the processing plant. One processor lost all of his delivery vessels to the buyback.
* Processors may be buying permits to expand their market share.
* Permit holders who were ineligible to take part in the Buyback Program are willing to sell their permits because of increased prices.
* Some buyers may be speculating the Council will relax its rules on ITQs.
* Some buyers are buying permits to obtain potential ITQ history.
* Some buyers may calculate that it's profitable to buy a permit and fish it during the three to five years it may take to implement ITQs. In 2002, the average active permit (total =223) averaged $122,000 in groundfish revenues. If the 2002 groundfish fishery was carried out by the remaining 172 permits, the average groundfish revenue per permit would increase to about $187,000.

Activating some permits may be helpful to some fishing communities. How has the Buyback Program affected fishing communities?

To help answer this question, we developed the three tables shown below using 2002 ex-vessel revenue data and port data developed by Dr. Jim Hastie (NMFS NWC). The first table shows by port the change in the number of vessels because of the Buyback Program. The second and third tables show, respectively, by port groups, the share of groundfish revenues and all-species revenues associated with buyback vessels. All species revenues include groundfish, crab, shrimp, and all other species landed by groundfish trawlers under permits issued in 2002. Dr. Jim Hastie identified two primary groundfish ports for each permit-one associated with non-whiting groundfish landings and one for whiting landings. For this analysis, information on the two primary ports was combined into a single primary port. If whiting landings are greater than 40 percent of the permit's total revenues (all species), we assigned the whiting primary port to the permit. If whiting landings were less than 40 percent of the permit's total revenues, we assigned the non-whiting primary port to the permit. There were also two at-sea whiting permits that had no shoreside landings, and these were assigned to a state but not to a port.

The Buyback Program affected almost all the groundfish ports and their communities. Few ports were unaffected. The ports of Eureka and Bellingham were the most affected with Bellingham losing all of its vessels to the Buyback Program. As pointed out previously, 40 of the remaining 172 permits, were idle in 2002. As indicated in these tables, four of the 91 Buyback permits were also idle in 2002. In terms of 2002 groundfish ex-vessel revenues, Buyback Program vessels accounted for 40 percent of the $32 million of landed by all groundfish trawlers either on shore or delivered to non-tribal motherships. These vessels also account for a similar share percentage of the $49 million in all species revenues.

Affected communities can respond to the potential loss in revenue and income from the Buyback Program in several ways. First, the remaining vessels in the Port can expand their effort to replace the revenues associated with Buyback Program participants to the extent that trip limits allow. Second, active vessels can be hired away from other communities. Finally, a local processor or fisherman can buy and fish an inactive permit. Available information on permit transfers suggests that three of the permits will be used in the port of Bellingham.

Community Effects of the Buyback

Primary Port	State	2002 Active Vessels	Buyback Vessels	Remaining Vessels	Percent Reduction
Avila	CA	7	4	3	-57%
Bodega Bay	CA	2	1	1	-50%
Fort Bragg	CA	13	4	9	-31%
Crescent City	CA	16	14	2	-88%
Santa Cruz	CA	2	0	2	0%
Eureka	CA	23	14	9	-61%
Monterey	CA	4	0	4	0%
Moss Landing	CA	8	4	4	-50%
Morrow Bay	CA	2	0	2	0%
Princeton/Half Moon Bay	CA	11	1	10	-9%
San Francisco	CA	4	1	3	-25%
Astoria	OR	40	13	27	-33%
Brookings	OR	9	5	4	-56%
Coos Bay	OR	24	8	16	-33%
Florence	OR	1	0	1	0%
Newport	OR	25	6	19	-24%
Tillamook/Garibaldi	OR	1	0	1	0%
Portland/Seattle	OR/WA	2	0	2	0%
Bellingham Way	WA	4	4	0	-100%
Blaine	WA	4	1	3	-25%
Ilwaco	WA	1	0	1	0%
Port Angeles	WA	7	4	3	-57%
Wesport	WA	9	3	6	-33%
All Ports	WA	26	12	14	-46%
All Ports	OR	101	32	69	-32%
All Ports	CA	92	43	49	-47%
Permits with no groundfish landings		44	4	40	-9%
Totals	All	263	91	172	-35%

2002 Ex-vessel Groundfish Revenues

		Total All Vessels	Buyback Vessels	Remaining Vessels	Percent Reduction
Bodega Bay/Princeton-Half Moon Bay/San Francisco	CA	$2,129,512	$359,738	$1,769,774	-17%
Crescent City/Eureka/Fort Bragg	CA	$6,695,023	$3,892,475	$2,802,548	-58%
Santa Cruz/Monterey/Moss Landing	CA	$1,199,239	$396,258	$802,981	-33%
Avila/Morrow Bay	CA	$1,073,632	$686,430	$387,202	-64%
Brookings	OR	$841,148	$548,289	$292,859	-65%
Coos Bay/Florence	OR	$3,075,793	$1,111,435	$1,964,358	-36%
Newport/Mothership	OR	$5,038,353	$961,614	$4,076,739	-19%
Astoria/Tillamook	OR	$6,359,037	$2,247,633	$4,111,404	-35%
Bellingham Way/Blaine/Port Angeles	WA	$3,368,541	$2,082,658	$1,285,883	-62%
Ilwaco/Westport/Mothership	WA	$2,326,610	$475,830	$1,850,780	-20%
Total All Ports		$32,106,888	$12,762,360	$19,344,528	-40%
Total	CA	$11,097,406	$5,334,901	$5,762,505	-48%
Total	OR	$15,314,331	$4,868,971	$10,445,360	-32%
Total	WA	$5,695,151	$2,558,488	$3,136,663	-45%
Total All States		$32,106,888	$12,762,360	$19,344,528	-40%

2002 Ex-vessel All Species Revenues

		Total All Vessels	Buyback Vessels	Remaining Vessels	Percent Reduction
Bodega Bay/Princeton-Half Moon Bay/San Francisco	CA	$3,380,783	$519,712	$2,861,071	-15%
Crescent City/Eureka/Fort Bragg	CA	$8,960,672	$4,844,543	$4,116,129	-54%
Santa Cruz/Monterey/Moss Landing	CA	$1,561,241	$414,203	$1,147,038	-27%
Avila/Morrow Bay	CA	$1,688,695	$862,384	$826,311	-51%
Brookings	OR	$2,448,784	$1,324,372	$1,124,412	-54%
Coos Bay/Florence	OR	$6,595,785	$2,775,972	$3,819,813	-42%
Newport/Mothership	OR	$6,711,731	$1,478,007	$5,233,724	-22%
Astoria/Tillamook	OR	$9,339,371	$3,030,195	$6,309,176	-32%
Bellingham Way/Blaine/Port Angeles	WA	$3,570,446	$2,276,191	$1,294,255	-64%
Ilwaco/Westport/Mothership	WA	$3,871,312	$903,221	$2,968,091	-23%
Non-fish landings-1	??	$1,090,574	$0	$1,090,574	0%
Total All Ports		$49,219,394	$18,428,800	$30,790,594	-37%
Total	CA	$15,591,391	$6,640,842	$8,950,549	-43%
Total	OR	$25,095,671	$8,608,546	$16,487,125	-34%
Total	WA	$7,441,758	$3,179,412	$4,262,346	-43%
Non-fish landings-1	??	$1,090,574	$0	$1,090,574	
Total All States and Non-Fish landings		$49,219,394	$18,428,800	$30,790,594	-37%

Comparison of "Latent Permit" Alternatives and Projection

For 2004, after considering recent permit transfers and the potential for increased harvests of whiting, 24 - 30 "latent" permits remain in the fishery.

Minimum landing requirements (MLR) used in selecting the first recipients of limited entry permits usually combine elements of time, (usually a number of years) and landings or deliveries (pounds landed or delivered). For example, the minimum landings requirement (MLR) used to qualify trawl vessels for the current limited entry system is the following:

> "The current owner of a vessel which met the MLRs between July 11, 1984 and August 1, 1988 (the window) may qualify for an "A" gear endorsement. The MLRs are as follows:
>
> Trawl: At least 9 days in which over 500 pounds of any groundfish species caught with groundfish trawl gear except Pacific whiting are landed or delivered or 450 mt of landings or deliveries of any groundfish species caught with groundfish trawl gear except Pacific whiting, or 17 days in which over 500 pounds of Pacific whiting caught with groundfish trawl gear are landed or delivered, or 3,750 mt of landings or deliveries of Pacific whiting caught with groundfish trawl gear." (Amendment 6, Pacific Groundfish FMP, p 2-3

"Latent" Definition-Alternative 1

Similarly, any definition of "latent" would typically have the same elements. Under a simple MLR of 1 pound a year, 40 permits were latent in 2002 and 2003, compared to the 20 or less latent permits during the 1998-2000 period. The increase in unfished permits is likely the result of declining trends in groundfish harvest, especially whiting harvest. In expanding this MLR to one that applies to consecutive years, four permits may be deemed "chronically latent" as they were not fished at all during 1998 to 2003. Twenty-four permits may be deemed latent as they were not fished at all during the entire 2000-2003 period. Finally, forty permits may be deemed "recently latent" as they were not fished in 2002. A slightly different set of forty permits was not fished in 2003. Given that 20 permits have changed hands with 14 of these permits not being fished in 2002, would yield an estimate of 26 latent permits. As these estimates are based on lenient MLRs (needing only 1 pound of landing to in each of these three years to meet this requirement or 1 pound in 2002) perhaps a lower bound on the number of existing latent permits is 24 permits.

Number of Unfished Permits by Consecutive Period

1998-2003	4
1999-2003	7
2000-2003	13
2001-2003	24
2002-2003	33
2003	40

Note that the Council's Trawl IQ Committee is taking a similar approach in exploring two alternative recent participation requirements for IQ eligibility. One alternative would require participation based on a certain number of trips and/or years during the 1998-2003 period. A second alternative would base qualification for IQ consideration based on the 2000-2003 time period.

<u>"Latent" Definition Alternative 2</u>

An alternative way of defining a latent permit is to define a latent permit as one where less than 50,000 lbs. were landed in a given year. This is an arbitrary choice based organizing permits according to the following categories of harvest based on 2002 data.

Groundfish Range Low lbs	**Harvest High lbs**	**Number of Permits**	**Groundfish Total Lbs**	**Groundfish Total Revenue**	**Groundfish Average lbs/permit**	**Groundfish Average $/permit**
0	**0**	30	0	$0	0	$0
0	**0**	10	0	$0	0	$0
1	**15,000**	10	65,554	$41,422	6,555	$4,142
16,000	**50,000**	6	233,843	$113,879	38,974	$18,980
51,000	**100,000**	7	529,940	$319,852	75,706	$45,693
101,000	**200,000**	29	4,440,717	$2,517,061	153,128	$86,795
201,000	**400,000**	44	12,112,506	$6,703,388	275,284	$152,350
401,000	**1,000,000**	6	3,889,682	$1,099,961	648,280	$183,327
>1,000,000		30	152,446,116	$8,548,965	5,081,537	$284,966
Totals		172	173,718,358	$19,344,528	1,009,990	$112,468

There were 40 permits with no recorded groundfish landings in 2002 and another 10 with harvests between 1 and 15,000 lbs. Another 6 permits had landing between 16,000 and 50,000 lbs. The decision was not to define as latent the 7 permits within the 51,000 to 100,000 lb. category. The average revenue per permit for permits in this category is significant - $45,693. Assuming a crew share of 39%, permits in this category earn enough to pay a crew member wages equivalent to that of $18,000, which is approximately the per-capita income associated with in Astoria, Oregon-- one of the key groundfish ports. (According to 2000 U.S. Census data, the median income for a household in Astoria is $33,011, and the median income for a family is $41,446. Males have a median income of $29,813 versus $22,121 for females. The per capita income for the city is $18,759.)

In 2002, 56 permits had associated harvests less than 50,000 lbs. Since October 1, 2003, 20 permits have changed hands with three having harvests greater than 50,000 lbs. in 2002. Therefore, under this definition, permit buyers collectively have bought 17 "latent" permits. Because they were purchased, we can expect that these permits will become active. The increase in the whiting resource for 2004 is also expected to activate an additional 12 permits by existing owners for use in the mothership fishery. (Table below describes suggests 11 mothership permits but discussion above on "Strategic Planning suggests 12 permits.) Subtracting these two sets of permits from the 56 permits, leaves an estimate of 27 latent permits.

Size Distribution of Permits that landed less than 50,000 lbs in 2002:

Permit Endorsed Length (feet)	Latent Mothership	Non-Mother
33-40	0	3
41-50	0	11
51-60	0	12
61-70	0	5
71-80	3	9
81-90	2	5
91-100	0	0
101-110	3	0
111+	3	0
Total	11	45
Total Length Feet	1088	2720
Average	99	58
Median	105	59
Total "points"	632	795

Alternative Comparison

Therefore, comparing these two alternatives gives a sense there may be 24 to 27 latent permits in the fishery. In simpler terms, there may be "something on the order of "30 " latent permits remaining in the fishery. If these permits were removed, this would bring the fishery to 142 permits.

Appendix 1

Adapted from: Consolidated Appropriations Resolution 2003, Public Law 108-7
Division N--Emergency Relief and Offsets
Title V--Fisheries Disasters
(Page H.J. Res.2--539)

TITLE V--FISHERIES DISASTERS

Sec. 501. (a) Fisheries Disasters.--In addition to amounts appropriated or otherwise made available, $100,000,000 is appropriated to the Department of Commerce for fisheries disaster assistance. Not more than 5 percent of such funds may be used for administrative expenses, and no funds may be used for lobbying activities or representational expenses.

....

(c) Northeast and West Coast.--$10,000,000 shall be made to conduct a voluntary fishing capacity reduction program in the Northeast multispecies fishery and $10,000,000 shall be made available to conduct a voluntary fishing capacity reduction program in the West Coast groundfish fishery. Such sums shall supplement the voluntary capacity reduction program authorized for the fishery in section 211 of Public law 107-206 and be consistent with 312(b) of the Magnuson-Stevens Fishery Conservation and Management Act and the requirements relating to the capacity program in section 211 of Public Law 107-206 that shall--

(1) permanently revoke all fishery licenses, fishery permits, area and species endorsements and any other fishery privileges issued to a vessel or vessels (or to persons on the basis of their operation of that vessel or vessels) removed under the program; and

(2) ensure that vessels removed under the program are made permanently ineligible to participate in any fishery worldwide, and that the owners of such vessels will operate only under the United States flag or be scrapped as a reduction vessel pursuant to section 600.1011(c) of title 50, Code of Federal Regulations.

Conference Report to Accompany H.J. Res. 2

Adapted from 108th Congress House Representatives, Report 108-10 (February 13 (legislative day, February 12), 2003): MAKING FURTHER CONTINUING APPROPRIATIONS FOR THE FISCAL YEAR 2003, AND FOR OTHER PURPOSES (page 70)

SEC. *212*. (a) The Secretary of Commerce shall implement a fishing capacity reduction program for the West Coast groundfish fishery pursuant to section 212 of P.L. 107-206 and 16 U.S.C. 1861a(b)-(e) except that: the program may apply to multiple fisheries, except that within 90 days after the date of enactment of this Act, the Secretary shall publish a public notice in the Federal Register and issue an invitation to bid for reduction payments that specifies the contractual terms and conditions under which bids shall be made and accepted under this section; except that: Section 144(d0(1)(K)(3) of title I, division B of P.L. 106-554 shall apply to the program implemented by this section.

(b) A reduction fishery is eligible for capacity reduction under the program implemented under this section; except that no vessel harvesting and processing whiting in the catcher-processors sector (section 19 660.323(a)(4)(A) of title 50, Code of Federal Regulations) may participate in any capacity reduction referendum or industry fee established under this section.

(c) A referendum on the industry fee system shall occur after bids have been submitted, and such bids have been accepted by the Secretary, as follows: members of the reduction fishery, and persons who have been issued Washington, Oregon, or California Dungeness crab and Pink shrimp permits, shall be eligible to vote in the referendum to approve an industry fee system; referendum votes cast in each fishery shall be weighted in proportion to the debt obligation of each fishery, as calculated in subsection (f) of this section; the industry fee system shall be approved if the referendum votes cast in favor of the proposed system constitute a simple majority of the participants voting; except that notwithstanding 5 U.S.C. 553 and 16 U.S.C. 1861a(e), the Secretary shall not prepare or publish proposed or final regulations for the implementation of the program under this section before the referendum is conducted.

(d) Nothing in this section shall be construed to prohibit the Pacific Fishery management Council from recommending, or the Secretary from approving, changes to any fishery management plan, in accordance with applicable law; or the Secretary from promulgating regulations (including regulations governing this program), after an industry fee system has been approved by the reduction fishery.

(e) The Secretary shall determine, and state in the public notice published under paragraph (a), all program implementation aspects the Secretary deems relevant

(f) Any bid submitted in response to the invitation to bid issued by the Secretary under this section shall be irrevocable; the Secretary shall use a bid acceptance procedure that ranks each bid in accordance with this paragraph and with additional criteria, if any, established by the Secretary: for each bid from a qualified bidder that meets the bidding requirements in the public notice or the invitation to bid, the Secretary shall determine a bid score by dividing the bid's dollar amount by the average annual total ex-vessel dollar value of landings of Pacific groundfish, Dungeness crab, and Pink shrimp based on the 3 highest total annual revenues earned from such stocks that the bidder's reduction vessel landed during 1998, 1999, 2000, or 2001. For purposes of this paragraph, the term ``total annual revenue" means the revenue earned in a single year from such stocks. The Secretary shall accept each qualified bid in rank order of bid score from the lowest to the highest until acceptance of the next qualified bid with the next lowest bid score would cause the reduction cost to exceed the reduction loan's maximum amount. Acceptance of a bid by the Secretary shall create a binding reduction contract between the United States and the person whose bid is accepted, the performance of which shall be subject only to the conclusion of a successful referendum, except that a person whose bid is accepted by the Secretary under this section shall relinquish all permits in the reduction fishery and may Dungeness crab and Pink shrimp permits issued by Washington, Oregon, or California; except that the Secretary shall revoke the Pacific groundfish permit, as well as all Federal fishery licenses, fishery permits, area, and species endorsements, and any other fishery privileges issued to a vessel or vessels (or to persons on the basis of their operation or ownership of that vessel or vessels) removed under the program.

(g) The Secretary shall establish separate reduction loan sub-amounts and repayment fees for fish sellers in the reduction fishery and for fish sellers in each of the fee-share fisheries by dividing the total ex-vessel dollar value during the bid scoring period of all reduction vessel landings from the reduction fishery and from each of the fee-share fisheries by the total such value of all such landings for all such fisheries; and multiplying the reduction loan amount by each of the quotients resulting from each of the divisions above. Each of the resulting products shall be the reduction loan sub-amount for the reduction fishery and for each of the fee-share fisheries to which each of such products pertains; except that, each fish seller in the reduction fishery and in each of the fee-share fisheries shall pay the fees required by the reduction loan sub-amounts allocated to it under this paragraph; except that, the Secretary may enter into agreements with Washington, Oregon, and California to collect any fees established under this paragraph.

(h) Notwithstanding 46 U.S.C. App. 1279(b)(4), the reduction loan's term shall not be less than 30 years.

(i) It is the sense of the Congress that the States of Washington, Oregon, and California should revoke all relinquishment permits in each of the fee-share fisheries immediately after reduction payment, and otherwise to implement appropriate State fisheries management and conservation provisions in each of the fee-share fisheries that establishes a program that meets the requirements of 16 U.S.C. 141861a(b)(1)(B) as if it were applicable to fee-share fisheries.

(j) The term ``fee-share fishery" means a fishery, other than the reduction fishery, whose members are eligible to vote in a referendum for an industry fee system under paragraph (c). The term ``reduction fishery" means that portion of a fishery holding limited entry fishing permits endorsed for the operation of trawl gear and issued under the Federal Pacific Coast Groundfish Fishery Management Plan.

MAGNUSON ACT

SEC. 312. TRANSITION TO SUSTAINABLE FISHERIES[7] 16 U.S.C. 1861a

(a) FISHERIES DISASTER RELIEF.--

(1) At the discretion of the Secretary or at the request of the Governor of an affected State or a fishing community, the Secretary shall determine whether there is a commercial fishery failure due to a fishery resource disaster as a result of--

(A) natural causes;

(B) man-made causes beyond the control of fishery managers to mitigate through conservation and management measures; or

(C) undetermined causes.

(2) Upon the determination under paragraph (1) that there is a commercial fishery failure, the Secretary is authorized to make sums available to be used by the affected State, fishing community, or by the Secretary in cooperation with the affected State or fishing community for assessing the economic and social effects of the commercial fishery failure, or any activity that the Secretary determines is appropriate to restore the fishery or prevent a similar failure in the future and to assist a fishing community affected by such failure. Before making funds available for an activity authorized under this section, the Secretary shall make a determination that such activity will not expand the size or scope of the commercial fishery failure in that fishery or
into other fisheries or other geographic regions.

(3) The Federal share of the cost of any activity carried out under the authority of this subsection shall not exceed 75 percent of the cost of that activity.

(4) There are authorized to be appropriated to the Secretary such sums as are necessary for each of the fiscal years 1996, 1997, 1998, and 1999.

(b) FISHING CAPACITY REDUCTION PROGRAM.--

(1) The Secretary, at the request of the appropriate Council for fisheries under the authority of such Council, or the Governor of a State for fisheries under State authority, may conduct a fishing capacity reduction program (referred to in this section as the 'program') in a fishery if the Secretary determines that the program--

(A) is necessary to prevent or end overfishing, rebuild stocks of fish, or achieve measurable and significant improvements in the conservation and management of the fishery;

(B) is consistent with the Federal or State fishery management plan or program in effect for such fishery, as appropriate, and that the fishery management plan--

(i) will prevent the replacement of fishing capacity removed by the program through a moratorium on new entrants, restrictions on vessel upgrades, and other effort control measures, taking into account the full potential fishing capacity of the fleet; and
(ii) establishes a specified or target total allowable catch or other measures that trigger closure of the fishery or adjustments to reduce catch; and

(C) is cost-effective and capable of repaying any debt obligation incurred under section 1111 of title XI of the Merchant Marine Act, 1936.

(2) The objective of the program shall be to obtain the maximum sustained reduction in fishing capacity at the least cost and in a minimum period of time. To achieve that objective, the Secretary is authorized to pay--

(A) the owner of a fishing vessel, if such vessel is (i) scrapped, or (ii) through the Secretary of the department in which the Coast Guard is operating, subjected to title restrictions that permanently prohibit and effectively prevent its use in fishing, and if the permit authorizing the participation of the vessel in the fishery is surrendered for permanent revocation and the owner relinquishes any claim associated with the vessel and permit that could qualify such owner for any present or future limited access system permit in the fishery for which the program is established; or

(B) the holder of a permit authorizing participation in the fishery, if such permit is surrendered for permanent revocation, and such holder relinquishes any claim associated with the permit and vessel used to harvest fishery resources under the permit that could qualify such holder for any present or future limited access system permit in the fishery for which the program was established.

(3) Participation in the program shall be voluntary, but the Secretary shall ensure compliance by all who do participate.

(4) The Secretary shall consult, as appropriate, with Councils, Federal agencies, State and regional authorities, affected fishing communities, participants in the fishery, conservation organizations, and other interested parties throughout the development and implementation of any program under this section.

(c) PROGRAM FUNDING.--

(1) The program may be funded by any combination of amounts--

(A) available under clause (iv) of section 2(b)(1)(A) of the Act of August 11, 1939 (15 U.S.C.

713c-3(b)(1)(A); the Saltonstall-Kennedy Act);

(B) appropriated for the purposes of this section;

(C) provided by an industry fee system established under subsection (d) and in accordance with section 1111 of title XI of the Merchant Marine Act, 1936; or

(D) provided from any State or other public sources or private or non-profit organizations.

(2) All funds for the program, including any fees established under subsection (d), shall be paid into the fishing capacity reduction fund established under section 1111 of title XI of the Merchant Marine Act, 1936.

(d) INDUSTRY FEE SYSTEM.--

(1) (A) If an industry fee system is necessary to fund the program, the Secretary, at the request of the appropriate Council, may conduct a referendum on such system. Prior to the referendum, the Secretary, in consultation with the Council, shall--

(i) identify, to the extent practicable, and notify all permit or vessel owners who would be affected by the program; and
(ii) make available to such owners information about the industry fee system describing the schedule, procedures, and eligibility requirements for the referendum, the proposed program, and the amount and duration and any other terms and conditions of the proposed fee system.

(B) The industry fee system shall be considered approved if the referendum votes which are cast in favor of the proposed system constitute a two-thirds majority of the participants voting.

(2) Notwithstanding section 304(d) and consistent with an approved industry fee system, the Secretary is authorized to establish such a system to fund the program and repay debt obligations incurred pursuant to section 1111 of title XI of the Merchant Marine Act, 1936. The fees for a program established under this section shall--

(A) be determined by the Secretary and adjusted from time to time as the Secretary considers necessary to ensure theavailability of sufficient funds to repay such debt obligations;

(B) not exceed 5 percent of the ex-vessel value of all fish harvested from the fishery for which the program is established;

(C) be deducted by the first ex-vessel fish purchaser from the proceeds otherwise payable to the seller and accounted for andforwarded by such fish purchasers to the Secretary in such manner as the Secretary may establish; and

(D) be in effect only until such time as the debt obligation has been fully paid.

(e) IMPLEMENTATION PLAN.--

(1) The Secretary, in consultation with the appropriate Council or State and other interested parties, shall prepare and publish in the Federal Register for a 60-day public comment period an implementation plan, including proposed regulations, for each program. The implementation plan shall--

(A) define criteria for determining types and numbers of vessels which are eligible for participation in the program taking into account characteristics of the fishery, the requirements of applicable fishery management plans, the needs of fishing communities, and the need to minimize program costs; and

(B) establish procedures for program participation (such as submission of owner bid under an auction system or fair market-value assessment) including any terms and conditions for participation which the Secretary deems to be reasonably necessary to meet the goals of the program.

(2) During the 60-day public comment period--

(A) the Secretary shall conduct a public hearing in each State affected by the program; and

(B) the appropriate Council or State shall submit its comments and recommendations, if any, regarding the plan and regulations.

(3) Within 45 days after the close of the public comment period, the Secretary, in consultation with the appropriate Council or State, shall analyze the public comment received and publish in the Federal Register a final implementation plan for the program and regulations for its implementation. The Secretary may not adopt a final implementation plan involving industry fees or debt obligation unless an industry fee system has been approved by a referendum under this section.

Attachment 2

September 30, 2003

Dear Groundfish Referendum Voter:

I enclose a ballot for your vote in the Pacific Coast groundfish buyback referendum. Our records indicate that you're the holder or owner of record of the fishing permit specified on the enclosed ballot, and this qualifies you to one vote.

The referendum determines whether voters approve or disapprove the post-buyback landing fees necessary to repay a $36 million buyback loan financing about 78% of the buyback's $46 million maximum cost (a $10 million appropriation pays for the remainder).

Please note carefully:

- ***You may not submit your vote to us before October 15, 2003.***

- ***For your vote to be effective, you must complete the enclosed ballot and return it to us in the enclosed envelope in time for us to receive it not later than October 29, 2003.***

You may return the completed ballot to us by U.S. mail, overnight delivery, or any other method you choose. Whatever method you choose, please put the ballot in the enclosed envelope.

If you have more than one permit qualifying you to vote, you'll receive an additional ballot for each additional permit. We'll *separately* mail you one ballot for each permit qualifying you to vote. You're qualified to vote once for each of your groundfish trawl permits and once again for each of your California, Oregon, or Washington Dungeness crab or pink shrimp permits. We'll weight each vote as the table in item number twelve below indicates.

For further details about the referendum and related matters, please see the letter I sent you on July 30, 2003.

The remainder of this letter concerns the buyback bidding results, which may effect how you want to vote. The following summarizes the bidding results:

(1) How many bids in what amount did we receive?

108 bids totaling $59,786,471.

(2) How many bids in what amount may we accept?

We may accept the lowest scoring bids until accepting the next lowest scoring bid would cause the buyback to exceed its maximum $46 million cost. Consequently, there are 92 acceptable bids for $45,752,471.

(3) How many vessels do the acceptable bids cause to be permanently removed from all fishing?

92 vessels.

(4) How many fishing permits do the acceptable bids cause to be relinquished, how many are in the seven fee paying fisheries, and what percentage of the total existing permits is this?

240 permits will be relinquished. 213 of these permits involve the seven fisheries subject to repaying the buyback loan (the other 27 involved other Federal fisheries other). The 213 permits are distributed among the seven fisheries fee paying fisheries as follows:

FISHERY	PERMITS IN EACH FISHERY		
	NUMBER	NUMBER RELINQUISHED	PERCENTAGE OF TOTAL EXISTING
Groundfish[1]	263	92	34.98%
CA crab	632	23	3.64%
CA shrimp	77	31	40.26%
OR crab	443	10	2.26%
OR shrimp	185	40	21.62%
WA crab	232	3	1.29%
WA shrimp	109	14	12.84%
Total	1,941	213	-

[1] CA, OR, and WA trawl fishery, excluding whiting catcher/processors (which were unqualified to bid).

(5) During the four years from 1998 through 2001, what was the *average*, annual, ex-vessel value of fish landed in each of the seven fisheries by the 92 vessels and 213 permits in the acceptable bids, and what percentage of the total value in each fishery is this?

FISHERY	*AVERAGE* ANNUAL VALUE IN EACH FISHERY		
	VALUE REMOVED	FISHERY'S TOTAL VALUE	PERCENTAGE OF TOTAL VALUE REMOVED
Groundfish:			
• *Excluding* whiting	$15,561,899	$33,800,713	46.04%
• *Including* whiting	$15,972,354	$43,799,118	36.47%
CA crab	$1,302,847	$14,955,003	8.71%
CA shrimp	$376,288	$1,267,120	29.70%
OR crab	$763,259	$19,657,008	3.88%
OR shrimp	$1,243,970	$7,628,189	16.31%
WA crab	$206,185	$18,228,037	1.13%
WA shrimp	$144,777	$1,374,177	10.54%
Total	$20,009,680	-	-

(6) *Prospectively*, what portion of a nearly $36 million buyback loan would each of the seven fisheries repay, and what percentage of the projected post-buyback landing value in each fishery would the *initial* loan repayment fee be?

FISHERY	LOAN PORTION	LANDING FEE PERCENTAGE
Groundfish	$28,538,743	5.00%
CA crab	$2,327,872	1.28%
CA shrimp	$672,336	4.35%
OR crab	$1,363,760	0.57%
OR shrimp	$2,222,675	2.39%
WA crab	$368,403	0.17%
WA shrimp	$258,682	1.54%
Total	$35,752,471	-

(7) *All other things being equal*, what's the relationship in each of the seven fisheries between the annual loan repayment expense and the extra average ex-vessel landing value *potentially* available each year to post-buyback vessels in each fishery?

FISHERY	TOTAL ANNUAL *EXPENSE* OF REPAYING LOAN	EXTRA *AVERAGE* ANNUAL *EX-VESSEL LANDING VALUE* AVAILABLE TO POST-BUYBACK VESSELS	EXTRA *LANDING VALUE* PER EACH $1.00 OF LOAN *EXPENSE*
Groundfish	$2,340,853	$15,972,354	$6.82
CA crab	$190,941	$1,302,847	$6.82
CA shrimp	$55,147	$376,288	$6.82
OR crab	$111,861	$763,259	$6.82
OR shrimp	$182,312	$1,243,970	$6.82
WA crab	$30,218	$206,185	$6.82
WA shrimp	$21,218	$144,777	$6.82
Total	$2,932,550	$20,009,680	$6.82

(8) What's the *average* effect for each post-buyback permit holder?

All other things being equal, the bidding results mean greater ex-vessel revenues for fewer post-buyback permit owners. Using the *average* annual ex-vessel landing value in each of the seven fisheries from 1998 through 2001, the following tables illustrate the buyback's *potential* effect in each of the fisheries:

	GROUNDFISH		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	263	171	92 less
Average, annual, total ex-vessel gross revenue	$43.8 million	$43.8 million	none
Average per permit	$166,536	$256,135	$89,599 more
Minus 5% Fee	-	$12,807	$12,807
Net *average per permit*	-	$243,328	$76,792 more

	CA CRAB		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	632	609	23 less
Average, annual, total ex-vessel gross revenue	$15.0 million	$15.0 million	none
Average per permit	$23,663	$24,556	$893 more
Minus 1.28% Fee	-	$314	$314
Net *average per permit*	-	$24,242	$579 more

	CA SHRIMP		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	77	31	46 less
Average, annual, total ex-vessel gross revenue	$1.27 million	$1.27 million	none
Average per permit	$16,456	$27,546	$11,090 more
Minus 4.35% Fee	-	$1,198	$1,198
Net *average per permit*	-	$26,348	$9,892 more

	OR CRAB		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	443	433	10 less
Average, annual, total ex-vessel gross revenue	$19.7 million	$19.7 million	none
Average per permit	$44,372	$45,397	$1,025 more
Minus 0.57% Fee	-	$259	$259
Net *average per permit*	-	$45,138	$766 more

	OR SHRIMP		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	185	145	40 less
Average, annual, total ex-vessel gross revenue	$7.6 million	$7.6 million	none
Average per permit	$41,234	$52,608	$11,374 more
Minus 2.39% Fee	-	$1,257	$1,257
Net *average per permit*	-	$51,351	$10,117 more

	WA CRAB		
	BEFORE BUYBACK	**AFTER BUYBACK**	**NET DIFFERENCE**
Number of permits	232	229	3 less
Average, annual, total ex-vessel gross revenue	$18.2 million	$18.2 million	none
Average per permit	$78,569	$79,598	$1,029 more
Minus 0.17% Fee	-	$135	$135
Net *average per permit*	-	$79,463	$894 more

	WA SHRIMP		
	BEFORE BUYBACK	AFTER BUYBACK	NET DIFFERENCE
Number of permits	109	95	14 less
Average, annual, total ex-vessel gross revenue	$1.38 million	$1.38 million	none
Average per permit	$12,607	$14,465	$1,858 more
Minus 1.54% Fee	-	$223	$223
Net *average per permit*	-	$14,242	$1,635 more

(9) What's the practical effect?
If (a) each $1 spent on buyback loan repayment fees results in $6.82 of extra gross operating revenue and (b) the operating cost of producing the extra revenue doesn't increase, the practical effect would be $5.82 earned for each $1 spent. The fixed operating costs (for example, debt service and insurance) should remain the same with or without the buyback. Consequently, any potential increase in operating costs needed to produce the extra gross revenue should be limited to variable operating costs, and the degree to which this may reduce the $5.82 gain may vary among permit holders and fisheries.

(10) Will the buyback loan repayment fees be tax deductible?

We believe the landing fees each post-buyback harvester pays will be deductible as an expense of doing business, but this is an Internal Revenue Service determination.

(11) Will the fee rates decrease in the future?

The thirty-year buyback loan is a *fixed* principal amount at a *fixed* interest rate, and ex-vessel prices will presumably inflate over the next 30 years. *All other things being equal*, if ex-vessel prices inflate over time, the fee rates will become a smaller percentage of landing values.

(12) How will we weight votes from each of the seven fisheries?

FISHERY	TOTAL EX-VESSEL VALUE, DURING 4 YEARS FROM 1998-2001, OF CAPACITY WHICH BUYBACK REMOVES		
	EACH OF 7 FISHERIES (DIVIDEND)	DIVIDED BY *ALL 7* FISHERIES (DIVISOR)	EQUALS WEIGHTING PERCENTAGE FOR *EACH OF 7* FISHERIES
Groundfish	$63,889,417	$80,038,721	79.82%
CA crab	$5,211,386	same	6.51%
CA shrimp	$1,505,152	same	1.88%
OR crab	$3,053,036	same	3.82%
OR shrimp	$4,975,881	same	6.22%
WA crab	$824,741	same	1.03%
WA shrimp	$579,108	same	0.72%
Total	$80,038,721	same	100.00%

This concludes the buyback bidding summary.

After October 29, 2003 *(the last day for our receipts of votes)*, we will notify all bidders and voters of the referendum results and publish a reduction payment tender notice in the Federal Register as soon as we possibly can.

Please note the following two corrections to the table on page No. 5 of my July 30, 2003, letter about the referendum:

- In the second column's heading, "2003" should be "2001", and

- The table should have indicated that the ex-vessel values in the second and third columns are those of the accepted bidders' buyback vessels.

Please do not hesitate to contact us, at the following numbers and addresses, if you need further referendum or buyback information of any kind:

PERSON	NUMBERS/ADDRESS	
	TELEPHONE (301) 713-2390	E-MAIL ADDRESS
Mike Sturtevant	Extension 212	michael.a.sturtevant@noaa.gov
Shawn Barry	Extension 186	shawn.barry@noaa.gov
Mike Grable	Extension 185	michael.grable@noaa.gov

We look forward to receiving your referendum ballot not later than October 29, 2003.

Sincerely,

Michael L. Grable, Chief
Financial Services Division

ENCLOSURE (one ballot for one permit)

Exhibit C.17.c
Supplemental GAP Report
April 2004

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON LATENT LIMITED ENTRY TRAWL PERMITS

The Groundfish Advisory Subpanel (GAP) received a report rom Dr. Steve Freese of the NMFS Northwest Region regarding the status of latent permits in the groundfish fishery.

After reviewing the report and discussing its methodology and contents with Dr. Freese, the GAP concluded that there should be no action taken at this time to address any perceived problems with latent permits. Any time there are massive changes in management systems, time will be needed for effects to move through the system and allow the system to stabilize at different levels. At the moment, we are dealing with the after-effects of a vessel buyback; changes in trip limits; perceptions of future actions regarding individual quotas; and significant restraints needed to avoid species designated as overfished. Combine this with the normal vagaries of markets, changing management, and alternative fishing opportunities in other fisheries, and you get a fishery in a high state of flux. At this point, it is premature to address a problem that, in fact, may not exist.

Finally, the GAP notes that one of the criticism leveled against effort restriction programs is the lack of opportunities for new entrants. Having latent - and possible lower valued - permits available for purchase will help to answer this criticism.

PFMC
04/08/04