# REGIONAL ELECTRONIC TECHNOLOGIES IMPLEMENTATION PLAN for MARINE FISHERIES in the WEST COAST REGION

## I. INTRODUCTION

The implementation of marine fisheries management regulations in recent years that require near real-time reporting of retained catch fishery related impacts by species at the vessel level have challenged the methodological and budgetary limits of contemporary data collection methods such as on-board observers, self-reporting, dockside monitoring, and filing landing receipts. Further, the demands for more precise, timely, and comprehensive fishery-related data continue to rise as fishery managers strive for greater by-catch control and optimized target stock catches via increasingly more sophisticated regulatory approaches. Electronic technologies[1] (ET) are emerging as a more effective and efficient solution to meet these challenges and demands. Opportunities to carry out existing data tasks in a more efficient manner are particularly important in time of increasing budgetary constraints.

In May 2013, the National Marine Fisheries Service (NMFS) issued Policy Directive 30-133, *Policy on Electronic Technologies and Fishery-Dependent Data Collection* (attached), which called for the development of Regional Electronic Technology Implementation Plans to address regionally specific fishery data collection issues and needs. Importantly, the Policy Directive did not state that electronic technologies were appropriate for all of a region's fisheries or fishery management plans (FMP). Rather, it called for the identification of fisheries or FMPs for which electronic technologies are appropriate. In describing an implementation plan, it is important to acknowledge the Pacific Fishery Management Council's (Pacific Council) policy role in the development of the regulations necessitating the collection of data and, in some cases, regulatory requirements for the use of ET. While there is always a linkage between Council management policy and the design of the data system, the specifics of how management data needs are met are often left to the implementing agencies. In that regard, the roles of several key partners, in addition to the NMFS and the Council, will need to be taken into account in any electronic technologies implementation plan: the Pacific States Marine Fisheries Commission (Pacific Commission) as the clearing house of West Coast fishery catch information, and the States of Washington, Oregon, and California, West Coast States and Northwest Indian Tribes in their roles as the original collectors of most shore-based catch accounting information.

This Plan is to describe the intent to consider the use of ET in the management of West Coast marine fisheries, including implementation necessities by the aforementioned entities, over the course of the next five years. The Plan is to provide a list of fisheries or data collection methods across fisheries that are target candidates for the application of ET to achieve costs savings, economies of scale, and greater efficiency in catch and discard information. The roles and effects on responsible agencies should be addressed. The Plan needs to address funding issues including the possibility of industry cost sharing. Lastly, an evaluation protocol is needed to assess ET effectiveness after implementation.

[1] Electronic technologies for the purposes of this plan include vessel monitoring systems (VMS), electronic logbooks (EL), video cameras for observer-type electronic monitoring (EM), electronic fish ticket (EFT) systems and other technologies that provide EM and electronic reporting (ER).

## II. Plan Content

The following draft outline contains suggested components for a Regional Electronic Technology Implementation Plan

1) Overview of the Regional Electronic Technology Implementation Plan
    a. Overall goal of electronic technology plan
        - Clear objectives of electronic technology plan
        - Overall Plan Development and Oversight
    b. Technological capabilities
    c. Costs
        - Industry Costs
        - Pacific Fishery Management Council Costs
        - NMFS Costs
            - West Coast Regional Office Costs
            - Science Center Costs
                - Northwest Fishery Science Center
                - Southwest Fishery Science Center
        - State Costs
        - Tribal Costs
    d. Funding for regional plan implementation
        - Identified Funding Sources
        - Industry Cost Share
        - Statement about what we're spending in the current year, 2014
        - A table of future funding needs for ET plans by year
    e. Regulatory changes needed to implement electronic technologies
        - Electronic reporting
        - Electronic monitoring
        - Other
    f. Proposed evaluation method(s)
        - Develop Evaluation Metrics
        - Stakeholder assessments
        - Cost/benefit
        - Schedule (e.g., 5-year periodic)

2) Recommendations/Concerns/Issues
        - Technical/scientific
        - Budgetary
        - Regulations
        - Implications for non-federal fisheries management
        - Implications for existing programs including federal observer programs
        - Other
            - Confidentiality
            - Law Enforcement including chain of custody
            - Lack of EM providers
            - Effects on third-party observer providers
            - Assessing changes Data Quality
            - Apples to Apples Comparison Cost Comparisons between Observer Costs and EM Costs

- Assessing Costs Impacts on Industry
- Keeping up with changes in Technology (and allowing for Industry Innovation.

3) List of Fisheries Suitable for Implementation of Electronic Technologies
    a. Fisheries/FMPs in the electronic technologies plan.
        - FMP Assessments
            - FMP Goals and Objectives
            - Role of Electronic Technology in Achieving FMP Goals and Objectives
            - Current State of Electronic Technology in FMP Fisheries
            - Future Desired State of Electronic Technology
    b. Overall Conclusions
        - Fisheries that are included and why
        - Fisheries that aren't included and why
        - Common Needs Across FMPs

4) Schedule/Timeline for Implementation of Regional Electronic Technology Plan, e.g., 5 Year Planning Horizon
    a. Timetable for components of regional electronic technology Plan
        - Fishery by fishery
            - Current Rule Making/Implementation Plans
            - Future Plans
                - Development Plan
                - Industry/Council/Agency - Consultation Process
                - Potential effects on Conservation and Management
                - Potential effects on current Data Collection Systems
                - Potential Pilot Studies
                - Cost Analysis
                - Funding Analysis
                - Regulatory Process
                - Implementation and Infrastructure Development Plan
                - Outreach
    b. Prioritization of Electronic Technology FMP Plans
    c. Five year Plan Schedule
        - Major Milestones
        - Measures of Progress

5) Evaluation Of Implementation Progress
    a. Number of FMPs with defined fishery-dependent data collection and monitoring goals
    b. The number of FMPs reviewed to identify fisheries where the adoption of additional technologies would be appropriate for achieving data needs
    c. For fisheries where additional electronic technologies are appropriate, the number of FMPs with electronic technologies incorporated into fishery dependent data collection programs
    d. Needed Course Corrections and Why

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| ***NATIONAL MARINE FISHERIES SERVICE POLICY DIRECTIVE 30-133***<br>***MAY 3, 2013*** |
| ***Administration and Operations*** |
| ***POLICY ON ELECTRONIC TECHNOLOGIES AND FISHERY-DEPENDENT DATA COLLECTION*** |
| **NOTICE:** This publication is available at: http://www.nmfs.noaa.gov/directives/. |

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|---|---|
| **OPR:** F/OP<br>**Type of Issuance:** Initial | **Certified by:** F/OP (M. Holliday) |
| ***SUMMARY OF REVISIONS:*** | |

Introduction.

This policy provides guidance on the adoption of electronic technology solutions in fishery- dependent data collection programs. Electronic technologies include the use of vessel monitoring systems (VMS), electronic logbooks, video cameras for electronic monitoring (EM), and other technologies that provide EM and electronic reporting (ER). The policy also includes guidance on the funding for electronic technology use in fishery-dependent data collection programs.

Constraining budgets and increasing demands for data are driving the need to evaluate and improve existing fishery-dependent data collection programs, in particular with respect to cost-effectiveness, economies of scale and sharing of electronic technology solutions across regions. The demands for more precise, timelier, and more comprehensive fishery-dependent data continue to rise every year.

The implementation of fisheries management regulations that require near real-time monitoring of catch by species at the vessel level have challenged the methodological and budgetary limits of data collection methods such as self-reporting, on-board observers, and dockside monitoring. A policy and process to consider the adoption of electronic technology options can help ensure the agency's fishery-dependent data collection programs are cost- effective and sustainable.

Objective.

It is the policy of the National Oceanic & Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NOAA Fisheries) to encourage the consideration of electronic technologies to complement and/or improve existing fishery-dependent data collection programs to achieve the most cost-effective and sustainable approach that ensures alignment of management goals, data needs, funding sources and regulations.

To achieve this:

1. NOAA Fisheries encourages the consideration of all electronic technology options to meet science, management, and compliance data needs.

2. Fishery-dependent data collection programs will be designed and periodically reviewed by NOAA Fisheries regions to ensure effective, efficient monitoring programs that meet industry and government needs, increase coordination between regions, and promote sharing of research, development and operational outcomes.

3. Fishery-dependent data collection programs may be comprised of a combination of methods and techniques including self-reporting, on-board observers, and dockside monitoring, as well as the use of electronic technologies including electronic reporting and video monitoring.

4. Where full retention regulations and associated dockside catch accounting measures are in place, NOAA Fisheries supports and encourages the evaluation/adoption of video cameras to meet monitoring and compliance needs in federally managed fisheries.

5. NOAA Fisheries encourages the use of electronic technologies that utilize open source code or standards that facilitate data integration and offer long-term cost savings rather than becoming dependent on proprietary software.

6. NOAA Fisheries, in consultation with the Councils and subject matter experts, will assemble guidance and best practices for use by Regional Offices, Councils and stakeholders when they consider electronic technology options. Implementation of electronic technologies in a fishery-dependent data collection program is subject to the Magnuson-Stevens Act and Council regulatory process, other relevant state and federal regulations, and the availability of funds.

7. No electronic technology-based fishery-dependent data collection program will be approved by NOAA if its provisions create an unfunded or unsustainable cost of implementation or operation contrary to applicable law or regulation. Funding of fishery-dependent data collection programs is expected to consider the entire range of funding authorities available under federal law, including those that allow collection of funds from industry.

8. Where cost-sharing of monitoring costs between the agency and industry is deemed appropriate and approved under applicable law and regulation, NOAA Fisheries will work with Councils and stakeholders to develop transition plans from present to future funding arrangements.

Authorities and Responsibilities.

This policy directive establishes the following authorities and responsibilities:

(1) The NOAA Fisheries Science Board and Regulatory Board are the Executive-level sponsors of the execution of this policy, including oversight of the development of guidance and best practices. Staff support to the Boards will be provided by the Offices of Policy,

Sustainable Fisheries, and Science and Technology. Technical assistance will be provided by *ad hoc* working groups, NOAA Fisheries Headquarters (HQ), Region and Science Center subject matter experts, and other agency or contract resources as requested by the Science or Regulatory Board, subject to the availability of funds. Approval of guidance and best practices is subject to Leadership Council concurrence and Assistant Administrator approval.

(2) Regional Administrators and the Office of Sustainable Fisheries - Implementation of this policy will rely on Regional Offices (and the Office of Sustainable Fisheries with respect to Atlantic Highly Migratory Species) initiating consultations in FY 2013 with their respective Science Centers, Councils, States, Commissions, industry, and other stakeholders on the consideration and design, as appropriate, of fishery-dependent data collection programs that utilize electronic technologies for each Federal fishery.

Measuring Effectiveness.

(1) The consultations by the Regional Administrators and the Office of Sustainable Fisheries will be initiated in FY2013 with the goal of completing by the end of calendar year 2014 a schedule of where and how to adopt appropriate electronic technologies, if any, for all fishery management plans (FMPs).

The following metrics will be used to evaluate progress towards the implementation of this policy:

- The number of FMPs with defined fishery-dependent data collection monitoring goals.
- The number of FMPs reviewed to identify fisheries where the adoption of additional electronic technologies would be appropriate for achieving data needs.
- For fisheries where additional electronic technologies are identified as appropriate, the number of FMPs with electronic technologies incorporated into fishery-dependent data collection programs.

Status reviews of the metrics will take place twice a year by the Regulatory and Science Boards.

References.

Procedural directives will be issued to implement this policy as needed. This policy directive is supported by the glossary of terms listed in Attachment 1.
Signature and Date Line.

_____

Sam D. Rauch III Date
Acting Assistant Administrator
National Marine Fisheries Service

## Attachment 1
## GLOSSARY

**Terms**

***Electronic Technology(ies)*** – Any electronic tool used to support catch monitoring efforts both on shore and at sea, including electronic reporting (e.g., e-logbooks, tablets, and other input devices) and electronic monitoring (Vessel Monitoring Systems, electronic cameras, and sensors on-board fishing vessels).

***Electronic Monitoring (EM)*** – The use of technologies – such as vessel monitoring systems or video cameras – to passively monitor fishing operations through observing or tracking. Video monitoring is often referred to as EM.

***Electronic Reporting (ER)*** – The use of technologies – such as smart phones, computers and tablets – to record, transmit, receive, and store fishery data.

***Fishery-dependent Data Collection Program*** - Data collected in association with commercial, recreational or subsistence/customary fish harvesting or subsequent processing activities or operations, as opposed to data collected via means independent of fishing operations, such as from research vessel survey cruises or remote sensing devices.

***Full Retention*** – A type of fishery where total catch is retained and brought to shore, without discards. This is a generic definition, used in the Policy Directive for illustrative purposes only. There are multiple stages in the fishing process where intentional and unintentional discards can occur. Such variations (e.g., maximum retention, operational discards, prohibited species catch, etc.) require specific definition in each fishery for regulatory compliance and/or enforcement purposes.

**Excerpts from: Electronic Monitoring and Electronic Reporting: Guidance & Best Practices for Federally-Managed Fisheries**

**The full document is available at:**
**http://www.nmfs.noaa.gov/op/snippets/em_er_discussion_draft_august_2013.pdf**

***PHASE I Checklist: Current Assessment***

- ✓ Describe current monitoring system
- ✓ Inventory current fleet, government & service provider infrastructure
- ✓ Evaluate strengths/weaknesses of existing monitoring tools (e.g., observers, dockside monitors, ER, EM, etc.) relative to specific fishery
- ✓ Summarize existing regulatory framework
- ✓ Identify potential funding sources

***PHASE II Checklist: Identification of goals***

- ✓ Identify data needs based on FMP objectives, scientific needs, protected species requirements, and characteristics of fleet
- ✓ Engage stakeholders including scientists, enforcement staff, managers, and industry to discuss and adjust, if needed, identified data needs
- ✓ Based on input, define monitoring goals as explicitly as possible:
    - Precision ranges on catch and discards
    - Spatial, temporal, and gear characteristics needed for stock assessments
    - Non-target and protected species
    - Timeliness and frequency

## *PHASE III Checklist: Program Design*

- ✓ Using identified goals, conduct preliminary comparative analysis of different monitoring tools, including cost
- ✓ Once monitoring options(s) are identified, evaluate:
  - Durability
  - Enforceability
  - Data quality
  - Operability/maintenance requirements
  - Timeliness and data integration
  - Fish/catch handling consequences
  - Confidentiality
  - Archiving needs
  - Costs (start-up & maintenance)
- ✓ Identify any needed regulatory changes to support new monitoring program
- ✓ Evaluate funding mechanisms identified in Phase I
- ✓ Select final preferred monitoring tool(s)
- ✓ Establish a timeline for review of monitoring program

## *PHASE IV Checklist: Pre- Implementation*

- ✓ Purchase hardware or other equipment, if needed
- ✓ Train State, Council, Federal or other staff or use outside resources (e.g., contractor) to support implementation of monitoring program, including necessary IT and user support
- ✓ Establish data handling and management procedures
- ✓ Install necessary equipment and test
- ✓ If using ER or EM, create protocols for a) equipment failure contingencies and b) vessel-to-land communication
- ✓ Determine long-term funding mechanism based on refined cost estimates from pre-implementation

## *PHASE V Checklist: Implementation*

- ✓ Implement any required regulatory changes
- ✓ Ensure funding mechanisms are working
- ✓ Expand infrastructure purchases and installation to entire fleet/fishery
- ✓ Ensure appropriate amount of human resources are trained and ready to support program implementation, including IT support
- ✓ If using ER or EM, update or refine protocols from pre-implementation for a) equipment failure and b) vessel-to-land communication
- ✓ Execute hotline, user-support or other troubleshooting process
- ✓ Establish process for collecting feedback on monitoring tool(s) on regular basis to inform future improvements

## *PHASE VI Checklist: Review and Adapt*

- ✓ Using feedback collected and engagement with stakeholders, evaluate performance of monitoring program versus identified goals
- ✓ Every 5 years, or as otherwise determined in Phase I, re- evaluate goals of the monitoring program and funding mechanism (i.e., return to Phase I and refresh cycle)

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July 14, 2014

Chairman Richard B. Robins, Jr.
2014 Council Coordination Committee
Mid-Atlantic Fishery Management Council
800 N. State Street, Suite 201
Dover, DE 19901

Dear Chairman Robins:

We received your recent letter on behalf of the Council Coordination Committee regarding Oceana's March 2014 report *Wasted Catch: Unsolved Problems in U.S. Fisheries*. We have evaluated your concerns and provided comprehensive explanations and examples to address them in the following pages. Oceana stands by the *Wasted Catch* report, which uses the most comprehensive and recently updated data available from the federal government and does not include factual inaccuracies or misinformation.

Many of the criticisms outlined in the letter from the Council Coordination Committee are related to data taken from the National Marine Fisheries Service's *National Bycatch Report* (NBR), which was also communicated by the Council Coordination Committee at its 2014 meeting in Virginia Beach. While much of our report is based on government data obtained from the national report, more recent data from specific fisheries were used where appropriate. As noted in the report, we made the decision to focus on the NBR for nationwide consistency. As you are fully aware, fisheries data are not reported in the same manner in each region; therefore, the most consistent source of data was, and continues to be, the 2014 NBR.

Contrary to concerns raised in your correspondence, the report does highlight positive steps that have been taken to reduce bycatch in U.S. fisheries. The purpose of *Wasted Catch*, however, is to provide a national overview of the problem of bycatch suited for the general public, to highlight the fisheries and gears that still need improvement, and to suggest solutions that would further reduce bycatch. The report was not intended to chronicle the status and progress of every fishery in the U.S. We understand that an overview such as this cannot capture every detail of every fishery, which is why we call on the National Marine Fisheries Service (NMFS) to compile and publish better quality data and full fishery reporting in future national bycatch updates. We call on the Council Coordination Committee to reiterate this request for improved reporting and to actively work toward achieving regional consistency.

In the pages below, we have addressed the Council Coordination Committee's specific concerns with *Wasted Catch* to clarify our intentions with the report and our future goals. We hope that these responses resolve your concerns and that we can continue to work with the Councils and NMFS in developing and implementing fisheries management measures that benefit both fishermen and fishery resources.

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**List of Concerns Identified by the Council Coordination Committee**

**GENERAL COMMENTS**

**The Definition of Bycatch**

*The report states that "Bycatch is the capture of non-target fish and ocean wildlife, including what is brought to port and what is discarded at sea, dead or dying" (p. 6). It would be more helpful and less confusing to have aligned your definition with the Magnuson-Stevens Act, which would be all unused/discarded fish, regardless of condition (dead or surviving discarding). It would also be helpful to cite current discard mortality rate estimates when they are available.*

Section 3 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) defines "bycatch" as fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. In the Oceana report, we define bycatch as the catch of non-target fish and ocean wildlife, including what is brought to port and what is discarded at sea. There are no significant differences between these two definitions that are misleading when discussing the general impacts of bycatch. Furthermore, our definition is important for thinking about retained incidental catch, such as juvenile fish, that are brought to port and reduced and sold as fish meal. It is important that this bycatch is avoided in the first place, which is supported by the MSA.

We agree that discard mortality rates are important, but are most appropriate for fishery and gear-specific studies. Unfortunately, they are not often available; they should be included in future reporting by NMFS.

**Bycatch vs. Marine Mammal Mortality**

*The report states that "Bycatch exceeds mortality limits established by law for 20 percent of the marine mammal populations in the U.S." (p. 13). Bycatch and mortality of marine mammals are two different things, and this is a mismatched comparison.*

This statistic was not meant to conflate mortality with bycatch. Oceana simply used common language to explain a complex term, Potential Biological Removal (PBR), in a reader-friendly way. However, in the case of marine mammals, bycatch often leads to mortality, serious injury, diminished reproductive capacity or other stress-induced illness. For this reason, it is important to establish hard limits on the capture and mortality of protected species.

**Minimizing Bycatch through Habitat Conservation**

*The report states that conservation of habitat for juvenile fish would minimize bycatch (p. 32). This assumes that protecting habitat affects the number of discards.*

This assertion is a misrepresentation of Oceana's statement. The report states that a possible solution in the Northeast bottom trawl fishery is to "Conserve habitat for juvenile fish to bolster the recovery of depleted stocks and minimize bycatch."

Conserving habitat helps stocks rebuild, and when they do so, a healthy size distribution will allow for more efficient catch of legal-sized fish with less bycatch than when targeting a depleted stock. Conserving essential fish habitat for spawning, breeding, feeding and growth to maturity by juveniles is a common approach supported by the Magnuson-Stevens Act and subsequent guidance on Essential Fish Habitat (EFH) conservation. Furthermore, identifying juvenile habitat and minimizing fishing in these areas will reduce interactions with juveniles, effectively reducing bycatch.

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**Theme of Notable Progress**

*While section titles in the report suggest some "notable progress," the lack of time series information to describe trends means that readers cannot interpret the snapshot provided in the report in terms of whether or not (or to what extent) progress has been made in reducing bycatch.*

The *Wasted Catch* report explicitly mentions progress with a number of different examples:

- "In Alaska groundfish fisheries, halibut and salmon are prohibited species that cannot be targeted or brought to port, and they are managed with a bycatch limit in trawl fisheries targeting pollock, sole, flounder and cod. If fishermen exceed the bycatch limits, they risk prematurely ending their season. In 2012, the North Pacific Fishery Management Council voted to reduce halibut bycatch quota by 15 percent in the Gulf of Alaska trawl fishery, bringing the limit to approximately 4 million pounds." (p. 16)

- "Additionally, in 2011, after years of Oceana advocacy, New England sea scallop fishermen developed a new type of dredge that included deflector panels and other components to minimize the number of sea turtles caught and crushed by the heavy steel gear." (p. 20)

- "For example, in 2003, the California Fish and Game Commission banned the use of bottom trawls to catch spot prawns in Southern California. This fishery had previously discarded 17 pounds of fish (many of them severely depleted rockfish) for every 1 pound they kept. After the ruling, fishermen transitioned to using traps instead, a move that dramatically reduced bycatch and improved the market value of the spot prawns they sell." (p. 21)

- "For example, pollock trawl companies have implemented an electronic monitoring system using real-time reporting from other fishermen in a cooperative effort to avoid bycatch hotspots. In order to comply with bycatch limits, Alaska trawl fishermen report where and when they encounter the most salmon each day so that the information can be circulated to the entire fleet and others can avoid these hotspots. This approach keeps the fleet fishing longer and saves salmon, representing hundreds of thousands of dollars in economic value." (p. 22)

- In 2013, New England scallop fishermen, in conjunction with the University of Massachusetts, developed a similar technique to avoid catching yellowtail flounder, which dramatically reduced bycatch and allowed the fleet to maintain access to lucrative fishing grounds. Fishermen report bycatch through the program, which in turn disseminates near real-time information so the entire fleet can avoid bycatch hotspots." (p. 22)

Direct quotes from Oceana staff in the media:

- "Cano-Stocco acknowledges that the United States is actually one of the better nations when it comes to preventing unnecessary carnage to the creatures of the sea."
  *Report: A fifth of U.S. fish are tossed out*
  By Jason Huffman, March 20, 2014

- "'Proven solutions and innovative management strategies can significantly reduce the unnecessary deaths of sharks, sea turtles, dolphins and other marine life, while maintaining vibrant fisheries,' said Dr. Geoff Shester, California program director at Oceana."
  *Bycatch' Is Likely On Your Dinner Plate*
  By Joan Reddy , March 21, 2014

- "While pressing for better data, conservation groups including Oceana hope to hold on to what they see as improvements in fisheries stocks benefiting from the changes made in 2006. 'We are looking to make sure that we don't roll back the progress on our fisheries,' Cano-Stocco said. 'There's been better management in place, so we certainly don't want to see that go away.'"
  *Report: Weak Oversight Leaves Endangered Species Vulnerable to Fishermen's Nets*
  By Randy Leonard, March 20, 2014

- "Oceana said that although U.S. fishermen have made great progress in reducing what's known as bycatch – sea life that becomes indiscriminately ensnared in nets or lines – up to 22 percent of the overall catch is still tossed back into the water."
  *9 dirtiest fisheries: 2 California industries make the list, Oregon absent*
  By Lynne Terry, March 21, 2014

## REGIONAL CONCERNS

### MID-ATLANTIC

**Turtle Bycatch**
*The National Bycatch Report Update (p. 22) does state the average turtle interaction rate for Mid-Atlantic bottom trawl (fish and scallop) fisheries to be 353. However, only 110 of those are in the summer flounder, scup, and black sea bass fisheries (scallops and croaker account for most of the rest), and that 110 is composed of 60 turtles estimated caught and 50 turtles that were estimated to have interacted/escaped with turtle excluder devices.*

This comment, as is stated in the Council's own letter to Oceana, has more to do with how fisheries are delineated and compiled in the *National Bycatch Report*. We will take care to distinguish between fisheries identified by target catch versus those identified by gear in the future. However, in this case, Oceana should have noted these 350 captures as inclusive of both mortalities and interactions.

*In addition, in the 2012 summer flounder, scup, and black sea bass specifications environmental assessment, it notes that for 2008-2010 there were 12 actual (versus extrapolated) observed sea turtle takes (all loggerhead) and that 10 of those were released alive (83%) and 2 (17%) were dead.*

There will always be a difference between observed and estimated events. Only focusing on observed bycatch grossly underestimates the actual takes and represents a dangerous course for any fishery management organization. Extrapolated estimates are derived by NMFS and widely accepted as being important to report, therefore Oceana's use of these estimates is appropriate. If better information about sea turtle bycatch in the summer flounder, scup and sea bass fishery was available as of 2012, it should have been incorporated into the updated NBR. Oceana is happy to report on the successful reduction of bycatch, but can only do so if the updated information is publicly available.

### NEW ENGLAND

**Target Species**
*For example, the placement of halibut as the first target species for the bottom trawl fishery is a misrepresentation as current regulations allow vessels to only land one halibut per trip.*

The ordering of target species was not intended to reflect relative importance. Oceana included halibut in the summary of the Northeast bottom trawl fishery to describe the nature of the fishery with recognizable species for a public audience. At no time does this report attach relative catch magnitude or importance to this list.

**Sturgeon Mortality Rates**
*The report states that the New England and Mid-Atlantic Gillnet Fishery is responsible for "more than 1,200 mortalities" of sturgeon (p. 36). While "more than 1,200" is applicable to total bycatch, observer "data indicates that mortality rates of Atlantic sturgeon caught in…gillnet gear is approximately…20%", again confusing bycatch versus mortality.*

Both the map on p. 27 and the fact sheet on p. 36 state "1,200 endangered sturgeon were captured as bycatch each year from 2006-2010," which specifically distinguishes between bycatch and bycatch mortality. Oceana once again calls attention to the need to manage takes of Endangered Species Act (ESA) species in addition to bycatch. Because of the recent listing of sturgeon under the ESA, overall takes (both lethal and non-lethal) are important and must be accounted for in assessing the overall performance of the fishery.

**Sea Turtle Mortality**
*The report references the U.S. National Bycatch Report Update and provides an estimate of 350 sea turtle mortalities in the New England and Mid-Atlantic gillnet fisheries. This is a misrepresentation of the data as it implies 100% of the turtles are killed.*

As noted above, this should have been documented as "bycatch" or "interactions" rather than "mortalities." However, Oceana calls attention to the multiple requirements of the Magnuson-Stevens Act and Endangered Species Act when managing takes and bycatch of ESA species. The unknown fate of a bycaught endangered or threatened animal highlights the need for managers to establish take limits that account for the high uncertainty of post-release mortality rates.

*Interactions with sea turtles in this region are unlikely because sea temperatures are colder than those preferred by sea turtles. It is unclear why this is included as one of the problems for the northeast bottom trawl fishery.*

The *Wasted Catch* report clearly includes sea turtle bycatch as an issue with the Mid-Atlantic bottom trawl fishery with annual estimates (p. 35). The inclusion of sea turtles as an issue to be addressed in the Northeast bottom trawl fishery is based on geography of the fishery "modes" created by the Northeast Region Standardized Bycatch Reporting Methodology that blur the catch of Northeast and Mid-Atlantic fisheries. The lack of fishery-specific turtle bycatch management is the point we intended to make with the highlighted bullet.

**Northeast Bottom Trawl Discards**
*The report states that shrinking quotas encourage discarding (p. 32); the logic used to construct this statement is not intuitive and should be further explained.*

This comment paraphrases our text from page 32, which states that "Shrinking quotas encourage and even require many marketable fish to be discarded instead of being brought to port, an approach that does not conserve fish or benefit fishermen." We understand that quotas are critical to ensuring that overfishing does not occur and that fishermen do not like to throw fish away. Further, it should be noted that the New England Fishery Management Council's own team of experts, the Groundfish Plan Development Team,

noted its concern with incentives to discard as recently as October 2012, with this advice to the Council: "With the expected low ACLs in FY 2013, the incentives to discard constraining stocks may increase."[1]

**Skate Discards**
*The report states that the discarding of millions of skates in the bottom trawl fishery will likely cause a change to the population and the ecosystem, however, no supporting reference is provided.*

Researchers have noted that skate populations are not immune to the impacts of overfishing. Barndoor, thorny and winter skates have been depleted in the Northeast region, requiring landing prohibitions and trip limits. This statement was meant as a generalization of the potential consequences of high fishing mortality on a species complex, where serial depletion of species could occur before lagging stock assessments document the problem. The sentence also uses the word "change" and does not say by how much or in which direction. Oceana supports sustainable skate fisheries, but this will only be possible with species-specific reporting and when management measures can simultaneously recover depleted stocks while allowing harvests of more abundant ones.

**PACIFIC**

**Harpoon Fishery for Swordfish**
*The report does not reveal that harpoon gear is comparatively inefficient, and the method is considered artisanal rather than commercially viable. In other words, a harpoon fleet could not sustain the fishing community.*

The harpoon fishery for swordfish is the oldest swordfish fishery on the West Coast, historically supporting a vibrant fishing community. At its peak in 1979, prior to the authorization of drift gillnets, the harpoon fishery landed over 1,600 metric tons of swordfish, according to the California Department of Fish and Wildlife. That is comparable to annual swordfish catches by drift gillnets in the 1980s and far greater than any annual swordfish catches with drift gillnets in the past 18 years. We recognize that harpoons are not as efficient at catching swordfish as drift gillnets, largely explaining why drift gillnets have largely outcompeted harpoons. This trend is common in high-bycatch fisheries and explains why cleaner gears are outcompeted by high-bycatch gears. However, this does not mean that cleaner gears like harpoons are inherently not "commercially viable." In fact, harpoon-caught swordfish are still landed off California, sometimes in combination with swordfish caught with other methods, and it is a commercially viable swordfish gear in the Atlantic. Without explaining why harpooning is no longer commercially viable given its history in California, and without identifying the various challenges associated with increasing harpoon landings under current conditions, we find the CCC's general statements about harpooning misleading and factually inaccurate. Oceana believes it would be more productive to work collaboratively on ways to promote swordfish landings with harpoons and other proven clean gear types as a solution to the bycatch problems associated with the drift gillnet fishery.

**Sunfish Bycatch**
*The national report uses observed individuals expanded for sampling rate, while the SAFE document for the California drift gillnet fishery also notes that 98% of the ocean sunfish (molas) are returned alive and undamaged. The ocean sunfish catch represents 91% of the total bycatch in the California drift gillnet fishery.*

[1] NEFMC, 2012. Memo to Groundfish Oversight Committee, available: http://www.nefmc.org/nemulti/council_mtg_docs/Nov%202012/5_121012_PDT%20Meeting_Ver3.pdf

For the two California fisheries (swordfish drift gillnet and halibut set gillnet), we used the most up-to-date data summaries and reports from the West Coast region observer program.[2] Since this has the precise number of each species kept and discarded, it represents more accurate and up-to-date information than the national report or the SAFE reports.

The definition of bycatch in the Magnuson-Stevens Act (used by the Pacific Fishery Management Council) includes all commercial discards and does not specify between alive and dead. Since this report is centered on bycatch, we conducted our analyses on total commercial discards for consistency across fisheries. For some species, post-release mortality studies have been conducted, and therefore it is possible to obtain estimates of bycatch mortality. However, without such studies, the appropriate precautionary approach is to assume 100 percent discard mortality. For example, assuming 100 percent mortality is the standard for discards in the West Coast groundfish trawl fishery. Although onboard observers note that many ocean sunfish (*Mola mola)* are considered alive upon release, we are unaware of any post-release mortality studies for this species in drift gillnets. Without such studies, it would be inappropriate to ignore the live discards or assume that all "live" sunfish survived without impacts. Furthermore, NMFS has not prepared a stock assessment on ocean sunfish, nor many other discarded finfish, so there is no way to tell what the impact is on this population. Therefore, before discounting the high level of ocean sunfish discards in the drift gillnet fisheries, we urge the Council to seek studies of post-release mortality and an assessment of the effects of the high levels of discards on the ocean sunfish population.

**Observer Estimates**

*The report states that in 2010, an estimated 49 dolphins and 16 endangered sperm whales were seriously injured and killed in the California drift net fishery (p. 31) and that these numbers could be underestimates because observers cover less than 20 percent of the total fishing effort and almost half the boats are never observed at all. As mentioned above, the estimates from the National Bycatch Reports are expanded for sample rate, and therefore may be underestimates or overestimates.*

The numbers in our report come directly from the NMFS West Coast Region Observer Summaries and Reports (not the national reports), and the estimates are expanded for sample rate. These numbers were confirmed by NOAA Administrative Report LJ-12-01 by James Carretta and Lyle Enriquez. We acknowledge that the numbers could possibly be overestimates; however, Carretta and Enriquez point out several fundamental problems in the observer sampling which could bias the results, specifically the lack of randomness in the sampling:

> "The fraction of swordfish and thresher shark drift gillnet effort in 2010 that involved 'unobservable' or 'unobserved' vessels was approximately 40-45% of the total estimated effort, which raises concerns about the randomness of the observer sample. An underlying assumption of ratio estimation is that unobserved and observed fishing effort is 'equivalent'. This assumption requires that unobserved vessels are compliant with pinger, extender length, closure area, and other gear regulations, and that bycatch rates are no different from observed vessels. If bycatch rates on unobserved vessels are significantly different, this would bias the resulting bycatch estimates." (Carretta and Enriquez 2012, p. 6.)

Unfortunately, with the low levels of observer coverage and a high proportion of vessels that are never observed, there is significant uncertainty in the magnitude of total bycatch in this fishery. We believe it is

[2] NMFS 2007-2012. Fisheries Observer Program Data Summaries and Reports, available: http://www.westcoast.fisheries.noaa.gov/fisheries/wc_observer_programs/sw_observer_program_info/data_summ_report_sw_observer_fish.html

likely that the "observer effect," when fishing behavior differs with an observer onboard, may be in play, and it does not accurately represent fishery behavior of the entire fleet. That is another reason why Oceana has been requesting 100 percent observer coverage of the California Drift Gillnet Fishery, combined with hard caps on all protected marine life and discarded species.

**WESTERN PACIFIC**

**Western and Central Pacific Purse Seine Fisheries**
*The report omits U.S. purse seine fisheries operating primarily in the Western and Central Pacific, which make a considerable number of sets on fish aggregating devices (FADs). FAD sets are known to have substantial bycatch of juvenile bigeye tuna, and a range of other non-target pelagic species, most of which are all discarded.*

While bycatch occurring while fishing on FADs is concerning, Oceana was looking to draw attention to gear types that consistently have high bycatch wherever they are used (i.e. trawls, gillnets and longlines). Oceana is also aware that a number of groups with strong regional expertise are focused on reducing bycatch in central Pacific purse seine fisheries.

**Bycatch and Depletion of Stocks**
*The tacit assumption that bycatch leads to depletion of stocks is naïve and uninformed, and should not be applied uniformly to all species in a stock complex.*

Oceana does not make this blanket assertion in the *Wasted Catch* report. This concept is expressed in such ways as bycatch *can* lead or *has* led to the depletion of stocks, which does not imply that bycatch always leads to the depletion of stocks:

- Page 8: "Discarding large quantities of fish can lead to overfishing, prevent populations from recovering after decades of overexploitation, and disrupt the natural balance of marine ecosystems."

- *Wasted Catch* mentions this risk in the context of shark management (p.19) with this statement: "The continued depletion of shark species in the U.S. and around the world highlights the importance of stronger regulations to minimize bycatch." As very few fisheries target sharks, Oceana stands behind this statement and repeats the call for more effective management of shark bycatch in longline and other fisheries.

**Longline Fishing Gear**
*The report identifies longline fisheries as one of the three "harmful" gear types. However, longline fisheries, with sufficient gear modification and monitoring can be a "clean" gear, as demonstrated by the Hawaii longline fishery.*

Although Hawaii's longline fishery has been successful in reducing bycatch, it does not mean that all longlines have made similar improvements. We specifically focus on the Southeast snapper-grouper longline fishery and the Atlantic Highly Migratory Species longline fishery because they have high discard rates or a high impact on ESA-listed species. The main theme of *Wasted Catch* is promoting gear modification to reduce bycatch and improve efficiency. The report repeatedly states that longlines, gillnets and trawls can and should be modified through gear changes or management practices. We encourage continued research to support these kinds of temporal, spatial, or other adaptations to improve catch efficiency and reduce bycatch.

**Loggerhead Bycatch**
*The comments in the report regarding the increased loggerhead take limit in the Hawaii longline swordfish fishery are erroneous.*

Each fact in the referenced section on page 16 reflects recent science and policy decisions. From the Federal Register on October 4, 2012: "In this final rule, NMFS is revising the annual limits on incidental interactions that may occur between the fishery and leatherback and North Pacific loggerhead sea turtles to 26 and 34 interactions, respectively. If the fishery reaches either of the interaction limits in a given year, NMFS would close the fishery for the remainder of that year."[3]

**GULF OF MEXICO**

**Shrimp Bycatch Rates and Improvements**
*Estimates that shrimp bycatch is 10 pounds for every pound caught (p. 23 and p. 24) neglect to include the efforts to reduce bycatch since the 1990's (when this ratio was estimated). Since the implementation of many management measures, bycatch estimates have been reduced to somewhere between 4:1 and 6.5:1, and, just as importantly, reduction efforts are still ongoing.*

Oceana does not refute that improvements have been made. The referenced sections in *Wasted Catch* report "as much as 4-10 pounds of bycatch per 1 pound of marketable shrimp they bring to port," and that ratios have been as high as 10:1. This range captures the figures cited in the Council Coordination Committee critique and is fully footnoted to reports as recent as 2011. The discard rate of 64 percent is identical to that reported by NMFS in 2014.

**TED Compliance Rates**
*In direct contradiction, NMFS found that 75% of inspected vessels were fully compliant with TEDs and that those that were non-compliant were because of the angle of the TED.*

Oceana's 21 percent compliance rate was derived from the National Oceanic and Atmospheric Administration's enforcement memos received via a Freedom of Information Act request in 2011. Missing from this regional view is that not a single inspected vessel was found to be in compliance in Mississippi or Florida, while the highest compliance rate was found in Georgia, at only 47 percent. This report is cited as footnote 28 in *Wasted Catch*.

**Turtle Mortality**
*According to the NMFS National Bycatch Report Update (p. 12), there were an estimated 6,199 turtle mortalities in 2010 for the Gulf of Mexico shrimp trawl fishery and the Southeastern Atlantic shrimp trawl fishery combined, nearly an order of magnitude (8 times) lower than described in the Oceana report.*

In 2014, NMFS most recently estimated that more than 53,000 sea turtles are killed in Southeast shrimp trawls each year, with approximately half a million interactions.[4] According to the most recent Biological Opinion, observer data are not reliable enough to calculate bycatch estimates, and we eagerly await more accurate data in the future.

[3] http://www.fpir.noaa.gov/SFD/pdfs/77_FR_60637-Final_Rule-HI_SS_LL_sea_turtle_interaction_limits_2012-10-04.pdf.
[4] National Marine Fisheries Service. 2014. "Reinitiation of ESA S.7 Consultation on the Continued Implementation of the Sea Turtle regulations and the Continued Authorization of the Southeast U.S. Shrimp Fisheries in Federal Waters under the MSA." NOAA Southeast Regional Office, Protected Resources Division, St. Petersburg, FL.

*The statement that the southeast snapper-grouper longline fishery "likely" causes "significant mortalities" to sea turtles (p. 28) is false; sea turtles were not listed as heavily affected by the southeast snapper-grouper bottom longline fishery.*

Oceana would welcome evidence that Southeast longline fisheries do not have significant bycatch of sea turtles. Unfortunately, data reported in the NBR remains highly uncertain, with coefficients of variation for sea turtle bycatch in Southeast fisheries ranging from 0.69 to 33.7, implying that the variation (or degree of imprecision) is as much as 3,370 percent of the actual estimate for the snapper-grouper vertical line fishery, in the latter case. Oceana understands that deriving accurate and precise bycatch estimates for protected species is not easy, but it is difficult to ascertain the impact of fisheries from existing data. Therefore, we believe the word "likely" remains appropriate until other evidence is available.

Oceana would like to highlight recent work in the Southeast region to address turtle bycatch in the Gulf of Mexico bottom longline fishery through time-area management. The failure of South Atlantic fishery managers to take similar action unnecessarily puts sea turtle populations at risk, and Oceana calls on the South Atlantic Fishery Management Council to ensure that the turtle takes are not excessive in this fishery.

**Dusky Shark Bycatch**
*On page 19, there is no delineation that the bycatch estimates of dusky sharks are based on bycatch values spanning 4 years from the NMFS bycatch report.*

As is the case for all bycatch estimates in the Southeast region, entries are either spanning four years or from a single year. However, when they span four years, the table legend notes that those are yearly averages, so they do in fact apply to one year. Additionally, this means that in some years bycatch is significantly higher than those estimates, which could be concerning for an overfished species such as dusky sharks.

**Landings (Pounds) vs. Bycatch (Individuals)**
*The claim of a 66% discard rate in the bottom longline fishery is not validated by the NMFS National Bycatch Report Update, which does not present a bycatch ratio or percentage; these values cannot be estimated because landings are reported as pounds, and bycatch is reported as individuals.*

In *Wasted Catch*, bycatch is reported in pounds on all of the fishery fact sheets for consistency (pages 28-36). Bycatch reported in individual fish does present a computational challenge for conducting an overview study such as this. In an effort to derive nationwide robust bycatch estimates, we took a conservative approach to convert the number of discarded fish into pounds using five and ten percent of maximum weights for individual species to reflect our assumption that the majority of discarded fish are juveniles. While this might be a generalization, it is a conservative one and is explained in the report. NMFS recognizes that this inconsistency in reporting should be addressed in future NBR updates, which we look forward to seeing in the future.

**SOUTH ATLANTIC**

**Target Species in South Atlantic**
*On page 28, the statement that "Seven out of eight targeted species in this fishery are still being overfished in the South Atlantic, and bycatch estimates remain unknown" is not factually correct.*

These facts may have been outdated by the time the report was released. According to our interpretation of the 2013 Fish Stock Sustainability Index (FSSI) tables, of the 17 stocks within the South Atlantic

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Snapper-Grouper Fishery Management Plan, six are either overfished or overfishing continues, and nine have an unknown overfishing status, which is no less concerning.

**CONCLUSION**

In summary, Oceana fully stands by the report and will continue to raise awareness about ongoing bycatch problems. We can agree that quality bycatch data are essential for making informed management decisions and that we share the common goal of reducing bycatch in fisheries where it remains a problem. Despite notable improvements that have been made in many U.S. fisheries, there is more that can be done to improve fishing selectivity, accountability measures, and catch monitoring to benefit the understanding and management of bycatch into the future. We hope that these responses resolve your concerns and that we can continue to work with the Councils and NMFS in developing and implementing fisheries management measures that benefit both fishermen and fishery resources.

Sincerely,

Dominique Cano-Stocco
Responsible Fishing Campaign Director

cc: Eileen Sobeck
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# Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries (2002-2013)

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## EXECUTIVE SUMMARY

Pacific halibut mortality estimates are provided for 2002 through 2013 from all fishery sectors observed by the Northwest Fishery Science Center Groundfish Observer Program. These include:

- IFQ fisheries (2011-present)
- Limited entry (LE) bottom trawl (2002-2010)
- Non-nearshore fixed gear targeting groundfish (2002-present)
- Nearshore fixed gear (2003-present)
- Pink shrimp trawl (2004-present)
- California halibut trawl (2002-present)
- At-sea Pacific hake (2002-present)

Final estimates are shown in Table ES-1, which is synonymous with Table 22 in the report. Unlike previous reports, we include in these two tables (and elsewhere in the report), the small amount of P. halibut landed and subsequently discarded at the dock in the Shoreside Hake and IFQ bottom trawl fisheries. These landed and then discarded at the dock amounts are listed by strata in Table 4 of the report. In 2013, the IFQ non-hake bottom trawl sector constituted the largest source of discard mortality of P. halibut among the sectors analyzed, followed by the non-nearshore fixed gear sector.

The 2013 estimate of IFQ P. halibut discard mortality, both north and south of 40º 10' N. lat., was 32.46 mt (summing values from Table ES1 might result in small difference due to rounding), about 10 mt less than the 2012 estimate (43.23 mt, Figure ES1). As in prior years, bottom trawl gear produced the largest component of IFQ discard mortality, followed in decreasing magnitude by, hook-&-line gear, pot gear, and midwater trawl gear (including the shoreside hake sector).

The 2013 estimated discard mortality from the non-nearshore fixed gear sectors (3.2 mt) was substantially lower than any year since 2002 (2002-2012: mean = 37.1, s.d. = 23.1). This significant decrease is likely due to the large decrease in discard ratios. However, it should also be noted that both effort and observer coverage decreased in some non-nearshore fixed gear subsectors. The drop in estimated discard mortality is particularly noticeable within limited entry (LE) sablefish endorsed and open access (OA) fixed gear sectors. In 2013, the amount of observed discarded P. halibut decreased more than the retained target species, resulting in lower discard ratios. The majority of non-nearshore fixed gear 2013 estimated discard mortality occurred in the limited entry (LE) sablefish endorsed component, which consists of federally permitted vessels fishing sablefish tier quota during the primary season (April-October). Specifically, discard rates for the non-nearshore fixed gear sector were highest on LE sablefish endorsed vessels fishing with longline gear in the area north of Point Chehalis, Washington. A smaller amount of P. halibut mortality also occurred on LE sablefish endorsed vessels fishing longline gear south of Point Chehalis and open access (OA) vessels targeting non-nearshore groundfish species with hook-&-line gear.

Pacific halibut discard in the nearshore fixed gear sector, pink shrimp trawl fishery, California halibut trawl fishery, and at-sea Pacific hake fishery represents a very small component of total P. halibut mortality.

The base data used in this 2013 report has been updated to include the most recent observer data available. Pacific Fisheries Information Network (PacFIN) data for the years 2011-13 used in this report were accessed March 2014 whereas the 2002-10 PacFIN data were last updated November

2012. The estimates for all sectors and years (except LE Trawl 2002-2010) have been recalculated based on these base data. In all other respects, this 2014 report uses the same methods as reported in Jannot et al. (2013).

**Table ES1.** Pacific halibut discard mortality estimates (metric tons, including a small amount discarded at the dock in the Shoreside Hake and IFQ Bottom Trawl fisheries) for all sectors observed by the NWFSC Groundfish Observer Program. Discard mortality rates were applied in the bottom trawl fisheries (LE and IFQ), IFQ hook-&-line, IFQ pot, and non-IFQ, non-nearshore fixed gear sectors, for which some information regarding survivorship was available. Rounding of values might mask very small weights in some categories and are presented here as 0. Tables with unrounded values are provided on the NOAA/NWFSC/FOS website. All weights are estimated based on whole fish (a.k.a. 'round weight', not head-&-gut). (* = Confidential data, less than 3 vessels observed; - = no observer coverage).

| | | | | | | | | | | | | | | | | Totals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | Mortality rate applied | No mortality rate |
| Year | LE bottom trawl | IFQ Fishery (2011 - Present) | | | | | | Non-nearshore fixed gear | | | Nearshore fixed gear[1] | Pink shrimp[1] | CA halibut[1,5] | At-sea Hake[1] | Total discard mortality | LE bottom trawl + Non-nearshore fixed gear | Nearshore + Pink shrimp + CA halibut +At-sea Hake |
| | | Shoreside Hake[1,2] | LE CA Halibut[1,3] | Bottom Trawl[2,3,4] | Midwater Trawl[1] | Hook-and-Line | Pot | LE endorsed | LE non-endorsed | OA | | | | | | | |
| 2002 | 344.82 | | | | | | | 22.10 | 0.00 | - | - | - | - | 1.14 | 368.06 | 366.92 | 1.14 |
| 2003 | 124.43 | | | | | | | 30.14 | 0.03 | - | 0.00 | - | 0.00 | 2.65 | 157.25 | 154.60 | 2.65 |
| 2004 | 133.12 | | | | | | | 32.55 | 0.00 | - | 1.00 | 0.00 | 0.70 | 1.13 | 168.50 | 165.67 | 2.83 |
| 2005 | 286.52 | | | | | | | 33.30 | 0.00 | - | 2.19 | 0.06 | 0.03 | 1.97 | 324.06 | 319.82 | 4.24 |
| 2006 | 242.47 | | | | | | | 101.24 | 0.00 | - | 0.54 | - | - | 0.83 | 345.09 | 343.71 | 1.38 |
| 2007 | 208.81 | | | | | | | 19.55 | 0.28 | 3.58 | 0.09 | 0.25 | 0.06 | 1.18 | 233.78 | 232.21 | 1.57 |
| 2008 | 207.81 | | | | | | | 40.34 | 0.47 | 6.79 | 0.36 | 0.00 | 0.33 | 3.98 | 260.09 | 255.42 | 4.67 |
| 2009 | 251.10 | | | | | | | 51.48 | 0.04 | 5.87 | 1.30 | 0.00 | 0.00 | 0.33 | 310.12 | 308.49 | 1.63 |
| 2010 | 180.97 | | | | | | | 21.48 | 0.06 | 5.34 | 0.08 | 0.00 | 0.00 | 1.57 | 209.51 | 207.86 | 1.65 |
| 2011 | | 0.35 | 0.00 | 31.44 | * | 0.97 | 0.88 | 21.23 | 3.42 | 2.19 | 3.08 | 0.19 | 0.00 | 0.61 | 64.36 | 60.48 | 3.88 |
| 2012 | | 0.62 | * | 40.44 | 0.00 | 2.34 | 0.51 | 23.11 | 2.57 | 3.98 | 2.24 | 0.00 | 0.00 | 0.64 | 76.46 | 73.58 | 2.88 |
| 2013 | | 1.32 | | 32.28 | 0.00 | 0.48 | 0.21 | 3.44 | 0.00 | 0.26 | 1.36 | 0.00 | 0.00 | 1.06 | 40.41 | 37.99 | 2.42 |
| Total | 1980.06 | 2.29 | * | 104.16 | 0.00 | 3.79 | 1.61 | 399.95 | 6.87 | 28.01 | 12.24 | 0.50 | 1.12 | 17.10 | 2557.70 | 2526.74 | 30.96 |

[1] Mortality rate of 100% applied

[2] Includes a small amout landed and discarded at the dock

[3] Starting in 2013, LE CA Halibut is reported with the Bottom Trawl IFQ

[4] Includes P. halibut caught both north and south of 40° 10′ N. latitude

[5] Since 2011, CA Halibut only includes Open Access sector because the Limited Entry sector is covered under the IFQ Fishery.

**Table ES2.** (a) A comparison of Pacific halibut IBQ total discard mortality (mortality rates applied; mt, north of 40°10′ N latitude) between the Vessel Account System (VAS) and the NWFSC Observer Program final estimation (includes small amount discarded at the dock). The two systems use different approaches (see Methods and Appendix B) to estimate P. halibut mortality. (b) Percent of legal-sized P. halibut (by weight) in the non-hake IFQ bottom trawl sector north of 40°10′ N. latitude.

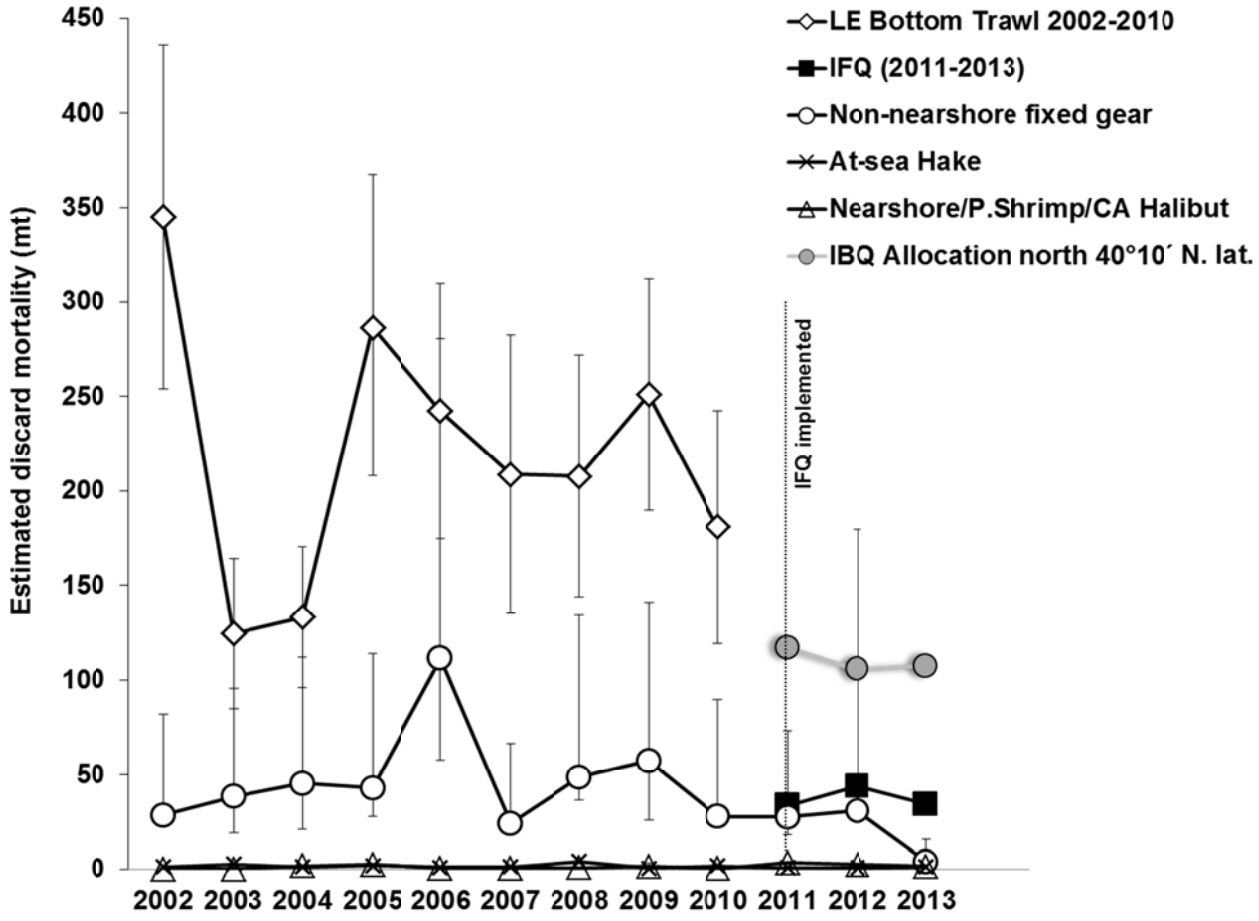
a.

| Year | Total IBQ mortality of P. halibut (mt) | |
|---|---|---|
| Source | VAS | Observer Program |
| 2011 | 32.14 | 33.10 |
| 2012 | 45.65 | 42.72 |
| 2013 | 32.98 | 32.46 |

b.

| Year | % legal-sized P. halibut in non-hake IFQ bottom trawl sector north of 40°10′ N. lat. |
|---|---|
| 2011 | 67% |
| 2012 | 67% |
| 2013 | 64% |

**Figure ES1.** Total estimated P. halibut discard mortality (mt ±1 SE, with mortality rates applied if applicable) from all sectors observed by the NWFSC Groundfish Observer Program. Estimates are not included for sectors and years where there were insufficient observer data. IFQ observations include all sectors except At-sea Hake sector. Values are reported in Table ES1.



# INTRODUCTION

Pacific halibut (*Hippoglossus stenolepis*) is found in coastal waters throughout the North Pacific. Off the west coast of the United States, it inhabits continental shelf areas (< 150 fm) from Washington to central California (Clark and Hare 1998). Pacific halibut has long supported a directed commercial fishery in the US and Canada, but it is also caught as bycatch in other fisheries that target demersal species inhabiting similar depths and seafloor habitat types (Chastain 2012). The objective of this report is to provide estimates of P. halibut bycatch in the U.S. west coast groundfish fishery from 2002-2013.

**West Coast Groundfish Fishery**

The west coast groundfish fishery is a multi-species fishery that utilizes a variety of gear types. The fishery harvests species designated in the Pacific Coast Groundfish Fishery Management Plan (FMP; PFMC 2011) and is managed by the Pacific Fishery Management Council (PFMC). Over 90 species are listed in the groundfish FMP, including a variety of rockfish, flatfish, roundfish, skates, and sharks. These species are found in both federal (> 5.6 km off-shore) and state waters (0-5.6 km). Groundfish are both targeted and caught incidentally by trawl nets, hook-&-line gears, and fish pots.

Under the FMP, the groundfish fishery consists of four management components:

The Limited Entry (LE) component encompasses all commercial fishers who hold a federal limited entry permit. The total number of limited entry permits available is restricted. Vessels with an LE permit are allocated a larger portion of the total allowable catch for commercially desirable species than vessels without an LE permit.

The Open Access (OA) component encompasses commercial fishers who do not hold a federal LE permit. Some states require fishers to carry a state issued OA permit for certain OA sectors.

The Recreational component includes recreational anglers who target or incidentally catch groundfish species. Estimates of P. halibut catch in recreational fisheries are compiled by the IPHC and are not covered by this report.

The Tribal component includes native tribal commercial fishers in Washington State that have treaty rights to fish groundfish. Estimates of P. halibut bycatch from tribal fisheries are compiled by the IPHC and are not included in this report, with the exception of the observed tribal at-sea Pacific hake sector which are included as part of the "At-sea hake" values included in ES Table1 and Table 22.

These four components can be further subdivided into sectors based on gear type, target species, permits and other regulatory factors. This report includes data from the following sectors:

- IFQ fishery (formerly LE bottom trawl and At-sea hake, 2002-2010): This sector is subdivided into the following components due to differences in gear type and target strategy:

    - Bottom trawl: Bottom trawl nets are used to catch a variety of non-hake groundfish species. Catch is delivered to shore-based processors.
    - Midwater non-hake trawl: Midwater trawl nets are used to target mid-water non-hake species. Catch is delivered to shore-based processors.
    - Pot: Pot gear is used to target groundfish species, primarily sablefish. Catch is delivered to shore-based processors.
    - Hook-and-line: Longlines are primarily used to target groundfish species, mainly sablefish. Catch is delivered to shore-based processors.
    - LE California halibut trawl: Bottom trawl nets are used to target California halibut by fishers holding a state California halibut permit and an LE federal trawl groundfish permit. Catch is delivered to shore-based processors.
    - Shoreside hake trawl: Midwater trawl nets are used to catch Pacific hake. Catch is delivered to shore-based processors.
    - At-sea motherships and catcher-processors: Midwater trawl nets are used to catch Pacific hake. Catcher vessels deliver unsorted catch to a mothership. The catch is sorted and processed aboard the mothership. Catcher-processors catch and process at-sea. This component also includes the at-sea processing component of the tribal sector. The tribal sector must operate within defined boundaries in waters off northwest Washington. The catch can be delivered to a contracted mothership by catcher vessels for processing or be caught and processed by a contracted catcher-processor.
- OA pink shrimp trawl: Trawl nets are used to target pink shrimp. Catch is delivered to shore-based processors.
- OA California halibut trawl: Trawl nets are used to target California halibut by fishers holding a state California halibut permit. Catch is delivered to shore-based processors.
- LE fixed gear (non-nearshore): This sector is subdivided into two components due to differences in permitting and management:
    - LE sablefish endorsed season: Longlines and pots are used to target sablefish. Catch is generally delivered to shore-based processors.
    - LE sablefish non-endorsed: Longlines and pots are used to target groundfish, primarily sablefish and thornyheads. Catch is delivered to shore-based processors or sold live.
- OA fixed gear (non-nearshore): Fixed gear, including longlines, pots, fishing poles, stick gear, etc. is used to target non-nearshore groundfish. Catch is delivered to shore-based processors.
- Nearshore fixed gear: A variety of fixed gear, including longlines, pots, fishing poles, stick gear, etc. are used to target nearshore rockfish and other nearshore species managed by state permits in Oregon and California. Catch is delivered to shore-based processors or sold live.

**Northwest Fisheries Science Center (NWFSC) Groundfish Observer Program**

The NWFSC Groundfish Observer Program observes commercial sectors that target or take groundfish as bycatch. The observer program has two units: the West Coast Groundfish Observer Program (WCGOP) and the At-Sea Hake Observer Program (A-SHOP).

The WCGOP Program was established in May 2001 by NOAA Fisheries (a.k.a., National

Marine Fishery Service, NMFS) in accordance with the Pacific Coast Groundfish Fishery Management Plan (50 CFR Part 660) (50 FR 20609). This regulation requires all vessels that catch groundfish in the US EEZ from 3-200 miles offshore carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has extended NMFS's ability to require vessels fishing in the 0-3 mile state territorial zone to carry observers.

The NWFSC Groundfish Observer Program's goal is to improve estimates of total catch and discard by observing groundfish fisheries along the U.S. west coast. The WCGOP and A-SHOP observe distinct sectors of the groundfish fishery. The WCGOP observes multiple sectors of the groundfish fishery, including: IFQ shore-side delivery of groundfish and Pacific hake, at-sea mothership catcher-vessels fishing for Pacific hake, LE and OA fixed gear, and state-permitted nearshore fixed gear sectors. The WCGOP also observes several fisheries that incidentally catch groundfish, including the California halibut trawl and pink shrimp trawl fisheries. The A-SHOP observes the IFQ fishery that delivers Pacific hake at-sea including: catcher-processor, mothership, and tribal vessels.

**Pacific Halibut Management and Fishery Interaction**

The International Pacific Halibut Commission (IPHC), a body founded through treaty agreement between the US and Canada, sets the P. halibut annual total allowable catch (TAC) for IPHC area 2A, the collective U.S. waters off the states of Washington, Oregon and California. The TAC is based on bycatch mortality, which takes into account potential survival after being discarded. Regulations for Area 2A are set by NOAA Fisheries West Coast Regional Office. Pacific halibut catch in Area 2A is divided between tribal and non-tribal fisheries, between commercial and recreational fisheries, and between recreational fisheries in different states (Washington, Oregon and California). The Pacific Fishery Management Council describes this P. halibut catch division each year in a catch-sharing plan. In 2013, the LE fixed gear sablefish endorsed sector was allowed to retain and land P. halibut north of Point Chehalis, WA. The IFQ shore-delivery Pacific hake fishery is a maximized-retention fishery. Under this fishery, small amounts of incidental take are allowed to be landed and subsequently donated to food banks or destroyed. In all other West Coast commercial groundfish fishery sectors, P. halibut must be discarded at-sea. However, small amounts of P. halibut are, on rare occasions, mixed with target species and accidentally landed. These individuals are subsequently donated or destroyed as in the shoreside hake fishery.

In 2011, the limited entry (LE) bottom trawl sector of the U.S. west coast groundfish fishery began fishing under an Individual Fishing Quota (IFQ) management program. An IFQ is defined as a federal permit under a limited access system to harvest a quantity of fish, representing a portion of the total allowable catch of a fishery that can be received or held for exclusive use by a person (MSA 16 USC 1802(23)). The implementation of the IFQ management program in 2011 resulted in changes to the methods used for estimating fishing mortality, including the mandate that vessels must carry NMFS observers on all IFQ fishing trips. A list of changes can be found in Jannot, et al. 2012.

Under the IFQ program, P. halibut is managed at the permit level, through Individual Bycatch Quota (IBQ) pounds. An IBQ accounts for bycatch mortality, which can assume some level of

survivorship. This is the only species managed under IBQ for the west coast groundfish IFQ fishery. Each federal groundfish permit with a trawl endorsement is allocated IBQ pounds for P. halibut caught north of 40° 10′ N. latitude. Pacific halibut caught south of 40° 10′ N. latitude are not managed as an IFQ quota but are reported here under the IFQ fishery.

Data collection and reporting for this fishery is described in the "Pacific Halibut Data Collection in the shore-based IFQ Fishery" sections by gear type. The shore-based IFQ fishery includes all IFQ fishery components with the exception of at-sea motherships and catcher-processors. Motherships and catcher-processors have a bycatch quota for P. halibut, but it is not accounted for at the permit level.

With the exception of the IFQ fishery, P. halibut bycatch mortality is accounted for at the fishery sector level only. P. halibut is regularly caught as bycatch in the LE sablefish endorsed fixed gear, LE sablefish non-endorsed fixed gear, and OA fixed gear sectors.

# METHODS

### Data Sources

Data sources for this analysis include onboard observer data (from the WCGOP and A-SHOP), and landing receipt data (referred to as fish tickets, obtained from PacFIN). To date, observer data is used as the sole source for discard estimation in the IFQ sectors. A list of fisheries, coverage priorities and data collection methods employed by WCGOP in each observed fishery can be found in the IFQ and Non-IFQ WCGOP manuals (NWFSC 2013b). A-SHOP program information and documentation on data collection methods can be found in the A-SHOP observer manual (NWFSC 2013b).

The sampling protocol employed by the WCGOP is primarily focused on the discarded portion of catch. To ensure that the recorded weights for the retained portion of the observed catch are accurate, haul-level retained catch weights recorded by observers are adjusted based on trip-level fish ticket records. This process is described in further detail on the WCGOP Data Processing webpage (NWFSC 2013a) and was conducted prior to the analyses presented in this report. All weights of P. halibut presented in this report are round weights, that is, whole, in-tact fish. IPHC converts these weights to dressed weights (i.e., head and organs removed).

For data processing purposes, species and species groups were defined based on management (NWFSC 2013c). A complete listing of groundfish species is defined in the Pacific Coast Groundfish Fishery Management Plan (PFMC 2011).

Fish ticket landing receipts are completed by fish-buyers in each port for each delivery of fish by a vessel. Fish tickets are trip-aggregated sales receipts for market categories that may represent single or multiple species. Fish tickets are issued to fish-buyers by a state agency and must be returned to the agency for processing. Fish ticket and species-composition data are submitted by state agencies to the PacFIN regional database. Annual fish ticket landings data were retrieved from the PacFIN database (years 2011-13 accessed March 2014; years 2002-10 accessed

November 2012) and subsequently divided into various sectors of the groundfish fishery as indicated in Figure 1 and in further detail online (NWFSC 2013c).

**Shore-based IFQ Fishery**

The methods used to report in-season IBQ estimates via the Vessel Account System (VAS) are separate from those methods used to estimate final fleet-wide P. halibut mortality. Methods for in-season IBQ estimation are discussed in Appendix B. Results obtained by methods described here resulted in fleet-wide estimates of P. halibut mortality that are very close to those reported by the VAS (Table ES2).

*Pacific Halibut Data Collection in the Shore-delivery IFQ Fishery*

The WCGOP designed sampling methodologies that help ensure P. halibut mortality can be estimated, regardless of the limitations imposed by the vessel, catch composition, or catch quantity. Three pieces of information are necessary to estimate P. halibut mortality (also see Table 1):

1. A count of individual P. halibut in the haul or sample
2. Actual or visual length measurements (cm)
3. A viability obtained by physical assessment of individual P. halibut using IPHC designed dichotomous keys that relate the physical condition of the fish to a viability code (NWFSC 2013b). A unique key is used for each gear type (trawl, longline, pot).

Observers could sample all or a subset of P. halibut caught in a haul/set. The proportion of P. halibut sampled is based on the number of P. halibut caught in the haul/set, the level of assistance provided by the crew, as well as other variables (e.g., physical space, weather). Sampling and assessment of P. halibut is dependent on crew assistance and cooperation. Regulations prohibit vessel crew from discarding any P. halibut without first notifying the observer. The vessel crew must comply with requests by the observer to ensure proper P. halibut sampling, including but not limited to: modifying P. halibut sorting procedures, assisting the observer by delivering the P. halibut to the observer, and modifying operations to ensure P. halibut sampling is completed. Table 1 describes the P. halibut data obtained on IFQ-permitted vessels fishing different gear types.

On vessels fishing fixed gear (pot or hook-&-line), observers must sample at least 50% of the gear per set. Actual length measurements are obtained on bottom trawl, midwater trawl, and pot vessels, but only visual length estimates are made on vessels fishing hook-&-line gear. Visual estimates are in 10 cm increments (55-64 cm, 65-74 cm, etc.).

The crew's cooperation is vital to the observer's sampling success during hook-&-line fishing. When an observer samples for P. halibut, the crew are not permitted to shake loose or discard any P. halibut before the observer can estimate the fish length, nor can they restrict the observer's view of the line as it comes out of the water. If requested by the observer, the crew is required to physically hand an individual fish to the observer or slow the gear retrieval.

**Table 1.** Data collected from P. halibut caught on IFQ vessels using different types of gear.

| Gear | Count | Length Measurement | Viability |
|---|---|---|---|
| Bottom trawl | all in the haul | actual, all or subset | yes |
| Midwater trawl | all in the haul | actual, all or subset | yes |
| Pot | all in sampled portion | actual, all or subset | yes |
| Hook -and- line | all in sampled portion | visual, all or subset | no |

Viability is assessed at the point of fish release when returned to sea. On vessels using "resuscitation boxes" or other techniques to increase the likelihood of survival, condition sampling is performed prior to the fish being returned to sea. Observations of several condition characteristics are used to assign each fish to one of three viability categories for trawl and pot gear: Excellent, Poor, or Dead (NWFSC 2013; Williams and Chen 2004). Observer field estimates of viability for P. halibut discarded in the IFQ fishery by vessels fishing bottom trawl or pot gear are used to compute the total estimated mortality of discarded P. halibut. IBQ weight (or simply IBQ) refers to the estimated mortality of discarded P. halibut, with the appropriate mortality rate applied based on viability (Tables 2 & 3). If no viability data or mortality rates are available, we assume 100% mortality.

Viability categories are used to assign mortality rates to P. halibut. Mortality rates for vessels fishing bottom trawl gear are based on mortality data collected by Hoag (1975), who found some survivorship among fish in the dead condition category. Mortality rates for vessels fishing pot gear are based on conservative assumptions of likely survival from pot-induced injuries (Williams and Wilderbuer 1995). Because of the difficulties of collecting P. halibut viability on hook-and-line vessels, we used a discard mortality rate (DMR) of 0.16, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008). Discard mortality was assumed to be 100% for all midwater trawl bycatch estimates.

**Table 2.** Mortality rates used for each of the condition categories (mc) for IFQ bottom trawl vessels (Clark et al. 1992).

| $m_c$ | Rate |
|---|---|
| $m_{exc}$ | 0.20 |
| $m_{poor}$ | 0.55 |
| $m_{dead}$ | 0.90 |

**Table 3.** Mortality rates used for each of the condition categories (mc) for IFQ pot gear vessels (IPHC, 2011).

| $m_c$ | Rate |
|---|---|
| $m_{exc}$ | 0.00 |
| $m_{poor}$ | 1.00 |
| $m_{dead}$ | 1.00 |

*Final Shore-based IFQ Fishery Bycatch Estimation*

We stratified IFQ P. halibut bycatch data based on sector (shoreside non-hake groundfish, shoreside Pacific hake, at-sea Pacific hake, and LE California halibut) and gear (bottom trawl, midwater trawl, pot, hook-&-line). Within the shoreside non-hake groundfish sector, we further stratified using area and depth within each gear type. We maintained area and depth strata that were applied to bottom trawl, hook-&-line, and pot gear in previous reports (see Table 4 of this report for specific strata; Heery et al. 2010, Jannot et al. 2011, 2012, 2013) because prior work demonstrated that these variables were correlated with P. halibut bycatch (Heery et al. 2010). Observations from IFQ vessels fishing midwater trawl gear targeting Pacific hake or other midwater target species were not post-stratified. Similarly, observations of IFQ vessels targeting California halibut with bottom trawl gear were not post-stratified. In addition to the strata described above, we also provide bycatch estimates north and south of the North/South groundfish management line (40°10′ N. lat.) for each sector and gear type.

Despite the 100% observer coverage mandate in 2013, there were some rare occasions (e.g., observer illness) when tows or sets were either only partially sampled, or not sampled. In this report, we made the following assumption about IFQ data: if an observer sampled P. halibut on unsampled or partially sampled hauls, we assumed that all P. halibut were sampled on those hauls and therefore did not expand estimates on these hauls. The intent of this assumption is to more accurately estimate P. halibut mortality without over-estimating the true value (i.e., "double counting"). However, if additional unsampled weight occurred in the same stratum, we used ratio estimators to apportion unsampled weight to specific species, including P. halibut, within each stratum. To obtain the estimated weight of P. halibut ($W$) when the entire haul or set was unsampled, the unsampled discard weight, summed across unsampled hauls within the stratum, was multiplied by the ratio of the weight of P. halibut discard (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species in all fully sampled hauls within a stratum:

$$\widehat{W}_{p,s} = \sum_{p} x_{p,s} \times \frac{\sum_f w_{f,s}}{\sum_f x_{f,s}}$$

where, for each stratum:
$s$ = stratum, which includes sector and year and could include, area, depth, gear
$p$ = unsampled haul
$f$ = fully sampled haul
$x$ = weight of discarded catch
$\widehat{W}$ = estimated weight of unsampled P. halibut in the stratum

$w$ = sampled weight of P. halibut

The unsampled weight of partially sampled hauls or sets was categorized into weight of non-IFQ species (NIFQ) or IFQ species. Unsampled IFQ species weight was further categorized into IFQ flatfish (IFQFF), IFQ rockfish (IFQRF), IFQ roundfish (IFQRD) and IFQ mixed species (IFQM). For the purposes of this report, we assume that unsampled P. halibut would only occur in NIFQ (south of 40°10′ north latitude only), IFQM, or IFQFF unsampled categories. Thus, those are the only categories for which P. halibut is estimated. IFQM included all 2013 IFQ managed species (see 76 FR 27508 for a listing of IFQ species). NIFQ included all species encountered that were not designated as an IFQ managed species. IFQFF included all IFQ flatfish species managed as a complex under the groundfish FMP. North of the 40°10′ north latitude groundfish management line, P. halibut would be included in unsampled IFQFF or IFQM categories. South of the groundfish management line, P. halibut would only be included in the unsampled NIFQ category.

To obtain the estimated weight of P. halibut ($\widehat{W}$) in partially sampled hauls or sets, the unsampled discard weight, summed across partially sampled hauls within the stratum, was multiplied by the ratio of the weight of P. halibut (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species occurring within a category (NIFQ, IFQFF, IFQM) in all fully sampled hauls within a stratum. Estimated P. halibut weight was summed across unsampled categories.

$$\widehat{W}_{p,s} = \sum_{y} \left( \sum_{p} x_{p,y,s} \times \frac{\sum_{f} w_{f,s}}{\sum_{f} x_{f,y,s}} \right)$$

where, for each stratum:
$s$ = stratum, which includes year and sector, and could include, area, depth, gear
$y$ = unsampled category (either NIFQ, IFQFF, or IFQM)
$p$ = partially sampled haul
$f$ = fully sampled haul
$x$ = weight of discarded catch
$\widehat{W}$ = estimated weight of unsampled P. halibut in the stratum
$w$ = sampled weight of P. halibut

Expanded weights of P. halibut obtained using the equations above for unsampled or partially sampled hauls were then added to the sampled weight of P. halibut within each stratum to obtain the total P. halibut weight per stratum.

*Viability Analysis*

We used observer field estimates of viability for P. halibut discarded in the IFQ fishery by vessels fishing bottom or pot gear to compute the total estimated mortality of discarded P. halibut by IFQ gear/sector and stratum.

To account for the impact of fish size on survivorship, we computed a weighted mortality rate for each condition category. Length measurements associated with each viability record were converted to weight based on the IPHC length-weight relationship:

$$W = 6.921\times10^{-6} \cdot L^{3.24}$$

where:
$L$ = fork length (cm)
$W$ = weight (lbs., whole fish)

A discard mortality rate for each condition category was then computed as the proportion of P. halibut sampled weight in a viability category multiplied by the viability category-specific mortality rate (see Tables 2 & 3 above):

$$DMR_{csj} = m_c \times P_{csj}$$

where:
$s$ = stratum, which could include, area, depth, gear, and sector
$c$ = viability condition (Excellent, Poor, Dead)
$j$ = year
$m_c$ = mortality rate
$P$ = proportion of sampled P. halibut weight ($w$)
$DMR$ = discard mortality rate

Discard mortality rates for each condition category $c$ and stratum $s$ were then multiplied by gross discard estimates to compute total estimated discard mortality for each of the two gear types separately:

$$\hat{F}_{sj} = \sum_{c} \left( B_{sj} \cdot DMR_{sj} \right)$$

where:
$s$ = stratum, which could include, area, depth, gear, and sector
$c$ = viability condition (Excellent, Poor, Dead)
$j$ = year
$F$ = total estimated discard mortality
$B$ = gross estimated discard weight
$DMR$ = discard mortality rate

Viability data are collected from only a subsample of the P. halibut that observers encounter. Based on previous evaluations by Wallace and Hastie (2009), we expect that survivorship of P. halibut in bottom trawl tows are most directly affected by the length of the tow and the amount of catch that fills the net. These variables are not part of the bycatch ratio stratification process (above), and their use in stratifying viability data would make it difficult to then apply discard mortality rates to initial gross estimates of bycatch. We found that tow duration was directly related to depth, one of the variables used to stratify discard ratios and initial gross discard

estimates for bottom trawl gear. Because depth and tow duration appeared to co-vary, we used depth and area to stratify IFQ viability data collected from bottom trawl gear. For IFQ viability data collected from pot gear, only area is used to stratify the data. For longline gear, we used a discard mortality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

Final estimates of P. halibut bycatch and discard mortality are also presented in the context of the estimated mortality of legal-sized halibut. This was computed by applying the proportion of sampled P. halibut weight in each depth stratum that was from legal-sized fish (82 cm or larger) to initial estimates. Viabilities were then applied to gross legal-sized discard estimates in the same manner as described above.

*Length Frequencies*

The length frequency distribution for P. halibut in the 2011-2013 IFQ fishery is provided in Table 10. Pacific halibut pose unique challenges for observer sampling. Observers typically measure the length of P. halibut and then convert the measurement to weight using the IPHC length-weight conversion table. Occasionally, observers weigh individual fish. Sometimes crew members presort the catch by removing P. halibut and immediately return them to sea. Vessel crews presort P. halibut to increase the likelihood of survival of the discarded fish. Presorting is prevalent on vessels fishing with hook-&-line gear. Fishers have raised concerns regarding crew safety when landing large P. halibut. In addition, hook-&-line fishers are concerned that P. halibut individuals would be injured during landing because of their interaction with the vessel 'crucifier' (gear used to strip the bait and any catch off of the hook and gangion line). Therefore, shake-offs prior to the crucifier (a form of pre-sorting) is almost universal on IFQ hook-&-line vessels. Another case of pre-sorting can occur when halibut are too heavy and/or awkward to weigh in observer baskets. In all cases of pre-sorting, random samples are not available. Therefore, observers visually estimate the length of the halibut in ten-centimeter units (40cm, 50cm , 60cm, etc.), which are later converted to weight using the IPHC length-weight conversion table.

Table A1 (Appendix A) provides the actual observed length frequency distributions of discarded P. halibut for vessels fishing IFQ using bottom trawl or pot gear. These length frequencies have been weighted based on the ratio of total estimated P. halibut discard weight to the weight of P. halibut that was measured in each stratum (see Appendix A for further details). Because size-specific mortality rates have not been determined, we were not able to compute the length frequency distribution of discarded fish that died. However, we have summarized the proportion of length measurements in each condition category (Excellent, Poor, and Dead) in Table 2A (Appendix A) to inform size-specific modeling of mortality. The frequency of sampled fish within each condition category was weighted in the same manner as length frequency distributions and then summarized for each 2 cm length bin.

**Non-nearshore Fixed Gear Fishery**

The WCGOP samples each non-nearshore fixed gear sector through separate random selection processes, with the limited entry (LE) sablefish endorsed season permits receiving the highest level of coverage, then LE sablefish non-endorsed permits, and open access (OA) fixed gear the lowest. LE sablefish endorsed vessels that fish outside of the primary season or that have reached

their tier quota in the primary season are not observed. Given this sampling structure and anticipated differences in variance from one sector to the next, we chose to maintain sector as a stratification variable in our analysis. Testing of alternative stratification schemes (Heery et al. 2010) indicated that latitude and gear type were the most important variables with respect to P. halibut bycatch in the non-nearshore fixed gear groundfish fishery. Bycatch estimates were produced separately for each sector and gear combination. Two latitudinal strata were applied to the LE sablefish endorsed longline sector (north and south of Point Chehalis, Washington = 46° 53.30′ N. lat.) because previous modeling demonstrated that these strata significantly improved the fit of predicted bycatch amounts to the amounts observed (Heery et al. 2010). Point Chehalis, WA was used in previous estimates of P. halibut bycatch in the LE sablefish endorsed season longline sector because of its relevance to groundfish management and its apparent ability to split out higher bycatch rates off the northern coast of Washington (Heery and Bellman 2009). Evaluations of latitudinal strata for the other fixed gear sectors did not improve the fit of models to an extent that justified their use. Thus, we maintained previous stratifications for the other groundfish fixed gear sectors (Heery and Bellman 2009, Heery et al. 2010, Jannot et al. 2011, 2012, 2013).

*Discard Estimation*

A deterministic approach was used to estimate P. halibut discard for all sectors of the non-nearshore groundfish fixed gear fishery. Discard ratios were computed from observer data as the discarded weight of P. halibut divided by the retained weight of either sablefish or all FMP groundfish (except Pacific hake), depending on the sector (Table 13; FMP groundfish species: NWFSC 2013c). Ratio denominators were identified for each sector of the non-nearshore fixed gear fishery based on the targeting behavior of that sector (Table 12). Discard ratios were then multiplied by the total sector landed weight of either sablefish or FMP groundfish (except Pacific hake), corresponding to the denominator used to compute the observed discard ratio for each sector. This provided an expanded gross estimate of P. halibut discard for each sector. A discard mortality rate (discussed below) was then applied to compute estimated discard mortality.

Total landed weights for each sector are obtained from fish ticket landing receipts. Fish tickets for fixed gear that included recorded weights for sablefish were included in the non-nearshore fixed gear sector. Commercial fixed gear fish tickets with recorded nearshore species weight were not used in this portion of the fixed gear analysis, regardless of whether they included recorded weights for sablefish (Figure 1). In addition, fixed gear fish tickets without recorded sablefish or nearshore species were included in the non-nearshore fixed gear sectors only if groundfish landings were greater than non-groundfish landings based on a unique vessel and landing date.

Fish tickets from the non-nearshore fixed gear sector were partitioned into the three commercial fixed-gear sectors (LE sablefish endorsed season, LE sablefish non-endorsed, and OA fixed gear) through the following process. Commercial fixed-gear fish tickets were first divided out by whether the vessel had a federal groundfish permit (limited entry) or no federal groundfish permit (open access). OA fish tickets were placed in the OA fixed gear groundfish sector. Next, LE fish tickets were separated based on whether the vessel's federal groundfish permit(s) had a sablefish endorsement with tier quota for the primary season or if it was not endorsed (also referred to as 'zero' tier). Fish tickets for all LE sablefish vessels with tier endorsements that

were operating within this period and within their allotted tier quota were placed in the LE sablefish endorsed sector. If LE sablefish endorsed vessels fished outside of the primary season (November through March) or made trips within the season after they had reached their tier quota, the fish tickets were placed in the LE sablefish non-endorsed sector. In addition, fish tickets from non-endorsed LE vessels were also placed in the LE sablefish non-endorsed sector.

Further processing of fish tickets identified and removed the directed commercial P. halibut fishery landings from the non-nearshore fixed gear analysis. The directed P. halibut fishery occurs for only a few days each year, during 10-hour openings that are designated by the IPHC. LE and OA fixed gear vessels that typically target groundfish can participate in the directed fishery. For most fixed gear vessels, (other than LE sablefish endorsed vessels north of Point Chehalis) this is the only time during which they are allowed to land P. halibut. Fish tickets that included P. halibut landings on or within the 2 days after a directed fishery opening were considered to be part of the directed fishery and not part of the non-nearshore fixed gear fishery targeting federal FMP groundfish. These fish tickets were removed prior to our analysis. This approach may have resulted in the removal of some non-directed fishery landings north of Point Chehalis, but any bias introduced by this step is considered to be extremely small given the short time period across which fish tickets were removed. This filtering step was applied to the area north of Point Chehalis only.

WCGOP observer data were stratified according to sector and gear type (longline and pot/trap). As discussed earlier, one additional latitudinal stratum at Point Chehalis, Washington (46° 53.30' N lat.) was used for the LE sablefish endorsed longline sector. Some retention of P. halibut was allowed in the LE sablefish endorsed season in the area north of Point Chehalis. The Point Chehalis line was the only latitudinal stratification incorporated into this portion of the analysis and was only applied to the LE sablefish endorsed sector. Discard amounts provided for the other two fixed gear sectors represent coast-wide estimates.

The number of observed trips, sets, and vessels are summarized for each sector, gear type, and area (where applicable) (Table 11). The landed weight of sablefish and FMP groundfish (excluding Pacific hake) is used as a measure for expanding discard from observed trips to the entire fleet (Table 12 and13). Observed discard ratios were calculated by sector, gear type and area based on the following equation:

$$\hat{D}_s = \frac{\sum_t d_{st}}{\sum_t r_t} \times F_s$$

where:
*s*: stratum, including year, sector, gear type, and area
*t*: observed sets
*d*: observed discard (mt) of P. halibut
*r*: observed retained weight (mt) of sablefish or all FMP groundfish except Pacific hake
*F*: weight (mt) of retained sablefish or all FMP groundfish excluding Pacific hake recorded on fish tickets in strata *s*

$\hat{D}_s$ : Discard estimate for stratum *s*

For all strata except the LE sablefish non-endorsed longline and the OA sectors, discard ratios were calculated by dividing the stratum discard weight of P. halibut by the retained catch weight of sablefish. Retained groundfish was used as the ratio denominator for the LE sablefish non-endorsed longline and the OA sectors because these sectors target a wider range of groundfish species. A broader denominator was therefore necessary to effectively capture the level of fishing effort in these sectors. Please refer to earlier reports for further details of data pooling and discard ratios in prior years of observer coverage.

Where FMP groundfish (excluding Pacific hake) was used to compute discard ratios, any retained weights recorded by the observer not appearing on fish tickets were excluded from the denominator. This prevents double-counting associated with differences in the species codes used by observers and processors. For instance, while observers may record rockfish catch at the species level, various species of rockfish are often grouped, weighed, and recorded together on the fish ticket by the processor under a grouped market category, e.g., northern unspecified slope rockfish. In some cases, this difference in species coding prevents observer and fish ticket weights from being matched and adjusted properly. Species coding on fish tickets varies considerably between processors and over time, and it is not possible to make assumptions regarding which individual observer-recorded species likely coincide with species grouping codes on fish tickets. By using only the retained groundfish weight from fish tickets in discard ratio denominators, we prevent double-counting of retained weights. This is not a factor when using a single species in the denominator, such as sablefish, as any retained weights in observer and fish ticket data that share the same species code will match and adjust properly.

The expansion factors for each fishery sector and gear type can be found in Table 13. The discard rate multiplied by the expansion factor yielded an expanded gross P. halibut discard estimate for each stratum (Table 15). If landings were made by a fixed gear sector for which there were zero or very few WCGOP observations, the most appropriate observed discard ratio was selected and applied to those landings based on similarities in the fishery management structure, fishing and discard behavior, and the gear fished. The LE sablefish endorsed vessels fishing outside of the primary season with pot gear often land a small amount of groundfish; however, this portion of the fleet is not observed by the WCGOP program. Given similarities in gear type and catch composition, OA fixed gear pot observations were selected as the most appropriate source of information for an observed discard rate (Table 12).

*Discard Mortality Rates*

Once an initial gross estimate of P. halibut discard had been produced, this value was multiplied by a discard mortality rate (Table 15) to generate a final discard mortality estimate (Tables 15 & 16 and Figure 3). Ideally, discard mortality would be approximated based on viabilities in a manner similar to the approach used for IFQ bottom trawl and pot gear. WCGOP observers do record viability conditions as P. halibut are discarded from non-IFQ longline vessels. However, observers only started systematically sampling P. halibut viabilities on non-IFQ longline vessels in 2011 and not enough observations are available at this point in time to effectively use these data. Viabilities from pot gear would be appropriate to use in estimating discard mortality,

bycatch of P. halibut in pot gear is infrequent and the sample size was too small to utilize in this analysis.

Thus, P. halibut viabilities recorded from the non-nearshore fixed gear fishery were not used in our analysis because we have too few observations. We plan on trying to incorporate viabilities from fixed gear vessels in a future report. Discard mortality rates therefore had to be identified through other means. Review of the literature on P. halibut bycatch revealed little that could be applied to the entire discard estimate. Several studies have examined the survivorship of P. halibut in various conditions (Kaimmer and Trumble 1998, Trumble et al. 2000). However, without any information on the state of discard P. halibut, the findings from these examinations could not be used.

Instead, we relied on discard mortality rates computed for Alaska groundfish fisheries (Williams 2008). An 18% discard mortality rate was applied to estimates for pot gear, coinciding with the DMR used for the sablefish pot CDQ fishery in Alaska. For longline gear, we used a discard mortality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

For additional context, we present the length frequency distribution of P. halibut from visual length estimates and physically measured lengths in non-nearshore fixed gear sectors (Table 17) and the proportion of sampled P. halibut discard of legal (>82 cm) and sublegal ($\leq$ 82 cm) sizes in non-nearshore fixed gear sectors (Table 18). The majority of P. halibut lengths recorded in these fisheries were visual estimates of length, rounded to the nearest 10 cm. In other words, specimens that are 76 cm and 82 cm are both visually estimated to be 80 cm. With this level of resolution, it was not possible to compute the exact proportion of sublegal versus legal P. halibut from visually estimated lengths. Visual estimates were instead summarized in the manner in which they are recorded; with sublegal and legal sized halibut falling within the 75-84 cm length bin. Observers have been instructed to make physical measurements of P. halibut lengths from randomly sampled fish on LE sablefish endorsed vessels, with the help of vessel crew.

**Other Fisheries**

Pacific halibut bycatch was also observed in the nearshore groundfish fixed gear sector (Table 19), the state pink shrimp trawl fisheries (Table 20), and the OA California halibut trawl fishery (Table 21) (LE California halibut is covered under the IFQ fishery). Bycatch estimates for these three fishery sectors were computed based on the following equation:

$$\hat{B} = \frac{\sum_t b_t}{\sum_t r_t} \times F$$

where:
*b*: observed discard (mt) of P. halibut on set/haul *t*
*r*: observed retained weight (mt) of target species on set/haul *t*
*F*: weight (mt) of retained target species

$\hat{B}$ : Discard estimate of P. halibut (mt)

The nearshore fixed gear fishery targets a variety of groundfish species that inhabit areas less than 50 fathoms deep. All species included in the nearshore target group as listed in the WCGOP data processing appendix were included in the denominator when calculating bycatch ratios for the nearshore fixed gear sector. Pink shrimp and California halibut were considered the target species in their respective fisheries. Discard mortality rates are not available for these fisheries due to a lack of information regarding survivorship. Therefore, we assumed 100% mortality.

# RESULTS

## IFQ Fishery

All participating vessels carry an observer on all fishing trips under IFQ management (100% trips observed). For most strata, 99% or more of the observed IFQ tows or sets were sampled (Table 4). Non-IFQ species represented the largest portion of unsampled catch (Table 4), non-IFQ species sampling is a lower priority under WCGOP sampling protocols (NWFSC 2013b).

The total estimated weight of P. halibut from unsampled tows or sets in 2013 represents a small fraction (1.03 mt, or ~ 1.5%) of the total 2013 IFQ gross discard weight of P. halibut (Table 5). Unsampled P. halibut catch from both unsampled and partially sampled hauls represented 1.5% of the total gross discard weight (1.0 of 70.0 mt). Sixty-seven percent of the estimated gross discard weight (0.67 mt) came from unsampled IFQM, whereas another 30% (0.3 mt) came from unsampled hauls (Table 5). The remainder was estimated from unsampled IFQFF or NIFQ catch (~0.06 mt).

Gross bycatch estimates and total discard mortality estimates were largest for vessels fishing bottom trawl gear, north of the 40°10′ N. latitude management line in depths greater than 60 fathoms (Tables 7, 8). This gear-area-depth stratum accounts for ~78% of 2013 P. halibut discard mortality in the fishery. The next largest fraction (~21%) of total discard mortality is found in the same gear-area combination in shallow waters (<60 fm). Together, bottom trawl gear fishing north of the 40°10′ N. latitude management line accounts for 98% of the 2013 P. halibut discard mortality in the IFQ fishery (Tables 7, 8).

In terms of viability, the majority of individuals were classified as either Excellent or Dead, depending on the stratum (Table 6). Individuals caught with bottom trawls were approximately evenly split between the Excellent and Dead categories in the area north of Point Chehalis in shallow depths, but a greater number of individuals were Excellent in deeper depths in this area (Table 6). This pattern was reversed south of Point Chehalis: at depths less than 60 fathoms the majority of individuals were Excellent, whereas deeper than 60 fm the majority of individuals were Dead (Table 6).

Of the few individuals sampled from midwater trawl gear in the Shoreside Hake sector, most individuals were categorized as Excellent (Table 6). Midwater trawl vessels fishing for hake to

be delivered shoreside place the catch directly in the hold, with only rare presorting events. The majority of P. halibut caught with pot gear are categorized as Excellent viability (Table 6).

Estimated P. halibut discard mortality from all sectors and gears of the 2013 IFQ fishery was 24% less than the 2011 IFQ estimated discard mortality. This is probably due to the significant drop in effort and P. halibut catch by IFQ hook-&-line vessels in 2013 compared to 2012 (Table 4). In general, bottom trawl effort was similar in 2013 and 2012, with slightly more effort in 2013 (Table 4), especially in March and October 2013 compared to the same months in 2012 (Figure 5).

The 2013 IFQ estimated P. halibut discard mortality for all gears was 82% less than the estimated discard mortality from the 2010 LE bottom trawl fishery (Figure ES1) and 85% less than the average mortality in the LE bottom trawl fishery over the years 2002-2010. Two changes in the fishery could explain this decrease in P. halibut catch. First, IBQs for P. halibut might have increased fisher incentives to avoid P. halibut bycatch and thereby changed fisher behavior (i.e., changing fishing grounds or gear). Second, testing and use of gear to exclude P.halibut from the catch became general practice in much of the trawl fleet, which enabled fishermen to increase fishing activity without additional risk to quota.

Estimated bycatch weight of P. halibut (1.1 mt) from the At-sea Hake component of the 2013 IFQ fishery increased from the 2012 (0.6 mt) but remained within the range of values recorded from 2002-2013 (0.3-4.0 mt; Table 22).

**Non-Nearshore Fixed Gear Fishery**

From 2011 to 2013, estimated discard mortality of P. halibut in the longline portion of the LE sablefish endorsed sector decreased each year in the area north of Point Chehalis, WA (Table 15). Compared to 2012, the 2013 observed discard ratio decreased north of Point Chehalis, while the fleet-wide landings of sablefish remained similar. This indicates a drop in P. halibut encounters in this sector (Table 13). In 2013, the longline portion of the LE sablefish endorsed sector fishing south of Point Chehalis also saw a large drop the discard ratio relative to 2012 values (Table 13), resulting in historically low P. halibut estimated discards. Decreased P. halibut discard mortality both north and south of Pt. Chehalis led to a very low 2013 coast-wide estimate for the LE sablefish endorsed sector (Table 15 & Figure 3). Gross estimated discard of P. halibut from the pot portion of the LE sablefish endorsed sector was also low very low compared to recent years, again, likely due to low encounter rates (Table 15).

Discard of P. halibut among the sablefish non-endorsed fixed gear sectors (LE and OA) during 2013 deviated from previous years. In 2013, estimated discard mortality in both the LE and OA sablefish non-endorsed longline/hook-&-line sectors were both at historical lows relative to previous years (Table 15). Effort in the LE sablefish non-endorsed sector was similar to 2012, suggesting that declines in P. halibut discards was likely caused by lower encounter rates (relative to past years). Effort in the hook-&-line OA sector was very low compared to past years (Table 13), suggesting reduced effort contributed to reduced P. halibut mortality. The estimated discard mortality for OA pot gear vessels was also very low relative to 2012 (Table 15), again with effort similar to 2012 but encounter rates apparently declining relative to 2012 (Table 13).

A large source of uncertainty in our estimates of P. halibut discard mortality on non-nearshore fixed gear vessels is the actual discard mortality rate applied to initial gross estimates. A small sample size of observed viability data are available from sablefish vessels fishing with pots, but not enough to be used in discard mortality estimation. Instead, we relied on findings from observed pot vessels in Alaska that assign specimens to the same condition codes used for trawl gear and then apply the discard mortality rates assumed by Williams (2008). This informed our decision to increase the discard mortality rate applied to pot estimates to 18% from 16%. As more viability information is collected by WCGOP observers from pot vessels, we intend to apply this directly to compute discard mortality in a manner consistent with the methods of Williams (2008).

Similar to trawl gear, discard mortality rates have been determined experimentally for P. halibut caught with longline gear (Kaimmer and Trumble 1998, Trumble et al. 2000). To apply these rates, P. halibut caught on longlines are assigned to one of four condition categories (minor, moderate, severe, and dead) based on the extent of their injuries at the time of release. Kaimmer and Trumble (1998) derived discard mortality rates for each of these categories using mark-recapture data. Their rates were later updated by Trumble et al. (2000) to account for hook sizes that are more consistent with gear used on the U.S. west coast for commercial purposes.

For reasons described earlier, P. halibut were infrequently brought on-board observed fixed gear vessels from 2002 to 2010, resulting in a small and potentially biased sample of viability data. Mortality rates specified by Trumble et al. (2000) cannot therefore be used in conjunction with these data to assess overall discard mortality. However, changes were implemented in the 2011 WCGOP data collection protocol that allowed observers on fixed gear vessels to collect a random sample of P. halibut from which to gather viability data. Sample sizes remain low but data collection continues. In the interim, discard mortality rates of 16% for longline gear and 18% for pot gear (Williams 2008) are thought to be the best option currently available.

### Other Fisheries

Very small amounts of P. halibut bycatch were recorded in other observed fisheries. Even assuming 100% mortality, bycatch estimates for the nearshore groundfish fixed gear sector, pink shrimp trawl fishery, and the OA sector of the California halibut trawl fishery made up a minor portion of the total mortality estimate for P. halibut (Tables 19, 20, 21).

## SUMMARY & CONCLUSIONS

### IFQ Fishery

- Estimated P. halibut discard mortality from the entire 2013 IFQ fishery represents a 24% decrease from 2012, 80% lower than the 2010 LE bottom trawl fishery estimate.
- The decrease from 2012 to 2013 does not appear to be related to bottom trawl effort as measured by number of vessels, tows, or hours towed. Rather, the decrease in effort among IFQ hook-&-line vessels appears to be the primary contributor to this decrease.

- P. halibut discard from the at-sea Pacific hake fishery in 2013 was slightly elevated relative to 2012, but still well within the historical range (2002-2013).

**Non-IFQ Fisheries**

- The 2013 estimates of P. halibut discard mortality in all Non-Nearshore fixed gear sectors were historical lows. Dramatically decreased encounter rates probably drive this decrease; however both effort and observer coverage were also reduced in 2013 relative to previous years.

  These differences occur in all non-nearshore fixed gear sectors; however, the largest changes were seen in the LE sablefish endorsed sector fishing longlines south of Pt. Chehalis and the OA hook-&-line fixed gear sector coastwide.

- Estimated P. halibut mortality in all other non-IFQ observed sectors/fisheries are within the range observed in previous years.

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## REFERENCES

IPHC Staff and Chastain, E. 2012. International Pacific Halibut Commission Annual Report 2011. International Pacific Halibut Commmission, Seattle, WA, USA. http://www.iphc.int/publications/annual/ar2011.pdf

Clark, W. G., and S. R. Hare. 1998. Accounting for bycatch in management of the Pacific halibut fishery. Journal of Fisheries Management 18:809-821.

Clark, W. G., S. H. Hoag, R. J. Trumble, and G. H. Williams. 1992. Re-estimation of survival for trawl caught halibut released in different condition factors. International Pacific Halibut Commission, Report of Assessment and Research Activities 1992:197-206.

Heery, E., and M. Bellman. 2009. Observed and Estimated Total Discard of Pacific Halibut in the 2002-2008 U.S. West Coast Groundfish Non-Nearshore Fixed Gear Fishery.

http://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/datareport/docs/pacifichalibut_fgtotalmortality0208_final.pdf

Heery, E., M. Bellman, and J. Majewski. 2010. Pacific halibut bycatch in the U.S. west coast groundfish fishery from 2002 through 2009. West Coast Groundfish Observer Program. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/datareport/docs/pacifichalibut_totalmortality_2010.pdf

Hoag, S. H. 1975. Survival of Halibut Released After Capture By Trawls. International Pacific Halibut Commission, Scientific Report No. 57. 18 p.

Jannot, J. E., A. W. Al-Humaidhi, M. A. Bellman, N. B. Riley, and J. Majewski. 2012. Pacific halibut bycatch in the U.S. west coast IFQ groundfish fishery (2011) and the non-IFQ groundfish fisheries (2002-2011). NWFSC Observer Program. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/pacifichalibut_2002_2011.pdf

Jannot, J. E., M. Bellman, and J. Majewski. 2011. Pacific Halibut Bycatch in the U.S. West Coast Groundfish Fishery, 2002-2010. West Coast Groundfish Observer Program. NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/pacifichalibut_totalmortality_2010.pdf

Jannot, J. E., M. A. Bellman, M. Mandrup, N. Riley, and J. McVeigh. 2013. Pacific halibut bycatch in the US west coast groundfish fisheries (2002-2012). NOAA Fisheries, NWFSC Observer Program, 2725 Montlake Blvd. E., Seattle, WA 98112. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/pdf/pacifichalibut_2002_2012.pdf

Kaimmer, S. M., and R. J. Trumble. 1998. Injury, condition, and mortality of Pacific halibut bycatch following careful release of Pacific cod and sablefish longline fisheries. Fisheries Research 38:131-144.

NWFSC. 2013a. FOS Observer Program Data Processing. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_processing.cfm

NWFSC. 2013b. FOS Observer Program Manuals. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_collection/training.cfm

NWFSC. 2013c. WCGOP Data Processing Appendix. http://www.nwfsc.noaa.gov/research/divisions/fram/observation/xls/DataProcessingAppendix_2012Data_Final.xlsx

PFMC. 2011. Pacific Groundfish Fishery Management Plan for the California, Oregon, and Washington Groundfish Fishery. http://www.pcouncil.org/wp-content/uploads/GF_FMP_FINAL_Dec2011.pdf

Trumble, R. J., S. M. Kaimmer, and G. H. Williams. 2000. Estimation of discard mortality rates for Pacific halibut bycatch in groundfish longline fisheries. North American Journal of Fisheries Management 20:931-939.

Wallace, J., and J. Hastie. 2009. Pacific halibut bycatch in IPHC area 2A in the 2008 groundfish bottom trawl fishery. NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112.

Williams, G. H. 2008. Pacific halibut discard mortality rates in the 2006 open access and CDQ groundfish fisheries, and recommendations for discard mortality rates needed for monitoring halibut bycatch in 2008 CDQ fisheries. International Pacific Halibut Commission, Seattle, WA.

Williams, G. H., and D. Chen. 2004. Pacific halibut discard mortality rates in the 1990-2002 Alaskan groundfish fisheries, with recommendations for monitoring in 2004. International Pacific Halibut Commission. Report of Assessment and Research Activities 2003:227-244.

Williams, G. H., and T. K. Wilderbuer. 1995. Discard mortality rates of Pacific halibut bycatch: Fishery differences and trends during 1990-1993.*in* Proceedings of the International Symposium on North Pacific flatfish. Alaska Sea Grant College Program Report. University of Alaska Fairbanks.

# TABLES

**Table 4**. Number of vessels, trips, and tows/sets observed and metric tons of sampled Pacific halibut discard at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) in the IFQ fishery by gear type fished. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). Some tows/sets are only partially sampled. Partially sampled tows/sets are included in the "No. of sampled tows", but for clarity, the number of unsampled catch categories in partially sampled tows/sets is provided. Some tows/sets are completely unsampled as noted below. (*) Confidential data, (-) not applicable.

| Bottom Trawl[1] | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area / Depth (fm) / Year | No. of vessels | No. of trips | No. sampled tows | No. unsampled tows | sampled tow hours | unsampled tow hours | sampled P. halibut discarded at sea (mt) | P. halibut landed and discarded at the dock (mt) | Unsampled categories from partially sampled hauls | | | Coverage Rate | |
| | | | | | | | | | IFQFF | IFQM | Non-IFQ | % tows sampled | % tow hours sampled |
| **North of Pt. Chehalis** | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | |
| 2011 | 13 | 46 | 303 | 0 | 836 | 0.00 | 7.36 | 0.00 | 1 | 4 | 8 | 100.0% | 100.0% |
| 2012 | 13 | 65 | 316 | 5 | 704 | 6.80 | 4.77 | 0.00 | 0 | 0 | 1 | 98.4% | 99.0% |
| 2013 | 11 | 96 | 464 | 1 | 1154 | 3.05 | 5.43 | 0.00 | 1 | 0 | 10 | 99.8% | 99.7% |
| **> 60** | | | | | | | | | | | | | |
| 2011 | 22 | 146 | 1108 | 2 | 4265 | 11.83 | 21.65 | 0.01 | 1 | 5 | 48 | 99.8% | 99.7% |
| 2012 | 19 | 168 | 1337 | 3 | 5142 | 13.67 | 30.18 | 0.03 | 0 | 13 | 30 | 99.8% | 99.7% |
| 2013 | 17 | 203 | 1703 | 4 | 6198 | 15.70 | 29.66 | 0.14 | 2 | 3 | 32 | 99.8% | 99.7% |
| **40° 10' to Pt. Chehalis** | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | |
| 2011 | 20 | 137 | 1115 | 12 | 2127 | 24.40 | 10.48 | 0.00 | 9 | 2 | 33 | 98.9% | 98.9% |
| 2012 | 21 | 155 | 977 | 8 | 1951 | 18.51 | 7.73 | 0.00 | 1 | 3 | 14 | 99.2% | 99.1% |
| 2013 | 20 | 207 | 949 | 2 | 2216 | 5.25 | 8.47 | 0.00 | 0 | 8 | 14 | 99.8% | 99.8% |
| **> 60** | | | | | | | | | | | | | |
| 2011 | 56 | 754 | 5105 | 25 | 26500 | 133.26 | 22.02 | 0.01 | 5 | 13 | 133 | 99.5% | 99.5% |
| 2012 | 54 | 710 | 4551 | 24 | 23741 | 91.42 | 19.87 | 0.04 | 2 | 17 | 111 | 99.5% | 99.6% |
| 2013 | 54 | 755 | 4995 | 14 | 25390 | 64.76 | 20.44 | 0.02 | 1 | 18 | 143 | 99.7% | 99.7% |
| **South of 40° 10' N Lat** | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | |
| 2011 | 3 | 23 | 66 | 0 | 164 | 0.00 | 0.17 | 0.00 | 3 | 0 | 1 | 100.0% | 100.0% |
| 2012 | * | * | * | * | * | * | * | * | * | * | * | * | * |
| [1] 2013 | 4 | 56 | 171 | 0 | 453 | 0.00 | 0.03 | 0.00 | 0 | 0 | 0 | 100% | 100% |
| **> 60** | | | | | | | | | | | | | |
| 2011 | 15 | 241 | 1373 | 3 | 5983 | 12.07 | 0.16 | 0.00 | 3 | 0 | 34 | 99.8% | 99.8% |
| 2012 | 13 | 255 | 1645 | 3 | 6215 | 4.08 | 0.81 | 0.00 | 1 | 1 | 66 | 99.8% | 99.9% |
| [1] 2013 | 14 | 283 | 1787 | 2 | 6806 | 2.75 | 0.88 | 0.00 | 0 | 2 | 69 | 99.9% | 100.0% |
| **LE CA Halibut** | | | | | | | | | | | | | |
| **South of 40° 10' N Lat** | | | | | | | | | | | | | |
| 2011 | 3 | 63 | 157 | 0 | 513.33 | 0.00 | 0.00 | 0.00 | 0 | 0 | 2 | 100.0% | 100.0% |
| 2012 | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 2013 | LE CA Halibut aggregated with non-hake IFQ Bottom Trawl above to meet confidentiality | | | | | | | | | | | | |

## Table 4. continued

**Midwater Trawl**

| Area / Year | No. of vessels | No. of trips | No. sampled tows | No. unsampled tows | sampled tow hours | unsampled tow hours | sampled P. halibut discarded at sea (mt) | P. halibut landed and discarded at the dock (mt) | Unsampled categories from partially sampled hauls | | | Coverage Rate | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | IFQFF | IFQM | Non-IFQ | % tows sampled | hours sampled |
| **Non-hake shoreside** | | | | | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | | | | | |
| 2011 | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 2012 | 4 | 8 | 23 | 0 | 63.21 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 100% | 100% |
| 2013 | 4 | 13 | 36 | 0 | 51.18 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 100% | 100% |
| **Shoreside Hake** | | | | | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | | | | | |
| 2011 | 26 | 913 | 1701 | 0 | 3940 | 0.00 | 0.03 | 0.33 | 0 | 0 | 2 | 100% | 100% |
| 2012 | 24 | 715 | 1564 | 0 | 5902 | 0.00 | 0.00 | 0.62 | 0 | 0 | 3 | 100% | 100% |
| 2013 | 25 | 946 | 1724 | 0 | 4656 | 0.00 | 0.05 | 1.26 | 0 | 0 | 2 | 100% | 100% |

**Hook-and-Line**

| Area / Year | No. of vessels | No. of trips | No. sampled sets | No. unsampled sets | sampled tow hours | unsampled tow hours | sampled P. halibut discarded at sea (mt) | P. halibut landed and discarded at the dock (mt) | Unsampled categories from partially sampled sets | | | Coverage Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | IFQFF | IFQM | Non-IFQ | % sets sampled |
| **North of 40° 10' N Lat** | | | | | | | | | | | | |
| 2011 | 6 | 21 | 410 | 1 | - | - | 6.06 | 0.00 | 0 | 0 | 0 | 99.8% |
| 2012 | 6 | 22 | 486 | 0 | - | - | 14.66 | 0.00 | 0 | 0 | 0 | 100% |
| **South of 40° 10' N Lat** | | | | | | | | | | | | |
| 2011 | 6 | 71 | 212 | 0 | - | - | 0.00 | 0.00 | 0 | 0 | 1 | 100% |
| 2012 | * | * | * | * | - | - | * | * | * | * | * | * |
| **Coastwide** | | | | | | | | | | | | |
| 2013 | 4 | 18 | 153 | 0 | - | - | 3.00 | 0.00 | 0 | 0 | 0 | 100% |

**Pot**

| Area / Year | No. of vessels | No. of trips | No. sampled sets | No. unsampled sets | sampled tow hours | unsampled tow hours | sampled P. halibut discarded at sea (mt) | P. halibut landed and discarded at the dock (mt) | partially sampled sets | | | Coverage Rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | IFQFF | IFQM | Non-IFQ | % sets sampled |
| **North of Pt. Chehalis** | | | | | | | | | | | | |
| 2011 | 3 | 12 | 63 | 0 | - | - | 1.03 | 0.00 | 0 | 0 | 0 | 100% |
| 2012 | 5 | 45 | 419 | 0 | - | - | 1.27 | 0.00 | 0 | 0 | 7 | 100% |
| 2013 | 3 | 12 | 165 | 0 | - | - | 0.22 | 0.00 | 0 | 0 | 1 | 100% |
| **40° 10' to Pt. Chehalis** | | | | | | | | | | | | |
| 2011 | 8 | 75 | 714 | 2 | - | - | 2.30 | 0.00 | 0 | 0 | 1 | 99.7% |
| 2012 | 9 | 60 | 468 | 0 | - | - | 0.62 | 0.00 | 0 | 0 | 0 | 100% |
| 2013 | 5 | 40 | 502 | 0 | - | - | 0.76 | 0.00 | 0 | 0 | 2 | 100% |
| **South of 40° 10' N Lat** | | | | | - | - | | | | | | |
| 2011 | 11 | 148 | 738 | 0 | - | - | 0.00 | 0.00 | 0 | 0 | 2 | 100% |
| 2012 | 13 | 167 | 814 | 0 | - | - | 0.00 | 0.00 | 0 | 0 | 1 | 100% |
| 2013 | 6 | 41 | 411 | 0 | - | - | 0.00 | 0.00 | 0 | 0 | 2 | 100% |

**Table 5.** Values used to calculate the expanded weight (mt) of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ fishery by year. Unsampled catch weight could be assigned to one of four categories: IFQ flatfish species, IFQ mixed species, non-IFQ species, or all species (IFQ & non-IFQ). The sampled weight (mt), discard ratio, unsampled weight (mt) and estimated P. halibut gross discard (mt) are presented within each category, as a function of gear or sector, depth (bottom trawl only), management area, and area north or south of Point Chehalis, WA. The sum of expanded weight (mt) is the sum of the estimated gross P. halibut discard across categories. The sampled discarded PHLB weight (mt) is the sum of sampled PHLB. The total discard (gross) is the sum of the PHLB in unsampled hauls plus the sampled PHLB. (*) Confidential data.

| Bottom Trawl[1] | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IFQ Flatfish | | | | Mixed IFQ Species | | | | Non-IFQ Species | | | | All Species (IFQ & Non-IFQ) | | | | | |
| Area / Depth (fm) / Year | Sampled Weight | Discard Ratio | Unsampled Weight | Est. Discard | Sampled Weight | Discard Ratio | Unsampled Weight | Est. Discard | Sampled Weight | Discard Ratio | Unsampled Weight | Est. Discard | Sampled Weight | Discard Ratio | Unsampled Weight | Est. Discard | Sum of Exp. Discard Weight | Sampled Discarded PHLB | Total Discard |
| **North of Pt. Chehalis** | | | | | | | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 60.63 | 0.12 | 0.14 | 0.02 | 80.91 | 0.09 | 3.86 | 0.35 | 59.87 | 0.00 | 2.27 | 0.00 | 140.78 | 0.05 | 0.00 | 0.00 | 0.37 | 7.44 | 7.81 |
| 2012 | 50.77 | 0.09 | 0.00 | 0.00 | 56.29 | 0.08 | 0.00 | 0.00 | 46.49 | 0.00 | 0.09 | 0.00 | 102.78 | 0.05 | 0.56 | 0.03 | 0.03 | 4.77 | 4.80 |
| 2013 | 104.68 | 0.05 | 0.07 | 0.00 | 114.61 | 0.05 | 0.00 | 0.00 | 93.58 | 0.00 | 1.41 | 0.00 | 208.19 | 0.03 | 0.91 | 0.02 | 0.03 | 5.43 | 5.46 |
| **> 60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 115.56 | 0.19 | 0.45 | 0.09 | 143.92 | 0.16 | 0.84 | 0.13 | 224.45 | 0.00 | 3.19 | 0.00 | 368.37 | 0.06 | 0.10 | 0.01 | 0.23 | 22.47 | 22.69 |
| 2012 | 94.35 | 0.42 | 0.00 | 0.00 | 132.42 | 0.30 | 1.48 | 0.44 | 285.15 | 0.00 | 4.70 | 0.00 | 417.57 | 0.09 | 12.10 | 1.14 | 1.58 | 39.48 | 41.07 |
| 2013 | 185.79 | 0.16 | 0.20 | 0.03 | 227.34 | 0.13 | 1.07 | 0.14 | 244.38 | 0.00 | 2.41 | 0.00 | 943.44 | 0.13 | 1.39 | 0.09 | 0.26 | 59.33 | 29.92 |
| **40° 10' to Pt. Chehalis** | | | | | | | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 97.22 | 0.11 | 0.61 | 0.07 | 118.33 | 0.09 | 2.40 | 0.22 | 192.38 | 0.00 | 5.03 | 0.00 | 310.71 | 0.03 | 3.77 | 0.13 | 0.41 | 10.66 | 11.07 |
| 2012 | 72.52 | 0.11 | 0.28 | 0.03 | 86.27 | 0.09 | 0.85 | 0.08 | 145.99 | 0.00 | 1.07 | 0.00 | 232.26 | 0.03 | 1.95 | 0.06 | 0.17 | 7.73 | 7.91 |
| 2013 | 109.66 | 0.08 | 0.00 | 0.00 | 120.95 | 0.07 | 0.86 | 0.06 | 138.76 | 0.00 | 1.60 | 0.00 | 259.71 | 0.03 | 0.41 | 0.01 | 0.07 | 8.47 | 8.55 |
| **> 60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 190.51 | 0.12 | 0.78 | 0.09 | 352.78 | 0.06 | 3.77 | 0.24 | 761.38 | 0.00 | 12.08 | 0.00 | 1114.17 | 0.02 | 6.38 | 0.13 | 0.45 | 22.06 | 22.51 |
| 2012 | 180.28 | 0.11 | 0.06 | 0.01 | 369.65 | 0.05 | 6.42 | 0.35 | 646.39 | 0.00 | 8.29 | 0.00 | 1016.03 | 0.02 | 6.63 | 0.13 | 0.48 | 19.88 | 20.36 |
| 2013 | 229.40 | 0.09 | 0.07 | 0.01 | 401.88 | 0.05 | 9.27 | 0.47 | 712.67 | 0.00 | 9.36 | 0.00 | 2229.10 | 0.04 | 9.59 | 0.18 | 0.65 | 40.92 | 21.11 |
| **South of 40° 10' N Lat[1]** | | | | | | | | | | | | | | | | | | | |
| **0-60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 4.60 | 0.00 | 0.04 | 0.00 | 5.04 | 0.00 | 0.00 | 0.00 | 11.75 | 0.01 | 0.01 | 0.00 | 16.79 | 0.01 | 0.00 | 0.00 | 0.00 | 0.17 | 0.17 |
| 2012 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| [1] 2013 | 4.55 | 0.00 | 0.00 | 0.00 | 6.65 | 0.00 | 0.00 | 0.00 | 66.93 | 0.00 | 0.00 | 0.00 | 73.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 |
| **> 60** | | | | | | | | | | | | | | | | | | | |
| 2011 | 155.01 | 0.00 | 0.10 | 0.00 | 275.06 | 0.00 | 0.00 | 0.00 | 223.70 | 0.00 | 2.86 | 0.00 | 498.76 | 0.00 | 1.36 | 0.00 | 0.00 | 0.16 | 0.16 |
| 2012 | 80.42 | 0.00 | 0.01 | 0.00 | 266.50 | 0.00 | 0.03 | 0.00 | 222.98 | 0.00 | 7.08 | 0.03 | 489.48 | 0.00 | 1.93 | 0.00 | 0.03 | 0.81 | 0.84 |
| [1] 2013 | 119.64 | 0.00 | 0.00 | 0.00 | 364.86 | 0.00 | 0.07 | 0.00 | 296.89 | 0.00 | 7.47 | 0.02 | 1323.49 | 0.00 | 0.23 | 0.00 | 0.02 | 1.76 | 0.90 |
| **LE CA Halibut** | | | | | | | | | | | | | | | | | | | |
| **South of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | 0.73 | 0.00 | 0.00 | 0.00 | 0.74 | 0.00 | 0.00 | 0.00 | 75.42 | 0.00 | 0.01 | 0.00 | 76.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2012 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 2013 | LE CA Halibut aggregated with non-hake IFQ Bottom Trawl Above to meet confidentiality | | | | | | | | | | | | | | | | | | |

[1] Includes LE CA Halibut

## Table 5. continued

**Midwater Trawl**

| Area / Year | IFQ Flatfish Sampled Weight | IFQ Flatfish Discard Ratio | IFQ Flatfish Unsampled Weight | IFQ Flatfish Est. Discard | Mixed IFQ Species Sampled Weight | Mixed IFQ Species Discard Ratio | Mixed IFQ Species Unsampled Weight | Mixed IFQ Species Est. Discard | Non-IFQ Species Sampled Weight | Non-IFQ Species Discard Ratio | Non-IFQ Species Unsampled Weight | Non-IFQ Species Est. Discard | All Species (IFQ & Non-IFQ) Sampled Weight | All Species (IFQ & Non-IFQ) Discard Ratio | All Species (IFQ & Non-IFQ) Unsampled Weight | All Species (IFQ & Non-IFQ) Est. Discard | Sum of Exp. Discard Weight | Sampled Discarded PHLB | Total Discard |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Non-hake shoreside** | | | | | | | | | | | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Shoreside Hake** | | | | | | | | | | | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | 0.03 | 0.99 | 0.00 | 0.00 | 521.49 | 0.00 | 0.00 | 0.00 | 3.82 | 0.00 | 1.37 | 0.00 | 525.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 |
| 2012 | 0.00 | 0.00 | 0.00 | 0.00 | 128.31 | 0.00 | 0.00 | 0.00 | 8.19 | 0.00 | 0.36 | 0.00 | 136.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.05 | 1.00 | 0.00 | 0.00 | 460.78 | 0.00 | 0.00 | 0.00 | 7.30 | 0.00 | 0.25 | 0.00 | 468.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.05 |

**Hook-and-Line**

| Area / Year | IFQ Flatfish Sampled Weight | IFQ Flatfish Discard Ratio | IFQ Flatfish Unsampled Weight | IFQ Flatfish Est. Discard | Mixed IFQ Species Sampled Weight | Mixed IFQ Species Discard Ratio | Mixed IFQ Species Unsampled Weight | Mixed IFQ Species Est. Discard | Non-IFQ Species Sampled Weight | Non-IFQ Species Discard Ratio | Non-IFQ Species Unsampled Weight | Non-IFQ Species Est. Discard | All Species (IFQ & Non-IFQ) Sampled Weight | All Species (IFQ & Non-IFQ) Discard Ratio | All Species (IFQ & Non-IFQ) Unsampled Weight | All Species (IFQ & Non-IFQ) Est. Discard | Sum of Exp. Discard Weight | Sampled Discarded PHLB | Total Discard |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | 7.19 | 0.84 | 0.00 | 0.00 | 22.06 | 0.27 | 0.00 | 0.00 | 56.74 | 0.00 | 0.00 | 0.00 | 78.81 | 0.08 | 0.00 | 0.00 | 0.00 | 6.06 | 6.06 |
| 2012 | 19.30 | 0.76 | 0.00 | 0.00 | 36.79 | 0.40 | 0.00 | 0.00 | 96.58 | 0.00 | 0.00 | 0.00 | 133.38 | 0.11 | 0.00 | 0.00 | 0.00 | 14.66 | 14.66 |
| **South of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | 0.18 | 0.00 | 0.00 | 0.00 | 3.72 | 0.00 | 0.00 | 0.00 | 21.06 | 0.00 | 0.00 | 0.00 | 24.78 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2012 | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * | * |
| **Coastwide** | | | | | | | | | | | | | | | | | | | |
| 2013 | 5.10 | 0.59 | 0.00 | 0.00 | 8.23 | 0.36 | 0.00 | 0.00 | 27.60 | 0.00 | 0.00 | 0.00 | 35.83 | 0.08 | 0.00 | 0.00 | 0.00 | 3.00 | 3.00 |

**Pot**

| Area / Year | IFQ Flatfish Sampled weight | IFQ Flatfish Discard Ratio | IFQ Flatfish Unsampled weight | IFQ Flatfish Est. Discard | Mixed IFQ Species Sampled weight | Mixed IFQ Species Discard Ratio | Mixed IFQ Species Unsampled weight | Mixed IFQ Species Est. Discard | Non-IFQ Species Sampled weight | Non-IFQ Species Discard Ratio | Non-IFQ Species Unsampled weight | Non-IFQ Species Est. Discard | All Species (IFQ & Non-IFQ) Sampled weight | All Species (IFQ & Non-IFQ) Discard Ratio | All Species (IFQ & Non-IFQ) Unsampled weight | All Species (IFQ & Non-IFQ) Est. Discard | Sum of Exp. Discard Weight | Sampled Discarded PHLB | Total Discard |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North of Pt. Chehalis** | | | | | | | | | | | | | | | | | | | |
| 2011 | 1.05 | 0.98 | 0.00 | 0.00 | 1.56 | 0.66 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 0.00 | 1.82 | 0.57 | 0.00 | 0.00 | 0.00 | 1.03 | 1.03 |
| 2012 | 2.46 | 0.52 | 0.00 | 0.00 | 9.15 | 0.14 | 0.00 | 0.00 | 2.27 | 0.00 | 0.01 | 0.00 | 11.42 | 0.11 | 0.00 | 0.00 | 0.00 | 1.27 | 1.27 |
| 2013 | 0.28 | 0.79 | 0.00 | 0.00 | 1.08 | 0.20 | 0.00 | 0.00 | 0.66 | 0.00 | 0.01 | 0.00 | 1.73 | 0.13 | 0.00 | 0.00 | 0.00 | 0.22 | 0.22 |
| **40° 10' to Pt. Chehalis** | | | | | | | | | | | | | | | | | | | |
| 2011 | 2.45 | 0.94 | 0.00 | 0.00 | 7.95 | 0.29 | 0.00 | 0.00 | 3.38 | 0.00 | 0.00 | 0.00 | 11.33 | 0.20 | 0.01 | 0.00 | 0.00 | 2.30 | 2.31 |
| 2012 | 1.22 | 0.51 | 0.00 | 0.00 | 3.86 | 0.16 | 0.00 | 0.00 | 6.03 | 0.00 | 0.00 | 0.00 | 9.88 | 0.06 | 0.00 | 0.00 | 0.00 | 0.62 | 0.62 |
| 2013 | 1.23 | 0.62 | 0.00 | 0.00 | 6.77 | 0.11 | 0.00 | 0.00 | 10.90 | 0.00 | 0.00 | 0.00 | 17.67 | 0.04 | 0.00 | 0.00 | 0.00 | 0.76 | 0.76 |
| **South of 40° 10' N Lat** | | | | | | | | | | | | | | | | | | | |
| 2011 | 0.30 | 0.00 | 0.00 | 0.00 | 6.49 | 0.00 | 0.00 | 0.00 | 6.91 | 0.00 | 0.00 | 0.00 | 13.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2012 | 0.52 | 0.00 | 0.00 | 0.00 | 4.22 | 0.00 | 0.00 | 0.00 | 4.67 | 0.00 | 0.00 | 0.00 | 8.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2013 | 0.03 | 0.00 | 0.00 | 0.00 | 3.01 | 0.00 | 0.00 | 0.00 | 3.62 | 0.00 | 0.00 | 0.00 | 6.64 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**Table 6.** Pacific halibut viabilities in the U.S. west coast groundfish IFQ fishery by gear, management area, area north or south of Point Chehalis, WA, depth (bottom trawl only), and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead (Appendices N and O, WCGOP manual 2013), consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. (*) Confidential data, (-) viabilities or weighted percentages not estimated, see text for explanation.

| Bottom Trawl[1] | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Area** / **Depth (fm)** | **Number** | | | | **Weighted percentages in each category** | | |
| Year | Exc | Poor | Dead | Total | Exc | Poor | Dead |
| **North of Pt. Chehalis** | | | | | | | |
| **0-60** | | | | | | | |
| 2011 | 517 | 137 | 308 | 962 | 57% | 14% | 28% |
| 2012 | 314 | 156 | 299 | 769 | 46% | 20% | 34% |
| 2013 | 327 | 114 | 464 | 905 | 41% | 14% | 45% |
| **> 60** | | | | | | | |
| 2011 | 1063 | 439 | 927 | 2429 | 47% | 18% | 35% |
| 2012 | 1299 | 709 | 1368 | 3376 | 40% | 21% | 39% |
| 2013 | 2100 | 534 | 984 | 3618 | 62% | 14% | 24% |
| **40° 10' to Pt. Chehalis** | | | | | | | |
| **0-60** | | | | | | | |
| 2011 | 1076 | 169 | 199 | 1444 | 80% | 10% | 10% |
| 2012 | 791 | 175 | 229 | 1195 | 68% | 14% | 18% |
| 2013 | 659 | 238 | 260 | 1157 | 59% | 22% | 19% |
| **> 60** | | | | | | | |
| 2011 | 967 | 554 | 1188 | 2709 | 38% | 20% | 42% |
| 2012 | 859 | 447 | 1201 | 2507 | 36% | 17% | 47% |
| 2013 | 753 | 404 | 1100 | 2257 | 35% | 19% | 47% |
| **South of 40° 10' N Lat** | | | | | | | |
| **0-60** | | | | | | | |
| 2011 | 0 | 0 | 10 | 10 | 0% | 0% | 100% |
| 2012 | * | * | * | * | * | * | * |
| [1] 2013 | 2 | 0 | 0 | 2 | 100% | 0% | 0% |
| **> 60** | | | | | | | |
| 2011 | 7 | 1 | 6 | 14 | 48% | 6% | 46% |
| 2012 | 35 | 7 | 36 | 78 | 49% | 9% | 42% |
| [1] 2013 | 27 | 14 | 51 | 92 | 32% | 16% | 52% |
| **LE CA Halibut South of 40° 10' N Lat** | | | | | | | |
| 2011 | 0 | 0 | 0 | 0 | 0% | 0% | 0% |
| 2012 | * | * | * | * | * | * | * |
| 2013 | LE CA Halibut aggregated with non-hake IFQ above | | | | | | |

[1]Includes LE CA Halibut

**Table 6. continued**

| Midwater Trawl | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Area** | **Number** | | | | **Weighted percentages** | | |
| Year | Exc | Poor | Dead | Total | Exc | Poor | Dead |
| **Non-hake shoreside** | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | |
| 2011 | * | * | * | * | * | * | * |
| 2012 | 0 | 0 | 0 | 0 | 0% | 0% | 0% |
| 2013 | 0 | 0 | 0 | 0 | 0% | 0% | 0% |
| **Shoreside Hake** | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | |
| 2011 | 0 | 1 | 2 | 3 | 0% | 46% | 54% |
| 2012 | 0 | 0 | 0 | 0 | 0% | 0% | 0% |
| 2013 | 2 | 0 | 1 | 3 | 92% | 0% | 8% |

| Hook-and-Line | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Area** | **Number** | | | | **Weighted percentages** | | |
| Year | Exc | Poor | Dead | Total | Exc | Poor | Dead |
| **North of 40° 10' N Lat** | | | | | | | |
| 2011 | - | - | - | 902 | - | - | - |
| 2012 | - | - | - | 1271 | - | - | - |
| **South of 40° 10' N Lat** | | | | | | | |
| 2011 | - | - | - | 0 | - | - | - |
| 2012 | * | * | * | * | * | * | * |
| **Coastwide** | | | | | | | |
| 2013 | - | - | - | 404 | - | - | - |

| Pot | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Area** | **Number** | | | | **Weighted percentages** | | |
| Year | Exc | Poor | Dead | Total | Exc | Poor | Dead |
| **North of Pt. Chehalis** | | | | | | | |
| 2011 | 53 | 3 | 19 | 75 | 84% | 2% | 14% |
| 2012 | 103 | 21 | 24 | 148 | 66% | 17% | 17% |
| 2013 | 18 | 1 | 11 | 30 | 61% | 2% | 37% |
| **40° 10' to Pt. Chehalis** | | | | | | | |
| 2011 | 149 | 10 | 65 | 224 | 69% | 5% | 26% |
| 2012 | 58 | 4 | 3 | 65 | 87% | 8% | 5% |
| 2013 | 76 | 7 | 8 | 91 | 83% | 7% | 10% |
| **South of 40° 10' N Lat** | | | | | | | |
| 2011 | 0 | 0 | 0 | 0 | - | - | - |
| 2012 | 0 | 0 | 0 | 0 | - | - | - |
| 2013 | 0 | 0 | 0 | 0 | - | - | - |

**Table 7.** Estimated gross discard (mt) and discard mortality (mt) of Pacific halibut in the U.S. west coast groundfish IFQ fishery by gear type, management area, area north or south of Point Chehalis, WA, depth (bottom trawl only), and year. Estimates were allocated to the three condition categories based on information presented in Table 6. DMR = Discard Mortality Rate. (*) Confidential data, (-) viabilities not estimated.

| Bottom Trawl[1] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Area** / **Depth (fm)** | **Estimate Gross Discard (mt)** | | | | **Estimated Discard Mortality (mt)** | | | | **DMR** |
| Year | Exc | Poor | Dead | Total | m(Exc) | m(Poor) | m(Dead) | m(Total) | |
| **North of Pt. Chehalis** | | | | | | | | | |
| **0-60** | | | | | | | | | |
| 2011 | 4.48 | 1.11 | 2.22 | 7.81 | 0.90 | 0.61 | 2.00 | 3.51 | 45% |
| 2012 | 2.20 | 0.97 | 1.62 | 4.80 | 0.44 | 0.54 | 1.46 | 2.44 | 51% |
| 2013 | 2.24 | 0.74 | 2.48 | 5.46 | 0.45 | 0.41 | 2.23 | 3.08 | 57% |
| **> 60** | | | | | | | | | |
| 2011 | 10.61 | 4.14 | 7.95 | 22.69 | 2.12 | 2.28 | 7.15 | 11.55 | 51% |
| 2012 | 16.57 | 8.55 | 15.95 | 41.07 | 3.31 | 4.70 | 14.35 | 22.37 | 54% |
| 2013 | 18.58 | 4.26 | 7.08 | 29.92 | 3.72 | 2.34 | 6.38 | 12.43 | 42% |
| **40° 10' to Pt. Chehalis** | | | | | | | | | |
| **0-60** | | | | | | | | | |
| 2011 | 8.89 | 1.06 | 1.13 | 11.07 | 1.78 | 0.58 | 1.02 | 3.38 | 30% |
| 2012 | 5.35 | 1.10 | 1.46 | 7.91 | 1.07 | 0.60 | 1.31 | 2.99 | 38% |
| 2013 | 5.05 | 1.85 | 1.64 | 8.55 | 1.01 | 1.02 | 1.48 | 3.51 | 41% |
| **> 60** | | | | | | | | | |
| 2011 | 8.46 | 4.55 | 9.51 | 22.51 | 1.69 | 2.50 | 8.56 | 12.75 | 57% |
| 2012 | 7.35 | 3.54 | 9.47 | 20.36 | 1.47 | 1.95 | 8.52 | 11.94 | 59% |
| 2013 | 7.30 | 3.91 | 9.90 | 21.11 | 1.46 | 2.15 | 8.91 | 12.52 | 59% |
| **South of 40° 10' N Lat**[1] | | | | | | | | | |
| **0-60** | | | | | | | | | |
| 2011 | 0.00 | 0.00 | 0.17 | 0.17 | 0.00 | 0.00 | 0.15 | 0.15 | 90% |
| 2012 | * | * | * | * | * | * | * | * | * |
| [1] 2013 | 0.03 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.01 | 20% |
| **> 60** | | | | | | | | | |
| 2011 | 0.08 | 0.01 | 0.08 | 0.16 | 0.02 | 0.01 | 0.07 | 0.09 | 54% |
| 2012 | 0.41 | 0.08 | 0.35 | 0.84 | 0.08 | 0.04 | 0.31 | 0.44 | 52% |
| [1] 2013 | 0.29 | 0.14 | 0.47 | 0.90 | 0.06 | 0.08 | 0.42 | 0.56 | 62% |
| **LE CA Halibut** | | | | | | | | | |
| **South of 40° 10' N Lat** | | | | | | | | | |
| 2011 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2012 | * | * | * | * | * | * | * | * | * |
| 2013 | LE CA Halibut aggregated with non-hake IFQ above | | | | | | | | |

[1]Includes LE CA Halibut

**Table 7. continued**

| Midwater Trawl | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Area** | **Estimate Gross Discard (mt)** | | | | **Estimated Discard Mortality (mt)** | | | | **DMR** |
| Year | Exc | Poor | Dead | Total | m(Exc) | m(Poor) | m(Dead) | m(Total) | |
| **Non-Hake Shoreside** | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | |
| 2011 | * | * | * | * | * | * | * | * | * |
| 2012 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2013 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| **Shoreside Hake** | | | | | | | | | |
| **North of 40° 10' N Lat** | | | | | | | | | |
| 2011 | 0.00 | 0.01 | 0.01 | 0.03 | - | - | - | 0.03 | 100% |
| 2012 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2013 | 0.05 | 0.00 | 0.00 | 0.05 | - | - | - | 0.05 | 100% |

| Hook and Line | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Area** | **Estimate Gross Discard (mt)** | | | | **Estimated Discard Mortality (mt)** | | | | **DMR** |
| Year | Exc | Poor | Dead | Total | m(Exc) | m(Poor) | m(Dead) | m(Total) | |
| **North of Pt. Chehalis** | | | | | | | | | |
| 2011 | - | - | - | 6.06 | - | - | - | 0.97 | 16% |
| 2012 | - | - | - | 14.66 | - | - | - | 2.34 | 16% |
| **40° 10' to Pt. Chehalis** | | | | | | | | | |
| 2011 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2012 | * | * | * | * | * | * | * | * | * |
| **Coastwide** | | | | | | | | | |
| 2013 | - | - | - | 3.00 | - | - | - | 0.48 | 16% |

| Pot | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Area** | **Estimate Gross Discard (mt)** | | | | **Estimated Discard Mortality (mt)** | | | | **DMR** |
| Year | Exc | Poor | Dead | Total | m(Exc) | m(Poor) | m(Dead) | m(Total) | |
| **North of Pt. Chehalis** | | | | | | | | | |
| 2011 | 0.86 | 0.02 | 0.15 | 1.03 | 0.00 | 0.02 | 0.15 | 0.17 | 16% |
| 2012 | 0.84 | 0.21 | 0.21 | 1.27 | 0.00 | 0.21 | 0.21 | 0.43 | 34% |
| 2013 | 0.13 | 0.00 | 0.08 | 0.22 | 0.00 | 0.00 | 0.08 | 0.09 | 39% |
| **40° 10' to Pt. Chehalis** | | | | | | | | | |
| 2011 | 1.59 | 0.11 | 0.61 | 2.31 | 0.00 | 0.11 | 0.61 | 0.71 | 31% |
| 2012 | 0.54 | 0.05 | 0.03 | 0.62 | 0.00 | 0.05 | 0.03 | 0.08 | 13% |
| 2013 | 0.63 | 0.05 | 0.07 | 0.76 | 0.00 | 0.05 | 0.07 | 0.13 | 17% |
| **South of 40° 10' N Lat** | | | | | | | | | |
| 2011 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2012 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |
| 2013 | - | - | - | 0.00 | - | - | - | 0.00 | 0% |

**Table 8.** Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight in the U.S. west coast groundfish IFQ fishery by gear, management area, area north or south of Point Chehalis, WA, depth (bottom trawl only), and year. (*) Confidential data. The proportion of legal-sized P. halibut in the non-hake IFQ bottom trawl sector north of 40°10′ N. lat. is 64%.

| Bottom Trawl[1] | | | | |
|---|---|---|---|---|
| **Area**<br>**Depth (fm)**<br>Year | **Total discard (mt)** | **Total discard mortality (mt)** | **Estimated legal-sized mortality (mt)** | **Estimated % legal-sized discarded by weight** |
| **North of Pt. Chehalis** | | | | |
| **0-60** | | | | |
| 2011 | 7.81 | 3.51 | 1.92 | 55% |
| 2012 | 4.80 | 2.44 | 1.14 | 47% |
| 2013 | 5.46 | 3.08 | 1.23 | 40% |
| **> 60** | | | | |
| 2011 | 22.69 | 11.55 | 8.15 | 71% |
| 2012 | 41.07 | 22.37 | 15.48 | 69% |
| 2013 | 29.92 | 12.43 | 7.97 | 64% |
| **40° 10' to Pt. Chehalis** | | | | |
| **0-60** | | | | |
| 2011 | 11.07 | 3.38 | 2.10 | 62% |
| 2012 | 7.91 | 2.99 | 1.58 | 53% |
| 2013 | 8.55 | 3.51 | 2.18 | 62% |
| **> 60** | | | | |
| 2011 | 22.51 | 12.75 | 8.78 | 69% |
| 2012 | 20.36 | 11.94 | 8.44 | 71% |
| 2013 | 21.11 | 12.52 | 8.83 | 70% |
| **South of 40° 10' N Lat**[1] | | | | |
| **0-60** | | | | |
| 2011 | 0.17 | 0.15 | 0.15 | 100% |
| 2012 | * | * | * | * |
| [1] 2013 | 0.03 | 0.01 | 0.01 | 100% |
| **> 60** | | | | |
| 2011 | 0.16 | 0.09 | 0.09 | 97% |
| 2012 | 0.84 | 0.44 | 0.38 | 86% |
| [1] 2013 | 0.90 | 0.56 | 0.45 | 80% |
| **LE CA Halibut** | | | | |
| **South of 40° 10' N Lat** | | | | |
| 2011 | 0.00 | 0.00 | 0.00 | 0% |
| 2012 | * | * | * | * |
| 2013 | LE CA Halibut aggregated with non-hake IFQ above | | | |

[1]Includes LE CA Halibut

**Table 8. continued**

| Midwater Trawl | | | | |
|---|---|---|---|---|
| Area / Year | Total bycatch (mt) | Total discard mortality (mt) | legal-sized mortality (mt) | legal-sized discarded by |
| **Non-Hake Shoreside** | | | | |
| **North of 40° 10' N Lat** | | | | |
| 2011 | * | * | * | * |
| 2012 | 0.00 | 0.00 | 0.00 | 0% |
| 2013 | 0.00 | 0.00 | 0.00 | 0% |
| **Shoreside Hake** | | | | |
| **North of 40° 10' N Lat** | | | | |
| 2011 | 0.03 | 0.03 | 0.02 | 76% |
| 2012 | 0.00 | 0.00 | 0.00 | 0% |
| 2013 | 0.05 | 0.05 | 0.05 | 92% |

| Hook-and-Line | | | | |
|---|---|---|---|---|
| Area / Year | Total bycatch (mt) | Total discard mortality (mt) | legal-sized mortality (mt) | legal-sized discarded by |
| **North of 40° 10' N Lat** | | | | |
| 2011 | 6.06 | 0.97 | 0.43 | 45% |
| 2012 | 14.66 | 2.34 | 1.81 | 77% |
| **South of 40° 10' N Lat** | | | | |
| 2011 | 0.00 | 0.00 | 0.00 | 0% |
| 2012 | * | * | * | * |
| **Coastwide** | | | | |
| 2013 | 3.00 | 0.48 | 0.24 | 50% |

| Pot | | | | |
|---|---|---|---|---|
| Area / Year | Total bycatch (mt) | Total discard mortality (mt) | legal-sized mortality (mt) | legal-sized discarded by |
| **North of Pt. Chehalis** | | | | |
| 2011 | 1.03 | 0.17 | 0.13 | 77% |
| 2012 | 1.27 | 0.43 | 0.34 | 81% |
| 2013 | 0.22 | 0.09 | 0.07 | 78% |
| **40° 10' to Pt. Chehalis** | | | | |
| 2011 | 2.31 | 0.71 | 0.53 | 74% |
| 2012 | 0.62 | 0.08 | 0.06 | 74% |
| 2013 | 0.76 | 0.13 | 0.09 | 71% |
| **South of 40° 10' N Lat** | | | | |
| 2011 | 0.00 | 0.00 | 0.00 | 0% |
| 2012 | 0.00 | 0.00 | 0.00 | 0% |
| 2013 | 0.00 | 0.00 | 0.00 | 0% |

**Table 9.** Pacific halibut bycatch by month for vessels fishing bottom trawl gear in the 2013 IFQ fishery. The number of vessels per area-depth-month stratum do not meet confidentiality requirements; therefore we only present monthly estimates coastwide across all depths.

| Month | Expanded Discard (mt) | Sampled Discard (mt) | Total Bycatch (mt) |
|---|---|---|---|
| Jan | 0.01 | 3.77 | 3.77 |
| Feb | 0.01 | 5.59 | 5.60 |
| Mar | 0.05 | 12.72 | 12.76 |
| Apr | 0.11 | 6.05 | 6.16 |
| May | 0.05 | 4.21 | 4.27 |
| Jun | 0.07 | 6.38 | 6.45 |
| Jul | 0.03 | 6.25 | 6.28 |
| Aug | 0.04 | 5.43 | 5.46 |
| Sep | 0.03 | 5.70 | 5.73 |
| Oct | 0.41 | 3.17 | 3.59 |
| Nov | 0.44 | 2.41 | 2.85 |
| Dec | 0.00 | 3.27 | 3.27 |

**Table 10.** Pacific halibut length frequencies in the U.S. west coast groundfish IFQ fishery (2011-2013) by gear type. (a) Actual measurement of P. halibut lengths (cm). (b) Visual estimates of P. halibut lengths (cm). Note that there were no actual measurements from vessels fishing with hook-&-line gear. The lower limits on the length intervals are inclusive, while the upper limits are exclusive.

**IFQ Fishery 2011-2013**

a. Physical measurements

| | No. of fish caught | |
|---|---|---|
| **Length bin (cm)** | Bottom Trawl | Pot |
| 17-22 | 1 | 0 |
| 22-27 | 1 | 0 |
| 27-32 | 3 | 0 |
| 32-37 | 9 | 0 |
| 37-42 | 15 | 0 |
| 42-47 | 22 | 1 |
| 47-52 | 52 | 1 |
| 52-57 | 121 | 4 |
| 57-62 | 573 | 10 |
| 62-67 | 1894 | 16 |
| 67-72 | 2999 | 39 |
| 72-77 | 3958 | 84 |
| 77-82 | 3429 | 104 |
| 82-87 | 3075 | 137 |
| 87-92 | 2335 | 95 |
| 92-97 | 1776 | 55 |
| 97-102 | 1142 | 32 |
| 102-107 | 797 | 18 |
| 107-112 | 528 | 14 |
| 112-117 | 337 | 8 |
| 117-122 | 173 | 5 |
| 122-127 | 102 | 3 |
| 127-132 | 44 | 2 |
| 132-137 | 24 | 2 |
| 137-142 | 9 | 1 |
| 142-147 | 11 | 0 |
| 147-152 | 3 | 0 |
| 152-157 | 1 | 0 |
| 157-162 | 0 | 1 |
| 162-167 | 0 | 1 |
| 167-172 | 0 | 1 |
| 172-177 | 0 | 0 |
| 177-182 | 0 | 0 |
| 182-187 | 0 | 0 |
| 187-192 | 0 | 0 |
| 192-197 | 0 | 0 |
| 197-202 | 0 | 1 |

b. Visual estimates

| | No. of fish caught with | | |
|---|---|---|---|
| **Length bin (cm)** | Bottom Trawl | Pot | Hook and Line |
| 30 | 0 | 1 | 20 |
| 40 | 2 | 2 | 109 |
| 50 | 3 | 1 | 231 |
| 60 | 6 | 2 | 422 |
| 70 | 26 | 4 | 550 |
| 80 | 10 | 13 | 424 |
| 90 | 15 | 7 | 325 |
| 100 | 11 | 7 | 199 |
| 110 | 4 | 1 | 142 |
| 120 | 7 | 2 | 83 |
| 130 | 2 | 1 | 29 |
| 140 | 3 | 0 | 12 |
| 150 | 2 | 0 | 1 |
| 160 | 0 | 0 | 1 |
| 170 | 0 | 0 | 2 |
| 180 | 0 | 0 | 1 |

**Table 11.** Number of observed trips, sets, and vessels by year in the non-IFQ fixed gear fisheries, which includes limited-entry (LE) sablefish endorsed, LE sablefish non-endorsed, and open-access (OA) fixed gear sectors.

| | LE Sablefish Endorsed | | | LE Sablefish Non-Endorsed | OA Fixed Gear | | LE Sablefish Endorsed | | | LE Sablefish Non-Endorsed | OA Fixed Gear | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Longline | | | | | | Longline | | | | | |
| Year | North of Pt Chehalis | South of Pt Chehalis | Pot | Longline | Hook-and-line Gears | Pot | North of Pt Chehalis | South of Pt Chehalis | Pot | Longline | Hook-and-line Gears | Pot |
| | **Number of observed vessels** | | | | | | **Number of observed trips** | | | | | |
| 2002 | 9 | 18 | 6 | 4 | 0 | 0 | 23 | 47 | 23 | 11 | 0 | 0 |
| 2003 | 8 | 8 | 6 | 17 | 13 | 7 | 25 | 25 | 35 | 130 | 41 | 16 |
| 2004 | 6 | 13 | 3 | 14 | 14 | 17 | 13 | 35 | 13 | 62 | 42 | 96 |
| 2005 | 10 | 18 | 7 | 11 | 10 | 14 | 31 | 73 | 39 | 35 | 34 | 43 |
| 2006 | 9 | 10 | 7 | 21 | 7 | 15 | 31 | 34 | 39 | 121 | 10 | 38 |
| 2007 | 9 | 14 | 4 | 36 | 25 | 20 | 36 | 40 | 30 | 158 | 50 | 45 |
| 2008 | 6 | 13 | 6 | 32 | 33 | 20 | 17 | 60 | 24 | 122 | 58 | 55 |
| 2009 | 4 | 6 | 3 | 34 | 33 | 18 | 13 | 34 | 27 | 138 | 68 | 30 |
| 2010 | 5 | 20 | 7 | 38 | 37 | 26 | 18 | 127 | 43 | 226 | 69 | 40 |
| 2011 | 7 | 20 | 3 | 38 | 40 | 28 | 18 | 84 | 22 | 201 | 68 | 60 |
| 2012 | 5 | 16 | 5 | 26 | 24 | 19 | 7 | 86 | 19 | 128 | 34 | 35 |
| 2013 | 6 | 14 | 3 | 22 | 14 | 17 | 12 | 48 | 14 | 124 | 23 | 25 |
| | **Number of observed sets** | | | | | | | | | | | |
| 2002 | 207 | 181 | 247 | 22 | 0 | 0 | | | | | | |
| 2003 | 191 | 158 | 362 | 219 | 49 | 50 | | | | | | |
| 2004 | 115 | 205 | 139 | 130 | 50 | 185 | | | | | | |
| 2005 | 388 | 275 | 491 | 60 | 37 | 50 | | | | | | |
| 2006 | 291 | 159 | 288 | 196 | 11 | 39 | | | | | | |
| 2007 | 381 | 136 | 154 | 303 | 66 | 72 | | | | | | |
| 2008 | 194 | 345 | 329 | 220 | 68 | 74 | | | | | | |
| 2009 | 178 | 109 | 67 | 271 | 101 | 45 | | | | | | |
| 2010 | 251 | 505 | 314 | 470 | 104 | 69 | | | | | | |
| 2011 | 284 | 389 | 227 | 426 | 100 | 84 | | | | | | |
| 2012 | 47 | 485 | 351 | 252 | 53 | 70 | | | | | | |
| 2013 | 135 | 216 | 49 | 248 | 30 | 48 | | | | | | |

**Table 12.** Expansion factors and WCGOP observed discard rate by gear type for limited entry (LE) and open access (OA) non-nearshore fixed gear sectors used to expand discard estimates of Pacific halibut to the fleet-wide level.

| Fishery | | Expansion Factor | Observed Discard Rate Applied | |
|---|---|---|---|---|
| LE Sablefish Endorsed | Longline<br>Pot | Retained Sablefish | LE Sablefish Endorsed | Longline<br>Pot |
| LE Sablefish Non-Endorsed | Longline<br>Pot | Retained Groundfish<br>Retained Sablefish | LE Sablefish Non-Endorsed<br>OA Fixed Gear -- | Longline<br>Pot |
| OA Fixed Gear | Hook-and-line<br>Pot | Retained Groundfish | OA Fixed Gear -- | Hook-and-line<br>Pot |

-- No discard ratio or discard estimate was computed in the OA fixed gear sector for 2002-2006 because the WCGOP only covered OA vessels in California during this time.

**Table 13.** Total sablefish and groundfish landings (mt) and observed discard ratios for each sector and gear type in the non-nearshore fixed gear fishery. Sablefish landings were used as the discard ratio denominator and expansion factor in all cases except for the limited-entry (LE) sablefish non-primary and the OA fixed gear sectors, where target species include a variety of groundfish species.

| | LE Sablefish Endorsed | | | LE Sablefish Non-Endorsed | | OA Fixed Gear | |
|---|---|---|---|---|---|---|---|
| | Longline | | | | | | |
| | North of Pt Chehalis | South of Pt Chehalis | Pot | Longline | Pot | Hook-and-Line Gears | Pot |
| **Expansion factor Total fleet landings** | *Sablefish landings (mt)* | | | *Groundfish landings* | *Sablefish landings* | *Groundfish landings (mt)* | |
| 2002 | 384 | 407 | 352 | 625 | 7 | 388 | 109 |
| 2003 | 458 | 571 | 604 | 546 | 7 | 548 | 186 |
| 2004 | 653 | 653 | 620 | 400 | 11 | 474 | 186 |
| 2005 | 586 | 674 | 615 | 553 | 3 | 625 | 379 |
| 2006 | 660 | 709 | 582 | 468 | 30 | 495 | 443 |
| 2007 | 467 | 605 | 428 | 515 | 2 | 272 | 258 |
| 2008 | 394 | 695 | 433 | 642 | 3 | 428 | 241 |
| 2009 | 435 | 1006 | 489 | 810 | 7 | 668 | 373 |
| 2010 | 259 | 1031 | 509 | 1016 | 17 | 774 | 326 |
| 2011 | 223 | 924 | 372 | 1242 | 24 | 446 | 256 |
| 2012 | 200 | 855 | 297 | 807 | 9 | 334 | 126 |
| 2013 | 208 | 528 | 283 | 814 | 15 | 170 | 154 |
| **Observed Pacific halibut discard ratios** | | | | | | | |
| 2002 | 0.3297 | 0.0283 | 0.0114 | - | - | - | - |
| 2003 | 0.3532 | 0.0467 | 0.0005 | 0.0003 | - | - | - |
| 2004 | 0.2369 | 0.0746 | 0.0526 | - | - | - | - |
| 2005 | 0.3318 | 0.0204 | 0.0043 | - | - | - | - |
| 2006 | 0.7827 | 0.1636 | 0.0271 | - | - | - | - |
| 2007 | 0.2184 | 0.0333 | 0.0092 | 0.0033 | - | 0.0785 | 0.0035 |
| 2008 | 0.3715 | 0.1523 | 0.0153 | 0.0046 | - | 0.0986 | 0.0009 |
| 2009 | 0.6436 | 0.0413 | 0.0017 | 0.0003 | - | 0.0545 | 0.0007 |
| 2010 | 0.2642 | 0.0637 | 0.0105 | 0.0004 | - | 0.0424 | 0.0016 |
| 2011 | 0.4780 | 0.0281 | 0.0110 | 0.0172 | - | 0.0305 | 0.0003 |
| 2012 | 0.4534 | 0.0628 | 0.0209 | 0.0199 | - | 0.0731 | 0.0032 |
| 2013 | 0.0871 | 0.0064 | 0.0000 | 0.0000 | - | 0.0089 | 0.0008 |

- No discard ratio is provided for the OA fixed gear sector for 2002-2006 because the WCGOP only covered OA vessels in California during this time.
Because OA pot discard rates were used to estimate LE non-endorsed discard, discard ratios for this sector-gear were excluded.

**Table 14.** Percent of observed trips that caught Pacific halibut by sector, gear, and area (where applicable). Observed average, minimum and maximum annual catch and annual discard weights are also provided, along with the percent of P. halibut catch weight that was discard by year.

| | LE Sablefish Endorsed | | | LE Sablefish Non-Endorsed | | OA Fixed Gear | |
|---|---|---|---|---|---|---|---|
| | Longline | | | | | | |
| | North of Pt Chehalis | South of Pt Chehalis | Pot | Longline | Pot | Hook-and-Line Gears | Pot |
| **% of observed trips that caught Pacific halibut** | | | | | | | |
| 2002 | 95.7% | 46.8% | 17.4% | 0% | -- | 0% | 0% |
| 2003 | 100% | 52.0% | 8.6% | 0.8% | -- | 0% | 0% |
| 2004 | 100% | 71.4% | 38.5% | 0% | -- | 0% | 0% |
| 2005 | 96.8% | 58.9% | 33.3% | 0% | -- | 0% | 0% |
| 2006 | 100% | 76.5% | 56.4% | 0% | -- | 10.0% | 0% |
| 2007 | 94.4% | 47.5% | 33.3% | 1.9% | -- | 26.0% | 6.7% |
| 2008 | 100% | 78.3% | 83.3% | 3.3% | -- | 34.5% | 5.5% |
| 2009 | 84.6% | 35.3% | 33.3% | 0.7% | -- | 38.2% | 10.0% |
| 2010 | 83.3% | 47.2% | 51.2% | 1.3% | -- | 21.7% | 2.5% |
| 2011 | 88.9% | 42.9% | 45.5% | 6.0% | -- | 30.9% | 6.7% |
| 2012 | 71.4% | 58.1% | 31.6% | 7.0% | -- | 32.4% | 8.6% |
| 2013 | 83.3% | 27.1% | 21.4% | 0.0% | -- | 13.0% | 4.0% |
| **Observed annual catch (mt) of Pacific halibut** | | | | | | | |
| Mean | 39.9 | 10.9 | 2.0 | 0.3 | -- | 0.8 | 0.0 |
| Min | 8.0 | 0.7 | 0.1 | 0.0 | -- | 0.0 | 0.0 |
| Max | 118.4 | 36.6 | 5.4 | 1.4 | -- | 1.6 | 0.0 |
| **Observed annual discard (mt) of Pacific halibut** | | | | | | | |
| Mean | 34.6 | 10.8 | 2.0 | 0.3 | -- | 0.8 | 0.0 |
| Min | 5.5 | 0.7 | 0.1 | 0.0 | -- | 0.0 | 0.0 |
| Max | 109.6 | 36.6 | 5.4 | 1.4 | -- | 1.6 | 0.0 |
| **% of Pacific halibut catch that was discarded** | | | | | | | |
| 2002 | 77.6% | 95.5% | 100% | n.o.c. | -- | n.o.c. | n.o.c. |
| 2003 | 80.1% | 99.4% | 100% | 100% | -- | n.o.c. | n.o.c. |
| 2004 | 76.3% | 97.3% | 100% | n.o.c. | -- | n.o.c. | n.o.c. |
| 2005 | 82.7% | 100.0% | 100% | n.o.c. | -- | n.o.c. | n.o.c. |
| 2006 | 92.6% | 97.5% | 100% | n.o.c. | -- | 100% | n.o.c. |
| 2007 | 78.0% | 100% | 100% | 100% | -- | 100% | 100% |
| 2008 | 87.4% | 100% | 100% | 100% | -- | 100% | 100% |
| 2009 | 100% | 100% | 100% | 100% | -- | 100% | 100% |
| 2010 | 100% | 100% | 100% | 100% | -- | 100% | 100% |
| 2011 | 100% | 100% | 100% | 100% | -- | 100% | 100% |
| 2012 | 96.6% | 100% | 100% | 100% | -- | 100% | 100% |
| 2013 | 69.0% | 100% | 0% | 0% | -- | 100% | 100% |

n.o.c. No observed catch of Pacific halibut and thus a % discarded calculation is not possible.

-- No WCGOP observers were deployed for the sector/year/gear type combination.

**Table 15.** Estimated gross discard (mt) and discard mortality (mt) in the limited entry (LE) sablefish endorsed, LE sablefish non-endorsed, and open access (OA) fixed gear sectors**.** Estimated discard mortality (mt) was computed by applying a 16% (longline) or 18% (pot) discard mortality rate to gross discard estimates. Discard estimates were not initially computed for the 2002 - 2006 OA fixed gear sector because the WCGOP only observed OA fixed gear vessels off of California during that time. To estimate values for these years, a combined discard rate from 2007 and 2008 (when there was coastwide observation) was subsequently applied. The results of assuming the 2007-2008 discard rate are shown in brackets.

| | LE Sablefish Endorsed (mt) | | | | LE Sablefish Non-Endorsed (mt) | | OA Fixed Gear (mt) | |
|---|---|---|---|---|---|---|---|---|
| | Longline | | | Pot | Longline | Pot | Hook-and-Line | Pot |
| | North of Pt Chehalis | South of Pt Chehalis | Coastwide | Coastwide | Coastwide | Coastwide | Coastwide | Coastwide |
| Year | Gross discard estimate | Gross discard estimate | Gross discard estimate | Gross discard estimate | Gross discard estimate | Gross discard estimate ‡ | Gross discard estimate ‡ | Gross discard estimate ‡ |
| 2002 | 126.63 | 11.50 | 138.13 | 4.03 | 0.00 | ‡ [0.0] | ‡ [35.2] | ‡ [0.2] |
| 2003 | 161.70 | 26.66 | 188.36 | 0.30 | 0.17 | ‡ [0.0] | ‡ [49.8] | ‡ [0.4] |
| 2004 | 154.74 | 48.68 | 203.42 | 32.60 | 0.00 | ‡ [0.0] | ‡ [43.1] | ‡ [0.4] |
| 2005 | 194.36 | 13.76 | 208.12 | 2.62 | 0.00 | ‡ [0.0] | ‡ [56.7] | ‡ [0.8] |
| 2006 | 516.79 | 115.97 | 632.76 | 15.79 | 0.00 | ‡ [0.1] | ‡ [44.9] | ‡ [0.9] |
| 2007 | 102.01 | 20.15 | 122.16 | 3.94 | 1.72 | 0.01 | 21.36 | 0.89 |
| 2008 | 146.34 | 105.80 | 252.14 | 6.62 | 2.94 | 0.00 | 42.20 | 0.23 |
| 2009 | 280.20 | 41.57 | 321.77 | 0.85 | 0.26 | 0.01 | 36.37 | 0.27 |
| 2010 | 68.54 | 65.71 | 134.25 | 5.34 | 0.37 | 0.03 | 32.82 | 0.51 |
| 2011 | 106.72 | 25.95 | 132.67 | 4.08 | 21.35 | 0.01 | 13.58 | 0.06 |
| 2012 | 90.74 | 53.72 | 144.46 | 6.22 | 16.00 | 0.03 | 24.42 | 0.41 |
| 2013 | 18.12 | 3.36 | 21.48 | 0.00 | 0.00 | 0.01 | 1.51 | 0.12 |
| Year | Estimated discard mortality (16%) | Estimated discard mortality (16%) | Estimated discard mortality (16%) | Estimated discard mortality (18%) | Estimated discard mortality (16%) | Estimated discard mortality (18%) | Estimated discard mortality (16%) | Estimated discard mortality (18%) |
| 2002 | 20.26 | 1.84 | 22.10 | 0.73 | 0.00 | -- ‡ | -- ‡ | -- ‡ |
| 2003 | 25.87 | 4.27 | 30.14 | 0.05 | 0.03 | -- ‡ | -- ‡ | -- ‡ |
| 2004 | 24.76 | 7.79 | 32.55 | 5.87 | 0.00 | -- ‡ | -- ‡ | -- ‡ |
| 2005 | 31.10 | 2.20 | 33.30 | 0.47 | 0.00 | -- ‡ | -- ‡ | -- ‡ |
| 2006 | 82.69 | 18.56 | 101.24 | 2.84 | 0.00 | -- ‡ | -- ‡ | -- ‡ |
| 2007 | 16.32 | 3.22 | 19.55 | 0.71 | 0.28 | 0.00 | 3.42 | 0.16 |
| 2008 | 23.41 | 16.93 | 40.34 | 1.19 | 0.47 | 0.00 | 6.75 | 0.04 |
| 2009 | 44.83 | 6.65 | 51.48 | 0.15 | 0.04 | 0.00 | 5.82 | 0.05 |
| 2010 | 10.97 | 10.51 | 21.48 | 0.96 | 0.06 | 0.00 | 5.25 | 0.09 |
| 2011 | 17.08 | 4.15 | 21.23 | 0.73 | 3.42 | 0.00 | 2.17 | 0.01 |
| 2012 | 14.52 | 8.60 | 23.11 | 1.12 | 2.56 | 0.00 | 3.91 | 0.07 |
| 2013 | 2.90 | 0.54 | 3.44 | 0.00 | 0.00 | 0.00 | 0.24 | 0.02 |

‡ The LE sablefish non-endorsed pot sector has not been observed by the WCGOP and therefore estimates are based on discard rates from observed OA fixed gear pot vessels.

**Table 16.** Estimated discard mortality (mt) from each sector of the non-nearshore fixed gear fishery, by year.

| | Estimated discard mortality (mt) | | | |
|---|---|---|---|---|
| | LE Sablefish Endorsed | LE Sablefish Non-Endorsed | OA Fixed Gear | All Sectors |
| 2002 | 22.83 | 0.00 | 0.00 | 22.83 |
| 2003 | 30.19 | 0.03 | 0.00 | 30.22 |
| 2004 | 38.42 | 0.00 | 0.00 | 38.42 |
| 2005 | 33.77 | 0.00 | 0.00 | 33.77 |
| 2006 | 104.08 | 0.00 | 0.00 | 104.08 |
| 2007 | 20.25 | 0.28 | 3.58 | 24.11 |
| 2008 | 41.53 | 0.47 | 6.79 | 48.80 |
| 2009 | 51.64 | 0.04 | 5.87 | 57.55 |
| 2010 | 22.44 | 0.06 | 5.34 | 27.85 |
| 2011 | 21.96 | 3.42 | 2.19 | 27.56 |
| 2012 | 24.23 | 2.57 | 3.98 | 30.78 |
| 2013 | 3.44 | 0.00 | 0.26 | 3.70 |

**Table 17.** Pacific halibut length frequencies collected by WCGOP observers in the LE sablefish endorsed, LE sablefish non-endorsed, and OA fixed gear fisheries, including both pot and longline gears (2002-to present). (a) Physical measures of P. halibut lengths (cm). (b) Visual estimates of P. halibut lengths (cm). Note that observers were only required to collect physical measurements from LE sablefish endorsed vessels starting in 2011. The lower limits on the length intervals are inclusive, while the upper limits are exclusive.

**Fixed Gear Sectors 2002-2013**

a. Physical measurements

| Length bin (cm) | No. of fish caught with: Hook and Line | No. of fish caught with: Pot |
|---|---|---|
| **LE Endorsed** | | |
| 42-47 | 2 | 0 |
| 47-52 | 7 | 0 |
| 52-57 | 11 | 0 |
| 57-62 | 25 | 5 |
| 62-67 | 65 | 10 |
| 67-72 | 159 | 33 |
| 72-77 | 287 | 87 |
| 77-82 | 305 | 86 |
| 82-87 | 246 | 82 |
| 87-92 | 212 | 51 |
| 92-97 | 189 | 36 |
| 97-102 | 123 | 15 |
| 102-107 | 74 | 7 |
| 107-112 | 44 | 3 |
| 112-117 | 32 | 2 |
| 117-122 | 18 | 1 |
| 122-127 | 10 | 5 |
| 127-132 | 1 | 1 |
| 132-137 | 3 | 0 |
| 137-142 | 1 | 0 |
| 142-147 | 0 | 1 |
| **LE Non-endorsed** | | |
| 67-72 | 4 | 0 |
| 72-77 | 10 | 0 |
| 77-82 | 11 | 0 |
| 82-87 | 7 | 0 |
| 87-92 | 14 | 0 |
| 92-97 | 8 | 0 |
| 97-102 | 3 | 0 |
| 102-107 | 4 | 0 |
| 107-112 | 3 | 0 |
| 112-117 | 3 | 0 |
| 117-122 | 2 | 0 |
| 122-127 | 1 | 0 |
| 132-137 | 1 | 0 |
| **OA Fixed Gear** | | |
| 42-47 | 2 | 0 |
| 47-52 | 1 | 0 |
| 52-57 | 1 | 0 |
| 57-62 | 2 | 0 |
| 62-67 | 8 | 1 |
| 67-72 | 6 | 2 |
| 72-77 | 17 | 2 |
| 77-82 | 16 | 1 |
| 82-87 | 20 | 1 |
| 87-92 | 16 | 2 |
| 92-97 | 9 | 0 |
| 97-102 | 7 | 0 |
| 102-107 | 4 | 0 |
| 107-112 | 6 | 1 |
| 112-117 | 1 | 0 |
| 117-122 | 1 | 0 |
| 122-127 | 1 | 0 |

b. Visual estimates

| Length bin (cm) | No. of fish caught with: Hook and Line | No. of fish caught with: Pot |
|---|---|---|
| **LE Endorsed** | | |
| 20 | 0 | 0 |
| 30 | 21 | 0 |
| 40 | 56 | 1 |
| 50 | 308 | 5 |
| 60 | 2997 | 43 |
| 70 | 5069 | 104 |
| 80 | 5436 | 76 |
| 90 | 4324 | 71 |
| 100 | 2357 | 35 |
| 110 | 834 | 16 |
| 120 | 342 | 9 |
| 130 | 104 | 2 |
| 140 | 21 | 3 |
| 150 | 5 | 0 |
| 160 | 1 | 0 |
| 170 | 0 | 0 |
| **LE Non-endorsed** | | |
| 50 | 2 | 0 |
| 60 | 11 | 0 |
| 70 | 29 | 0 |
| 80 | 36 | 0 |
| 90 | 22 | 0 |
| 100 | 14 | 0 |
| 110 | 8 | 0 |
| 120 | 9 | 0 |
| 130 | 4 | 0 |
| **OA Fixed Gear** | | |
| 40 | 2 | 0 |
| 50 | 3 | 0 |
| 60 | 13 | 0 |
| 70 | 25 | 1 |
| 80 | 48 | 0 |
| 90 | 28 | 0 |
| 100 | 14 | 0 |
| 110 | 5 | 0 |
| 120 | 1 | 0 |
| 130 | 1 | 0 |

**Table 18.** Pacific halibut physically measured lengths and visual estimates of lengths approximating legal (> 82 cm) versus sublegal definitions (IPHC), collected by the WCGOP in the LE sablefish endorsed, LE non-endorsed, and OA fixed gear sectors (2002-present).

| | Pacific halibut lengths | |
|---|---|---|
| | Number | Percentage |
| **Actual length** | | |
| < 82 cm | 1166 | 48% |
| ≥ 82 cm | 1272 | 52% |
| **Visual estimate** | | |
| 0 - 74 cm | 10311 | 40% |
| 75 - 84 cm | 6290 | 24% |
| 85 - 150 cm | 9329 | 36% |

**Table 19.** Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the nearshore fixed gear groundfish fisheries by state and year. The WCGOP began observing the California nearshore fishery in 2003 and the Oregon nearshore fishery in 2004. Bycatch estimates in this table are not intended to represent mortality values, as discard mortality rates are not available for the nearshore fixed gear fishery.

**Nearshore fixed gear groundfish fishery sector**

| State | Observed | | | | | | | Total fleet catch of nearshore species (mt) | Estimated | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Fleet observer coverage rate ** | Number of observed sets | % of sets with Pacific halibut | Pacific halibut bycatch (mt) | Nearshore species retained (mt) | Pacific halibut bycatch rate | SE | | Pacific halibut bycatch (mt) | Lower bound (mt) | Upper bound (mt) |
| **Oregon** | | | | | | | | | | | |
| 2002 | *not observed* | -- | -- | -- | -- | -- | -- | 279 | -- | -- | -- |
| 2003 | *not observed* | -- | -- | -- | -- | -- | -- | 208 | -- | -- | -- |
| 2004 | 4.9% | 207 | 1.9% | 0.05 | 10 | 0.00 | 0.00 | 210 | 1.005 | 0.002 | 2.121 |
| 2005 | 6.3% | 167 | 0.6% | 0.03 | 11 | 0.00 | 0.00 | 181 | 0.514 | 0.002 | 1.521 |
| 2006 | 11.6% | 379 | 1.3% | 0.06 | 19 | 0.00 | 0.00 | 168 | 0.543 | 0.005 | 1.081 |
| 2007 | 8.9% | 242 | 0.4% | 0.01 | 16 | 0.00 | 0.00 | 182 | 0.087 | 0.002 | 0.259 |
| 2008 | 7.6% | 183 | 0.5% | 0.03 | 14 | 0.00 | 0.00 | 189 | 0.360 | 0.002 | 1.067 |
| 2009 | 6.2% | 219 | 2.3% | 0.08 | 14 | 0.01 | 0.00 | 224 | 1.298 | 0.060 | 2.536 |
| 2010 | 7.7% | 210 | 0.5% | 0.01 | 13 | 0.00 | 0.00 | 173 | 0.080 | 0.002 | 0.236 |
| 2011 | 8.1% | 244 | 2.0% | 0.09 | 16 | 0.01 | 0.00 | 195 | 1.102 | 0.002 | 2.279 |
| 2012 | 10.4% | 287 | 1.4% | 0.11 | 21 | 0.01 | 0.00 | 197 | 1.080 | 0.002 | 2.368 |
| 2013 | 7.7% | 262 | 0.8% | 0.02 | 16 | 0.00 | 0.00 | 209 | 0.294 | 0.002 | 0.709 |
| **California** | | | | | | | | | | | |
| 2002 | *not observed* | -- | -- | -- | -- | -- | -- | 380 | -- | -- | -- |
| 2003 | 3.2% | 205 | 0.0% | 0.00 | 8 | 0.00 | 0.00 | 255 | 0.000 | 0.000 | 0.000 |
| 2004 | 8.0% | 422 | 0.0% | 0.00 | 23 | 0.00 | 0.00 | 288 | 0.000 | 0.000 | 0.000 |
| 2005 | 4.8% | 219 | 0.9% | 0.08 | 13 | 0.01 | 0.01 | 280 | 1.672 | 0.003 | 4.604 |
| 2006 | 3.2% | 158 | 0.0% | 0.00 | 8 | 0.00 | 0.00 | 258 | 0.000 | 0.000 | 0.000 |
| 2007 | 4.4% | 224 | 0.0% | 0.00 | 12 | 0.00 | 0.00 | 273 | 0.000 | 0.000 | 0.000 |
| 2008 | 2.2% | 87 | 0.0% | 0.00 | 7 | 0.00 | 0.00 | 294 | 0.000 | 0.000 | 0.000 |
| 2009 | 2.6% | 122 | 0.0% | 0.00 | 7 | 0.00 | 0.00 | 260 | 0.000 | 0.000 | 0.000 |
| 2010 | 3.2% | 117 | 0.0% | 0.00 | 7 | 0.00 | 0.00 | 219 | 0.000 | 0.000 | 0.000 |
| 2011 | 3.9% | 210 | 0.5% | 0.08 | 8 | 0.01 | 0.01 | 216 | 1.979 | 0.002 | 5.857 |
| 2012 | 5.9% | 239 | 1.3% | 0.07 | 12 | 0.01 | 0.00 | 201 | 1.190 | 0.002 | 2.863 |
| 2013 | 5.3% | 192 | 1.6% | 0.06 | 12 | 0.00 | 0.00 | 219 | 1.067 | 0.002 | 2.357 |

** Coverage rate in the nearshore sector is defined as the proportion of nearshore target species landings that were observed. Nearshore target species are listed in WCGOP Data Processing Appendix (NWFSCc 2013).

**Table 20.** Coverage information, bycatch rates, and bycatch estimates (mt) for Pacific halibut in the pink shrimp trawl fishery. The WCGOP began observing the pink shrimp fishery in 2004, but was not able to observe the fishery in 2006. Bycatch estimates in this table are not intended to represent morality values, as discard mortality rates are not available for the pink shrimp fishery.

**Pink shrimp trawl fishery**

| | Observed | | | | | | | Total fleet | Estimated | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Fleet observer coverage rate ** | Number of observed tows | % of tows with Pacific halibut | Pacific halibut bycatch (kg) | Pink shrimp retained (kg) | Pacific halibut bycatch rate | SE | catch of pink shrimp (mt) | Pacific halibut bycatch (mt) | Lower bound (mt) | Upper bound (mt) |
| 2002 | *not observed* | | - | - | - | - | - | 25,338 | - | - | - |
| 2003 | *not observed* | | - | - | - | - | - | 13,887 | - | - | - |
| 2004 | 6.5% | 1027 | 0.0% | 0.00 | 584 | 0.00000 | 0.00000 | 8,974 | 0.00 | 0.00 | 0.00 |
| 2005 | 3.9% | 509 | 0.2% | 0.00 | 425 | 0.00001 | 0.00001 | 10,862 | 0.06 | 0.11 | 0.17 |
| 2006 | *not observed* | | - | - | - | - | - | 8,400 | - | - | - |
| 2007 | 6.2% | 951 | 0.2% | 0.02 | 673 | 0.00002 | 0.00002 | 10,935 | 0.25 | 0.11 | 0.65 |
| 2008 | 5.2% | 840 | 0.0% | 0.00 | 806 | 0.00000 | 0.00000 | 15,375 | 0.00 | 0.00 | 0.00 |
| 2009 | 6.1% | 708 | 0.0% | 0.00 | 882 | 0.00000 | 0.00000 | 14,412 | 0.00 | 0.00 | 0.00 |
| 2010 | 11.7% | 1654 | 0.0% | 0.00 | 2,383 | 0.00000 | 0.00000 | 20,357 | 0.00 | 0.00 | 0.00 |
| 2011 | 13.9% | 2579 | 0.1% | 0.03 | 4,104 | 0.00001 | 0.00000 | 29,460 | 0.19 | 0.29 | 0.43 |
| 2012 | 13.6% | 2733 | 0.0% | 0.00 | 3,988 | 0.00000 | 0.00000 | 29,325 | 0.00 | 0.00 | 0.00 |
| 2013 | 10.5% | 1916 | 0.0% | 0.00 | 3,300 | 0.00000 | 0.00000 | 31,551 | 0.00 | 0.00 | 0.00 |

** Coverage rate in the pink shrimp trawl fishery is defined as the proportion of pink shrimp landings that were observed.

**Table 21.** Coverage information, bycatch rates, and bycatch estimates (mt) for Pacific halibut in the California halibut trawl fishery. The fishery is comprised of a limited entry component and an open access component. Beginning in 2011, the limited entry component of the California halibut fishery is observed under the IFQ groundfish fishery (see above). Bycatch estimates in this table are not intended to represent morality values, as discard mortality rates are not available for the California halibut fishery.

**California halibut trawl fishery**

| Sector | Observed | | | | | | | Total fleet | Estimated | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Fleet observer coverage rate ** | Number of observed tows | % of tows with Pacific halibut | Pacific halibut bycatch (kg) | California halibut retained (kg) | Pacific halibut bycatch rate | SE | catch of California halibut (mt) | Pacific halibut bycatch (mt) | Lower bound (mt) | Upper bound (mt) |
| **Limited Entry Sector** | | | | | | | | | | | |
| 2002 | 3.4% | 52 | 0.0% | 0.000 | 3.59 | 0.0000 | 0.0000 | 105 | 0.000 | 0.000 | 0.000 |
| 2003 | 18.1% | 206 | 0.0% | 0.000 | 19.10 | 0.0000 | 0.0000 | 106 | 0.000 | 0.000 | 0.000 |
| 2004 | 23.1% | 170 | 0.6% | 0.003 | 31.49 | 0.0001 | 0.0001 | 136 | 0.015 | 0.001 | 0.045 |
| 2005 | 16.2% | 233 | 0.4% | 0.005 | 30.51 | 0.0002 | 0.0002 | 189 | 0.029 | 0.002 | 0.086 |
| 2006 | 12.0% | 224 | 0.9% | 0.003 | 14.29 | 0.0002 | 0.0002 | 120 | 0.024 | 0.001 | 0.062 |
| 2007 | 13.9% | 80 | 1.3% | 0.008 | 5.45 | 0.0015 | 0.0015 | 39 | 0.058 | 0.000 | 0.173 |
| 2008 | 24.7% | 118 | 8.5% | 0.083 | 9.64 | 0.0086 | 0.0030 | 39 | 0.334 | 0.107 | 0.560 |
| 2009 | 6.0% | 29 | 0.0% | 0.000 | 2.90 | 0.0000 | 0.0000 | 48 | 0.000 | 0.000 | 0.000 |
| 2010 | 11.7% | 41 | 0.0% | 0.000 | 6.40 | 0.0000 | 0.0000 | 55 | 0.000 | 0.000 | 0.000 |
| 2011-present | Observed under IFQ Fishery, see Tables 4-8 | | | | | | | | | | |
| **Open Access Sector** | | | | | | | | | | | |
| 2002 | *ot observed* | | - | - | - | - | - | 36 | - | - | - |
| 2003 | 7.7% | 110 | 0.0% | 0.0 | 1.98 | 0.0000 | 0.0000 | 26 | 0.000 | 0.000 | 0.000 |
| 2004 | 7.2% | 244 | 1.6% | 0.0 | 5.10 | 0.0097 | 0.0058 | 71 | 0.686 | 0.001 | 1.494 |
| 2005 | 11.6% | 360 | 0.0% | 0.0 | 7.49 | 0.0000 | 0.0000 | 65 | 0.000 | 0.000 | 0.000 |
| 2006 | *ot observed* | | - | - | - | - | - | 55 | - | - | - |
| 2007 | 6.9% | 226 | 0.0% | 0.0 | 2.69 | 0.0000 | 0.0000 | 39 | 0.000 | 0.000 | 0.000 |
| 2008 | 5.1% | 197 | 0.0% | 0.0 | 2.61 | 0.0000 | 0.0000 | 51 | 0.000 | 0.000 | 0.000 |
| 2009 | 0.8% | 30 | 0.0% | 0.0 | 0.63 | 0.0000 | 0.0000 | 82 | 0.000 | 0.000 | 0.000 |
| 2010 | 3.4% | 111 | 0.0% | 0.0 | 2.35 | 0.0000 | 0.0000 | 69 | 0.000 | 0.000 | 0.000 |
| 2011 | 15.6% | 204 | 0.0% | 0.0 | 12.45 | 0.0000 | 0.0000 | 80 | 0.000 | 0.000 | 0.000 |
| 2012 | 6.4% | 77 | 0.0% | 0.0 | 3.54 | 0.0000 | 0.0000 | 56 | 0.000 | 0.000 | 0.000 |
| 2013 | 6.3% | 81 | 0.0% | 0.0 | 4.30 | 0.0000 | 0.0000 | 69 | 0.000 | 0.000 | 0.000 |

** Coverage rate in the California halibut trawl fishery is defined as the proportion of California halibut landings that were observed.

**Table 22.** Discard estimates for all fishery sectors observed by the NWFSC Groundfish Observer Program (WCGOP), 2002-2013. Total discard mortality estimates are also provided where discard mortality rates were applied. (* = Confidential data, less than 3 vessels observed, - = no observer coverage)

| | Year | LE bottom trawl (2002-2010) | IFQ Fishery (2011 - Present) | | | | | | Non-nearshore fixed gear | | | Nearshore fixed gear[1] | Pink shrimp[1] | CA halibut[1,5] | At-sea Hake[1] | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Shoreside Hake[1,2] | LE CA Halibut[1,3] | Bottom Trawl[2,3,4] | Midwater Trawl[1] | Hook and Line | Pot | LE endorsed | LE non-endorsed | OA | | | | | |
| Gross discard estimates (mt) | 2002 | 524.41 | | | | | | | 138.13 | 0.00 | - | - | - | - | 1.14 | 663.68 |
| | 2003 | 186.65 | | | | | | | 188.36 | 0.17 | - | 0.00 | - | 0.00 | 2.65 | 377.84 |
| | 2004 | 212.43 | | | | | | | 203.42 | 0.00 | - | 1.00 | 0.00 | 0.70 | 1.13 | 418.68 |
| | 2005 | 460.35 | | | | | | | 208.12 | 0.00 | - | 2.19 | 0.06 | 0.03 | 1.97 | 672.70 |
| | 2006 | 390.91 | | | | | | | 632.76 | 0.10 | - | 0.54 | - | - | 0.83 | 1025.15 |
| | 2007 | 294.38 | | | | | | | 122.16 | 1.73 | 22.25 | 0.09 | 0.25 | 0.06 | 1.18 | 442.08 |
| | 2008 | 305.21 | | | | | | | 252.14 | 2.94 | 42.42 | 0.36 | 0.00 | 0.33 | 3.98 | 607.38 |
| | 2009 | 385.24 | | | | | | | 321.77 | 0.26 | 36.64 | 1.30 | 0.00 | 0.00 | 0.33 | 745.54 |
| | 2010 | 265.08 | | | | | | | 134.25 | 0.40 | 33.33 | 0.08 | 0.00 | 0.00 | 1.57 | 434.71 |
| | 2011 | | 0.35 | 0.0 | 64.44 | * | 6.06 | 3.34 | 132.67 | 21.36 | 13.65 | 3.08 | 0.19 | 0.00 | 0.61 | 245.75 |
| | 2012 | | 0.62 | * | 75.27 | 0.0 | 14.66 | 1.89 | 144.46 | 16.03 | 24.83 | 2.27 | 0.00 | 0.00 | 0.64 | 280.67 |
| | 2013 | | 1.32 | | 66.13 | 0.0 | 3.00 | 0.98 | 21.48 | 0.01 | 1.63 | 1.36 | 0.00 | 0.00 | 1.06 | 96.97 |
| Total discard mortality (mt) | 2002 | 344.82 | | | | | | | 22.10 | 0.00 | - | - | - | - | 1.14 | 368.06 |
| | 2003 | 124.43 | | | | | | | 30.14 | 0.03 | - | 0.00 | - | 0.00 | 2.65 | 157.25 |
| | 2004 | 133.12 | | | | | | | 32.55 | 0.00 | - | 1.00 | 0.00 | 0.70 | 1.13 | 168.50 |
| | 2005 | 286.52 | | | | | | | 33.30 | 0.00 | - | 2.19 | 0.06 | 0.03 | 1.97 | 324.06 |
| | 2006 | 242.47 | | | | | | | 101.24 | 0.00 | - | 0.54 | - | - | 0.83 | 345.09 |
| | 2007 | 208.81 | | | | | | | 19.55 | 0.28 | 3.58 | 0.09 | 0.25 | 0.06 | 1.18 | 233.78 |
| | 2008 | 207.81 | | | | | | | 40.34 | 0.47 | 6.79 | 0.36 | 0.00 | 0.33 | 3.98 | 260.09 |
| | 2009 | 251.10 | | | | | | | 51.48 | 0.04 | 5.87 | 1.30 | 0.00 | 0.00 | 0.33 | 310.12 |
| | 2010 | 180.97 | | | | | | | 21.48 | 0.06 | 5.34 | 0.08 | 0.00 | 0.00 | 1.57 | 209.51 |
| | 2011 | | 0.35 | 0.0 | 31.44 | * | 0.97 | 0.88 | 21.23 | 3.42 | 2.19 | 3.08 | 0.19 | 0.00 | 0.61 | 64.36 |
| | 2012 | | 0.62 | * | 40.44 | 0.0 | 2.34 | 0.51 | 23.11 | 2.57 | 3.98 | 2.27 | 0.00 | 0.00 | 0.64 | 76.49 |
| | 2013 | | 1.32 | | 32.28 | 0.0 | 0.48 | 0.21 | 3.44 | 0.00 | 0.26 | 1.36 | 0.00 | 0.00 | 1.06 | 40.41 |

[1] Mortality rate of 100% applied

[2] Includes a small amout landed and discarded at the dock

[3] Starting in 2013, LE CA Halibut is reported with the Bottom Trawl IFQ

[4] Includes P. halibut caught both north and south of 40° 10′ N. latitude

[5] Since 2011, CA Halibut only includes Open Access sector because the Limited Entry sector is covered under the IFQ Fishery.

## FIGURES

**Figure 1.** Fish ticket data processing for division into 2013 groundfish fishery sectors after retrieval from the Pacific Fisheries Information Network (PacFIN) database. Grey boxes indicate sectors for which federal observer data is available. Fish ticket processing methods are updated regularly, thus this figure might differ from similar figures in previous reports.

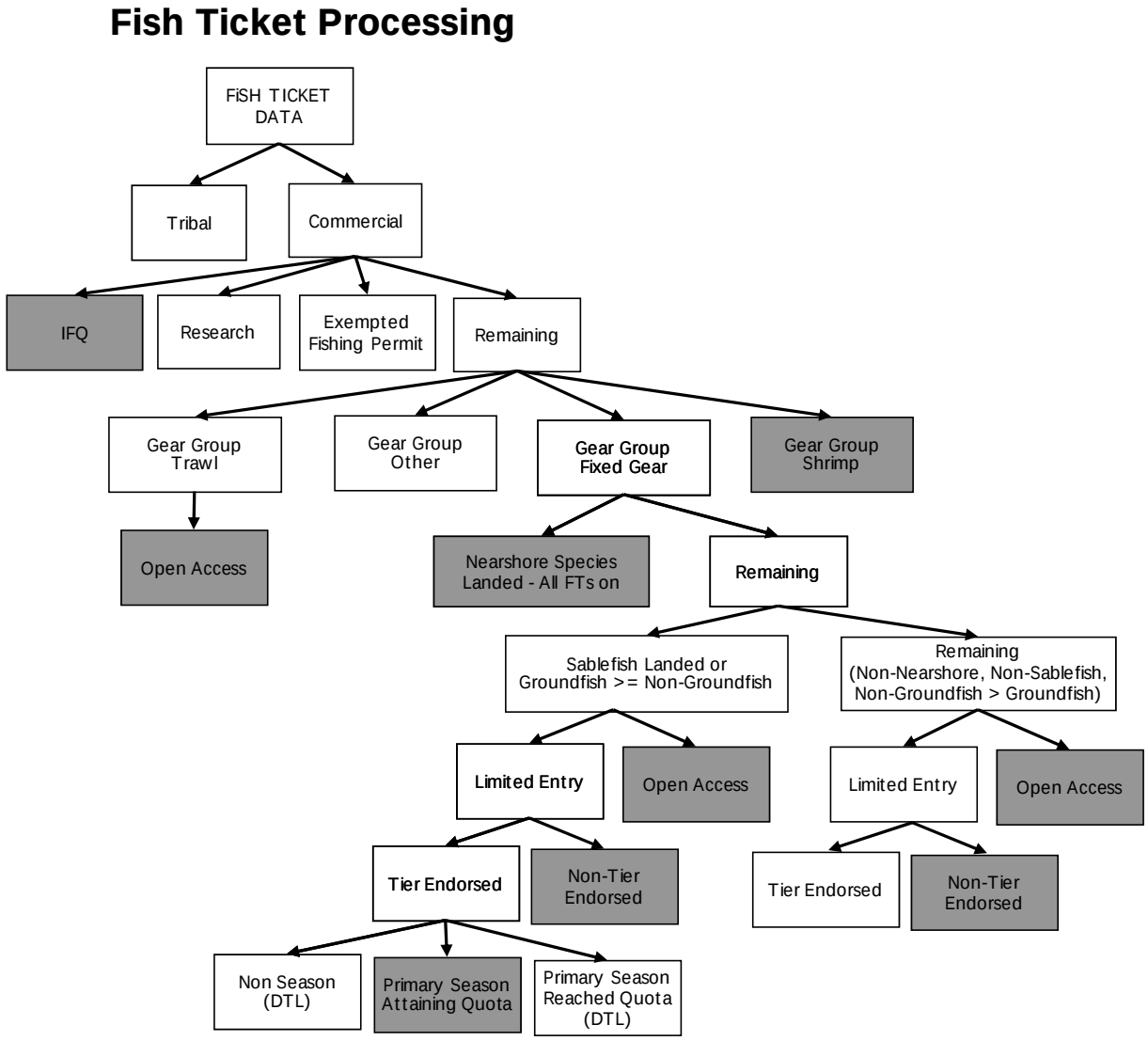


**Figure 2a.** Spatial distribution of Pacific halibut catch (mt/km$^2$) observed by the West Coast Groundfish Observer Program (2002-11), off the U.S. west coast (WA, OR). Gear types observed by the WCGOP include bottom trawl, midwater trawl, shrimp trawl, fixed gear hook-&-line and pot gear. The four catch classifications were defined by dividing the maximum value (2.0697) in half to obtain the 1.0349-2.0697 catch bin. The next lower bin was obtained by dividing the lower bound of the upper bin (1.0348) in half again to obtain the 0.51745-1.0348 catch bin. The remaining observations were allocated into equal proportions into the two lowest classifications. Cells calculated from less than 3 vessels were omitted from the map due to confidentiality.

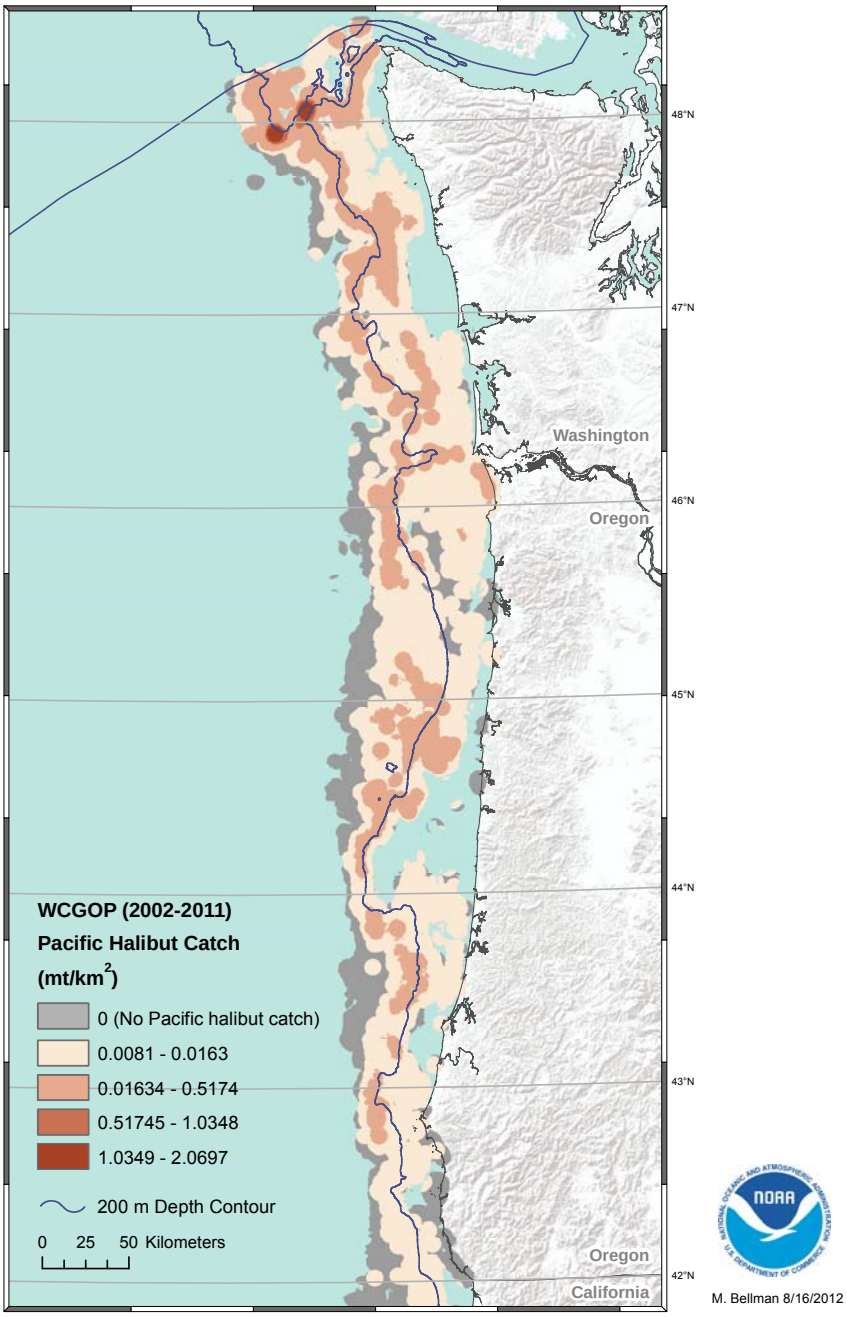


**Figure 2b.** Spatial distribution of Pacific halibut catch (mt/km$^2$) and fishing grounds observed by the West Coast Groundfish Observer Program, off the U.S. west coast (CA). See Figure 2a caption for full description.

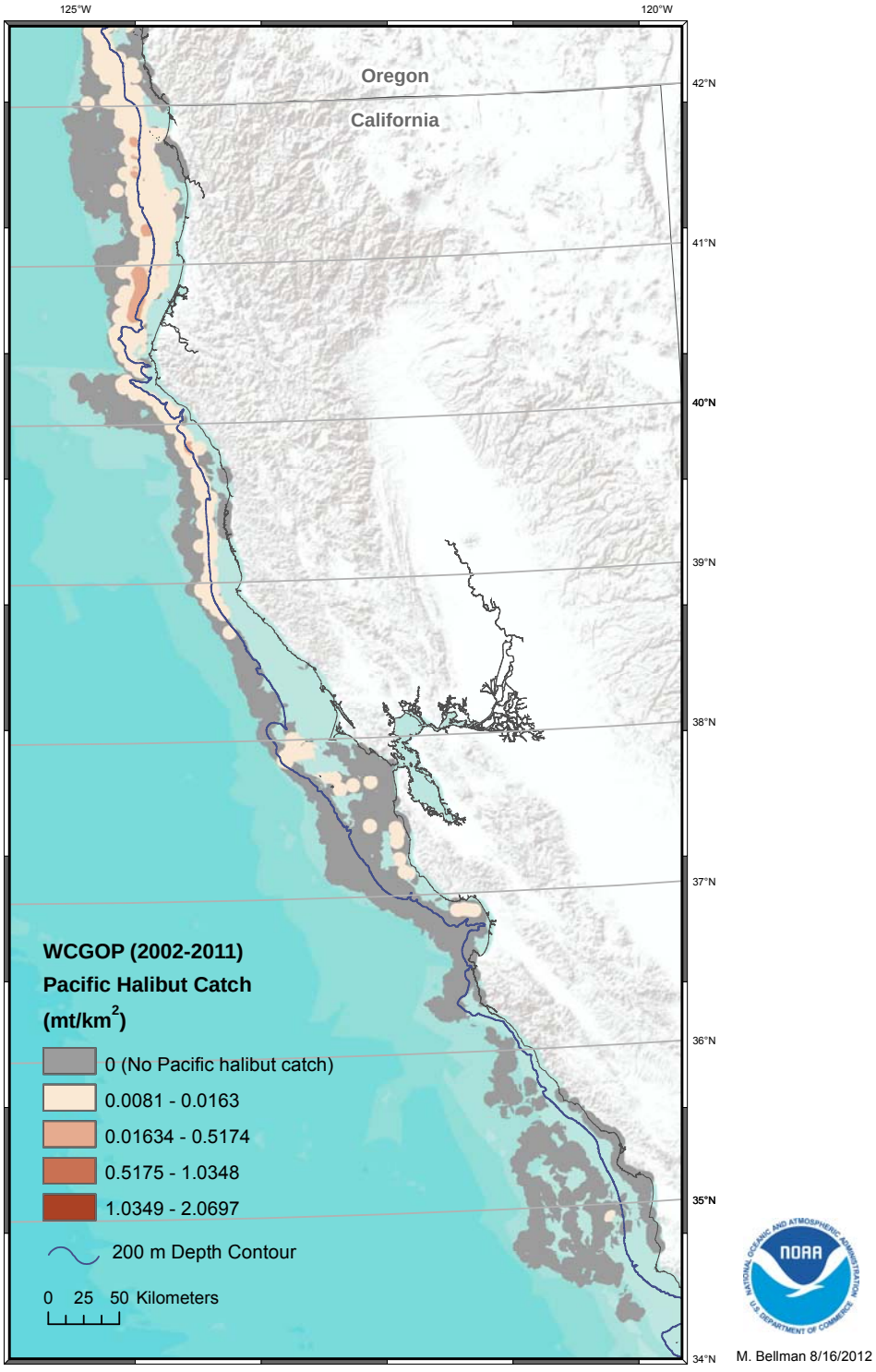


**Figure 3.** Estimated discard mortality of Pacific halibut in the non-nearshore groundfish fixed gear fishery. Estimates are presented for fixed gear sectors with annual discard estimates exceeding 1 mt, which included all components of the limited entry (LE) sablefish endorsed sector (longline gear (LL) by area and pot gear (POT) coastwide) and the open access (OA) sector using hook-&-line gears. The OA fixed gear sector was only observed in California from 2003-2006 and was not covered in 2002. A fixed average discard rate from 2007 and 2008 data was applied to generate 2002-2006 discard estimates for the OA sector. Although OA 2002-2006 discard estimates are not included in final total mortality summaries, they are shown here for comparison purposes. Other fixed gear sectors include LE sablefish non-endorsed and OA fixed gear vessels fishing with pot gear. The inset shows the 2013 estimates by sector for comparison.

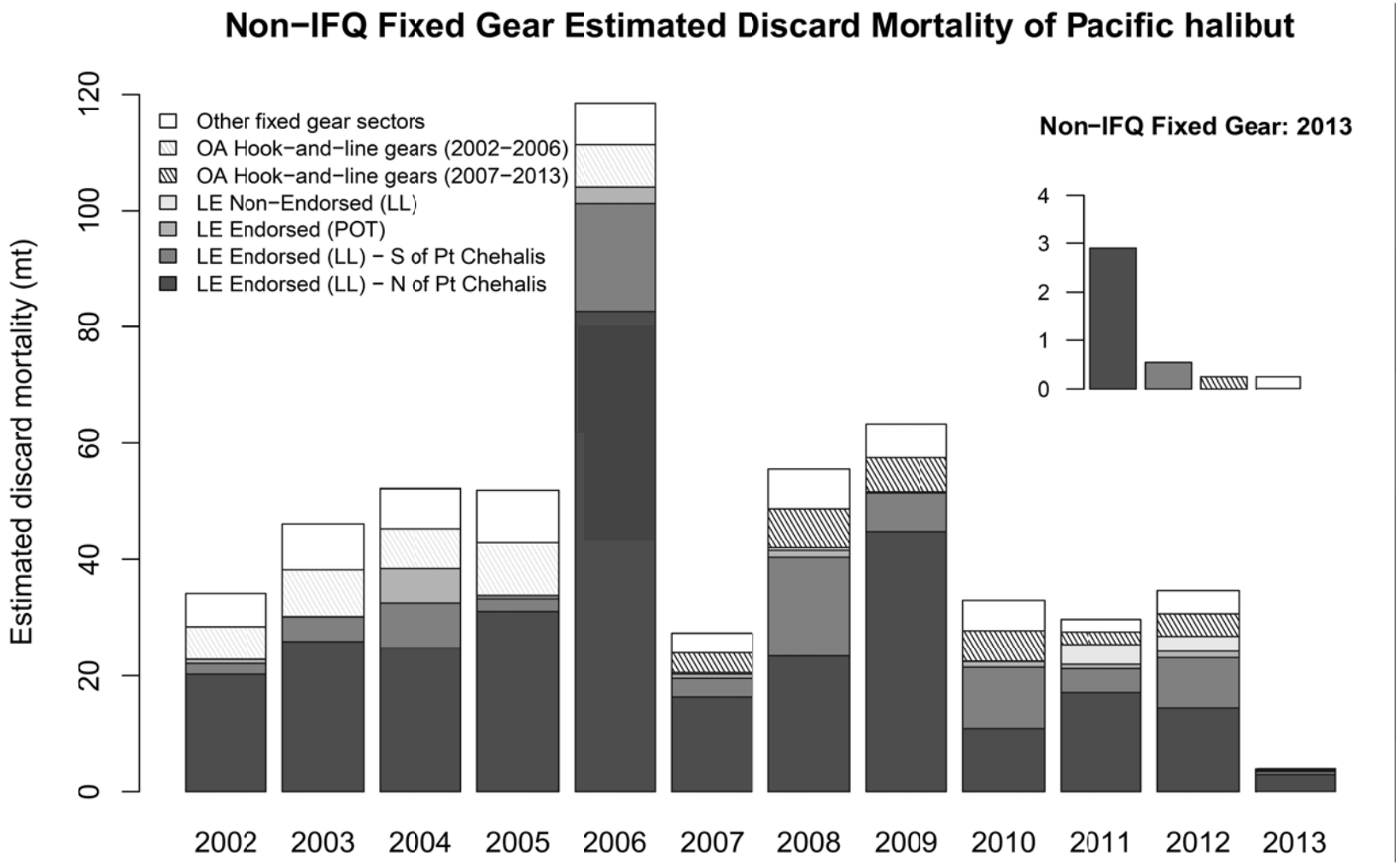


**Figure 4.** Length frequency distribution of discarded Pacific halibut on WCGOP observed Non-Nearshore Fixed Gear limited entry (LE) and open access (OA) groundfish vessels from September 2003 through December 2013. The majority of P. halibut lengths collected in this fishery were visual estimates (grey bars), which are only estimated in 10 cm bins.

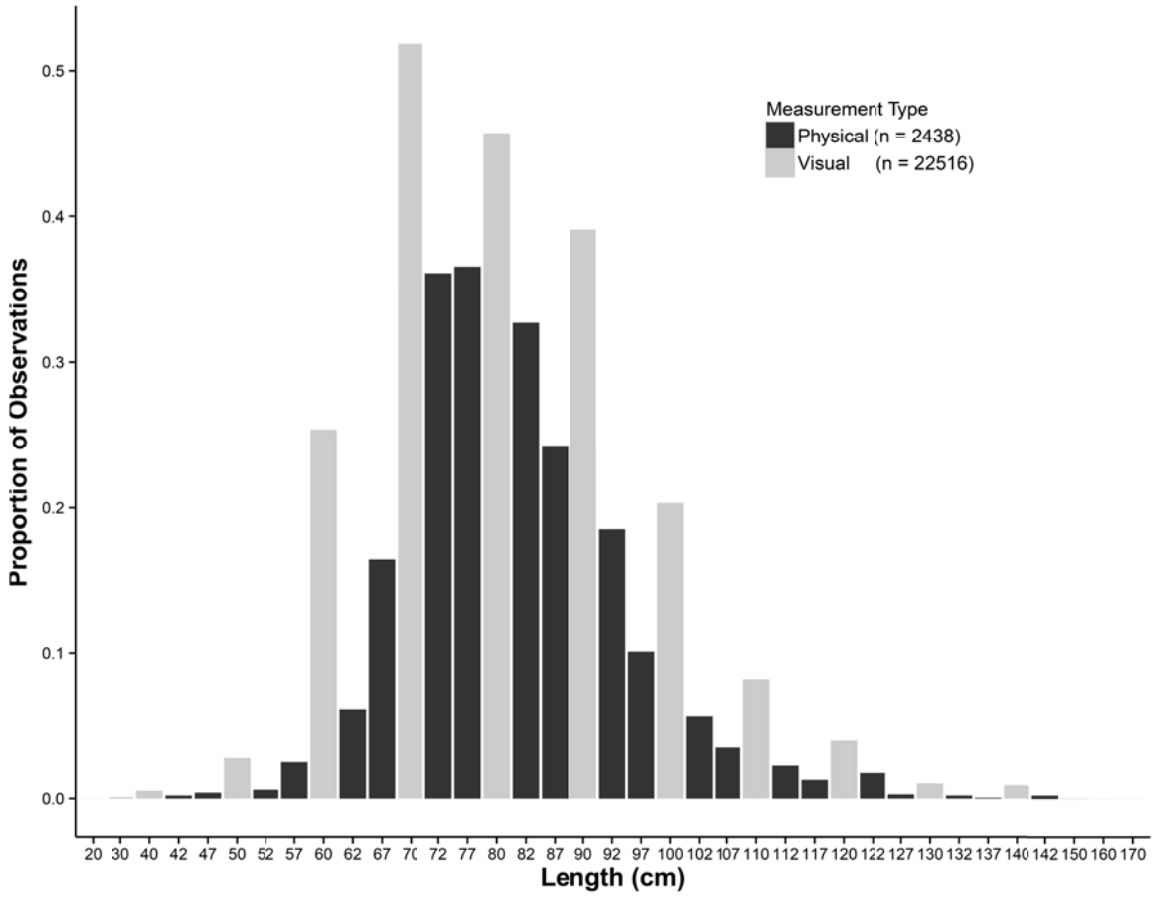
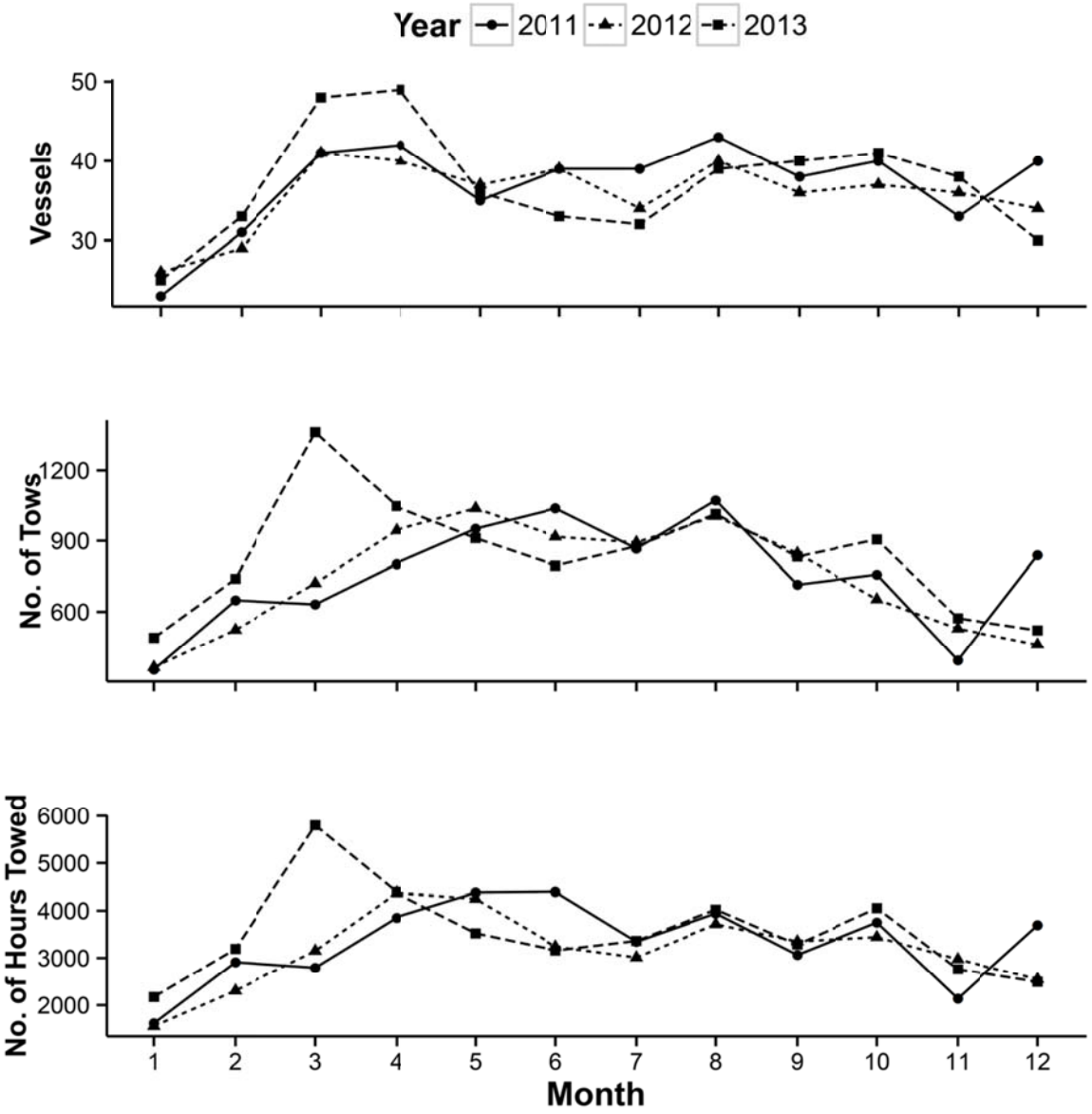


**Figure 5.** Number of vessels, tows, and tow hours for bottom trawl vessels in the IFQ fishery by month and year.



# APPENDIX A

Weighted catch composition data from the IFQ fishery for bottom trawl and pot gears. The frequency within each length bin was weighted based on the following equation:

$$n_{wghtd_l} = n_l \times \frac{W_{st}}{\sum_l w_{stl}} \times \frac{\sum_t W_{st}}{W_{st}} \times \frac{\hat{W}_s}{\sum_t W_{st}} = n_l \times \frac{\hat{W}_s}{\sum_l w_{stl}}$$

where:
$n_l$: number of measured fish in length bin $l$
$w_{stl}$: total weight of length $l$ fish measured, as determined through the IPHC length-weight relationship
$W_{st}$: total observed discard weight of Pacific halibut on tow $t$, in stratum $s$
$\hat{W}_s$: estimated total discard weight of P. halibut in stratum $s$

**Table A1.** Weighted length frequency distributions for Pacific halibut in the IFQ fishery for bottom trawl and pot gears, by year.

| Length bin (cm) | Bottom Trawl | | | Pot | | | Length bin (cm) | Bottom Trawl | | | Pot | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 102 | 0.0071 | 0.0076 | 0.0067 | 0.0025 | 0.0085 | 0.0103 |
| 2 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 104 | 0.0054 | 0.0043 | 0.0052 | 0.0024 | 0.0054 | 0.0043 |
| 4 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 106 | 0.0039 | 0.0035 | 0.0036 | 0.0000 | 0.0137 | 0.0170 |
| 6 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 108 | 0.0030 | 0.0034 | 0.0030 | 0.0035 | 0.0012 | 0.0000 |
| 8 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 110 | 0.0025 | 0.0034 | 0.0022 | 0.0014 | 0.0011 | 0.0045 |
| 10 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 112 | 0.0021 | 0.0021 | 0.0022 | 0.0013 | 0.0010 | 0.0000 |
| 12 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 114 | 0.0017 | 0.0015 | 0.0011 | 0.0028 | 0.0020 | 0.0000 |
| 14 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 116 | 0.0011 | 0.0012 | 0.0009 | 0.0005 | 0.0000 | 0.0000 |
| 16 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 118 | 0.0009 | 0.0007 | 0.0007 | 0.0011 | 0.0009 | 0.0028 |
| 18 | 0.0065 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 120 | 0.0005 | 0.0009 | 0.0004 | 0.0015 | 0.0000 | 0.0000 |
| 20 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 122 | 0.0005 | 0.0005 | 0.0005 | 0.0029 | 0.0000 | 0.0000 |
| 22 | 0.0000 | 0.0114 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 124 | 0.0006 | 0.0003 | 0.0002 | 0.0000 | 0.0000 | 0.0000 |
| 24 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 126 | 0.0003 | 0.0004 | 0.0001 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 128 | 0.0003 | 0.0000 | 0.0001 | 0.0008 | 0.0000 | 0.0000 |
| 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 130 | 0.0001 | 0.0000 | 0.0000 | 0.0004 | 0.0000 | 0.0000 |
| 30 | 0.0000 | 0.0083 | 0.0038 | 0.0000 | 0.0000 | 0.0000 | 132 | 0.0002 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 0.0000 | 0.0067 | 0.0030 | 0.0000 | 0.0000 | 0.0000 | 134 | 0.0000 | 0.0000 | 0.0001 | 0.0007 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0108 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 136 | 0.0001 | 0.0000 | 0.0000 | 0.0007 | 0.0000 | 0.0000 |
| 36 | 0.0000 | 0.0046 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 138 | 0.0000 | 0.0000 | 0.0000 | 0.0003 | 0.0000 | 0.0000 |
| 38 | 0.0000 | 0.0112 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 140 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | 0.0014 | 0.0056 | 0.0019 | 0.0000 | 0.0000 | 0.0000 | 142 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | 0.0023 | 0.0114 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 144 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 0.0000 | 0.0025 | 0.0000 | 0.0247 | 0.0000 | 0.0000 | 146 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 46 | 0.0003 | 0.0073 | 0.0006 | 0.0000 | 0.0000 | 0.0560 | 148 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 48 | 0.0029 | 0.0066 | 0.0028 | 0.0000 | 0.0000 | 0.0000 | 150 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | 0.0034 | 0.0074 | 0.0032 | 0.0000 | 0.0000 | 0.0000 | 152 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 52 | 0.0045 | 0.0073 | 0.0048 | 0.0000 | 0.0000 | 0.0000 | 154 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 54 | 0.0079 | 0.0059 | 0.0058 | 0.0129 | 0.0000 | 0.0440 | 156 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 56 | 0.0074 | 0.0063 | 0.0074 | 0.0054 | 0.0000 | 0.0000 | 158 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 58 | 0.0194 | 0.0150 | 0.0155 | 0.0151 | 0.0000 | 0.0000 | 160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 60 | 0.0323 | 0.0292 | 0.0275 | 0.0670 | 0.0000 | 0.0074 | 162 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 62 | 0.0442 | 0.0430 | 0.0554 | 0.0539 | 0.0000 | 0.0000 | 164 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 64 | 0.0565 | 0.0529 | 0.0615 | 0.0217 | 0.0377 | 0.0000 | 166 | 0.0000 | 0.0000 | 0.0000 | 0.0004 | 0.0000 | 0.0000 |
| 66 | 0.0588 | 0.0535 | 0.0709 | 0.0136 | 0.0113 | 0.0052 | 168 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 68 | 0.0570 | 0.0613 | 0.0674 | 0.0215 | 0.0308 | 0.0265 | 170 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 70 | 0.0762 | 0.0704 | 0.0770 | 0.0745 | 0.0239 | 0.0396 | 172 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 72 | 0.0736 | 0.0699 | 0.0815 | 0.0908 | 0.0608 | 0.1316 | 174 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 74 | 0.0858 | 0.0671 | 0.0720 | 0.0541 | 0.0595 | 0.1028 | 176 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 76 | 0.0669 | 0.0623 | 0.0671 | 0.0183 | 0.0295 | 0.0698 | 178 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 78 | 0.0561 | 0.0533 | 0.0586 | 0.0744 | 0.0907 | 0.0737 | 180 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 80 | 0.0571 | 0.0491 | 0.0522 | 0.1015 | 0.0891 | 0.0642 | 182 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 82 | 0.0479 | 0.0469 | 0.0462 | 0.0631 | 0.1473 | 0.1079 | 184 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 84 | 0.0461 | 0.0372 | 0.0394 | 0.0543 | 0.1230 | 0.0470 | 186 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 86 | 0.0309 | 0.0301 | 0.0331 | 0.0411 | 0.0636 | 0.0379 | 188 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 88 | 0.0285 | 0.0252 | 0.0246 | 0.0372 | 0.0659 | 0.0496 | 190 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 90 | 0.0258 | 0.0236 | 0.0246 | 0.0473 | 0.0399 | 0.0358 | 192 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 92 | 0.0213 | 0.0213 | 0.0208 | 0.0216 | 0.0337 | 0.0188 | 194 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 94 | 0.0167 | 0.0161 | 0.0152 | 0.0187 | 0.0260 | 0.0150 | 196 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 96 | 0.0134 | 0.0109 | 0.0114 | 0.0153 | 0.0259 | 0.0235 | 198 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 98 | 0.0097 | 0.0097 | 0.0094 | 0.0123 | 0.0016 | 0.0000 | 200 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0000 |
| 100 | 0.0086 | 0.0085 | 0.0080 | 0.0163 | 0.0062 | 0.0047 | | | | | | | |

**Table A2.** Percentage of weighted length measurements in each viability condition category, by gear type and year in the IFQ groundfish fishery.

| | Bottom Trawl | | | | | | | | | Pot | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length | Excellent | | | Poor | | | Dead | | | Excellent | | | Poor | | | Dead | | |
| bin (cm) | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| 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% | 0.0% | 0.0% |
| 2 | 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% | 0.0% |
| 4 | 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% | 0.0% |
| 6 | 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% | 0.0% |
| 8 | 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% | 0.0% |
| 10 | 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% | 0.0% |
| 12 | 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% | 0.0% |
| 14 | 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% | 0.0% |
| 16 | 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% | 0.0% |
| 18 | 100.0% | 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% | 0.0% |
| 20 | 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% | 0.0% |
| 22 | 0.0% | 100.0% | 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% |
| 24 | 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% | 0.0% |
| 26 | 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% | 0.0% |
| 28 | 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% | 0.0% |
| 30 | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 32 | 0.0% | 50.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 50.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 34 | 0.0% | 100.0% | 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% |
| 36 | 0.0% | 100.0% | 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% |
| 38 | 0.0% | 82.3% | 0.0% | 0.0% | 15.8% | 0.0% | 0.0% | 1.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 40 | 0.0% | 85.5% | 22.2% | 100.0% | 0.0% | 0.0% | 0.0% | 14.5% | 77.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 42 | 48.3% | 68.6% | 0.0% | 51.7% | 24.4% | 0.0% | 0.0% | 6.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 44 | 0.0% | 47.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 52.6% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 46 | 0.0% | 85.8% | 0.0% | 0.0% | 14.2% | 0.0% | 100.0% | 0.0% | 100.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 48 | 25.0% | 97.0% | 34.3% | 25.0% | 0.0% | 29.0% | 49.9% | 3.0% | 36.7% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 50 | 29.9% | 67.5% | 20.7% | 0.0% | 10.8% | 22.1% | 70.1% | 21.7% | 57.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 52 | 23.1% | 52.2% | 29.7% | 42.4% | 14.9% | 22.3% | 34.6% | 32.9% | 48.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 54 | 15.6% | 57.8% | 40.2% | 43.0% | 33.4% | 18.2% | 41.3% | 8.8% | 41.7% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 56 | 20.7% | 44.2% | 54.8% | 45.5% | 13.4% | 1.9% | 33.8% | 42.4% | 43.3% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 58 | 19.9% | 41.1% | 36.4% | 31.2% | 9.7% | 23.0% | 48.9% | 49.1% | 40.6% | 67.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 32.1% | 0.0% | 0.0% |
| 60 | 32.8% | 36.2% | 39.5% | 24.3% | 22.1% | 8.4% | 42.9% | 41.7% | 52.1% | 57.3% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 42.7% | 0.0% | 0.0% |
| 62 | 37.7% | 40.1% | 43.4% | 22.7% | 21.1% | 18.7% | 39.6% | 38.9% | 37.9% | 38.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 62.0% | 0.0% | 0.0% |
| 64 | 39.6% | 31.8% | 46.1% | 18.7% | 21.0% | 17.6% | 41.7% | 47.2% | 36.3% | 34.5% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 65.5% | 0.0% | 0.0% |
| 66 | 36.6% | 35.0% | 45.1% | 21.1% | 22.5% | 14.3% | 42.3% | 42.5% | 40.6% | 50.0% | 100.0% | 100.0% | 0.0% | 0.0% | 0.0% | 50.0% | 0.0% | 0.0% |
| 68 | 42.6% | 34.8% | 50.5% | 12.0% | 21.4% | 12.3% | 45.4% | 43.8% | 37.3% | 69.9% | 100.0% | 36.2% | 0.0% | 0.0% | 63.8% | 30.1% | 0.0% | 0.0% |
| 70 | 41.5% | 39.5% | 45.2% | 20.8% | 19.8% | 17.1% | 37.7% | 40.7% | 37.7% | 62.2% | 100.0% | 77.9% | 3.4% | 0.0% | 10.8% | 34.4% | 0.0% | 11.3% |
| 72 | 38.6% | 31.4% | 48.6% | 20.9% | 19.4% | 16.9% | 40.6% | 49.2% | 34.5% | 77.3% | 85.9% | 96.9% | 0.0% | 14.1% | 0.0% | 22.7% | 0.0% | 3.1% |
| 74 | 40.0% | 32.4% | 47.4% | 17.5% | 22.0% | 19.1% | 42.5% | 45.6% | 33.5% | 69.2% | 93.6% | 64.1% | 9.1% | 6.4% | 12.0% | 21.7% | 0.0% | 24.0% |
| 76 | 45.5% | 36.8% | 45.0% | 17.0% | 17.1% | 17.8% | 37.5% | 46.1% | 37.2% | 43.2% | 49.7% | 50.0% | 0.0% | 37.8% | 33.1% | 56.8% | 12.4% | 16.9% |
| 78 | 41.1% | 33.0% | 44.6% | 19.0% | 24.9% | 16.0% | 39.9% | 42.1% | 39.5% | 59.1% | 63.3% | 100.0% | 7.9% | 14.6% | 0.0% | 33.0% | 22.2% | 0.0% |
| 80 | 45.7% | 38.5% | 53.9% | 16.0% | 18.8% | 13.1% | 38.4% | 42.7% | 33.0% | 57.6% | 100.0% | 95.5% | 1.7% | 0.0% | 0.0% | 40.7% | 0.0% | 4.5% |
| 82 | 45.7% | 36.3% | 45.4% | 19.9% | 21.3% | 18.3% | 34.3% | 42.3% | 36.3% | 86.4% | 54.9% | 61.6% | 5.6% | 9.6% | 16.8% | 8.0% | 35.5% | 21.6% |
| 84 | 50.2% | 38.6% | 50.6% | 14.8% | 19.3% | 14.5% | 35.1% | 42.0% | 34.9% | 59.3% | 73.6% | 100.0% | 6.0% | 13.2% | 0.0% | 34.7% | 13.2% | 0.0% |
| 86 | 44.7% | 36.6% | 55.6% | 14.6% | 21.7% | 15.5% | 40.8% | 41.8% | 28.9% | 85.3% | 76.6% | 87.9% | 7.4% | 7.6% | 0.0% | 7.4% | 15.8% | 12.1% |
| 88 | 41.7% | 39.6% | 52.9% | 16.1% | 22.1% | 15.2% | 42.2% | 38.3% | 32.0% | 92.4% | 79.3% | 91.4% | 0.0% | 6.8% | 0.0% | 7.6% | 13.9% | 8.6% |
| 90 | 48.3% | 41.3% | 57.9% | 17.0% | 19.1% | 13.8% | 34.7% | 39.6% | 28.4% | 70.5% | 68.2% | 100.0% | 0.0% | 21.4% | 0.0% | 29.5% | 10.5% | 0.0% |
| 92 | 46.7% | 41.2% | 58.4% | 17.3% | 20.3% | 14.7% | 36.0% | 38.5% | 27.0% | 55.8% | 59.0% | 100.0% | 22.1% | 23.5% | 0.0% | 22.1% | 17.4% | 0.0% |
| 94 | 51.2% | 46.8% | 54.6% | 20.1% | 14.2% | 15.6% | 28.7% | 39.0% | 29.8% | 52.2% | 100.0% | 88.9% | 23.9% | 0.0% | 0.0% | 23.9% | 0.0% | 11.1% |
| 96 | 49.4% | 40.7% | 58.4% | 14.6% | 17.1% | 12.5% | 36.0% | 42.2% | 29.0% | 45.6% | 80.2% | 47.1% | 13.4% | 13.1% | 0.0% | 41.0% | 6.7% | 52.9% |
| 98 | 50.0% | 40.0% | 52.5% | 18.2% | 17.6% | 19.6% | 31.8% | 42.5% | 27.9% | 53.2% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 46.8% | 0.0% | 0.0% |
| 100 | 53.8% | 43.8% | 60.9% | 18.2% | 21.0% | 14.8% | 27.9% | 35.2% | 24.3% | 77.6% | 100.0% | 100.0% | 0.0% | 0.0% | 0.0% | 22.4% | 0.0% | 0.0% |
| 102 | 47.3% | 51.9% | 58.5% | 16.1% | 16.0% | 14.3% | 36.6% | 32.1% | 27.1% | 100.0% | 34.0% | 100.0% | 0.0% | 33.0% | 0.0% | 0.0% | 33.0% | 0.0% |
| 104 | 53.0% | 45.2% | 55.5% | 18.8% | 10.4% | 14.4% | 28.2% | 44.4% | 30.1% | 100.0% | 0.0% | 100.0% | 0.0% | 50.0% | 0.0% | 0.0% | 50.0% | 0.0% |

## Table A2. Continued

| Length | Bottom Trawl | | | | | | | | | Pot | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Excellent | | | Poor | | | Dead | | | Excellent | | | Poor | | | Dead | | |
| bin (cm) | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 | 2011 | 2012 | 2013 |
| 106 | 54.3% | 39.9% | 71.6% | 18.4% | 27.1% | 12.8% | 27.3% | 32.9% | 15.7% | 0.0% | 45.4% | 76.4% | 0.0% | 54.6% | 23.6% | 0.0% | 0.0% | 0.0% |
| 108 | 53.4% | 44.8% | 58.5% | 20.3% | 15.9% | 14.1% | 26.3% | 39.3% | 27.4% | 18.5% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 81.5% | 0.0% | 0.0% |
| 110 | 56.4% | 51.0% | 56.2% | 11.2% | 14.1% | 26.9% | 32.4% | 34.9% | 16.9% | 100.0% | 100.0% | 23.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 76.9% |
| 112 | 56.7% | 53.9% | 57.9% | 22.5% | 23.0% | 20.6% | 20.8% | 23.1% | 21.4% | 100.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 114 | 49.8% | 44.7% | 68.2% | 25.2% | 22.6% | 12.8% | 25.0% | 32.7% | 18.9% | 57.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 42.4% | 100.0% | 0.0% |
| 116 | 60.7% | 41.7% | 59.6% | 13.5% | 20.6% | 20.0% | 25.8% | 37.8% | 20.4% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 118 | 55.9% | 58.1% | 62.8% | 9.8% | 5.6% | 17.3% | 34.3% | 36.4% | 19.8% | 0.0% | 0.0% | 100.0% | 0.0% | 100.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 120 | 47.5% | 22.0% | 79.2% | 28.2% | 16.5% | 18.7% | 24.3% | 61.4% | 2.1% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 122 | 54.4% | 57.4% | 59.0% | 8.1% | 32.7% | 14.5% | 37.5% | 9.9% | 26.5% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 124 | 39.8% | 35.4% | 47.7% | 21.7% | 51.4% | 16.1% | 38.5% | 13.2% | 36.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 126 | 41.9% | 30.7% | 99.2% | 19.2% | 29.7% | 0.0% | 38.9% | 39.7% | 0.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 128 | 52.9% | 96.3% | 49.5% | 35.6% | 0.0% | 50.5% | 11.5% | 3.7% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 130 | 75.3% | 50.6% | 77.8% | 24.7% | 0.0% | 0.0% | 0.0% | 49.4% | 22.2% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 132 | 45.2% | 100.0% | 22.2% | 18.5% | 0.0% | 0.0% | 36.3% | 0.0% | 77.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 134 | 79.5% | 100.0% | 67.0% | 20.5% | 0.0% | 33.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 136 | 25.3% | 100.0% | 100.0% | 49.3% | 0.0% | 0.0% | 25.3% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 138 | 0.0% | 7.2% | 0.0% | 100.0% | 61.6% | 100.0% | 0.0% | 31.2% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 140 | 49.2% | 0.0% | 0.0% | 50.8% | 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% |
| 142 | 25.0% | 0.0% | 0.0% | 25.1% | 100.0% | 0.0% | 49.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 144 | 59.3% | 0.0% | 0.0% | 40.7% | 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% |
| 146 | 100.0% | 100.0% | 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% |
| 148 | 49.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 50.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 150 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 152 | 0.0% | 100.0% | 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% |
| 154 | 0.0% | 100.0% | 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% |
| 156 | 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% | 0.0% |
| 158 | 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% | 0.0% |
| 160 | 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% | 0.0% |
| 162 | 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% | 0.0% |
| 164 | 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% | 0.0% |
| 166 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 168 | 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% | 0.0% |
| 170 | 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% | 0.0% |
| 172 | 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% | 0.0% |
| 174 | 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% | 0.0% |
| 176 | 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% | 0.0% |
| 178 | 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% | 0.0% |
| 180 | 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% | 0.0% |
| 182 | 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% | 0.0% |
| 184 | 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% | 0.0% |
| 186 | 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% | 0.0% |
| 188 | 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% | 0.0% |
| 190 | 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% | 0.0% |
| 192 | 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% | 0.0% |
| 194 | 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% | 0.0% |
| 196 | 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% | 0.0% |
| 198 | 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% | 0.0% |
| 200 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 202 | 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% | 0.0% |
| 204 | 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% | 0.0% |
| 206 | 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% | 0.0% |
| 208 | 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% | 0.0% |
| 210 | 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% | 0.0% |

**Table A3.** Weighted length frequency distributions for Pacific halibut in the limited entry bottom trawl fishery, 2004-2010.

| | Weighted length frequency distribution | | | | | | |
|---|---|---|---|---|---|---|---|
| Length bin (cm) | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| 22 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 24 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 26 | 0.0000 | 0.0125 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 28 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 30 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 32 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 34 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 | 0.0000 |
| 36 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 38 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 40 | 0.0048 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 42 | 0.0000 | 0.0044 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 44 | 0.0025 | 0.0012 | 0.0057 | 0.0000 | 0.0000 | 0.0010 | 0.0000 |
| 46 | 0.0037 | 0.0000 | 0.0094 | 0.0000 | 0.0000 | 0.0009 | 0.0000 |
| 48 | 0.0000 | 0.0034 | 0.0046 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 50 | 0.0027 | 0.0068 | 0.0092 | 0.0000 | 0.0007 | 0.0010 | 0.0000 |
| 52 | 0.0021 | 0.0069 | 0.0080 | 0.0041 | 0.0001 | 0.0053 | 0.0000 |
| 54 | 0.0156 | 0.0076 | 0.0164 | 0.0042 | 0.0025 | 0.0004 | 0.0000 |
| 56 | 0.0138 | 0.0211 | 0.0242 | 0.0071 | 0.0022 | 0.0019 | 0.0000 |
| 58 | 0.0187 | 0.0331 | 0.0322 | 0.0293 | 0.0027 | 0.0091 | 0.0022 |
| 60 | 0.0400 | 0.0431 | 0.0670 | 0.0593 | 0.0169 | 0.0175 | 0.0056 |
| 62 | 0.0329 | 0.0719 | 0.0751 | 0.0638 | 0.0285 | 0.0275 | 0.0121 |
| 64 | 0.0428 | 0.0783 | 0.1001 | 0.0932 | 0.0614 | 0.0545 | 0.0155 |
| 66 | 0.0532 | 0.0807 | 0.0979 | 0.1150 | 0.0705 | 0.0606 | 0.0185 |
| 68 | 0.0757 | 0.0845 | 0.0870 | 0.0000 | 0.0599 | 0.0835 | 0.0256 |
| 70 | 0.0672 | 0.0851 | 0.0986 | 0.1022 | 0.0871 | 0.0971 | 0.0154 |
| 72 | 0.0774 | 0.0882 | 0.0478 | 0.1029 | 0.0973 | 0.0972 | 0.0314 |
| 74 | 0.0998 | 0.0746 | 0.0588 | 0.0840 | 0.1023 | 0.0941 | 0.0383 |
| 76 | 0.0890 | 0.0538 | 0.0461 | 0.0710 | 0.0743 | 0.0697 | 0.0284 |
| 78 | 0.0658 | 0.0506 | 0.0423 | 0.0539 | 0.0688 | 0.0744 | 0.0349 |
| 80 | 0.0586 | 0.0427 | 0.0372 | 0.0460 | 0.0599 | 0.0527 | 0.0298 |
| 82 | 0.0486 | 0.0320 | 0.0258 | 0.0325 | 0.0443 | 0.0434 | 0.0239 |
| 84 | 0.0337 | 0.0255 | 0.0186 | 0.0316 | 0.0428 | 0.0335 | 0.0227 |
| 86 | 0.0221 | 0.0166 | 0.0130 | 0.0000 | 0.0300 | 0.0290 | 0.0141 |
| 88 | 0.0235 | 0.0115 | 0.0120 | 0.0154 | 0.0263 | 0.0290 | 0.0122 |
| 90 | 0.0193 | 0.0127 | 0.0115 | 0.0168 | 0.0225 | 0.0263 | 0.0100 |
| 92 | 0.0157 | 0.0092 | 0.0101 | 0.0122 | 0.0179 | 0.0204 | 0.0094 |
| 94 | 0.0169 | 0.0108 | 0.0099 | 0.0148 | 0.0164 | 0.0151 | 0.0053 |
| 96 | 0.0062 | 0.0052 | 0.0066 | 0.0089 | 0.0143 | 0.0087 | 0.0066 |
| 98 | 0.0034 | 0.0058 | 0.0066 | 0.0091 | 0.0110 | 0.0103 | 0.0067 |
| 100 | 0.0089 | 0.0045 | 0.0025 | 0.0053 | 0.0080 | 0.0088 | 0.0023 |
| 102 | 0.0060 | 0.0034 | 0.0029 | 0.0036 | 0.0061 | 0.0069 | 0.0018 |
| 104 | 0.0065 | 0.0023 | 0.0027 | 0.0041 | 0.0083 | 0.0062 | 0.0021 |
| 106 | 0.0043 | 0.0029 | 0.0032 | 0.0031 | 0.0059 | 0.0028 | 0.0013 |
| 108 | 0.0016 | 0.0014 | 0.0019 | 0.0018 | 0.0027 | 0.0025 | 0.0014 |
| 110 | 0.0048 | 0.0015 | 0.0004 | 0.0017 | 0.0018 | 0.0021 | 0.0009 |
| 112 | 0.0015 | 0.0007 | 0.0020 | 0.0010 | 0.0016 | 0.0024 | 0.0013 |
| 114 | 0.0020 | 0.0010 | 0.0007 | 0.0007 | 0.0020 | 0.0017 | 0.0001 |
| 116 | 0.0026 | 0.0006 | 0.0002 | 0.0000 | 0.0010 | 0.0005 | 0.0005 |
| 118 | 0.0007 | 0.0004 | 0.0003 | 0.0002 | 0.0004 | 0.0002 | 0.0002 |
| 120 | 0.0013 | 0.0005 | 0.0002 | 0.0002 | 0.0005 | 0.0003 | 0.0002 |
| 122 | 0.0008 | 0.0003 | 0.0000 | 0.0004 | 0.0003 | 0.0003 | 0.0002 |
| 124 | 0.0010 | 0.0002 | 0.0001 | 0.0000 | 0.0003 | 0.0002 | 0.0003 |
| 126 | 0.0000 | 0.0001 | 0.0002 | 0.0001 | 0.0001 | 0.0002 | 0.0002 |
| 128 | 0.0002 | 0.0000 | 0.0002 | 0.0000 | 0.0000 | 0.0002 | 0.0000 |
| 130 | 0.0003 | 0.0002 | 0.0001 | 0.0002 | 0.0000 | 0.0002 | 0.0000 |
| 132 | 0.0005 | 0.0001 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 134 | 0.0006 | 0.0000 | 0.0001 | 0.0000 | 0.0001 | 0.0001 | 0.0000 |
| 136 | 0.0001 | 0.0001 | 0.0002 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| 138 | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| 140 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 0.0000 |
| 142 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0001 | 0.0000 |
| 144 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 146 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| 148 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 150 | 0.0001 | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 152 | 0.0002 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 154 | 0.0001 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 156 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 158 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 162 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 164 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

**Table A4.** Percentage of weighted length measurements in each condition category for the limited entry bottom trawl fishery, 2004-2010.

| Length | 2004 | | | 2005 | | | 2006 | | |
|---|---|---|---|---|---|---|---|---|---|
| bin (cm) | Exc | Poor | Dead | Exc | Poor | Dead | Exc | Poor | Dead |
| 22 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 24 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 26 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% |
| 28 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 30 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 32 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 34 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 36 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 38 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 40 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 42 | 0.0% | 0.0% | 0.0% | 0.0% | 88.4% | 11.6% | 0.0% | 0.0% | 0.0% |
| 44 | 0.0% | 0.0% | 100.0% | 0.0% | 70.8% | 29.2% | 0.0% | 0.0% | 100.0% |
| 46 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| 48 | 0.0% | 0.0% | 0.0% | 22.4% | 0.0% | 77.6% | 0.0% | 0.0% | 100.0% |
| 50 | 0.0% | 0.0% | 100.0% | 61.1% | 9.9% | 29.0% | 0.0% | 0.0% | 100.0% |
| 52 | 100.0% | 0.0% | 0.0% | 23.6% | 31.3% | 45.2% | 0.0% | 0.0% | 100.0% |
| 54 | 75.5% | 11.9% | 12.6% | 10.0% | 20.8% | 69.2% | 16.9% | 0.0% | 83.1% |
| 56 | 12.6% | 37.9% | 49.5% | 25.1% | 12.7% | 62.2% | 22.0% | 15.2% | 62.8% |
| 58 | 21.4% | 25.6% | 53.0% | 15.1% | 29.5% | 55.4% | 4.1% | 20.2% | 75.7% |
| 60 | 58.6% | 14.4% | 27.0% | 18.2% | 21.0% | 60.8% | 12.9% | 25.5% | 61.6% |
| 62 | 40.0% | 21.6% | 38.4% | 18.5% | 23.7% | 57.8% | 27.3% | 22.3% | 50.4% |
| 64 | 33.4% | 18.4% | 48.2% | 25.2% | 28.4% | 46.4% | 31.5% | 21.0% | 47.5% |
| 66 | 23.9% | 24.7% | 51.4% | 20.9% | 26.7% | 52.3% | 29.6% | 17.3% | 53.0% |
| 68 | 38.2% | 21.9% | 39.9% | 17.0% | 27.5% | 55.5% | 35.5% | 18.8% | 45.7% |
| 70 | 29.5% | 18.9% | 51.6% | 20.1% | 30.3% | 49.5% | 30.2% | 16.6% | 53.2% |
| 72 | 22.9% | 17.9% | 59.2% | 20.3% | 27.1% | 52.6% | 37.2% | 21.1% | 41.8% |
| 74 | 23.8% | 25.5% | 50.7% | 24.5% | 23.4% | 52.1% | 39.6% | 13.9% | 46.5% |
| 76 | 24.0% | 23.2% | 52.8% | 26.8% | 29.1% | 44.1% | 31.2% | 19.2% | 49.6% |
| 78 | 18.8% | 18.4% | 62.9% | 18.1% | 23.5% | 58.4% | 35.0% | 21.2% | 43.8% |
| 80 | 19.1% | 19.6% | 61.3% | 23.1% | 27.9% | 49.0% | 34.3% | 15.4% | 50.2% |
| 82 | 14.4% | 26.1% | 59.5% | 30.4% | 25.1% | 44.6% | 31.7% | 27.8% | 40.5% |
| 84 | 21.7% | 9.5% | 68.9% | 27.0% | 18.9% | 54.0% | 30.1% | 13.2% | 56.7% |
| 86 | 32.4% | 24.0% | 43.6% | 35.5% | 24.7% | 39.8% | 31.3% | 15.0% | 53.7% |
| 88 | 27.8% | 14.8% | 57.5% | 31.2% | 27.8% | 41.0% | 22.9% | 12.4% | 64.7% |
| 90 | 30.2% | 34.6% | 35.2% | 28.0% | 16.6% | 55.4% | 23.8% | 18.7% | 57.5% |
| 92 | 40.2% | 28.1% | 31.7% | 42.5% | 21.7% | 35.9% | 43.7% | 10.7% | 45.6% |
| 94 | 26.1% | 33.3% | 40.6% | 33.4% | 16.3% | 50.3% | 35.3% | 7.1% | 57.6% |
| 96 | 19.9% | 30.0% | 50.1% | 34.6% | 19.2% | 46.2% | 16.5% | 13.9% | 69.6% |
| 98 | 33.8% | 28.4% | 37.8% | 32.3% | 22.8% | 44.9% | 16.8% | 13.0% | 70.2% |
| 100 | 14.6% | 26.9% | 58.5% | 28.1% | 17.4% | 54.5% | 48.5% | 9.6% | 41.9% |
| 102 | 16.0% | 49.3% | 34.7% | 43.1% | 6.9% | 50.0% | 13.7% | 0.0% | 86.3% |
| 104 | 19.0% | 47.5% | 33.5% | 36.4% | 16.2% | 47.4% | 49.6% | 6.4% | 44.0% |
| 106 | 23.6% | 22.6% | 53.9% | 58.4% | 11.9% | 29.7% | 10.4% | 22.8% | 66.8% |
| 108 | 27.6% | 3.0% | 69.4% | 28.6% | 22.6% | 48.8% | 42.2% | 15.1% | 42.6% |
| 110 | 25.4% | 12.6% | 62.0% | 22.7% | 28.1% | 49.2% | 32.0% | 3.1% | 64.9% |
| 112 | 95.8% | 1.2% | 3.0% | 16.2% | 0.0% | 83.8% | 7.2% | 14.1% | 78.7% |
| 114 | 0.0% | 26.2% | 73.8% | 24.4% | 4.9% | 70.7% | 38.9% | 0.0% | 61.1% |
| 116 | 58.7% | 6.9% | 34.4% | 69.4% | 0.0% | 30.6% | 77.8% | 0.0% | 22.2% |
| 118 | 2.7% | 7.5% | 89.9% | 44.9% | 35.0% | 20.1% | 33.8% | 31.5% | 34.7% |
| 120 | 5.7% | 26.2% | 68.0% | 9.5% | 28.7% | 61.8% | 0.0% | 0.0% | 100.0% |
| 122 | 40.8% | 40.3% | 18.9% | 1.5% | 15.2% | 83.4% | 50.0% | 50.0% | 0.0% |
| 124 | 70.3% | 14.8% | 14.8% | 79.9% | 0.0% | 20.1% | 15.6% | 0.0% | 84.4% |
| 126 | 0.0% | 100.0% | 0.0% | 89.0% | 11.0% | 0.0% | 47.1% | 0.0% | 52.9% |
| 128 | 82.0% | 9.0% | 9.0% | 18.7% | 0.0% | 81.3% | 89.8% | 0.0% | 10.2% |
| 130 | 13.5% | 0.0% | 86.5% | 4.9% | 47.6% | 47.6% | 0.0% | 0.0% | 100.0% |
| 132 | 100.0% | 0.0% | 0.0% | 20.2% | 63.3% | 16.5% | 0.0% | 100.0% | 0.0% |
| 134 | 80.0% | 0.0% | 20.0% | 100.0% | 0.0% | 0.0% | 22.2% | 0.0% | 77.8% |
| 136 | 0.0% | 0.0% | 100.0% | 10.5% | 16.1% | 73.4% | 0.0% | 0.0% | 100.0% |
| 138 | 0.0% | 0.0% | 0.0% | 15.2% | 0.0% | 84.8% | 0.0% | 0.0% | 0.0% |
| 140 | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 100.0% | 0.0% | 0.0% |
| 142 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 144 | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 146 | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% |
| 148 | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 150 | 0.0% | 100.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| 152 | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 154 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 156 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 158 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 160 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 162 | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 164 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |

| Length | 2007 | | | 2008 | | | 2009 | | |
|---|---|---|---|---|---|---|---|---|---|
| bin (cm) | Exc | Poor | Dead | Exc | Poor | Dead | Exc | Poor | Dead |
| 22 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 24 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 26 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 28 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 30 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 32 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 34 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% |
| 36 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 38 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 40 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 42 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 44 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| 46 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 48 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 50 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 52 | 33.4% | 0.0% | 66.6% | 100.0% | 0.0% | 0.0% | 99.5% | 0.5% | 0.0% |
| 54 | 35.6% | 0.0% | 64.4% | 0.0% | 4.4% | 95.6% | 42.3% | 57.7% | 0.0% |
| 56 | 33.9% | 0.0% | 66.1% | 0.0% | 0.0% | 100.0% | 15.7% | 65.3% | 19.0% |
| 58 | 9.4% | 6.8% | 83.8% | 3.3% | 3.3% | 93.3% | 51.0% | 4.4% | 44.6% |
| 60 | 5.3% | 7.4% | 87.2% | 9.0% | 14.3% | 76.8% | 28.7% | 21.9% | 49.4% |
| 62 | 20.8% | 9.5% | 69.7% | 6.1% | 15.7% | 78.2% | 19.3% | 19.5% | 61.2% |
| 64 | 18.9% | 5.3% | 75.8% | 17.3% | 7.5% | 75.2% | 38.0% | 9.4% | 52.6% |
| 66 | 9.1% | 12.5% | 78.4% | 25.8% | 8.9% | 65.4% | 26.7% | 19.7% | 53.6% |
| 68 | 54.5% | 45.5% | 0.0% | 17.4% | 13.2% | 69.4% | 30.1% | 17.5% | 52.4% |
| 70 | 16.0% | 7.6% | 76.4% | 13.1% | 14.0% | 73.0% | 27.4% | 17.5% | 55.1% |
| 72 | 14.8% | 9.1% | 76.0% | 19.1% | 13.7% | 67.2% | 22.9% | 18.3% | 58.8% |
| 74 | 17.6% | 16.9% | 65.5% | 24.8% | 13.8% | 61.3% | 27.7% | 14.8% | 57.5% |
| 76 | 14.0% | 9.9% | 76.1% | 21.9% | 11.5% | 66.6% | 26.2% | 16.6% | 57.2% |
| 78 | 15.5% | 13.4% | 71.2% | 24.7% | 10.4% | 64.9% | 18.5% | 12.1% | 69.4% |
| 80 | 14.7% | 11.6% | 73.6% | 21.2% | 11.4% | 67.4% | 20.5% | 14.1% | 65.3% |
| 82 | 14.6% | 3.0% | 82.4% | 21.5% | 16.1% | 62.4% | 16.3% | 18.5% | 65.2% |
| 84 | 17.9% | 7.0% | 75.1% | 15.9% | 22.8% | 61.3% | 17.0% | 12.0% | 71.0% |
| 86 | 56.6% | 43.4% | 0.0% | 17.6% | 22.5% | 59.8% | 18.6% | 15.5% | 65.9% |
| 88 | 12.3% | 10.5% | 77.1% | 18.1% | 18.8% | 63.1% | 20.1% | 17.2% | 62.8% |
| 90 | 6.3% | 3.7% | 90.0% | 23.9% | 17.1% | 59.0% | 18.6% | 13.6% | 67.8% |
| 92 | 20.7% | 8.4% | 70.9% | 20.9% | 25.1% | 54.0% | 25.3% | 11.8% | 62.9% |
| 94 | 17.0% | 18.4% | 64.6% | 18.8% | 13.3% | 67.9% | 15.2% | 18.4% | 66.4% |
| 96 | 16.7% | 3.6% | 79.7% | 15.4% | 21.3% | 63.4% | 27.6% | 19.6% | 52.8% |
| 98 | 10.4% | 8.2% | 81.4% | 28.4% | 29.4% | 42.3% | 20.2% | 16.9% | 62.9% |
| 100 | 15.4% | 23.2% | 61.4% | 15.0% | 19.4% | 65.6% | 13.4% | 25.5% | 61.1% |
| 102 | 40.3% | 9.2% | 50.6% | 27.6% | 28.4% | 44.1% | 24.8% | 23.8% | 51.4% |
| 104 | 16.7% | 15.8% | 67.5% | 36.6% | 11.7% | 51.7% | 28.0% | 8.4% | 63.7% |
| 106 | 30.7% | 20.1% | 49.2% | 34.8% | 7.7% | 57.6% | 24.0% | 13.5% | 62.5% |
| 108 | 29.0% | 2.3% | 68.7% | 19.4% | 14.2% | 66.4% | 18.2% | 27.7% | 54.1% |
| 110 | 11.7% | 45.1% | 43.2% | 40.2% | 8.0% | 51.9% | 29.6% | 10.4% | 60.0% |
| 112 | 26.9% | 23.3% | 49.8% | 25.1% | 9.2% | 65.7% | 14.7% | 17.4% | 67.9% |
| 114 | 20.1% | 0.0% | 79.9% | 22.4% | 22.7% | 54.9% | 31.2% | 7.4% | 61.5% |
| 116 | 0.0% | 0.0% | 100.0% | 41.6% | 4.8% | 53.6% | 79.5% | 0.5% | 20.0% |
| 118 | 0.0% | 0.0% | 100.0% | 25.5% | 38.6% | 35.9% | 40.9% | 4.4% | 54.6% |
| 120 | 85.1% | 0.0% | 14.9% | 65.5% | 34.5% | 0.0% | 48.0% | 0.7% | 51.2% |
| 122 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 100.0% | 34.7% | 0.0% | 65.3% |
| 124 | 0.0% | 0.0% | 0.0% | 0.0% | 70.9% | 29.1% | 26.1% | 37.0% | 37.0% |
| 126 | 49.4% | 0.0% | 50.6% | 0.0% | 0.0% | 100.0% | 59.2% | 40.8% | 0.0% |
| 128 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 55.7% | 1.0% | 43.3% |
| 130 | 13.8% | 0.0% | 86.2% | 0.0% | 0.0% | 0.0% | 35.0% | 65.0% | 0.0% |
| 132 | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |
| 134 | 0.0% | 0.0% | 0.0% | 94.7% | 0.0% | 5.3% | 100.0% | 0.0% | 0.0% |
| 136 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 100.0% | 0.0% | 0.0% |
| 138 | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 140 | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 142 | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 144 | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 146 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 148 | 0.0% | 0.0% | 100.0% | 100.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 150 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 152 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 154 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 156 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 158 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 100.0% | 0.0% | 0.0% |
| 160 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 162 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 164 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |

| Length | 2010 | | | Length | 2010 | | | Length | 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| bin (cm) | Exc | Poor | Dead | bin | Exc | Poor | Dead | bin | Exc | Poor | Dead |
| 10 | 0.0% | 100.0% | 0.0% | 58 | 100.0% | 0.0% | 0.0% | 106 | 2.4% | 0.0% | 97.6% |
| 12 | 0.0% | 0.0% | 0.0% | 60 | 33.4% | 0.0% | 66.6% | 108 | 0.0% | 20.1% | 79.9% |
| 14 | 0.0% | 0.0% | 0.0% | 62 | 15.7% | 29.4% | 54.9% | 110 | 14.2% | 58.8% | 27.0% |
| 16 | 0.0% | 0.0% | 0.0% | 64 | 30.1% | 21.2% | 48.7% | 112 | 39.9% | 0.0% | 60.1% |
| 18 | 0.0% | 0.0% | 0.0% | 66 | 17.8% | 15.4% | 66.8% | 114 | 0.0% | 0.0% | 100.0% |
| 20 | 0.0% | 0.0% | 0.0% | 68 | 15.0% | 10.3% | 74.8% | 116 | 50.0% | 0.0% | 50.0% |
| 22 | 0.0% | 0.0% | 0.0% | 70 | 22.2% | 7.4% | 70.4% | 118 | 0.0% | 100.0% | 0.0% |
| 24 | 0.0% | 0.0% | 0.0% | 72 | 23.6% | 17.4% | 59.0% | 120 | 0.0% | 0.0% | 100.0% |
| 26 | 0.0% | 0.0% | 0.0% | 74 | 13.5% | 24.8% | 61.7% | 122 | 0.0% | 0.0% | 100.0% |
| 28 | 0.0% | 0.0% | 0.0% | 76 | 20.1% | 16.9% | 63.0% | 124 | 100.0% | 0.0% | 0.0% |
| 30 | 0.0% | 0.0% | 0.0% | 78 | 17.0% | 17.4% | 65.7% | 126 | 0.0% | 100.0% | 0.0% |
| 32 | 0.0% | 0.0% | 0.0% | 80 | 10.6% | 22.8% | 66.6% | 128 | 0.0% | 0.0% | 0.0% |
| 34 | 0.0% | 0.0% | 0.0% | 82 | 18.9% | 19.9% | 61.2% | 130 | 0.0% | 0.0% | 0.0% |
| 36 | 0.0% | 0.0% | 0.0% | 84 | 21.9% | 25.3% | 52.8% | 132 | 0.0% | 0.0% | 0.0% |
| 38 | 0.0% | 0.0% | 0.0% | 86 | 14.9% | 16.4% | 68.7% | 134 | 0.0% | 0.0% | 0.0% |
| 40 | 0.0% | 0.0% | 0.0% | 88 | 24.8% | 17.8% | 57.4% | 136 | 100.0% | 0.0% | 0.0% |
| 42 | 0.0% | 0.0% | 0.0% | 90 | 25.8% | 24.2% | 50.1% | 138 | 0.0% | 0.0% | 0.0% |
| 44 | 0.0% | 0.0% | 0.0% | 92 | 5.0% | 9.9% | 85.1% | 140 | 0.0% | 0.0% | 0.0% |
| 46 | 0.0% | 0.0% | 0.0% | 94 | 26.1% | 29.2% | 44.7% | 142 | 0.0% | 0.0% | 0.0% |
| 48 | 0.0% | 0.0% | 0.0% | 96 | 17.4% | 39.9% | 42.7% | 144 | 0.0% | 0.0% | 0.0% |
| 50 | 0.0% | 0.0% | 0.0% | 98 | 14.3% | 23.3% | 62.4% | 146 | 0.0% | 0.0% | 0.0% |
| 52 | 0.0% | 0.0% | 0.0% | 100 | 2.2% | 31.0% | 66.8% | 148 | 0.0% | 0.0% | 0.0% |
| 54 | 0.0% | 0.0% | 0.0% | 102 | 21.7% | 20.6% | 57.8% | 150 | 0.0% | 0.0% | 0.0% |
| 56 | 0.0% | 0.0% | 0.0% | 104 | 18.3% | 37.2% | 44.6% | 152 | 0.0% | 100.0% | 0.0% |
| | | | | | | | | 154 | 0.0% | 0.0% | 0.0% |

# APPENDIX B

Manual Pacific Halibut IBQ Expansions for Inseason Management

*Inseason reporting to the Vessel Account System*

The Vessel Account System (VAS) is a NOAA, West Coast Region database that allows fishers to manage their IFQ quota pounds. On a weekly basis, the WCGOP provided trip-level estimates of discarded P. halibut IBQ to the Pacific States Marine Fisheries Commission (PSMFC). The PSMFC then uploaded the data to the VAS. Occasionally, non-automated (i.e., manual) calculations of P. halibut IBQ were necessary. Manual calculations of P. halibut IBQ occurred as observer program staff identified the need and were uploaded directly to the VAS. Scenarios triggering a manual calculation and the equations used for those calculations are given in Table B2 below.

The WCGOP database calculates IBQ weight at the haul-level when the observer collects all the required data elements. The calculation is dependent on which gear type is fished.

*Inseason IBQ Weight Calculations for Bottom Trawl Gear*

The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table (Appendix C). The total weight of P. halibut in the haul is calculated as:

$$W = \frac{w}{n} \cdot N$$

where, for each haul:
$W$ = total weight of P. halibut
$w$ = sampled weight of P. halibut
$n$ = sampled number of P. halibut
$N$ = total number of P. halibut

IBQ weight for each haul is then calculated as:

$$W_{IBQ} = \sum_{c} \left( \frac{w_c}{\sum_c w_c} \cdot W \cdot m_c \right)$$

where, for each haul:

$c$ = viability condition category
$W_{IBQ}$ = IBQ weight (mortality rate applied) of P. halibut
$W$ = total weight of P. halibut in haul
$w$ = sampled weight of P. halibut
$m$ = mortality rate (Table 2)

*Inseason IBQ Weight Calculations for Pot Gear*

The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table. Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level. The total weight of P. halibut in the set is calculated as:

$$W = \left(\frac{w}{n} \cdot N\right) \cdot \left(\frac{P}{p}\right)$$

where, for each set:
$W$ = total weight of P. halibut
$w$ = sampled weight of P. halibut
$n$ = sampled number of P. halibut
$N$ = total number of P. halibut
$P$ = total number of pots fished
$p$ = sampled number of pots

IBQ weight for each set is then calculated as:

$$W_{IBQ} = \sum_{c} \left(\frac{w_c}{\sum_c w} \cdot W \cdot m_c\right)$$

where, for each set:
$c$ = viability condition category
$W_{IBQ}$= IBQ weight (mortality rate applied) of P. halibut
$W$ = total weight of P. halibut in set
$w$ = sampled weight of P. halibut
$m$ = mortality rate (Table 3)

*Inseason IBQ Weight Calculations for Hook-&-Line Gear*

The visual estimates of Pacific halibut length (10 cm increments) are converted to weight using the IPHC length-weight conversion table. Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level. The total weight of P. halibut in the set is calculated as:

$$W_{IBQ} = \left(\frac{H}{h} \cdot w\right) \cdot 0.16$$

where, for each set:

$W_{IBQ}$= IBQ weight (mortality rate applied) of P. halibut
$w$ = sampled weight of P. halibut
$H$ = total number of hooks fished
$h$ = sampled number of hooks
0.16 = IPHC mortality rate applied to hook-&-line gear

*Inseason IBQ Weight Manual Calculation Scenarios*

In 2013, there were a number of scenarios that resulted in the inability to calculate IBQ weight through the automated process (Appendix B). The most prevalent causes were the pre-sorting of P. halibut by the crew and improper sampling. In these scenarios, observer program staff reviewed the trip and calculated IBQ weight manually.

To determine the most appropriate method to manually calculate IBQ weight (Appendix B), the observer program data management team consulted with the IPHC. For bottom trawl and pot gear, the IPHC preferred the use of manually measured fish from other properly sampled hauls within the same trip, rather than the use of visually estimated lengths from the haul. All calculations utilized data from the same trip or a different trip from the same vessel. In other words, there was never a circumstance where data from Vessel A was used to calculate IBQ weight for Vessel B.

In addition to scenarios where the observer did not collect all required data, there were also instances of hauls where P. halibut was not sampled by the observer or all the gear was lost. In these instances, properly sampled hauls were used to estimate IBQ weight for the unsampled haul. Methods for expanding P. halibut weight to unsampled or partially sampled hauls varied by gear type.

To calculate P. halibut IBQ weight for unsampled trawl hauls, the sum of all IBQ weight from other properly sampled hauls is divided by the sum of tow duration (hours) from sampled hauls and multiplied by the tow duration of the unsampled haul.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t d}\right) \times D$$

where, for each tow:
$t$ = tow
$W_{IBQ}$ = unsampled IBQ weight (mortality rate applied) of P. halibut
$w_{IBQ}$ = sampled IBQ weight (mortality rate applied) of P. halibut
$d$ = tow duration (hr) of sampled haul
$D$ = tow duration (hr) of unsampled haul

To calculate P. halibut IBQ weight when trawl gear is lost (i.e., entire net or codend is lost), the sum of all P. halibut expanded species weight from other properly sampled hauls is divided by the sum of tow durations from sampled hauls, multiplied by the tow duration of the unsampled haul. For lost trawl gear, a mortality rate for the "dead" P. halibut viability condition (0.90) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t d}\right) \times D \times 0.90$$

where, for each tow with lost gear:
$t$ = tow
$W_{IBQ}$ = IBQ weight (mortality rate applied) of unsampled P. halibut
$w$ = weight of sampled P. halibut
$d$ = tow duration of sampled haul
$D$ = tow duration of unsampled haul

To calculate P. halibut IBQ weight in unsampled fixed gear sets, the sum of all P. halibut IBQ weight from sets with similar properties (i.e., date, depth, target, gear type, area; determined by WCGOP data managers) is divided by the sum of the number of gear units sampled, and the result is multiplied by the total number of gear units fished from the unsampled set.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g}\right) \times G$$

where, for each set:
$t$ = set
$W_{IBQ}$ = unsampled IBQ weight (mortality rate applied) of P. halibut
$w_{IBQ}$ = sampled IBQ weight (mortality rate applied) of P. halibut
$g$ = number of sampled gear units (e.g., hooks, pots)
$G$ = total number of gear units (e.g., hooks, pots) fished in the unsampled set

To calculate P. halibut IBQ weight when fixed gear is lost, the sum of P. halibut weight from the sampled portion of the set, or, if all gear is lost, from sets with similar properties is divided by the sum of units sampled, and the result is multiplied by the total hooks from the unsampled set. For any lost fixed gear, a mortality rate for the "dead" P. halibut viability condition (1.0) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t g}\right) \times G \times 1.0$$

where, for each set with lost gear:
$t$ = set
$W_{IBQ}$ = unsampled IBQ weight (mortality rate applied) of P. halibut
$w$ = sampled IBQ weight of P. halibut
$g$ = number of sampled gear units (e.g., hooks, pots)
$G$ = total number of gear units (e.g., hooks, pots) fished in the unsampled set

**Table B1.** The number of vessels and trips that required manual expansions of P. halibut IBQ weight in the 2013 U.S. west coast groundfish IFQ fishery. All values are counts unless otherwise stated.

| | | Reason for Manual Calculation | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Lost Gear | | | | |
| | Year | PHLB scenarios | Unsampled hauls (Trawl) | Trawl | Fixed | Total | IFQ Total | % of total |
| Vessels | 2011 | 13 | 16 | 4 | 1 | 24 | 108 | 22.22 * |
| | 2012 | 9 | 10 | 4 | 4 | 22 | 105 | 21.00 |
| | 2013[2] | 8 | 8 | 3 | 9 | 12 | 103 | 11.7 |
| Trips | 2011 | 19 | 21 | 4 | 3 | 38 | 2443 | 1.56 |
| | 2012 | 10 | 24 | 4 | 7[1] | 32 | 2181 | 1.5 |
| | 2013[2] | 16 | 23 | 3 | 36 | 46 | 2335 | 2.0 |

*Percentage of vessels with manually calculated discard may be included in one or more categories.
[1]Partial gear loss for fixed gear trips was not reported in 2012.
[2]Manual calculations due to unsampled or lost gear were performed in 2013. All discard for these events were reported via the automated load process.

**Scenario 1:** *Total count of PHLB exists with no length or viability data.*

Resolution: Determine an average mortality weight per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

**Scenario 2:** *Total count of PHLB exists with actual lengths and no viability data.*

Resolution: Determine catch weight for PHLB using the lengths in the haul and then apply that to the total count for a total weight. Determine CATCH_WEIGHT_MORT for all viabilities (E, P, D) from all other properly sampled hauls in the trip and apply to the CATCH_WEIGHT for IBQ estimate.

**Scenario 3:** *Total count of PHLB exists with visual estimates of PHLB lengths and no viabilities.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method is to determine an average IBQ per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

**Scenario 4:** *Total count of PHLB exists with visual estimates of PHLB lengths and proper in-hand viabilities.*

Resolution: The use of visual lengths was discouraged by the IPHC, so the most appropriate method here would be to determine an average IBQ per individual PHLB in the trip from all sampled hauls. Multiply that average by the total count of PHLB to determine an IBQ.

**Scenario 5:** *Total count of PHLB does not exist without any length or viability data*

Resolution: Confirm PHLB was present in the haul, and no data was collected on them. Determine an average IBQ per haul for all sampled hauls in the trip. This scenario is unlikely and, to date, has never occurred.

**Scenario 6:** *Total count of PHLB does not exist with length and no viability data.*

Resolution: Catch weight for the haul will be determined by taking the measured PHLB sample, convert to weight, divided by the number of fish sampled, multiplied by the average number of PHLB for all sampled hauls in the trip. Then the average mortality rates from the sampled hauls are applied to the calculated PHLB weight. and, to date, has never occurred.

**Scenario 7**: *Total count of PHLB does not exist with length and viability data.*

Resolution: Catch weight for the haul will be determined by taking the length of the PHLB sample, converted to weight, divided by the number of fish sampled, multiplied by the average number of PHLB for all sampled hauls in the trip. Since viabilities and lengths exist, IBQ can be determined using normal protocols and the calculated catch weight. and, to date, has never occurred.

**Scenario 8**: *Total count of PHLB does not exist with visual length and no viability data.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method here would be to determine an average IBQ per haul for all sampled hauls in the trip and apply to this haul as well.

**Scenario 9**: *Total count of PHLB does not exist with visual length and viability data.*

Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method here would be to determine an average IBQ per haul for all sampled hauls in the trip and apply to this haul as well.

**Scenario 10:** *Observer encounters predated fish that are dead and badly damaged so that accurate biological data cannot be collected.*

Resolution: If properly sampled PHLB exist in the haul they can be used to determine the portion of the catch weight attributed to the predated and non-predated fish. The IBQ for the PHLB not predated would be calculated separately using the data collected in the haul. The IBQ for the predated fish would be the portion of the PHLB catch weight attributed to the predated fish multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear.

If all PHLB in the haul are heavily predated then a catch weight for the haul will need to be determined. This can be done by taking the total count of PHLB in the haul times an average catch weight (not IBQ estimates) per PHLB from other hauls in the trip (or like "sets" if PHLB doesn't exist in any other hauls). The estimated catch weight will then be multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear to determine IBQ. In 2011, there were two instances where a P. halibut IBQ was manually calculated due to sand flea predation. In 2012, no sand flea predation was observed.

**Table B2.** Manual calculations used to determine Pacific halibut IBQ weight in the U.S. west coast groundfish IFQ fishery.

| SCENARIO | CALCULATION |
|---|---|
| 1 | ∑CATCH_WEIGHT_MORT for all sampled hauls x CATCH_COUNT for unsampled haul=PHLB IBQ<br>∑CATCH_COUNT for all sampled hauls |

| | |
|---|---|
| 2 | CATCH_WEIGHT = Σ SPECIMEN_LENGTH* x CATCH_COUNT<br>#_PHLB_SAMPLED_IFQ<br>CATCH_WEIGHT_MORT =<br>CATCH_WEIGHT_MORT Σ (E) + CATCH_WEIGHT_MORT Σ (P) + CATCH_WEIGHT_MORT Σ (D)<br><br>CATCH_WEIGHT_MORT Σ (E) =<br>Σ (SPECIMEN_LENGTH* where VIABILITY = E) for all sampled hauls x CATCH_WEIGHT x (.20**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls<br><br>CATCH_WEIGHT_MORT Σ (P) =<br>Σ (SPECIMEN_LENGTH* where VIABILITY = P) for all for all sampled hauls x CATCH_WEIGHT x (.55**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls<br><br>CATCH_WEIGHT_MORT Σ (D) =<br>Σ (SPECIMEN_LENGTH* where VIABILITY = D) for all sampled hauls x CATCH_WEIGHT x (.90**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls |
| 3, 4, 5 | ∑CATCH_WEIGHT_MORT for all sampled hauls x CATCH_COUNT for unsampled haul=PHLB IBQ<br>∑CATCH_COUNT for all sampled hauls |
| 6, 7 | Average CATCH_COUNT for all sampled hauls = ∑CATCH_COUNT for all sampled hauls<br>Total # sampled hauls<br>CATCH_WEIGHT = Σ SPECIMEN_LENGTH* x Average CATCH_COUNT for all sampled hauls<br>#_PHLB_SAMPLED_IFQ<br><br>CATCH_WEIGHT_MORT =<br>CATCH_WEIGHT_MORT Σ (E) + CATCH_WEIGHT_MORT Σ (P) + CATCH_WEIGHT_MORT Σ (D)<br><br>CATCH_WEIGHT_MORT Σ (E) =<br>Σ (SPECIMEN_LENGTH* where VIABILITY = E) for all sampled hauls x CATCH_WEIGHT x (.20**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls<br><br>CATCH_WEIGHT_MORT Σ (P) =<br>Σ (SPECIMEN_LENGTH* where VIABILITY = P) for all sampled hauls x CATCH_WEIGHT x (.55**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls<br><br>CATCH_WEIGHT_MORT Σ (D) = |

| | |
|---|---|
| | Σ (SPECIMEN_LENGTH* where VIABILITY = D) for all sampled hauls x CATCH_WEIGHT x (.90**)<br>Σ SPECIMEN_LENGTH* for all sampled hauls |
| 8, 9 | PHLB IBQ = ∑CATCH_WEIGHT_MORT for all sampled hauls<br>Total # of sampled hauls |
| 10 | CATCH_WEIGHT_MORT =<br>∑CATCH_WEIGHT _MORT for the properly sampled PHLB + (CATCH_WEIGHT estimate for the predated PHLB* Mortality rate for "dead" for that fishery) |

* Converted to weight using P. halibut length-weight conversion table (Appendix C below)

** IPHC mortality rates

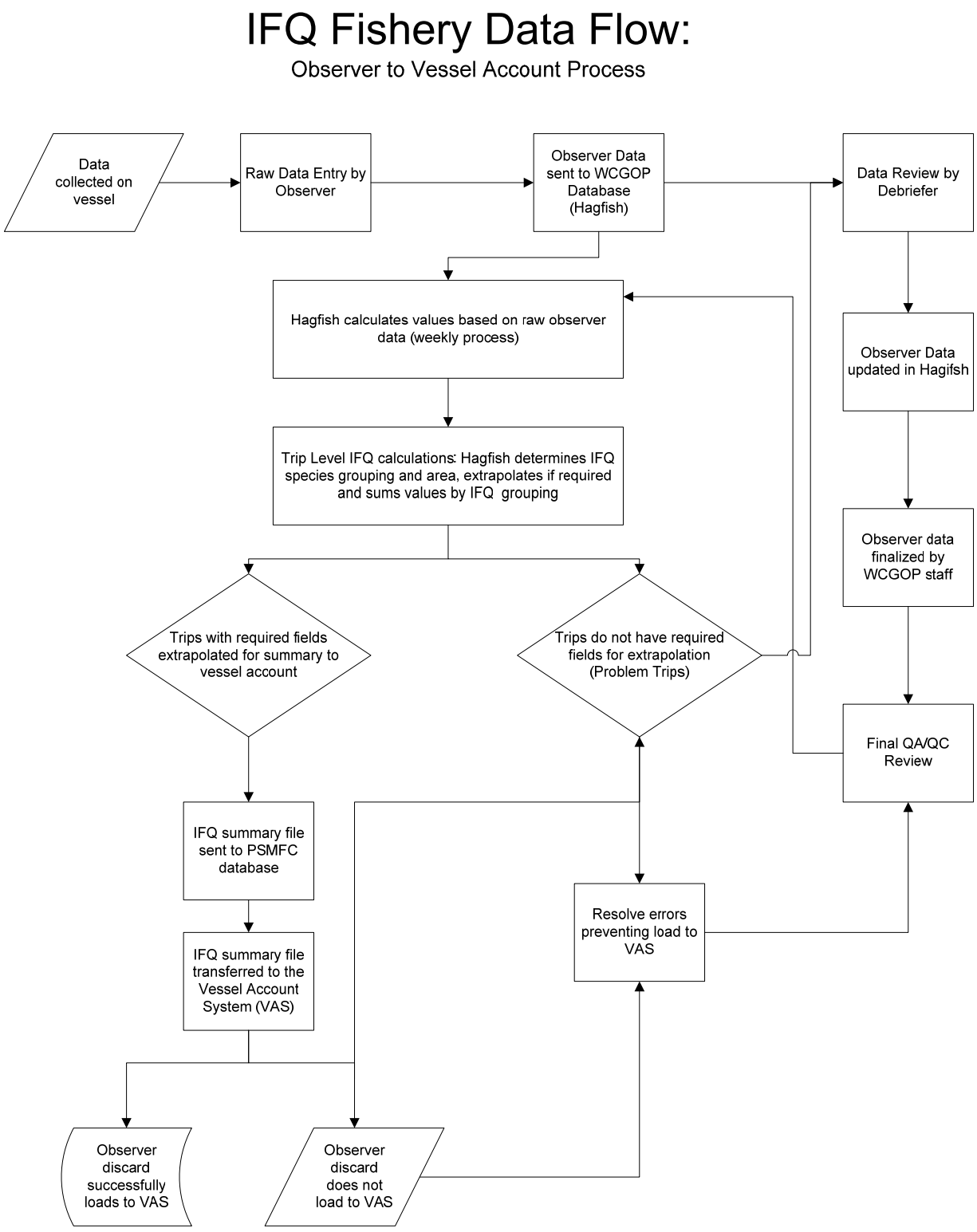
# APPENDIX C

**Table C1.** IPHC length weight conversion table for Pacific halibut

| Centimeter | Pounds | Kilograms | Centimeter | Pounds | Kilograms | Centimeter | Pounds | Kilograms | Centimeter | Pounds | Kilograms |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 0.02 | 0.01 | 71 | 9.19 | 4.17 | 131 | 66.82 | 30.31 | 191 | 226.70 | 102.83 |
| 11 | 0.02 | 0.01 | 72 | 9.61 | 4.36 | 132 | 68.48 | 31.06 | 192 | 230.56 | 104.58 |
| 12 | 0.02 | 0.01 | 73 | 10.05 | 4.56 | 133 | 70.17 | 31.83 | 193 | 234.48 | 106.36 |
| 13 | 0.04 | 0.02 | 74 | 10.49 | 4.76 | 134 | 71.89 | 32.61 | 194 | 238.45 | 108.16 |
| 14 | 0.04 | 0.02 | 75 | 10.98 | 4.98 | 135 | 73.66 | 33.41 | 195 | 242.44 | 109.97 |
| 15 | 0.07 | 0.03 | 76 | 11.44 | 5.19 | 136 | 75.44 | 34.22 | 196 | 246.50 | 111.81 |
| 16 | 0.07 | 0.03 | 77 | 11.95 | 5.42 | 137 | 77.25 | 35.04 | 197 | 250.60 | 113.67 |
| 17 | 0.09 | 0.04 | 78 | 12.46 | 5.65 | 138 | 79.08 | 35.87 | 198 | 255.74 | 116.00 |
| 18 | 0.11 | 0.05 | 79 | 12.99 | 5.89 | 139 | 80.95 | 36.72 | 199 | 258.93 | 117.45 |
| 19 | 0.13 | 0.06 | 80 | 13.51 | 6.13 | 140 | 82.87 | 37.59 | 200 | 263.17 | 119.37 |
| 20 | 0.15 | 0.07 | 81 | 14.07 | 6.38 | 141 | 84.79 | 38.46 | 201 | 267.46 | 121.32 |
| 21 | 0.18 | 0.08 | 82 | 14.64 | 6.64 | 142 | 86.75 | 39.35 | 202 | 271.79 | 123.28 |
| 22 | 0.20 | 0.09 | 83 | 15.23 | 6.91 | 143 | 88.76 | 40.26 | 203 | 276.17 | 125.27 |
| 23 | 0.24 | 0.11 | 84 | 15.83 | 7.18 | 144 | 90.79 | 41.18 | 204 | 280.60 | 127.28 |
| 24 | 0.26 | 0.12 | 85 | 16.45 | 7.46 | 145 | 92.84 | 42.11 | 205 | 285.10 | 129.32 |
| 25 | 0.31 | 0.14 | 86 | 17.09 | 7.75 | 146 | 94.93 | 43.06 | 206 | 289.62 | 131.37 |
| 26 | 0.35 | 0.16 | 87 | 17.75 | 8.05 | 147 | 97.05 | 44.02 | 207 | 294.21 | 133.45 |
| 27 | 0.40 | 0.18 | 88 | 18.41 | 8.35 | 148 | 99.21 | 45.00 | 208 | 298.84 | 135.55 |
| 28 | 0.46 | 0.21 | 89 | 19.09 | 8.66 | 149 | 101.39 | 45.99 | 209 | 303.51 | 137.67 |
| 29 | 0.51 | 0.23 | 90 | 19.80 | 8.98 | 150 | 103.62 | 47.00 | 210 | 308.25 | 139.82 |
| 30 | 0.57 | 0.26 | 91 | 20.53 | 9.31 | 151 | 105.87 | 48.02 | 211 | 313.03 | 141.99 |
| 31 | 0.62 | 0.28 | 92 | 21.25 | 9.64 | 152 | 108.16 | 49.06 | 212 | 317.86 | 144.18 |
| 32 | 0.71 | 0.32 | 93 | 22.02 | 9.99 | 153 | 110.50 | 50.12 | 213 | 322.73 | 146.39 |
| 33 | 0.77 | 0.35 | 94 | 22.80 | 10.34 | 154 | 112.83 | 51.18 | 214 | 327.67 | 148.63 |
| 34 | 0.84 | 0.38 | 95 | 23.59 | 10.70 | 155 | 115.24 | 52.27 | 215 | 332.65 | 150.89 |
| 35 | 0.93 | 0.42 | 96 | 24.41 | 11.07 | 156 | 117.66 | 53.37 | 216 | 337.70 | 153.18 |
| 36 | 1.01 | 0.46 | 97 | 25.24 | 11.45 | 157 | 120.13 | 54.49 | 217 | 342.79 | 155.49 |
| 37 | 1.10 | 0.50 | 98 | 26.08 | 11.83 | 158 | 122.62 | 55.62 | 218 | 347.93 | 157.82 |
| 38 | 1.21 | 0.55 | 99 | 26.96 | 12.23 | 159 | 125.16 | 56.77 | 219 | 353.13 | 160.18 |
| 39 | 1.32 | 0.60 | 100 | 27.87 | 12.64 | 160 | 127.71 | 57.93 | 220 | 358.38 | 162.56 |
| 40 | 1.43 | 0.65 | 101 | 28.77 | 13.05 | 161 | 130.32 | 59.11 | 221 | 363.69 | 164.97 |
| 41 | 1.59 | 0.72 | 102 | 29.70 | 13.47 | 162 | 132.96 | 60.31 | 222 | 369.05 | 167.40 |
| 42 | 1.68 | 0.76 | 103 | 30.67 | 13.91 | 163 | 135.65 | 61.53 | 223 | 374.45 | 169.85 |
| 43 | 1.81 | 0.82 | 104 | 31.64 | 14.35 | 164 | 138.36 | 62.76 | 224 | 379.92 | 172.33 |
| 44 | 1.94 | 0.88 | 105 | 32.63 | 14.80 | 165 | 141.12 | 64.01 | 225 | 385.45 | 174.84 |
| 45 | 2.09 | 0.95 | 106 | 33.64 | 15.26 | 166 | 143.90 | 65.27 | 226 | 391.03 | 177.37 |
| 46 | 2.25 | 1.02 | 107 | 34.68 | 15.73 | 167 | 146.72 | 66.55 | 227 | 396.67 | 179.93 |
| 47 | 2.43 | 1.10 | 108 | 35.74 | 16.21 | 168 | 149.54 | 67.83 | 228 | 402.36 | 182.51 |
| 48 | 2.58 | 1.17 | 109 | 36.84 | 16.71 | 169 | 152.49 | 69.17 | 229 | 408.09 | 185.11 |
| 49 | 2.76 | 1.25 | 110 | 37.94 | 17.21 | 170 | 155.45 | 70.51 | 230 | 413.91 | 187.75 |
| 50 | 2.95 | 1.34 | 111 | 39.07 | 17.72 | 171 | 158.42 | 71.86 | 231 | 419.76 | 190.40 |
| 51 | 3.15 | 1.43 | 112 | 40.21 | 18.24 | 172 | 161.44 | 73.23 | 232 | 425.69 | 193.09 |
| 52 | 3.35 | 1.52 | 113 | 41.38 | 18.77 | 173 | 164.51 | 74.62 | 233 | 431.66 | 195.80 |
| 53 | 3.57 | 1.62 | 114 | 42.59 | 19.32 | 174 | 167.60 | 76.02 | 234 | 437.68 | 198.53 |
| 54 | 3.79 | 1.72 | 115 | 43.81 | 19.87 | 175 | 170.75 | 77.45 | 235 | 443.76 | 201.29 |
| 55 | 4.01 | 1.82 | 116 | 45.06 | 20.44 | 176 | 173.92 | 78.89 | 236 | 449.91 | 204.08 |
| 56 | 4.25 | 1.93 | 117 | 46.32 | 21.01 | 177 | 177.14 | 80.35 | 237 | 456.13 | 206.90 |
| 57 | 4.52 | 2.05 | 118 | 47.62 | 21.60 | 178 | 180.40 | 81.83 | 238 | 462.39 | 209.74 |
| 58 | 4.76 | 2.16 | 119 | 48.94 | 22.20 | 179 | 183.71 | 83.33 | 239 | 468.72 | 212.61 |
| 59 | 5.05 | 2.29 | 120 | 50.29 | 22.81 | 180 | 187.06 | 84.85 | 240 | 475.09 | 215.50 |
| 60 | 5.31 | 2.41 | 121 | 51.65 | 23.43 | 181 | 190.46 | 86.39 | 241 | 481.55 | 218.43 |
| 61 | 5.62 | 2.55 | 122 | 53.07 | 24.07 | 182 | 193.87 | 87.94 | 242 | 488.05 | 221.38 |
| 62 | 5.93 | 2.69 | 123 | 54.48 | 24.71 | 183 | 197.36 | 89.52 | 243 | 494.60 | 224.35 |
| 63 | 6.24 | 2.83 | 124 | 55.93 | 25.37 | 184 | 200.86 | 91.11 | 244 | 501.24 | 227.36 |
| 64 | 6.57 | 2.98 | 125 | 57.41 | 26.04 | 185 | 204.43 | 92.73 | 245 | 507.92 | 230.39 |
| 65 | 6.90 | 3.13 | 126 | 58.91 | 26.72 | 186 | 208.03 | 94.36 | 246 | 514.66 | 233.45 |
| 66 | 7.25 | 3.29 | 127 | 60.43 | 27.41 | 187 | 211.67 | 96.01 | 247 | 521.48 | 236.54 |
| 67 | 7.61 | 3.45 | 128 | 61.99 | 28.12 | 188 | 214.71 | 97.39 | 248 | 528.36 | 239.66 |
| 68 | 7.98 | 3.62 | 129 | 63.56 | 28.83 | 189 | 218.50 | 99.11 | 249 | 535.28 | 242.80 |
| 69 | 8.38 | 3.80 | 130 | 65.17 | 29.56 | 190 | 222.89 | 101.10 | 250 | 542.29 | 245.98 |
| 70 | 8.77 | 3.98 | | | | | | | | | |

## APPENDIX D

**Figure D1.** IFQ groundfish fishery data flow from the West Coast Groundfish Observer Program (WCGOP) to the Vessel Account System (VAS) of the NW Regional Office.



From: **Eileen Sobeck - NOAA Federal** <eileen.sobeck@noaa.gov>
Date: Wed, Aug 27, 2014 at 3:17 PM
Subject: NOAA Announcing Proposed Rule for Regulating Offshore Marine Aquaculture in the Gulf of Mexico
To: _NMFS MAFAC <nmfs.mafac@noaa.gov>, _NMFS FMC Exec Directors <nmfs.rfmc@noaa.gov>

Today, we released the proposed rule for Regulating Offshore Marine Aquaculture in the Gulf of Mexico. This proposed rule marks the first time a Regional Fishery Management Council has approved a comprehensive regulatory program for aquaculture in federal waters. There will be a 60 day public comment period for this rule.

This proposed rule establishes a region-specific permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf of Mexico. This rule will allow for up to 20 offshore aquaculture operations to be permitted in federal waters of the Gulf, while providing comprehensive safeguards to ensure healthy oceans.

I would like to thank the Gulf Council, NOAA's Southeast Regional Administrator, Dr. Roy Crabtree, Director of the Office of Aquaculture, Dr. Michael Rubino, General Counsel and everyone involved who were dedicated to seeing this rule through. Once in place, this rule will allow for new opportunities for seafood production in the United States.

Additional information can be found here.

See attached bulletin regarding proposed rule.

National Marine Fisheries Service, Southeast Regional Office, 263 13th Avenue South, St. Petersburg, Florida 33701-5505

# Southeast Fishery Bulletin

Contact: Allison Garrett (727) 330-0309

August 27, 2014

## NOAA Seeks Public Comment on the Proposed Rule for the Aquaculture Plan for Federal Waters of the Gulf of Mexico

NOAA Fisheries is seeking public comment on a proposed rule for the Gulf of Mexico Fishery Management Council's Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico (Aquaculture Plan). The proposed rule published in the *Federal Register* on August 28, 2014 (XX FR XXXXX). The public comment period ends on October 27, 2014.

**Background**

Prior to the Aquaculture Plan, an exempted fishing permit was required to conduct aquaculture in federal waters. Since exempted fishing permits are of limited duration, they are not the best option for commercial aquaculture operations. The purpose of this rulemaking is to establish a regional permitting process to manage the development of an environmentally-sound and economically-sustainable aquaculture industry in federal waters of the Gulf of Mexico (Gulf). A maximum of twenty Gulf aquaculture permits over a period of 10 years could be issued under this proposed rule.

**The proposed rule would:**

- Establish Gulf aquaculture permit requirements, eligibility, and transferability.
- Establish application requirements, operational requirements, and restrictions for Gulf Aquaculture permits.
- Establish Gulf aquaculture permit duration and renewal periods.
- Specify allowable species for aquaculture purposes.
- Evaluate proposed aquaculture systems on a case-by-case basis.
- Establish marine aquaculture siting requirements and conditions.
- Create a restricted access zone around each aquaculture facility where no fishing may occur and no fishing vessels may operate in or transit through (unless they possess a copy of the facilities' aquaculture permit onboard).
- Establish recordkeeping and reporting requirements.
- Establish biological reference points (e.g., *maximum sustainable yield* which is the total yield harvested by all aquaculture operations in a given year), annual catch limit and accountability measures, and status determination criteria (e.g., overfishing and overfished status) for aquaculture operations.
- Specify procedures for modifying biological reference points and management measures for offshore marine aquaculture in the Gulf.

Other information on the Gulf aquaculture permit is also discussed in the Aquaculture Plan. If this rulemaking is implemented, the administrative functions associated with it (e.g., registration and account setup, landing transactions, and most reporting requirements) are intended to be accomplished online via the aquaculture Web site. A participant must have access to a computer and Internet access and must set up an appropriate online aquaculture account to participate.

**Request for Comments** (Comments accepted starting Thursday, August 28)

You may submit comments on the proposed rule, identified by "NOAA-NMFS-2008-0233" by any of the following methods:

- Electronic Submissions: Submit electronic public comments via the Federal e-Rulemaking Portal. Go to www.regulations.gov/#!docketDetail;D=NOAA-NMFS-2008-0233, click the "Comment Now!" icon, complete the required fields, and enter or attach your comments.
- Mail: Submit written comments to Jess Beck-Stimpert, Southeast Regional Office, NOAA Fisheries, 263 13th Avenue South, St. Petersburg, FL 33701.

Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NOAA Fisheries. All comments received are a part of the

public record and will generally be posted for public viewing on www.regulations.gov without change. All personal identifying information (e.g., name, address, etc.), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NOAA Fisheries will accept anonymous comments (enter "N/A" in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

Electronic copies of the Aquaculture Plan, which includes a final programmatic environmental impact statement, an initial regulatory flexibility analysis, and a regulatory impact review may be obtained from the Southeast Regional Office Web site at http://sero.nmfs.noaa.gov.

Comments must be received by October 27, 2014, to be considered by NOAA Fisheries in its decision on the final rule. All comments received by NOAA Fisheries specific to the proposed rule will be addressed in the final rule.

This bulletin provides only a summary of the information regarding the existing regulations. Any discrepancies between this bulletin and the regulations as published in the *Federal Register* will be resolved in favor of the *Federal Register*.

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August 27, 2014

Stephen Gittings
Science Director
NOAA's National Marine Sanctuary Program
1305 East-West Highway, 11th Floor
Silver Spring, Maryland 20910

Dear Dr. Gittings:

The Olympic Coast Intergovernmental Policy Council (IPC) consists of the Hoh, Makah, and Quileute Tribes, the Quinault Indian Nation, and the State of Washington and was established to facilitate communication and resource protection and advance scientific understanding within the boundaries of the Olympic Coast National Marine Sanctuary (OCNMS) among the resource co-managers. On behalf of the IPC, I am writing to invite you to participate in a scientific technical working group that will be tasked with documenting habitat types, using agreed-upon data standards and formats, off the Washington Coast.

Attached is a draft Scope of Work for this working group. The Scope of Work serves as the general policy guidance of the IPC, but is not definitive technical or scientific direction. One of the working group's tasks is to revise the objectives and methods in this Scope of Work as appropriate to meet the policy direction provided in the Purpose and Need. The IPC is seeking to describe and document what is and is not known about important habitats in our waters. This effort is modeled on the National Oceanic and Atmospheric Administration (NOAA) Habitat Assessment Improvement Plan (HAIP) of 2010.

The following initial tasks and general timeline have been identified by the IPC:

1. Convene the working group with members of the Coastal and Marine Ecological Classification Standard (CMECS) team to discuss whether that is the appropriate data standard and format based on available resources, expertise, and feasibility this fall. Report back to IPC.
2. Review the GIS habitat information developed by the State of Washington through their marine spatial planning (MSP) process to determine whether they are adequate for this analysis. Report back to the IPC including any additional data or analysis that would meet the purpose and need identified in the Scope of Work. This would be scheduled around the beginning of next year.

Because there is no funding identified for participation in this group, most of the work will likely be accomplished by email and webinar. We are seeking additional funds but they are not guaranteed. Further, you only need to participate in those meetings where you see your expertise is applicable and time allows. Thank you for your consideration and the IPC looks forward to hearing from you on your availability. Please contact Rob Jones at 360-374-5501 or rjones@nwifc.org for more information or to confirm your acceptance.

Sincerely,

Ed Johnstone, IPC Chairman

Enclosure: draft Scope of Work, Habitat Framework

CC: Will Stelle
Frank Lockhart
John Stein
Don McIsaac

# Draft Scope of Work
# *Habitat Framework*

*For Nearshore and Offshore Olympic Coast Ocean*

## Purpose and Need

The Olympic Coast Intergovernmental Policy Council (IPC) has agreed to establish a "Habitat Framework" that will outline criteria for important habitat types. To develop these criteria tribal, state, and federal resource managers need a common language to discuss habitats and how they support fishery resources and ecosystem function. Such a common language will improve the understanding of the ecosystem among managers and their ability to work cooperatively and collaboratively toward common goals.

The Habitat Framework will consist of a compilation of existing data sets into a comprehensive catalog to serve as the best available science for management decisions. This in turn can improve management initiatives and priorities such as ecosystem-based management, coastal and marine spatial planning, habitat protections (e.g. EFH), etc. and improve scientific understanding by contributing to integrated ecosystem assessments. Finally, it can help to identify data gaps and serve as a basis to inform filling those gaps based on shared priorities, available resources, or proposed projects (e.g. alternative energy siting).

This Framework will be developed by establishing known scientific information on habitats within the Olympic Coast National Marine Sanctuary, Coastal Treaty Tribes' usual and accustomed fishing grounds, and state waters. This will be done by a scientific and technical working group composed of federal, state, and tribal experts (hereafter Technical Workgroup). Their report containing a catalog of all known habitat types along with any higher-level information on their roles, productivity etc. will be used by policy representatives of the IPC to determine which are "of special importance" as well as how to coordinate management and conservation of those habitats.

## Objective 1: Catalog of Known Habitat Types

The first step in this work is to compile existing data sets and organize them using a consistent classification scheme. The Federal Geographic Data Committee has developed the Coastal and Marine Ecological Classification Standard (CMECS) for such a purpose[1]. The CMECS is a standardized hierarchical way of classifying habitats. It includes descriptors for the Water

[1] Background on this classification system and the CMECS Standard, June 2010, explaining the catalog of terms can be found here: http://www.csc.noaa.gov/digitalcoast/publications/cmecs

Column Component (structure and features of the water column), the Geoform Component (geomorphic and structural character of the coastline or seafloor), the Substrate Component (character and composition of surface and near-surface substrates), and the Biotic Component (assemblages of benthic and floating/suspended organisms). These descriptions can be combined to describe Biotopes – the combination of abiotic features and associated organisms.

Developing this catalog is the primary function of the Habitat Framework technical working group. As described below, they will compile existing information that has been collected within the Sanctuary, state waters adjacent to the Olympic Coast, and Coastal Treaty Tribes' U&As. This may include mapping and other habitat data from OCNMS, USGS, and other federal agencies as well as state and tribal data where available.

This catalog of habitat types will ultimately be the foundation that policy makers will use to determine what habitats are important. As such it will be important to characterize the data resolution (i.e. level of knowledge) available for making management decisions that might directly (e.g. special designations or habitat protections) or indirectly impact those habitats (e.g. harvest management or alternative energy siting).

### Deliverables

1. A catalog organizing all known habitat data into the CMECS classification components. This may require reconciling or reworking existing classification(s) of data into the CMECS (or other agreed-to) standard.
2. Development of GIS mapping data layers giving location and areal extent of habitat types for the components where data is available.

## Objective 2: Species Associations with Habitats

The second level of understanding within the Habitat Framework is describing species associations with particular habitat types. This second order level of understanding is analogous to "Level 1" understanding of essential fish habitat (EFH)[2] under the Magnuson Stevens Act as well as "Tier 1" for habitat assessments[3]. It would reflect presence or absence data of a species associated with a particular habitat. This should also include any known human uses or associations with a particular habitat type. Objective 2 also allows for the description of Biotopes (where data allows) under the CMECS Standard, which will provide a more precise and data-rich description of habitat type based on a number of Components.

[2] 50 CFR 600.815

[3] NMFS. 2010. Marine fisheries habitat assessment improvement plan. Report of the National Marine Fisheries Service Habitat Assessment Improvement Plan Team. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-108, 115 p.

This objective is customized somewhat from the CMECS Standard[4] used to create the underlying catalog of habitat types. CMECS uses those to develop Biotopes that do not include free moving organisms (i.e. it only includes sessile/attached organisms and associated plankton that cannot leave a region on the order of about a day). In order for the IPC to understand EFH, further the goals of ecosystem based management and ecosystem assessments, and describe the cultural importance of habitat types, it is necessary to document known interaction of all organisms with the habitat components described under Objective 1.

Under the CMECS Standard Biotopes are described using either qualitative or quantitative data. Under this objective it will be important for policy makers to understand whether a Biotope is based on qualitative or quantitative information. Likewise, any information on other species associations should list the data sources and a clear understanding of how those associations were measured.

### Deliverables

1. List of known and inferred associations of species, including humans, with habitats (Components) described from Objective 1. This should include, where possible, a description of how any of those associations have changed over time and data sources.
2. Catalog describing Biotopes under the CMECS Standard where possible.
    a. GIS layers should be developed reflecting these Biotopes.
    b. Each biotope developed should note whether it is based on quantitative or qualitative data.
3. GIS layers outlining of nektonic species and human associations with either Components or Biotopes as data allow.

## Objective 3: Ecosystem Services

This objective is a third order understanding of habitat and reflects relative contribution of habitats to ecosystem function, health, or services. This can be described in density of species associated with habitats, measures of biological productivity (e.g. growth, spawning potential, survival rates, etc.) associated with habitat, or other measures deemed relevant by the Technical Working Group. This objective corresponds to any of the higher levels of EFH description (i.e. 2-4) or higher Tiers of Excellence for habitat assessments (i.e. 2-3).

This objective is one of the most important for informing policy makers. While the first two objectives are concerned with what habitat types exist in the ecosystem and what occurs in those habitats, this objective seeks to answer what each habitat's role in the ecosystem is and/or what its relative contribution is. While data that supports the contribution of a habitat type to species within the ecosystem does not box policy makers into designating a habitat as "important", it

[4] This is, however, similar to the use of "Modifiers" outlined in Section 10 of the CMECS Standard.

does signal that there is a relatively large amount of data making the impact of the habitat on the associated biotic environment measureable.

## Deliverables

1. Specify for each of the Components described under Objective 1 or Biotopes under Objective 2 whether there is or is not evidence of their contribution to biological functions in the ecosystem and the source of that data (e.g. ongoing monitoring data, literature review, etc.)
2. Wherever higher levels of habitat use can be shown in available data, those should be converted to GIS layers for inclusion in the Habitat Framework.

**Revision of Seafood Watch Guidelines**

On September 2, 2014, the Monterey Bay Aquarium's Seafood Watch program released new guidelines that designate all groundfish caught in California, Oregon and Washington as either a Seafood Watch "Good Alternative" or "Best Choice." Specifically, all trawl- and longline-caught rockfish were upgraded from "Avoid" to either "Good Alternative" or "Best Choice"; Dover sole, English sole, Pacific sanddab and rex sole were upgraded from "Good Alternative" to "Best Choice"; Pacific grenadier has been upgraded from "Avoid" to "Good Alternative"; and U.S. Pacific spiny dogfish were upgraded from "Avoid" to "Best Choice."

According to the Seafood Watch program, the new recommendations were made based on reductions in the catch of overfished species, new stock assessments, area closures to protect habitat, new quotas that better account for uncertainty, and the implementation of catch shares.

Many major news outlets covered the story. Among them:

- Sacramento Bee: **Recovery knocks 21 fish species from watch list** (http://tinyurl.com/nbjqsgf); includes interview with Brad Pettinger.
- Los Angeles Times: **Seafood Watch cites dramatic turnaround in rockfish, other West Coast fish** (http://tinyurl.com/mo6235c)
- Oregonian: **Seafood Watch's sustainability guide upgrades 21 species of sole, snapper, other groundfish as good choices** (http://tinyurl.com/oskjguy);
- Huffington Post: **"Unprecedented" Turnaround For Nearly Two Dozen Fish Species Now Deemed Sustainable** (http://tinyurl.com/mfnt2tz)
- New York Times: **Revival of Species Puts Some Fish Back on Plates** (http://tinyurl.com/nuw9w84)
- Seattle Times: **Eat Up! These bottom fish make dramatic recovery on West Coast** (http://tinyurl.com/osaqoyp)
- Capital Public Radio: **21 West Coast Groundfish Taken Off "Fish To Avoid" List** (http://tinyurl.com/nrweg8z)

PFMC
9/3/2014

Supplemental Informational Report 7
September 2014

NATIONAL MARINE FISHERIES SERVICE REPORT --

# NMFS RESPONSE TO COUNCIL'S QUESTIONS CONCERNING THE EFFECTIVENESS, ACCURACY, AND COMPLETENESS OF PACIFIC COAST GROUNDFISH EFH

At its March 2014 meeting, the Council requested that the Northwest and Southwest Fisheries Science Centers investigate the question of groundfish essential fish habitat (EFH) effectiveness, accuracy, and completeness, in the best way possible within the next five months, using existing staff resources, and to present their findings for consideration at the September 2014 Council meeting. Following the March 2014 meeting, environmental and industry representatives decided to work together to resolve diverging issues in competing proposals to modify groundfish EFH. Because of this effort, groundfish EFH is no longer on the Council's agenda for the September meeting. However, in this report, the NWFSC, SWFSC, and WCR staff present much of the information that was requested by the Council in order to inform the negotiations among the environmental and industry proposers. The following table summarizes tasks and associated products, referenced by Council Member or requester. The products follow the table and are indexed by page number. A few products have not been completed and will be delivered, along with greater discussion of all products, at the Council's November meeting.

**NMFS Pacific Groundfish EFH Tasking for September Council Meeting**

| Section | Council Member / Requester | Task | Products | Page |
|---|---|---|---|---|
| **1** | Dale Myer | Describe and analyze effects of gear changes (e.g. footrope regs), Analyze untrawlable habitat as proxy for closed areas | List of gear changes and key papers, along with summary statement | **5** |
| **2** | Dale Myer | Analyze how Amendment 20 is affecting fishing | This analysis is required by the 2012 Biological Opinion, and its completion is anticipated in 2015 | **7** |
| **3** | Dale Myer | Analyze if Amendment 20 is having a positive effect on habitat | Analysis is dependent on first receiving the product described in Section 2 above | **7** |
| **4** | Dale Myer | Analyze effects of RCA | Products from Section 1 above and the Trawl RCA Boundary Modifications Final Environmental Assessment | **5 & 8** |
| **5** | Dale Myer | Analyze whiting data within efh conservation areas for bottom contact | Table of % of tows contacting the seafloor in closed vs. open areas by province and by depth | **9** |
| **6** | Michelle Culver | Maps of displaced or restored trawl effort that would result from proposals | GIS Layers and Maps | **10** |
| **7** | Michelle Culver | What % of trawl effort would be displaced/restored by proposals and what % of the area would be displaced or restored by the proposals? | Table with summary of the % of trawl effort displaced or restored by proposal by province by gear type | **15** |

| | | | | |
|---|---|---|---|---|
| **8** | Michelle Culver | What % of the catch composition in aggregate is in the proposed closed areas? | Table with % of aggregate catch (e.g., sharks, rockfishes, flatfishes, etc.) by proposal by province by gear type | **16** |
| **9** | Michelle Culver | Identify overlap in spatial boundaries among proposals | GIS Layers and Maps | **17** |
| **10** | Michelle Culver | Map of proposed closures with overlay of tribal areas (North of 46-degrees 53' N lat. to US-Canada border; shoreward of 125-degrees 44' W long.) | GIS Layers and Maps | **21** |
| **11** | Michelle Culver | Region should develop process options for implementation of new regulations in 2016 and 2017. More specifically, she asked the Region to come back with 1 or 2 options for the Council to consider on process and timelines that the Council can use to back calculate when they need to take action - i.e., when would the Council need to take final action for the regulations to be implemented by NMFS in 2016 or 2017? | Beyond the scope of the current NMFS Report | - |
| **12** | Michelle Culver | Maps of displaced or restored fixed gear effort that would result from proposals | GIS Layers and Maps | **23** |

| | | | | |
|---|---|---|---|---|
| **13** | Michelle Culver | What % of fixed gear effort would be displaced/restored by proposals and what % of the area would be displaced or restored by the proposals? | Table with summary of the % of fixed gear effort displaced or restored by proposal by province | **26** |
| **14** | Dan Wolford | Focus on objective of maintaining healthy fish populations rather than protecting habitat for habitat's sake. | NEPA purpose and needs statement; Beyond the scope of the current NMFS Report | **-** |
| **15** | Dan Wolford | Cost/benefit of areas to protect habitat | See Culver tasks and NEPA; Beyond the scope of the current NMFS Report | **-** |
| **16** | Dan Wolford | Gather a team to conduct independent scientific review of status quo and proposals | Beyond the scope of the current NMFS Report | **-** |
| **17** | Dan Wolford | Develop criteria for analyzing proposals | Beyond the scope of the current NMFS Report | **-** |
| **18** | Rich Lincoln | Where do proposals intersect RCAs? | GIS Layers and Maps | **27** |
| **19** | Council Staff | Areas where inaccuracies exist in previous designations | List of areas | **28** |
| **20** | Michelle Culver & David Sones | Summarize consultations, including acres protected | Table with narrative. | **29** |

## 1. DESCRIBE AND ANALYZE EFFECTS OF GEAR CHANGES (E.G. FOOTROPE REGS), ANALYZE UNTRAWLABLE HABITAT AS PROXY FOR CLOSED AREAS

As part of Phase 3 of the groundfish EFH process, the Council at their March 2014 meeting requested a summary of gear and area-based regulations relevant to fishery impacts to groundfish EFH – regardless of the intent of the regulation. For example, the Council and NMFS restricted the size of footropes in 2000 primarily to inhibit catch of overfished species of rockfishes that reside in rocky habitats. The regulation may have contributed to a sharp reduction in trawl impacts to rocky habitat (see Hannah 2003 below) and indeed, habitat protection was cited as a secondary intent of the regulation. Similarly, the Rockfish Conservation Areas primary intent is to limit fishery access to overfished species with the secondary effect of eliminating habitat impacts from bottom contact fishing gear from large areas of EFH.

Our approach to this Council request is to provide (1) relevant literature citations and abstracts, (2) relevant assessments and analyses from Amendment 19 to the groundfish FMP and the current EFH review, and (3) an overview of relevant regulations from federal, state, and tribal managers (see Appendix 1).

In comparison to the early 1990s, the Council and States have clearly been moving in a regulatory direction that results in less overall impacts to benthic habitat; however, it is unclear how the intensity of present impacts are distributed and how habitat is impacted at local or functional scales. Footrope restrictions implemented in 2000 have likely resulted in a general reduction of trawling in rocky habitats (Hannah 2003 and Bellman et al. 2005). Gear-specific Rockfish Conservation Areas have eliminated or reduced fishing effort in areas where the incidental catch of the adult life stage of overfished species was highest. The RCAs have, therefore, eliminated or reduced the impacts on habitat associated with those gear types. The overall management framework has resulted in a coastwide decline in trawl effort during 1999-2004 (Bellman and Heppell 2007). Trawl effort may have continued to decline due to rationalization of the trawl fishery; this will be assessed in an upcoming report to the Council currently scheduled for early 2015. Another major positive influence on habitat since the 1990s is the implementation of numerous federal, state, and tribal spatial regulations such as the federal EFH Conservation Areas, Marine Reserve in Oregon, Marine Protected Areas in California, prohibition of specified commercial fisheries areas off California and Washington, and a suite of other state and tribal management measures described above.

The Risk Assessment for Amendment 19 describes the metrics that characterize the extent of impacts to habitats, such as:

- The location and intensity of impacts (including fishing and non-fishing impacts);
- The sensitivity of specific habitat types to specific impacts at differing levels of intensity; and,

- The potential for habitats to recover between impact events.

The status of habitat relative to its capacity to fulfill specific ecological functions is a balance between how the habitat was impacted and how much recovery takes place between impacts. It was not possible to quantify the status of habitat for Amendment 19 due to insufficient data at the necessary resolution to model a relationship between the intensity of habitat stressors and their effect on habitat function. The information consolidated thus far for this review is an incremental update of the information from Amendment 19, but we are still unable to model the status of habitats at scales relevant to the potential impacts. While not comprehensive, this overview contributes to the considerable material already developed for the Council on this and similar questions. This material may be further developed during the remainder of Phase 3.

## 2. ANALYZE HOW AMENDMENT 20 IS AFFECTING FISHING

This analysis is required by the 2012 Biological Opinion and its completion is anticipated in 2015.

## 3. ANALYZE IF AMENDMENT 20 IS HAVING A POSITIVE EFFECT ON HABITAT

Analysis is dependent on first receiving product described above.

## 4. ANALYZE EFFECTS OF THE RCA

Considerable analysis relevant to this request has been reported in the NMFS "Trawl Rockfish Conservation Area (RCA) Boundary Modifications, Final Environmental Assessment", February 2014. Pending further review, the analysis contained in the Region's report is responsive to this Council request.

http://www.westcoast.fisheries.noaa.gov/publications/nepa/groundfish/misc_ea/rca_ea_3_4_14.pdf

## 5. ANALYZE WHITING DATA WITHIN EFH CONSERVATION AREAS FOR BOTTOM CONTACT

Table 1a. Summary of estimated frequency of "probable" bottom contact by vessels using midwater trawl gear in the at-sea hake fishery. "Probable" bottom contact is defined as the presence of either one or more benthic or demersal fish or invertebrate taxa in the catch.* Bottom contact is reported as frequency of hauls both coastwide and within existing EFH conservation areas. Data sources: At-Sea Hake Observer Program (at-sea sector; 12 Jun 2006 – 31 Dec 2013). Note: as an aid to interpreting this table: out of 949 hauls that occurred within the EFH Conservation Areas, 115 or 12.1% were interpreted as contacting the seafloor; out of 19,090 hauls that occurred outside of the EFH Conservation Areas, 4,353 or 22.8% were interpreted as contacting the seafloor; and out of 20,039 hauls that occurred coastwide, 4,468 or 22.3% were interpreted as contacting the seafloor.

| | Inside | | Outside | | Inside + Outside | |
|---|---|---|---|---|---|---|
| **Hauls (total)** | 949 | 4.7% | 19,090 | 95.3% | 20,039 | 100.0% |
| **Hauls with >=1 benthic taxa** | 115 | 12.1% | 4,353 | 22.8% | 4,468 | 22.3% |
| **Hauls with >=2 benthic taxa** | 31 | 3.3% | 1,808 | 9.5% | 1,839 | 9.2% |
| **Hauls with 1 benthic taxa** | 84 | 8.8% | 2,545 | 13.3% | 2,629 | 13.1% |

Table 1b. Summary of estimated frequency of "probable" bottom contact by vessels using midwater trawl gear in the shore-side hake fishery. "Probable" bottom contact is defined as the presence of either one or more benthic or demersal fish or invertebrate taxa in the catch.* Bottom contact is reported as frequency of trips coastwide. Data sources: IFQ shore-side hake fish ticket matched 2011 - 2013 observer data. Note: the data set includes a total of 4,989 hauls from 2,574 unique fishing trips, averaging about 2 hauls per trip.

| | Inside + Outside | |
|---|---|---|
| **Trips (total)** | 2,574 | |
| **Trips with >=1 benthic taxa** | 1,808 | 70.2% |
| **Trips with >=2 benthic taxa** | 955 | 37.1% |
| **Trips with 1 benthic taxa** | 853 | 33.1% |

*The set of taxa defined as benthic or demersal were determined by a team of expert marine ecologists and fisheries biologists.

## 6. MAPS OF DISPLACED OR RESTORED TRAWL EFFORT THAT WOULD RESULT FROM PROPOSALS

Tables 2, 3 and 4 present some metrics as background in order to interpret the responses to Council items 6, 7, and 8.

Table 2. Summary of existing Amendment 19 gear restrictions, reported in area (ha) and proportion of existing groundfish EFH. Amendment 19 gear restrictions include areas closed to four gear categories. The second line shows the total proportion of existing EFH closed to some type of fishing gear. Note: as an aid to interpreting this table, out of 50,525,459 ha designated as EFH, 70.2% (35,457,030 ha) are closed to some type of bottom contact fishing gear, and 32,688,218 ha (64.7%) of current EFH is closed to bottom trawl gear.

| | | |
|---|---|---|
| **Current EFH Designation** | 50,525,459 | |
| **Current EFH Cons. Area** | 35,457,030 | 70.2% |
| **bottom contact gear** | 232,300 | 0.5% |
| **bottom contact gear or other gear deployed deeper than 500-fm** | 200,899 | 0.4% |
| **bottom trawl gear** | 32,688,218 | 64.7% |
| **bottom trawl gear other than demersal seine** | 2,335,613 | 4.6% |

Table 3. Summary of area (ha) and proportion of existing EFH, encompassed by each proposal to modify groundfish EFH regulations. Some proposals include areas to either close or reopen areas to fishing. Each proposal is treated independently as some proposals overlap spatially. The last row summarizes the areal extent of all proposals combined, and accounts for overlapping areas.

| Proponent | Close | % EFH | Reopen | % EFH |
|---|---|---|---|---|
| **FMA** | 0 | 0% | 791 | 0.00% |
| **GFNMS** | 18,356 | 0.04% | 0 | 0% |
| **Greenpeace*** | 1,777,141 | 3.52% | 0 | 0% |
| **MBNMS** | 43,669 | 0.09% | 25,694 | 0.05% |
| **MCI*** | 1,213,044 | 2.40% | 0 | 0% |
| **Oceana/NRDC/OC*** | 5,368,883 | 10.63% | 52,128 | 0.10% |
| **Combined** | **7,288,734** | **14.43%** | **52,926** | **0.10%** |

*Only includes areas inside existing groundfish EFH.

Table 4. Summary of area (ha) proposed for expansion of EFH designation and subsequent closure to bottom trawls by Oceana, the Natural Resources Defense Council, and Ocean Conservancy.

| Proponent | Close | % EFH |
|---|---|---|
| **Oceana/NRDC/OC*** | **31,971,344** | **63.3%** |

**Notes on Map Projections Used in This Report**

Map projection used for analysis was consistent with that used for synthesis report. For this reason, areas calculated by individual proponents might be slightly different than those summarized below.

| | |
|---|---|
| Name: | WGS_1984_Transverse_Mercator |
| Authority: | Custom |
| Projection: | Transverse_Mercator |
| False_Easting: | 390000.0 |
| False_Northing: | 0.0 |
| Central_Meridian: | -121.6 |
| Scale_Factor: | 1.0 |
| Latitude_Of_Origin: | 31.96 |
| Linear Unit: | Meter (1.0) |

## MAPS OF DISPLACED OR RESTORED TRAWL EFFORT THAT WOULD RESULT FROM PROPOSALS

Coastwide maps of groundfish EFH proposal areas in relation to bottom trawl fishing intensity were developed for pre- (1 Jan 2002 – 11 Jun 2006) and post- (12 Jun 2006 – 31 Dec 2010) Amendment 19 regulations. Here we present one example of these maps from the Monterey Bay California area. A coastwide series of all maps is included in Appendices 2 and 3.

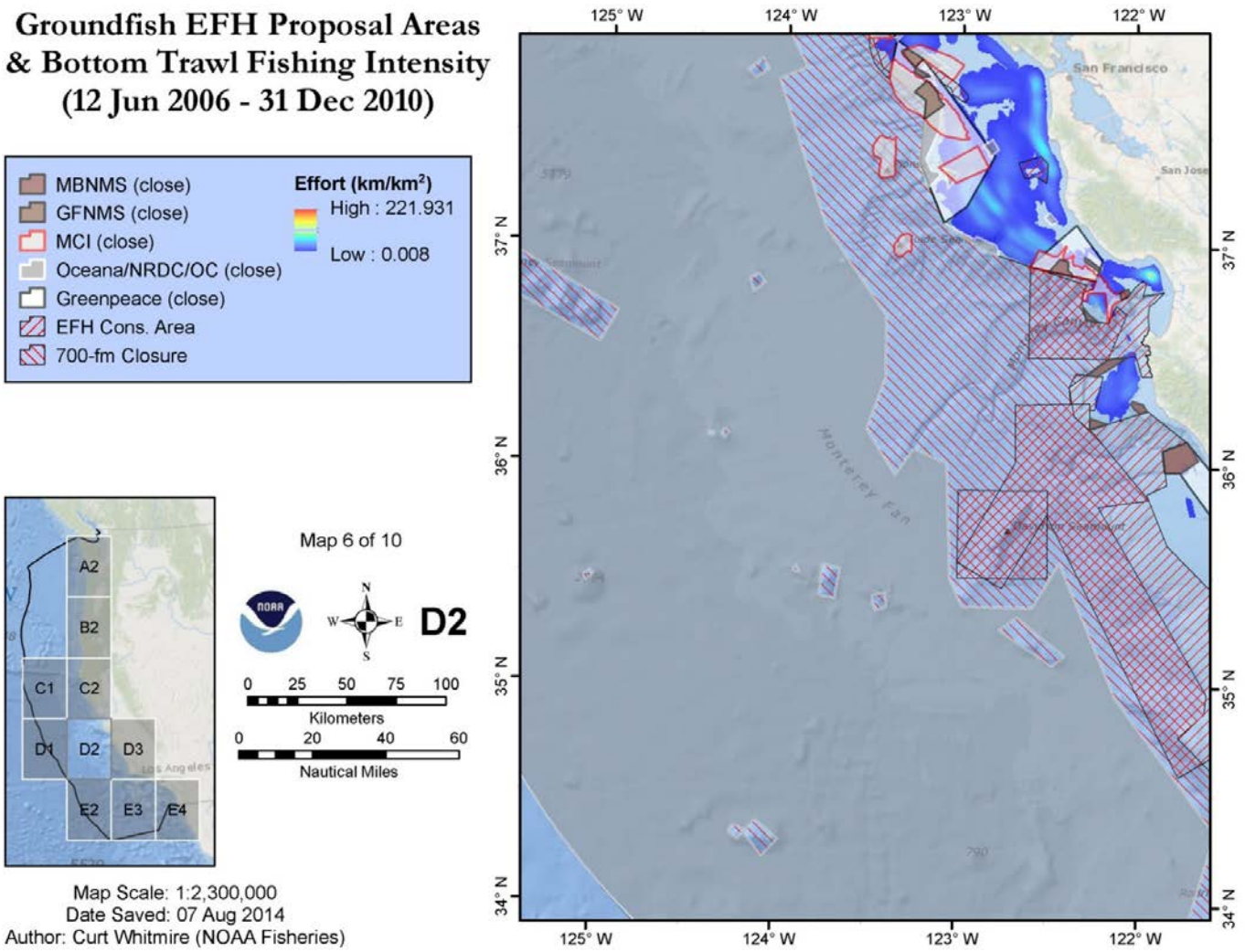


Figure 1. Map series showing overlap of groundfish EFH proposal areas with bottom trawl fishing intensity layer (12 Jun 2006 – 31 Dec 2010). Only those areas proposed to be closed to bottom trawl or all bottom contact fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: Pacific Fisheries Information Network (PacFIN).

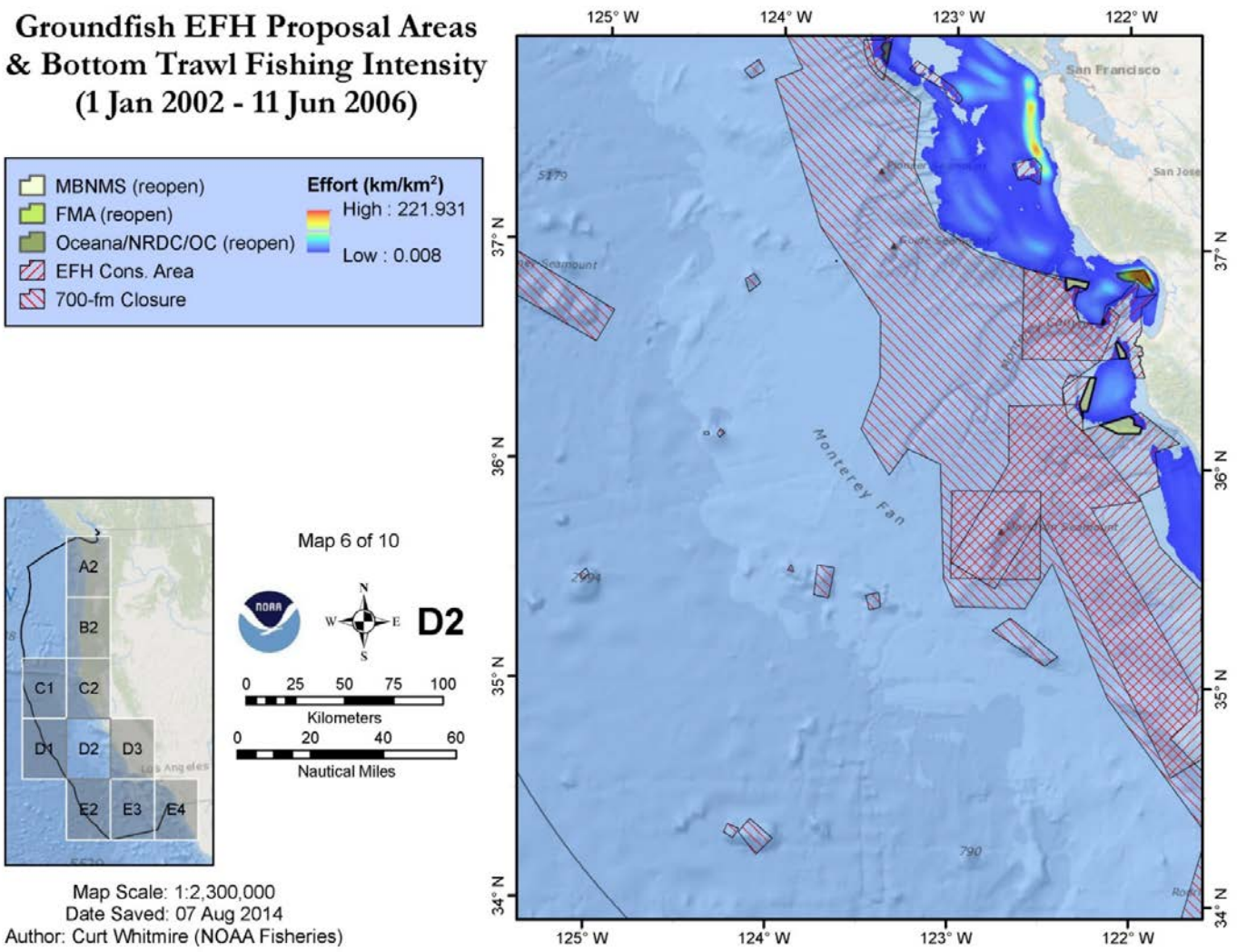


Figure 2. Map series showing overlap of groundfish EFH proposal areas with bottom trawl fishing intensity layer (1 Jan 2002 – 11 Jun 2006). Only those areas proposed to be reopened to bottom trawl fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: Pacific Fisheries Information Network (PacFIN).

## 7. WHAT PERCENTAGE OF TRAWL EFFORT WOULD BE DISPLACED/RESTORED BY PROPOSALS AND WHAT PERCENTAGE OF THE AREA WOULD BE DISPLACED OR RESTORED BY THE PROPOSALS?

Table 5. Summary of fishing effort (12 Jun 2006 – 31 Dec 2010) in areas proposed to be closed. Effort is reported in minimum tow length (km) and fishing events (#) for bottom trawl and fixed gear, respectively. Minimum tow lengths are calculated from a line connecting the haul start and end points, while fishing events are defined as points representing the haul start and end points. The proportion of coastwide fishing effort encompassed by each proposal for the entire time period is also reported. The last row summarizes fishing effort for of all proposals combined, and accounts for overlapping areas. Data sources: PacFIN logbook (trawl) and West Coast Groundfish Observer Program (fixed gear).

| | Bottom Trawl | | Fixed Gear* | |
|---|---|---|---|---|
| **Proponent** | **Length (km)** | **Proportion** | **#** | **Proportion** |
| **GFNMS~** | 96 | 0.01% | 0 | 0.0% |
| **Greenpeace** | 239,238 | 21.81% | 3,461 | 24.0% |
| **MBNMS** | 55 | 0.01% | 0 | 0.0% |
| **MCI** | 150,416 | 13.71% | 6 | 0.0% |
| **Oceana/NRDC/OC** | 24,402 | 2.22% | 0 | 0.0% |
| **Combined** | **329,590** | **30.0%** | **3,467** | **24.1%** |

*Only includes areas proposed to be closed to all bottom contact gears.

~For fixed gear summary, Option 2A used instead of 2B.

Table 6. Summary of fishing effort (1 Jan 2002 – 11 Jun 2006) in areas proposed to be reopened. Effort is reported in minimum tow length (km) and fishing events (#) for bottom trawl and fixed gear, respectively. Minimum tow lengths are calculated from a line connecting the haul start and end points, while fishing events are defined as points representing the haul start and end points. The proportion of coastwide fishing effort encompassed by each proposal for the entire time period is also reported. The last row summarizes fishing effort for of all proposals combined, and accounts for overlapping areas. Data sources: PacFIN logbook (trawl) and West Coast Groundfish Observer Program (fixed gear).

| | Bottom Trawl | | Fixed Gear | |
|---|---|---|---|---|
| **Proponent** | **Length (km)** | **Proportion** | **#** | **Proportion** |
| **FMA** | 38 | 0.0% | 0 | 0.0% |
| **MBNMS** | 606 | 0.1% | 12 | 0.1% |
| **Oceana/NRDC/OC** | 23,124 | 2.3% | 13 | 0.1% |
| **Combined** | **23,162** | **2.3%** | **13** | **0.1%** |

## 8. WHAT PERCENTAGE OF THE CATCH COMPOSITION IN AGGREGATE IS IN THE PROPOSED CLOSED AREAS?

Table 7. Summary of observed (discarded and retained) groundfish catch (12 Jun 2006 – 31 Dec 2010) in areas proposed to be closed. Catch is reported in kg for vessels using bottom trawl gear and summarized for all groundfish (last column) and four aggregate catch categories: rockfishes, flatfishes, roundfishes/grenadiers/morids, and sharks/skates/ratfishes. Haul catches were summarized based on the proportion of tow distance (i.e., line connecting start and end points) intersecting the relevant proposal areas. For example, if only 20% of a tow intersected a proposal area, only 20% of the groundfish catch from that haul was included in this summary. "Conf." is abbreviation of "confidential" and represents those proposals where fewer than 3 vessels are represented in the observed catch data. "NA" means no observed tows occurred within the proposal area for the relevant time period. Data source: West Coast Groundfish Observer Program.

| Proponent | Rockfishes | Flatfishes | Roundfishes | Sharks | Groundfishes |
|---|---|---|---|---|---|
| **GFNMS** | Conf. | Conf. | Conf. | Conf. | Conf. |
| **Greenpeace** | 1,038,683 | 4,416,254 | 1,176,289 | 453,071 | 7,084,296 |
| **MBNMS** | 734 | 583 | 418 | 86 | 1,821 |
| **MCI** | 628,914 | 3,707,309 | 758,657 | 311,409 | 5,406,288 |
| **Oceana/NRDC/OC** | 141,478 | 420,726 | 147,992 | 45,223 | 755,419 |

Table 8. Summary of observed (discarded and retained) groundfish catch (1 Jan 2002 – 11 Jun 2006) in areas proposed to be reopened. Catch is reported in kg for vessels using bottom trawl gear and summarized for all groundfish (last column) and four aggregate catch categories: rockfishes, flatfishes, roundfishes/grenadiers/morids, and sharks/skates/ratfishes. Haul catches were summarized based on the proportion of tow distance (i.e., line connecting start and end points) intersecting the relevant proposal areas. For example, if only 20% of a tow intersected a proposal area, only 20% of the groundfish catch from that haul was included in this summary. "NA" means no observed tows occurred within the proposal area for the relevant time period. Data source: West Coast Groundfish Observer Program.

| Proponent | Rockfishes | Flatfishes | Roundfishes | Sharks | Groundfishes |
|---|---|---|---|---|---|
| **FMA** | NA | NA | NA | NA | NA |
| **MBNMS** | 5,362 | 6,058 | 5,640 | 223 | 17,283 |
| **Oceana/NRDC/OC** | 7,508 | 14,935 | 7,899 | 11,246 | 41,588 |

## 9. IDENTIFY OVERLAP IN SPATIAL BOUNDARIES AMONG PROPOSALS

Maps were developed of all groundfish EFH proposal areas, along with existing groundfish EFH conservation areas. Here we present one example of these maps from the Monterey Bay California area. The complete coastwide map series can be found in Appendix 4. In addition, this section includes the associated tabular information on overlap of groundfish EFH proposal areas.

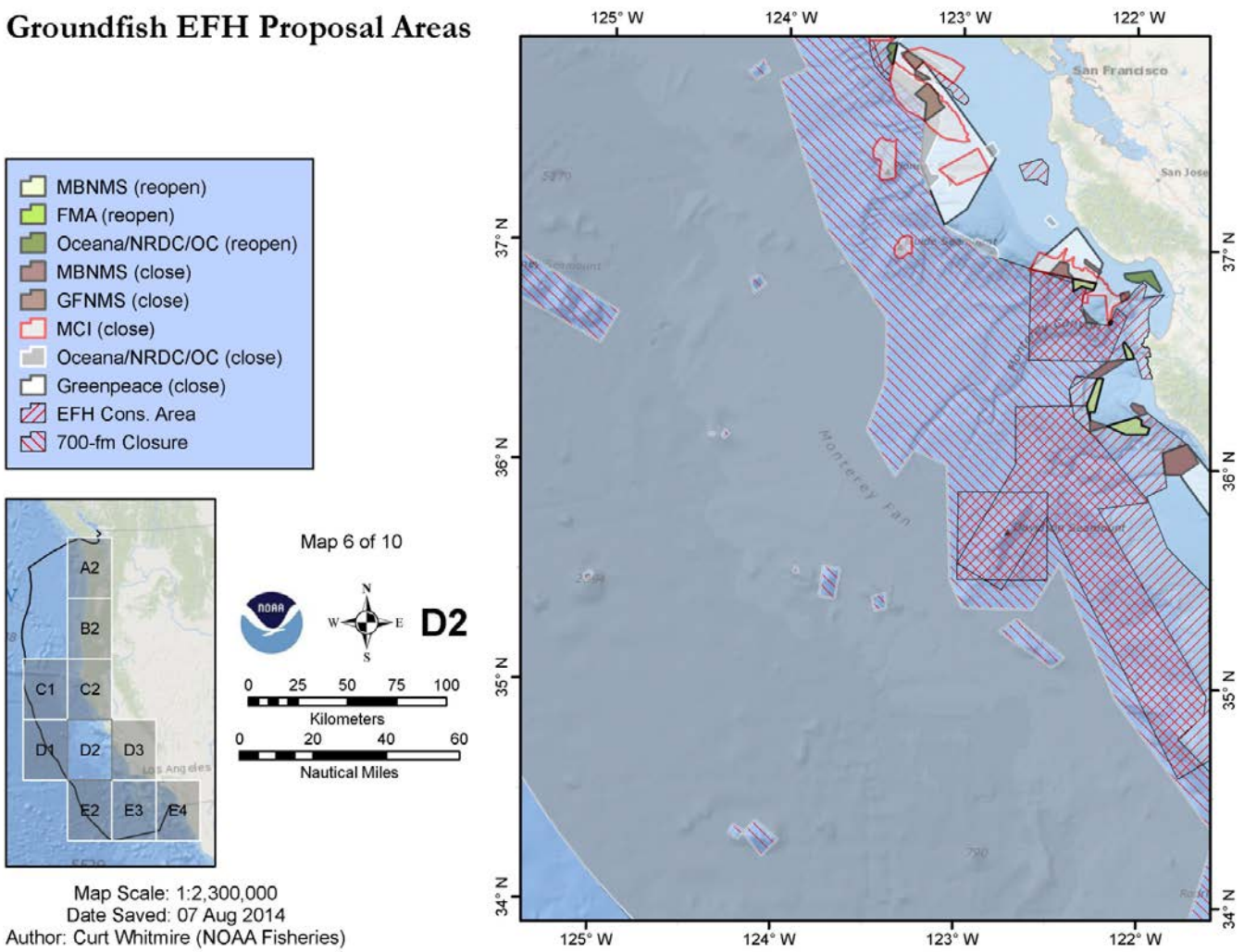


Figure 3. Map series showing overlap of groundfish EFH proposal areas. Also shown are existing groundfish EFH conservation areas (red hashing).

Table 9. Summary of overlap, reported in area (ha), among proposals to modify groundfish EFH regulations by closing additional areas to use of various gear types.

| Proponent | FMA | GFNMS | Greenpeace | MBNMS | MCI | Oceana/NRDC/OC |
|---|---|---|---|---|---|---|
| **FMA** | - | 0 | 0 | 0 | 0 | 0 |
| **GFNMS** | 0 | - | 18,356 | 0 | 16,520 | 18,144 |
| **Greenpeace** | 0 | 18,356 | - | 28,733 | 371,617 | 470,731 |
| **MBNMS** | 0 | 0 | 28,733 | - | 5,917 | 43,573 |
| **MCI** | 0 | 16,520 | 371,617 | 5,917 | - | 325,848 |
| **Oceana/NRDC/OC** | 0 | 18,144 | 470,731 | 43,573 | 325,848 | - |

Table 10. Summary of overlap, reported in proportion of area for proposal listed in first column, among proposals to modify groundfish EFH regulations by closing additional areas to use of various gear types.

| Proponent | FMA | GFNMS | Greenpeace | MBNMS | MCI | Oceana/NRDC/OC |
|---|---|---|---|---|---|---|
| **FMA** | - | 0% | 0% | 0% | 0% | 0% |
| **GFNMS** | 0% | - | 100.0% | 0% | 90.0% | 98.8% |
| **Greenpeace** | 0% | 1.0% | - | 1.6% | 20.9% | 26.5% |
| **MBNMS** | 0% | 0% | 65.8% | - | 13.5% | 99.8% |
| **MCI** | 0% | 1.4% | 30.6% | 0.5% | - | 26.9% |
| **Oceana/NRDC/OC** | 0% | 0.3% | 8.8% | 0.8% | 6.1% | - |

Table 11. Summary of overlap, reported in area (ha), among proposals to modify groundfish EFH regulations by reopening areas to use of various gear types.

| Proponent | FMA | GFNMS | Greenpeace | MBNMS | MCI | Oceana/NRDC/OC |
|---|---|---|---|---|---|---|
| **FMA** | - | 0 | 0 | 0 | 0 | 0 |
| **GFNMS** | 0 | - | 0 | 0 | 0 | 0 |
| **Greenpeace** | 0 | 0 | - | 0 | 0 | 0 |
| **MBNMS** | 0 | 0 | 0 | - | 0 | 25,687 |
| **MCI** | 0 | 0 | 0 | 0 | - | 0 |
| **Oceana/NRDC/OC** | 0 | 0 | 0 | 25,687 | 0 | - |

Table 12. Summary of overlap, reported in proportion of area for proposal listed in first column, among proposals to modify groundfish EFH regulations by reopening areas to use of various gear types.

| Proponent | FMA | GFNMS | Greenpeace | MBNMS | MCI | Oceana/NRDC/OC |
|---|---|---|---|---|---|---|
| **FMA** | - | 0% | 0% | 0% | 0% | 0% |
| **GFNMS** | 0% | - | 0% | 0% | 0% | 0% |
| **Greenpeace** | 0% | 0% | - | 0% | 0% | 0% |
| **MBNMS** | 0% | 0% | 0% | - | 0% | 58.8% |
| **MCI** | 0% | 0% | 0% | 0% | - | 0% |
| **Oceana/NRDC/OC** | 0% | 0% | 0% | 0.5% | 0% | - |

## 10. MAP OF PROPOSED CLOSURES WITH OVERLAY OF TRIBAL AREAS (NORTH OF 46-DEGREES 53’ N LATITUDE TO US-CANADA BORDER; SHOREWARD OF 125-DEGREES 44’ W LONGITUDE).

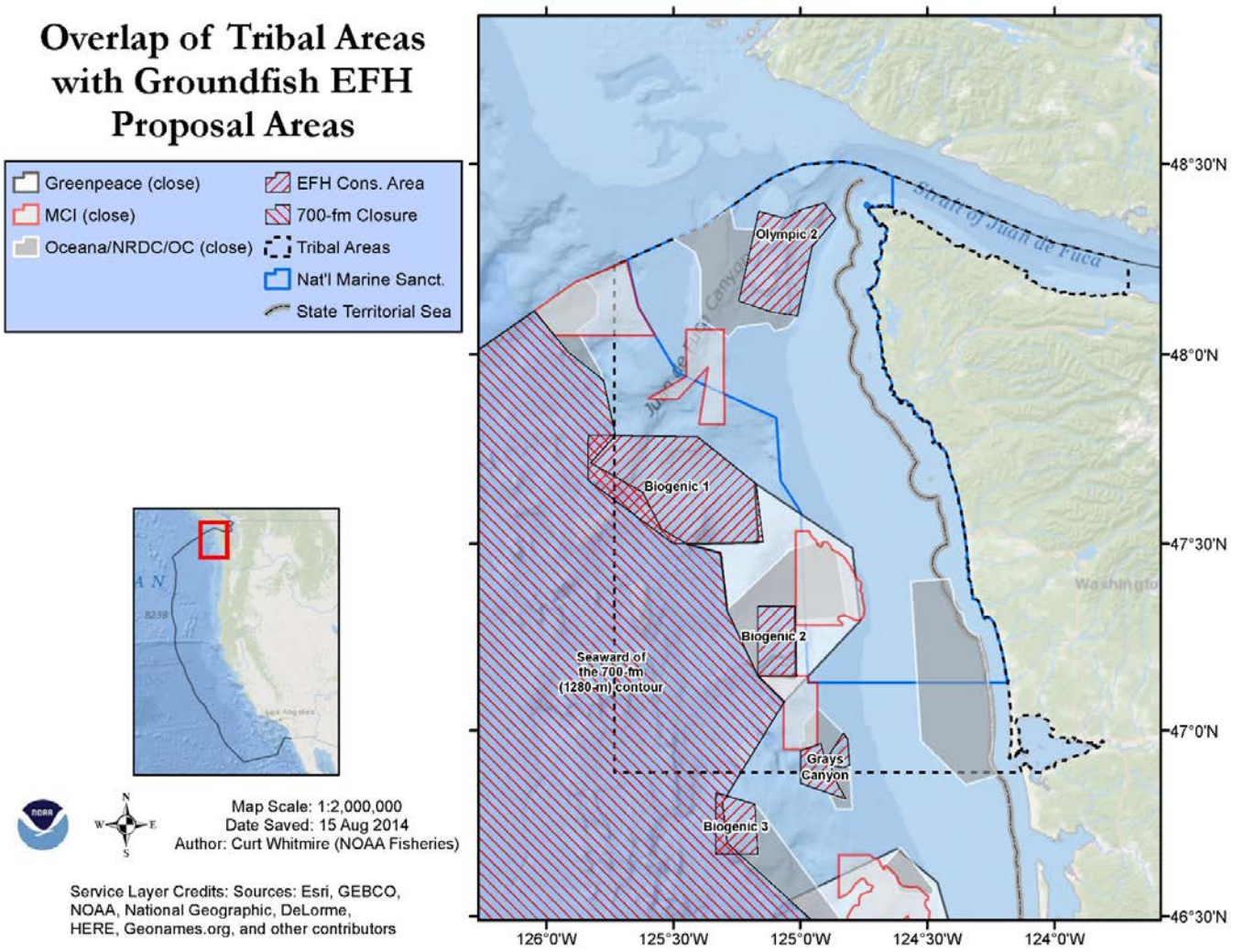


Figure 4. Map showing overlap of tribal areas (red line) with groundfish EFH proposal areas. Also shown are existing groundfish EFH conservation areas (red hashing) and boundary of Olympic Coast National Marine Sanctuary (blue). The Pacific Coast treaty tribes' usual and accustomed fishing areas within the fishery management area (FMA) were defined at 50 CFR 660.324. Since only the southern and western boundaries are explicitly defined, the eastern boundary was chosen arbitrarily for this figure. The tribal areas also extend beyond the northern boundary of the U.S. Exclusive Economic Zone but were "clipped" to be coincident with the FMA boundary.

## 12. MAPS OF DISPLACED OR RESTORED FIXED GEAR EFFOR THAT WOULD RESULT FROM PROPOSALS

Coastwide maps of groundfish EFH proposal areas in relation to fixed gear intensity were developed for pre (1 Jan 2002 – 11 Jun 2006)- and post (12 Jun 2006 – 31 Dec 2010)-Amendment 19 regulations. Here we present one example of these maps from the Monterey Bay California area. A coastwide series of all maps is included in Appendices 5 and 6.

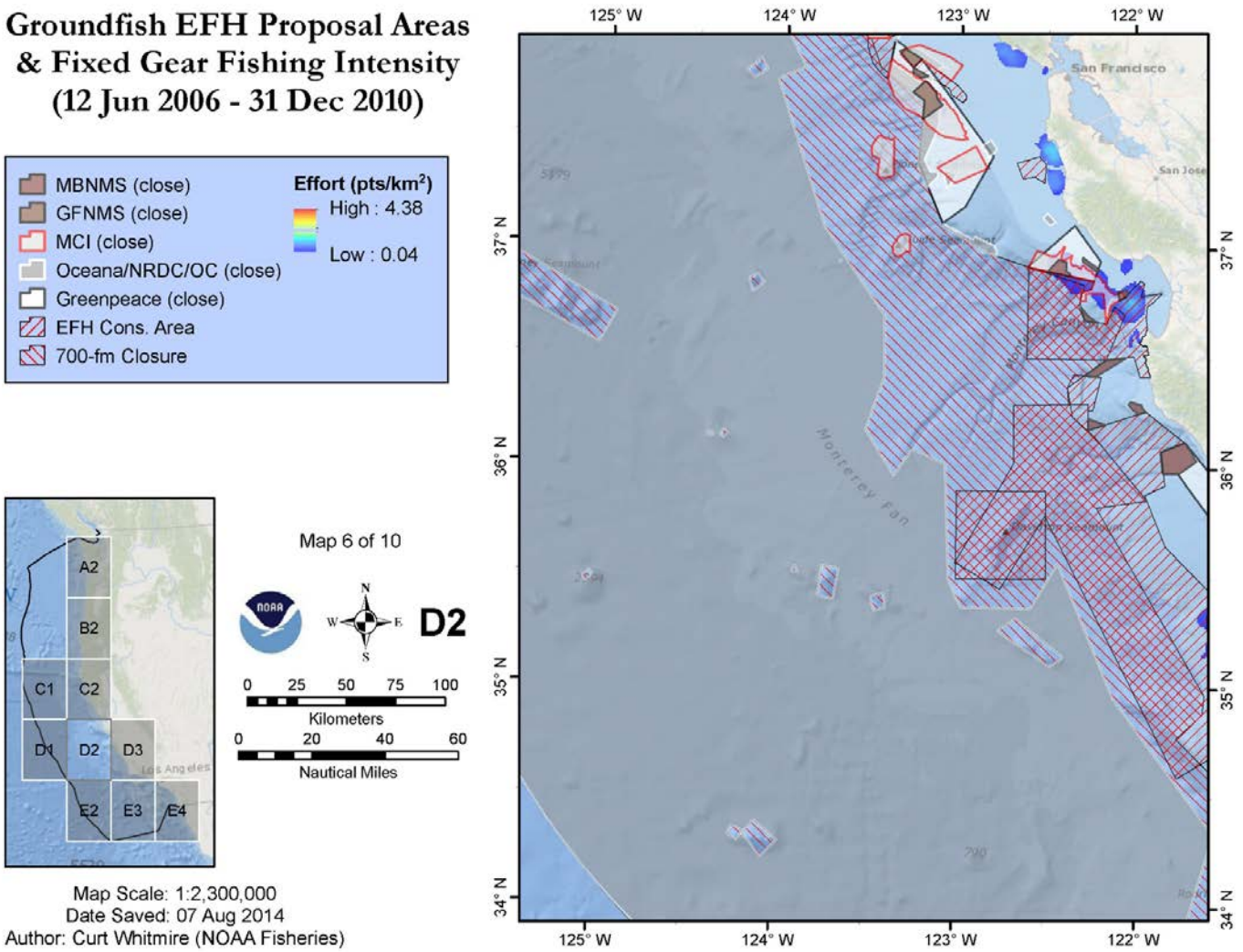


Figure 5. Map series showing overlap of groundfish EFH proposal areas with observed fixed gear fishing intensity layer (12 Jun 2006 – 31 Dec 2010). Only those areas proposed to be closed to bottom trawl or all bottom contact fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: West Coast Groundfish Observer Program. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely.

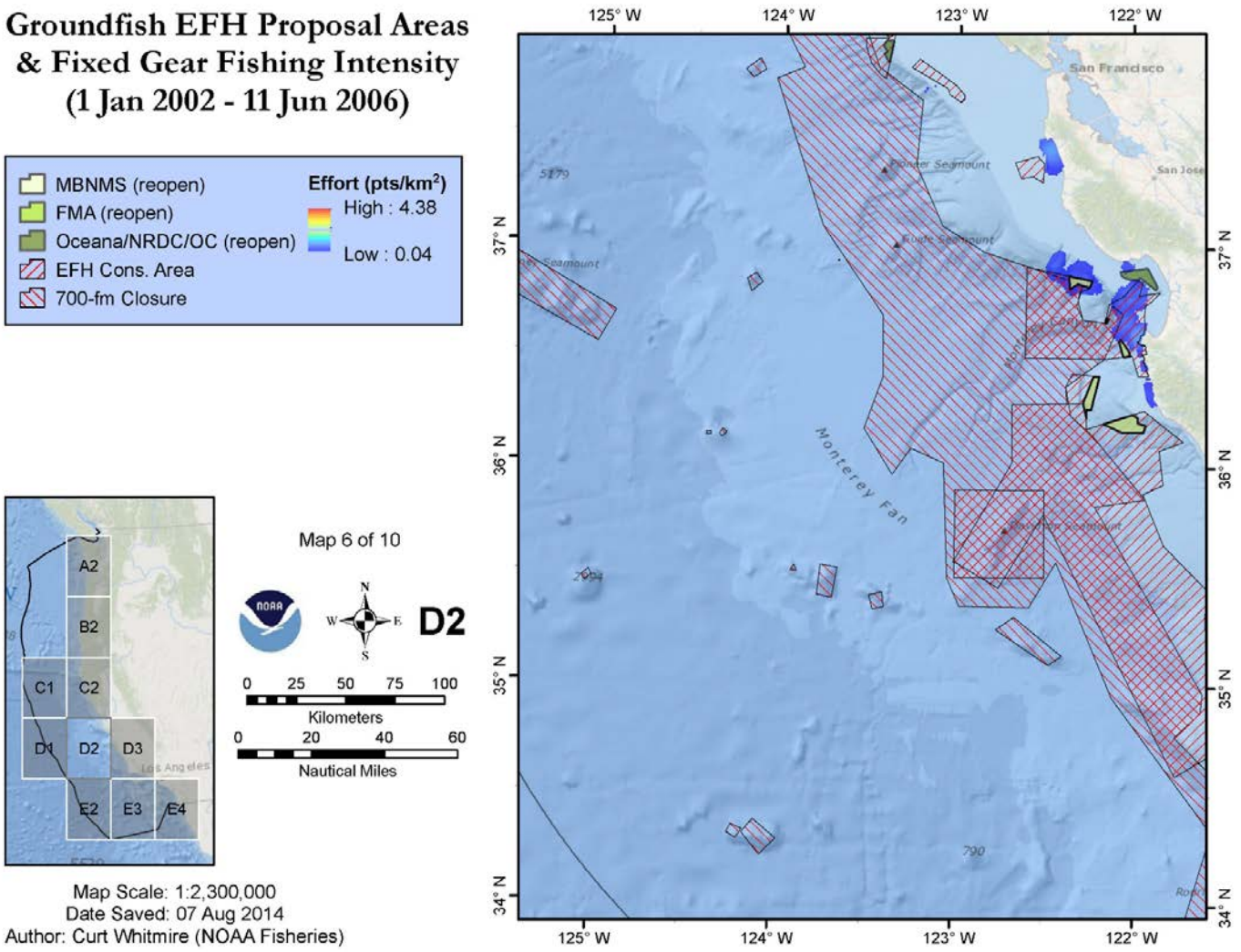


Figure 6. Map series showing overlap of groundfish EFH proposal areas with observed fixed gear fishing intensity layer (1 Jan 2002 – 11 Jun 2006). Only those areas proposed to be reopened to bottom trawl fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: West Coast Groundfish Observer Program. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely.

## 13. WHAT PERCENTAGE OF FIXED GEAR EFFORT WOULD BE DISPLACED/RESTORED BY PROPOSALS AND WHAT PERCENTAGE OF THE AREA WOULD BE DISPLACED OR RESTORED BY THE PROPOSALS?

Tabular summaries for fixed gear effort can be found in Tables 5 – 6 on page 15.

**18. WHERE DO PROPOSALS INTERSECT RCAS?**

Table 13. Summary of overlap reported in area (ha), between coastwide, permanently closed trawl RCA (i.e., 100-150 ftm lines) and proposals to modify groundfish EFH regulations. The last row summarizes the areal extent of all proposals combined, and accounts for overlapping areas.

| Proponent | Close | % RCA | Reopen | % RCA |
|---|---|---|---|---|
| **FMA** | 0 | 0% | 0 | 0% |
| **GFNMS** | 509 | 0.1% | 0 | 0% |
| **Greenpeace** | 109,460 | 12.2% | 0 | 0% |
| **MBNMS** | 1,709 | 0.2% | 0 | 0.00% |
| **MCI** | 60,050 | 6.7% | 0 | 0% |
| **Oceana/NRDC/OC** | 283,805 | 31.7% | 441 | 0.05% |
| **Combined** | **371,531** | **41.5%** | **441** | **0.05%** |

Table 14. Summary of overlap, reported in area (ha), between commercial trawl RCA (150-200 ftm lines, 40°10’ - 45°46’) and three proposals to modify groundfish EFH regulations. The last row summarizes the areal extent of all proposals combined, and accounts for overlapping areas.

| Proponent | Close | % RCA | Reopen | % RCA |
|---|---|---|---|---|
| **FMA** | 0 | 0% | 0 | 0% |
| **GFNMS** | 0 | 0% | 0 | 0% |
| **Greenpeace** | 61,162 | 31.6% | 0 | 0% |
| **MBNMS** | 0 | 0% | 0 | 0% |
| **MCI** | 14,338 | 7.4% | 0 | 0% |
| **Oceana/NRDC/OC** | 32,353 | 16.7% | 0 | 0% |
| **Combined** | **90,484** | **46.8%** | **0** | **0%** |

## 19. AREAS WHERE INACCURACIES EXIST IN PREVIOUS DESIGNATIONS

Two areas are known to have been inaccurately located or designated in the last EFH process:

1. Potato Bank in southern California was mis-located

2. One inshore area of the Eel River Canyon in northern California was mischaracterized

## 20. SUMMARIZE CONSULTATIONS, INCLUDING ACRES PROTECTED

NMFS maintains the Public Consultation Tracking System (PCTS)[1], a nationwide database on all EFH and ESA consultations. This database was queried to summarize the EFH consultations conducted by NMFS's Northwest, Southwest, and West Coast Regions on non-fishing actions (e.g., dredging, pile driving, stormwater discharges) and generate the following metrics for the period from 2011 through 2014 for consultations (Table 15):

1. The number of actions that were reviewed by NMFS for adverse effects to EFH. The number represents the total number of EFH consultations conducted by NMFS on *non-fishing actions*, each of which may cover the EFH from multiple FMPs.
2. The number of actions that were modified per NMFS advice. And action is modified per NMFS advice when, based on NMFS EFH Conservation Recommendations or NMFS advice during the consultation process, the Federal agency has modified its action to avoid or minimize the adverse effects of that action on EFH.
3. The number of actions where the Federal agency indicated whether or not It accepted NMFS's advice. This number is less than the total number of consultations conducted because NMFS does not always receive a response from the Federal agency.
4. The percent of actions modified per NMFS advice. This is calculated as projects modified/Projects where guidance is accepted or rejected.
5. The number of acres of EFH protected. An acre of EFH is considered "protected" when the action is modified per NMFS advice (see above) so that the adverse effects of the action on EFH are avoided or reduced. It is important to note the following when viewing the number of acres protected:
    a. protection can be temporary or permanent;
    b. protection can be complete or partial (i.e., when all adverse effects are avoided vs when some adverse effects are reduced);
    c. a single acre of EFH can be counted more than once if it is protected from multiple actions;
    d. many consultations include EFH under multiple FMPs and PCTS does not record the acres of EFH protected for each of them, therefore, this number includes EFH for all FMPs combined;
    e. the number of acres protected may include projects that underwent consultation but were not carried out.

[1] https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts.

Table 15. Summary of EFH consultations, 2011 through 2014 by NMFS NWR, SWR, and WCR.

| Metric | Year | | | | Total |
|---|---|---|---|---|---|
| | 2011 | 2012 | 2013 | 2014 | |
| Actions Reviewed | 1021 | 967 | 657 | 341 | 2986 |
| Actions Modified | 324 | 334 | 181 | 52 | 891 |
| Actions where guidance was accepted or rejected[1] | 340 | 368 | 256 | 81 | 1045 |
| Percent of Actions Modified | 95% | 91% | 71% | 64% | 85% |
| Acres Protected | 151,088 | 16,893 | 460,457 | 49,195 | 677,634 |

[1] Percent of actions modified is calculated as actions modified/actions were guidance was accepted or rejected

This assessment, while limited by the data available in PCTS, demonstrates that NMFS has been effective in protecting the habitats used by Council-managed species. EFH consultations are often combined with ESA consultations, and it is not possible to use PCTS to attribute the protection from a particular consultation to a particular statute. However, it is important to recognize that both statutes contribute to the protection of the habitats used by Council-managed fishes and the mechanism of that protection is less important than the protection itself.

## APPENDIX 1. EFFECTS OF GEAR CHANGES AND CLOSED AREAS ON GROUNDFISH EFH

### Selected Literature

**Mason, J., R. Kosaka, A. Mamula , C. Speir. 2012. Effort changes around a marine reserve: The case of the California Rockfish Conservation Area. Marine Policy 36 :1054–1063.**

**Abstract**: This article is an analysis of observed changes in the level of fishing effort and the spatial distribution of fishing effort following implementation of a marine reserve off the California coast. The Rockfish Conservation Area (RCA) closes the area between depth contour based boundaries to commercial trawl fishing. In this analysis, commercial fishing vessels are grouped based on their level of fishing effort within the closed area prior to the closure in order to compare changes in effort levels between groups. The results suggest that the RCA may have had a small effect on the level of fishing effort in the California groundfish trawl fishery. Spatial distribution of fishing effort before and after implementation of the marine reserve is also compared. Some concentration of effort occurred along parts of the closed area boundaries. This pattern suggests the ‘‘fishing the line’’ behavior noted in the marine reserve literature, but other possible explanations exist including the effects of coincident changes in other regulations and changing bioeconomic conditions.

**Hannah, R. W. 2003: Spatial changes in trawl fishing effort in response to footrope diameter restrictions in the U.S. west coast bottom trawl fishery, North American Journal of Fisheries Management 23:693-702.**

**Abstract**: Changes in the spatial distribution of U.S. west coast bottom-trawl effort in relation to areas of prime habitat for rockfishes *Sebastes* spp. were evaluated between 1992 and 2001. Prime trawlable rockfish habitat (PTRH) was defined based on the spatial distribution of high rockfish catches from logbook data for 1992–1995. Bottom-trawl effort was sharply reduced within PTRH after the establishment of maximum trawl footrope diameter restrictions in 2000. However, reductions in rockfish catch limits prior to 2000 had already reduced trawl activity within these areas, confounding the effects of reduced trip limits and footrope diameter restrictions. Fishing inside PTRH rebounded in 2001, when retention limits for yellowtail rockfish *Sebastes flavidus* as flatfish bycatch were raised, suggesting that limits may be as important as gear restrictions in determining the spatial distribution of trawl effort in this fishery. The untrawled area of PTRH between 43°N and 48°N in 2000–2001 was estimated at about 186,000 ha.

**Bellman, M.A., S.A. Heppell; and C. Goldfinger. 2005.Evaluation of a US west coast groundfish habitat conservation regulation via analysis of spatial and temporal patterns of trawl fishing effort. Canadian Journal of Fisheries and Aquatic Sciences 62: 2886–2900.**

**Abstract:** We examined the extent to which the 2000 Pacific Fishery Management Council footrope restriction shifted and reduced trawl fishing effort on Oregon fishing grounds, related these changes to the seafloor habitat type over which they occurred, and developed methods for enhancing spatial review of fishing effort. Density analysis of trawl start locations demonstrated how fishing efforts increased and decreased in relation to habitat distribution and fishery management actions between 1995 and 2002. Trawl effort patterns exhibited significant interannual variability and were patchy in distribution. Tow end-point locations from 1998 to 2001 were retrieved from manual logbooks for five reference sites located in proximity to rocky habitat. Trawl towlines were mapped and demonstrated a marked enhancement of fine-scale fishing effort resolution. Spatial shifts in fishing intensity (measured as kilometres towed) away from rock habitat were evident at all reference sites after the footrope restriction, with an average reduction of 86%. Some slight shifts into surrounding unconsolidated sediments also occurred. Our results indicate that the footrope restriction, in conjunction with associated landing limits, was effective in protecting rocky habitats from trawl fishing impacts. Continued spatial monitoring of trawl data would assist in fishery management assessment of conservation objectives for depleted groundfish and essential fish habitat protection.

**Bellman, M.A. and S.A. Heppell. 2007. Trawl Effort Distribution off the U.S. Pacific Coast: Regulatory Shifts and Seafloor Habitat Conservation. In: J. Heifetz, J. Dicosimo, A.J. Gharrett, M.S. Love, V.M. O'Connell, and R.D. Stanley (eds.), Biology, Assessment, and Management of North Pacific Rockfishes. Alaska Sea Grant College Program, Fairbanks, pp. 275-294. doi:10.4027/bamnpr.2007.16**

**Abstract**: The U.S. West Coast groundfish trawl fishery currently operates under a variety of management measures designed to rebuild depleted rockfish (*Sebastes* sp.) populations. Regulatory measures can shift or reduce trawling over seafloor habitats and thus act as a tool to protect the long-term sustainability of groundfish by conserving Essential Fish Habitat (EFH) from fishing impacts. Our analysis reviews the spatial and temporal extent of trawl fishing effort over the Pacific coast seafloor in the framework of complex fishery management from 1999 to 2004. Coast-wide trawl effort declined over these years, yet the remaining fishing effort changed in spatial extent and intensity and shifted between habitat types. The proportion of annual trawl effort on the continental shelf has increased. In recent years, trawl fishing effort has intensified along boundaries of depth-based spatial closures. This study emphasizes the benefits of increasing the spatial resolution of fishery data to better understand how fishing impacts on

habitat are minimized, identifying locations of potential habitat recovery, and the implications of fishery management measures on EFH conservation.

## Summary of Related Council Analyses

Amendment 19 Risk Assessment and EIS

NMFS and the Council developed a comprehensive risk assessment to consider EFH-related issues through the Council and NEPA processes. A significant portion of this risk assessment focused on fishing impacts, including the following products:

- **Description of fishing gears used on the U.S. Pacific Coast** (Recht 2003), with attention to components of gear that could impact structural features of habitat.
- **The Effects of Fishing on Habitat: A West Coast Perspective** (MRAG 2004; Appendix A-10), in which adverse impacts were indexed for each gear type and recovery times were estimated for each habitat type.
- **Impacts Model for Groundfish Essential Fish Habitat (**MRAG 2004), in which cumulative anthropogenic impacts to habitat (from fishing and non-fishing sources) were considered using limited data. Significant data gaps (FMP Appendix B.5) prevented a definitive determination of adverse impacts at a functional scale (e.g., quantifying population and ecosystem effects resulting from fishing impacts to habitat).

Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat Report to the Pacific Fishery Management Council Phase 1: New Information

The Council's Phase 1 Report reviewed new information since implementation of Amendment 19 including information on fishing activities that may affect EFH. The following sections are relevant to this overview:

- **Fishing Effects on EFH by Gear Type** (Section 4.1). The section updates the fishing gear descriptions from Amendment 19 including both federally managed and state managed gear types.
- **Information on Habitat Effects of Fishing Gear** (Section 4.3). Since 2005, there have been several new publications, including peer-reviewed literature, white papers and technical memorandums, relevant to West Coast groundfish fisheries that have studied: 1) the effects of fishing gear on benthic habitats; 2) predictive modeling of biogenic habitats; and 3) the effects of fishing gear-related marine debris on habitats. An annotated bibliography of recent articles is presented in **Appendix J**. The recent studies on the effects of fishing gear on benthic habitats are primarily focused on the effects of trawling and marine debris.

The Phase 1 report concludes: (1) effects of fishing with mobile, bottom-contact fishing gear on benthic habitats are increasingly well-established worldwide; (2) there is little new information on recovery of seafloor habitats from the effects of fishing and, therefore, an improved evaluation of fishing impacts is hindered; (3) long estimates of recovery time, on the order of 100s of years, should be used for hard corals; and (4) with regard to impacts from recreational fishing gear, biogenic habitats are most at-risk followed by hard substrata and soft sediments.

Groundfish Essential Fish Habitat Synthesis Report (NMFS, April 2013)
The Council's Synthesis Report summarizes data compiled in Phase 1 including:

- Analyses of Federally-Managed Fishery Pressures and Gear-Type-Specific Distribution (Sections 4.1 and 4.2).
- Analyses of Fishing Effort Relative to Spatial Management Boundaries (Section 4.3).
- An Update of the Sensitivity and Recovery Indices from Amendment 19 (Groundfish EFH Synthesis Report Appendices – Section 3).

Relevant findings in the Synthesis report include: (1) approximately 10% of the upper slope and shelf of all habitat along the west coast is included in ecologically important closed areas (EFH conservation areas), and the bottom trawl closure seaward of 700 ftm accounts for the majority of the conservation areas; (2) effort from federally observed groundfish fisheries is highest in the Northern region, and is heavily concentrated on the upper slope and shelf over soft habitats along the entire coast; (3) patterns of fishing effort have remained moderately stable over the previous decade, but have likely varied over longer periods; there has been some displacement of trawling activity seaward from conservation areas; (4) EFH conservation areas protect some groundfish species from fishing more than others; and (5) EFH conservation areas protect many deep-sea coral and sponge habitats, but additional areas remain open to some or all bottom contact gears.

## Summary of Relevant Regulations

Pacific Coast Groundfish FMP

*Commercial Gear Prohibitions (FMP Section 6.6.1.1)*

- The use of setnets is prohibited in all waters north of 38° N latitude.
- Bottom trawl gear with footropes larger than eight inches in diameter is prohibited shoreward of a line approximating the 100 fm depth contour.
- The use of bottom trawl footrope gear with a footrope diameter larger than 19 inches is prohibited in the fishery management area.
- The use of dredge gear is prohibited in the fishery management area.
- The use of beam trawl gear is prohibited in the fishery management area.

*Rockfish Conservation Areas (FMP Section 6.8.2)*
Since January 2003, the Council has used coastwide RCAs to reduce the incidental catch of overfished species in waters where they are more abundant. RCAs are designed to be gear-specific to better target protection for the species most affected by each gear group. The size and shape of the RCAs may be adjusted inseason via the routine management measures process (Section 6.2.1) by using previously adopted potential RCA boundary lines. Designation and adoption of new potential RCA boundary lines must be made through either a specifications-and-management-measures rulemaking (Section 6.2C) or a full rulemaking (Section 6.2 D).

*Long-term Bycatch Mitigation Closed Areas (FMP Section 6.8.4)*
These areas are similar in intent to RCAs; however, they do not vary seasonally and are not usually modified through inseason or biennial management. The areas are:

- Klamath River Conservation Zone (KRCZ)
- Columbia River Conservation Zone (CRCZ)
- Western Cowcod Conservation Area
- Eastern Cowcod Conservation Area
- Yelloweye Rockfish Conservation Area (YRCA)

*Ecol333333ogically Important Habitat Closed Areas (FMP Section 6.8.5)*
These are areas closed to specified fishing gears to minimize adverse effects of fishing on groundfish EFH. They include:

Bottom Trawl Closed Areas off Washington:

- Olympic 2
- Biogenic 1
- Biogenic 2
- Grays Canyon
- Biogenic 3

Bottom Trawl Closed Areas off of Oregon:

- Astoria Canyon
- Nehalem Bank/Shale Pile
- Siletz Deepwater
- Daisy Bank/Nelson Island
- Newport Rockpile/Stonewall Bank
- Heceta Bank
- Deepwater off Coos Bay
- Bandon High Spot
- Rogue Canyon

Bottom Trawl Closed Areas off of California:

- Eel River Canyon
- Blunts Reef
- Mendocino Ridge
- Delgada Canyon
- Tolo Bank
- Point Arena North
- Point Arena South Biogenic Area

- Cordell Bank/Biogenic Area
- Farallon Islands/Fanny Shoal
- Half Moon Bay
- Monterey Bay/Canyon
- Point Sur Deep
- Big Sur Coast/Port San Luis
- East San Lucia Bank
- Point Conception
- Hidden Reef/Kidney Bank
- Catalina Island
- Potato Bank
- Cherry Bank
- Cowcod Conservation Area East

Bottom Contact Closed Areas off of Oregon:

- Thompson Seamount
- President Jackson Seamount

Bottom Contact Closed Areas off of California:

- Cordell Bank (within 50 fm isobath)
- Harris Point
- Richardson Rock
- Scorpion
- Painted Cove
- Davidson Seamount
- Anacapa Island
- Carrington Point
- Judith Rock
- Skunk Point
- Footprint
- Gull Island
- South Point
- Santa Barbara

Bottom Trawl Footprint Closure (FMP Section 6.8.6)

As a precautionary measure, to mitigate the adverse effects of fishing on groundfish EFH, the West Coast EEZ seaward of a line approximating the 700 fm isobath is closed to bottom trawling to the outer extent of groundfish EFH.

<u>Washington State Fishery Management Regulations</u>

- State waters are closed to commercial groundfish fishing and shrimping.

Tribal Fishery Management Regulations

- Trawling is prohibited by Hoh, Quileute, and Quinault
- Makah restricts trawl footrope to 8”
- Reduced rockfish trip limits (consistent with federal regulations specified at CFR 660.50) coupled with full retention results in reduced effort

Oregon State Fishery Management Regulations

The following regulations were selected as those that may have more than a negligible impact to EFH. Metrics were not used to evaluate and prioritize the following list. The list simply provides some examples of state regulations that may impact EFH. The following bulleted list was organized as: (a) area closures, (b) gear restrictions and design, (c) trip or bag limits, (d) permits, and (e) other.

Closed Areas

- *Marine Protected Areas* (see above; http://www.dfw.state.or.us/OARs/12.pdf)
- *Marine Gardens*.—Seven areas along the Oregon coast are designated Marine Gardens, where take of most shellfish and marine invertebrates is prohibited. Special regulations for these Marine Gardens (page 102) and maps (pages 104-106) can be found in the Oregon sport fishing regulations (http://www.dfw.state.or.us/resources/licenses_regs/regulations.asp)
- *Other Protected Areas*.—Oregon also provide special protections for other shallower areas described as (a) two Subtidal Research Reserves that are closed to take of all shellfish and marine invertebrates, (b) five Intertidal Research Reserves that are closed to take of many shellfish and marine invertebrates, (c) one Habitat Refuge that is closed to take of marine fish, shellfish, and marine invertebrates, and (d) two other areas that are either closed to take of marine fish, shellfish, and marine invertebrates or closed to boats within a specific distance from the exposed reefs (rocks). More information on these other protected areas can be found in the Oregon Sport Fishing Regulations (http://www.dfw.state.or.us/resources/licenses_regs/regulations.asp)

Gear Restrictions and Design

- *Dungeness Crab Gear*.—Each pot must be individually marked with a surface buoy and other marking requirements (OAR 635-005-005-480), and it is unlawful to attach one crab pot or ring to another crab pot or ring by a common groundline or any other means (OAR 635-005-0485; http://www.dfw.state.or.us/OARs/05.pdf). These requirements may result in less impact to habitat than the alternative of fishing numerous pots linked together.
- *Shrimp trawl*.—It is unlawful to fish with trawl gear for pink shrimp for commercial purposes unless an approved rigid-grate bycatch reduction device is used in each net (OAR 635-005-0630; http://www.dfw.state.or.us/OARs/05.pdf). Although this does not have a direct impact to habitat, this regulation/requirement reduces bycatch of groundfish

(including overfished rockfish species) and non-groundfish species relative to the alternative of no rigid-grate.

- *Commercial Black Rockfish, Blue Rockfish, and Nearshore Fishery species*.—Except as provided in OAR 635-004-0360, it is unlawful to take Black Rockfish, Blue Rockfish, and Nearshore Fishery species by any means (a) other hook and line gear (all permits); or (b) Pot gear (one permit). Pot gear shall be limited to a maximum of 35 pots (OAR 635-0040-0340; http://www.dfw.state.or.us/OARs/04.pdf). This regulation severely restricts the number of pots that can be used when fishing in the Nearshore Fishery. Pot gear may have more impact on habitat than hook and line gear.

Trip and Bag Limits

- *Commercial fishery trip limits.*— Trip limits for Black Rockfish, Blue Rockfish, and Nearshore Fishery species (OAR 635-003-0355; http://www.dfw.state.or.us/OARs/04.pdf) may restrict effort to levels lower than otherwise would occur. These commercial trip limits may result in lower impacts to EFH and other habitats relative to the alternative of no trip limits.
- *Recreational bag limits*—Recreational bag limits (http://www.dfw.state.or.us/resources/licenses_regs/regulations.asp) may restrict effort to some degree (i.e., during a fishing trip), which in turn may result in less impact to habitat. Impacts to habitat by recreational gears are likely negligible relative to potential impacts by commercial fisheries with bottom-contact gear.

Permits

- *Dungeness Crab Gear*.—The number of Dungeness crab gear allocated to a permit is restricted (OAR 635-005-0405; http://www.dfw.state.or.us/OARs/05.pdf), which may reduce the impact to habitat relative to an unrestricted number of pots allowed for each permit
- *Pink Shrimp Permit.*—It is unlawful to take, land or possess pink shrimp for commercial purposes without first obtaining a Pink Shrimp Permit (OAR 635-005-0580). The number of Pink Shrimp Permits is limited (OAR 635-005-0590; http://www.dfw.state.or.us/OARs/05.pdf), which may reduce impacts to habitat relative to the alternative of open access.
- *Sea Urchin Permit:* It is unlawful to take, land, or possess sea urchins for commercial purposes without first obtaining a Sea Urchin Permit (OAR 635-005-0795). The number of Sea Urchin Permits is limited (OAR 635-005-0805; http://www.dfw.state.or.us/OARs/05.pdf), which may reduce impacts to habitat relative to the alternative of open access.

- *Black Rockfish / Blue Rockfish / Nearshore Fishery Permits*.—Except for incidental catch provisions, it is unlawful to take, land, or posses black, blue rockfish, and/or nearshore species without proper permits and endorsements (OAR 635-004-0300). These permits are limited (OAR 635-004-0310; http://www.dfw.state.or.us/OARs/04.pdf). Restricting

the number of permits also limits fishing effort. Limited effort may reduce impacts to habitat relative to the alternative of unlimited effort.

Other

- *Location of Fishing Effort*.—Logbooks are required for all commercial fisheries in Oregon (e.g., hook and line, pot, and shrimp trawl; http://www.dfw.state.or.us/OARs/). This requirement provides data that may be used to analyze and evaluate fishing effort within existing EFH or within proposed EFH.

California State Fishery Management Regulations

**FISH AND GAME CODE**
**2014**

**2850.5. Ocean Protection Council to Assume Responsibility for Policy Direction of MPAs**

Notwithstanding any other law and consistent with the authority granted under Section 2860, commencing on July 1, 2013, the Ocean Protection Council shall assume responsibility for the direction of policy of marine protected areas (MPAs).

(AD ’13)

**2851. Legislative Findings and Declarations**

The Legislature finds and declares all of the following:

(a) California’s marine protected areas (MPAs) were established on a piecemeal basis rather than according to a coherent plan and sound scientific guidelines. Many of these MPAs lack clearly defined purposes, effective management measures and enforcement. As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat.

(b) California’s extraordinary marine biological diversity is a vital asset to the state and nation. The diversity of species and ecosystems found in the state’s ocean waters is important to public health and well-being, ecological health, and ocean-dependent industry.

(c) Coastal development, water pollution, and other human activities threaten the health of marine habitat and the biological diversity found in California’s ocean waters. New technologies and demands have encouraged the expansion of fishing and other activities to formerly

inaccessible marine areas that once recharged nearby fisheries. As a result, ecosystems throughout the state's ocean waters are being altered, often at a rapid rate.

(d) Fish and other sea life are a sustainable resource, and fishing is an important community asset. MPAs and sound fishery management are complementary components of a comprehensive effort to sustain marine habitats and fisheries.

(e) Understanding of the impacts of human activities and the processes required to sustain the abundance and diversity of marine life is limited. The designation of certain areas as sea life reserves can help expand our knowledge by providing baseline information and improving our understanding of ecosystems where minimal disturbance occurs.

(f) Marine life reserves are an essential element of an MPA system because they protect habitat and ecosystems, conserve biological diversity, provide a sanctuary for fish and other sea life, enhance recreational and educational opportunities, provide a reference point against which scientists can measure changes elsewhere in the marine environment, and may help rebuild depleted fisheries.

(g) Despite the demonstrated value of marine life reserves, only 14 of the 220,000 square miles of combined state and federal ocean water off California, or six-thousandths of 1 percent, are set aside as genuine no take areas.

(h) For all of the above reasons, it is necessary to modify the existing collection of MPAs to ensure that they are designed and managed according to clear, conservation-based goals and guidelines that take full advantage of the multiple benefits that can be derived from the establishment of marine life reserves.

**2852. Definitions**

(c) "Marine protected area" (MPA) means a named, discrete geographic marine or estuarine area seaward of the mean high tide line or the mouth of a coastal river, including any area of intertidal or subtidal terrain, together with its overlying water and associated flora and fauna that has been designated by law, administrative action, or voter initiative to protect or conserve marine life and habitat. An MPA includes marine life reserves and other areas that allow for specified commercial and recreational activities, including fishing for certain species but not others, fishing with certain practices but not others, and kelp harvesting, provided that these activities are consistent with the objectives of the area and the goals and guidelines of this chapter. MPAs are primarily intended to protect or conserve marine life and habitat, and are therefore a subset of marine managed areas (MMAs), which are broader groups of named, discrete geographic areas along the coast that protect, conserve, or otherwise manage a variety of resources and uses,

including living marine resources, cultural and historical resources, and recreational opportunities.
(d) “Marine life reserve,” for the purposes of this chapter, means a marine protected area in which all extractive activities, including the taking of marine species, and, at the discretion of the commission and within the authority of the commission, other activities that upset the natural ecological functions of the area, are prohibited. While, to the extent feasible, the area shall be open to the public for managed enjoyment and study, the area shall be maintained to the extent practicable in an undisturbed and unpolluted state.

(AM ’00)

**2853. Redesign of MPA System: Goals and Elements**
(b) To improve the design and management of that system, the commission, pursuant to Section 2859, shall adopt a Marine Life Protection Program, which shall have all of the following goals:

(1) To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
(3) To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.
(4) To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.

**2856. Master Plan Preparation and Components**
(2) The master plan shall include all of the following components:
(A) Recommendations for the extent and types of habitat that should be represented in the MPA system and in marine life reserves. Habitat types described on maps shall include, to the extent possible using existing information, rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds.
(E) A simplified classification system, which shall be consistent with the goals of Section 2853 and the guidelines in subdivision (c) of Section 2857, and which may include protections for specific habitats or species, if no system that meets these specifications has already been developed.

**2860. Regulation of Commercial and Recreational Fishing or Taking of Marine Species in MPAs; Requirements for Adoption of New MPA**
(a) The commission may regulate commercial and recreational fishing and any other taking of marine species in MPAs.
(b) Notwithstanding any other provision of this code, the taking of a marine species in a marine life reserve is prohibited for any purpose, including recreational and commercial fishing,

except that the commission may authorize the taking of a marine species for scientific purposes, consistent with the purposes of this chapter, under a scientific collecting permit issued by the department.

(AD ’99)

**7050. Finding and Declaration**

(a) The Legislature finds and declares that the Pacific Ocean and its rich marine living resources are of great environmental, economic, aesthetic, recreational, educational, scientific, nutritional, social, and historic importance to the people of California.
b) It is the policy of the state to ensure the conservation, sustainable use, and, where feasible, restoration of California’s marine living resources for the benefit of all the citizens of the state. The objective of this policy shall be to accomplish all of the following:

(1) Conserve the health and diversity of marine ecosystems and marine living resources.

(2) Allow and encourage only those activities and uses of marine living resources that are sustainable.

(3) Recognize the importance of the aesthetic, educational, scientific, and recreational uses that do not involve the taking of California’s marine living resources.

(4) Recognize the importance to the economy and the culture of California of sustainable sport and commercial fisheries and the development of commercial aquaculture consistent with the marine living resource conservation policies of this part.

(5) Support and promote scientific research on marine ecosystems and their components to develop better information on which to base marine living resource management decisions.

(6) Manage marine living resources on the basis of the best available scientific information and other relevant information that the commission or department possesses or receives.

(7) Involve all interested parties, including, but not limited to, individuals from the sport and commercial fishing industries, aquaculture industries, coastal and ocean tourism and recreation industries, marine conservation organizations, local governments, marine scientists, and the public in marine living resource management decisions.

(8) Promote the dissemination of accurate information concerning the condition of, or management of, marine resources and fisheries by seeking out the best available information and making it available to the public through the marine resources management process.

(9) Coordinate and cooperate with adjacent states, as well as with Mexico and Canada, and encourage regional approaches to management of activities and uses that affect marine living resources. Particular attention shall be paid to coordinated approaches to the management of shared fisheries.

(AD ’98)

**7055. Legislative Finding and Declaration**

The Legislature finds and declares that it is the policy of the state that:

(a) California's marine sport and commercial fisheries, and the resources upon which they depend, are important to the people of the state and, to the extent practicable, shall be managed in accordance with the policies and other requirements of this part in order to assure the long-term economic, recreational, ecological, cultural, and social benefits of those fisheries and the marine habitats on which they depend.

(b) Programs for the conservation and management of the marine fishery resources of California shall be established and administered to prevent overfishing, to rebuild depressed stocks, to ensure conservation, to facilitate long-term protection and, where feasible, restoration of marine fishery habitats, and to achieve the sustainable use of the state's fishery resources.

**7056. Management of Commercial Fisheries; Objectives**

In order to achieve the primary fishery management goal of sustainability, every sport and commercial marine fishery under the jurisdiction of the state shall be managed under a system whose objectives include all of the following:

(b) The health of marine fishery habitat is maintained and, to the extent feasible, habitat is restored, and where appropriate, habitat is enhanced.

**7080. Contents of Summary**

Consistent with subdivision (b) of Section 7072, each fishery management plan prepared by the department shall summarize readily available information about the fishery including, but not limited to, all of the following:

(c) The habitat for the fishery and known threats to the habitat.

(d) The ecosystem role of the target species and the relationship of the fishery to the ecosystem role of the target species.

(AD '98)

**7083. Incorporation of Existing Conservation and Management Measures**

(a) Each fishery management plan prepared by the department shall incorporate the existing conservation and management measures provided in this code that are determined by the department to result in a sustainable fishery.

(b) If additional conservation and management measures are included in the plan, the department shall, consistent with subdivision (b) of Section 7072, summarize anticipated effects of those measures on relevant fish populations and habitats, on fishery participants, and on coastal communities and businesses that rely on the fishery.

(AD '98)

**7084. Measures to Minimize Adverse Effects on Habitat**

(a) Consistent with subdivision (b) of Section 7072, each fishery management plan or plan amendment prepared by the department for a fishery that the department has determined has adverse effects on marine fishery habitat shall include measures that, to the extent practicable, minimize adverse effects on habitat caused by fishing.

(b) Subdivision (a) does not apply to activities regulated by Chapter 6 (commencing with Section 6650) of Part 1.

(AD ’98)

**7712. Fishery Closures - Development of Alternative Sources of Gear**

Where a fishery is closed or restricted due to the need to protect a fishery resource, marine mammals, or sea birds, or due to a conflict with other fisheries or uses of the marine environment, it shall be the policy of the department and the commission, consistent with budgetary and personnel considerations, to assist and foster the development of alternative fisheries or alternative fishing gear for those commercial fishermen affected by the restrictions, closures, or resource losses, including, but not limited to, the issuing of experimental gear permits pursuant to Section 8606 for alternative fishing methods or fishing gear consistent with the policies set forth in this division.

(AM ’99)

**Article 13. Halibut Trawl Grounds**

**8495. Designated Area**

(a) The following area is designated as the California halibut trawl grounds:

The ocean waters lying between one and three nautical miles from the mainland shore lying south and east of a line running due west (270º true) from Point Arguello and north and west of a line running due south (180º true) from Point Mugu.

(b) Notwithstanding subdivision (a), the use of trawl gear for the take of fish is prohibited in the following areas of the California halibut trawl grounds:

(1) Around Point Arguello. The area from a line extending from Point Arguello true west (270º) and out three miles, to a line extending from Rocky Point true south (180º) and out three miles.

(2) Around Point Conception. From a point on land approximately one-half mile north of Point Conception at latitude 34º 27.5’ extending seaward true west (270º) from one to three miles, to a point on land approximately 1/2 mile east of Point Conception at longitude 120º 27.5’ extending seaward true south (180º) from one to three miles.

(3) In the Hueneme Canyon in that portion demarked by the IMO Vessel Traffic safety zone on NOAA/NOS Chart 18725 and from one mile to the three mile limit of state waters.

(4) In Mugu Canyon, from Laguna point, a line extending true south (180º) and out three miles, to Point Mugu, a line extending true south (180º) and from one to three miles.

(c)(1) Notwithstanding subdivision (a), commencing April 1, 2008, the following areas in the California halibut trawl grounds shall be closed to trawling, unless the commission finds that a bottom trawl fishery for halibut minimizes bycatch, is likely not damaging sea floor habitat, is not adversely affecting ecosystem health, and is not impeding reasonable restoration of kelp, coral, or other biogenic habitats:

(A) The ocean waters lying between one and three nautical miles from the mainland shore from a point east of a line extending seaward true south (180º) from a point on land approximately 1/2 mile east of Point Conception at longitude 120º 27.5’ to a line extending due south from Gaviota.

(B) The ocean waters lying between one and two nautical miles from the mainland shore lying east of a line extending due south from Santa Barbara Point (180º) and west of a line extending due south from Pitas Point (180º).

(C) Except as provided in subdivision (b), the ocean waters lying between one and three nautical miles from the mainland shore lying south and east of a line running due west (270º true) from Point Arguello to a line extending seaward true south (180º) from a point on land approximately 1/2 mile east of Point Conception at longitude 120º 27.5’, and from the western border of the IMO Vessel Traffic safety zone on NOAA/NOS Chart 18725 in Hueneme Canyon running south and east to a line running due south (180º N true) from Point Mugu.

(2) In making the finding described in paragraph (1), the commission shall pay special attention to areas where kelp and other biogenic habitats existed and where restoring those habitats is reasonably feasible, and to hard bottom areas and other substrate that may be particularly sensitive to bottom trawl impacts.

(d) Commencing January 1, 2008, the commission shall review information every three years from the federal groundfish observer program and other available research and monitoring information it determines relevant, and shall close any areas in the California halibut trawl grounds where it finds that the use of trawl gear does not minimize bycatch, is likely damaging sea floor habitat, is adversely affecting ecosystem health, or impedes reasonable restoration of kelp, coral, or other biogenic habitats. The commission shall pay special attention to areas where kelp and other biogenic habitats existed and where restoring those habitats is reasonably feasible, and to hard bottom areas and other substrate that may be particularly sensitive to bottom trawl impacts in making that finding.

(e) Notwithstanding any other provision of law, the commission shall determine the size, weight, and configuration of all parts of the trawl gear, including, but not limited to, net, mesh, doors, appurtenances, and towing equipment as it determines is necessary to ensure trawl gear is used in a sustainable manner within the California halibut trawl grounds.

(AM ’06)

**8598.4. Closure of Areas Established Under this Article**

Notwithstanding any other provision of this code, the director may close any portion of the fishery established under this article or any area in which this fishery is conducted, if, upon written finding, the director determines the action is necessary to protect any organisms listed in subdivision (a) of Section 8597 or the environment in which those organisms are located. The director shall reopen a fishery or any fishing areas previously closed pursuant to this section if the director determines that the conditions which necessitated the closure no longer exist.

**8841. Bottom Trawl Fisheries; Commission Authority; Use of Bycatch Reduction Device Required; Unlawful Activities**

(a) The commission is hereby granted authority over all state-managed bottom trawl fisheries not managed under a federal fishery management plan pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. Sec. 1801 et seq.) or a state fishery management plan pursuant to Part 1.7 (commencing with Section 7050), to ensure that resources are sustainably managed, to protect the health of ecosystems, and to provide for an orderly transition to sustainable gear types in situations where bottom trawling may not be compatible with these goals.

(b) The commission is hereby granted authority to manage all of the following fisheries in a manner that is consistent with this section and Part 1.7 (commencing with Section 7050):

(1) California halibut.

(2) Sea cucumber.

(3) Ridge-back, spot, and golden prawn.

(4) Pink shrimp.

(c) The commission is also granted authority over other types of gear targeting the same species as the bottom trawl fisheries referenced in subdivision (a) to manage in a manner that is consistent with the requirements of Part 1.7 (commencing with Section 7050).

(d) Every commercial bottom trawl vessel issued a state permit is subject to the requirements and policies of the federal groundfish observer program (50 C.F.R. 660.360).

(e) The commission may only authorize additional fishing areas for bottom trawls after it determines, based on the best available scientific information, that bottom trawling in those areas is sustainable, does not harm bottom habitat, and does not unreasonably conflict with other users.

(f) It is unlawful to use roller gear more than eight inches in diameter.

(g) Commencing April 1, 2006, it is unlawful to fish commercially for prawns or pink shrimp, unless an approved bycatch reduction device is used with each net. On or before April 1, 2006, the commission shall approve one or more bycatch reduction devices for use in the bottom trawl fishery. For purposes of this subdivision a rigid grate fish excluder device is the approved type of bycatch reduction device unless the commission, the Pacific Marine Fishery Management Council, or the National Marine Fisheries Service determines that a different type of fish

excluder device has an equal or greater effectiveness at reducing bycatch. If the commission does not approve a bycatch reduction device prior to April 1, 2006, then a device that is approved by the Pacific Marine Fishery Management Council or the National Marine Fisheries Service shall be deemed approved by the commission.

(h) Except as provided in Section 8495 or 8842, it is unlawful to engage in bottom trawling in ocean waters of the state.

(i) This section does not apply to the use of trawl nets pursuant to a scientific research permit.

(j) The commission shall facilitate the conversion of bottom trawlers to gear that is more sustainable if the commission determines that conversion will not contribute to overcapacity or overfishing. The commission may participate in, and encourage programs that support, conversion to low-impact gear or capacity reduction by trawl fleets. The department may not issue new permits to bottom trawlers to replace those retired through a conversion program.

(k) As soon as practicable, but not later than May 1, 2005, the commission and the department shall submit to the Pacific Fishery Management Council and the National Marine Fisheries Service a request for federal management measures for the pink shrimp fishery that the commission and the department determine are needed to reduce bycatch or protect habitat, to account for uncertainty, or to otherwise ensure consistency with federal groundfish management.

(l) No vessel may utilize bottom trawling gear without a state or federal permit.

(AM ’06)

**8842. Take Shrimp - Trawl Nets**

(d) Commencing January 1, 2008, the commission shall permit the taking of pink shrimp not less than two nautical miles from shore in waters that lie between a line extending due west from False Cape and a line extending due west from Point Reyes from the nearest point of land on the mainland shore, if the commission finds that, upon review of information from the federal groundfish observer program and other available research and monitoring information that it determines relevant, the use of trawl gear minimizes bycatch, will not damage seafloor habitat, will not adversely affect ecosystem health, and will not impede reasonable restoration of kelp, coral, or other biogenic habitats. The commission shall pay special attention to areas where kelp and other biogenic habitats existed and where restoring those habitats is feasible, and to hard bottom areas and other substrate that may be particularly sensitive to bottom trawl impacts in making that finding.

(AM ’04)

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**CALIFORNIA CODE OF REGULATIONS**
**APRIL 2014**
**TITLE 14. NATURAL RESOURCES**
**DIVISION 1. FISH AND GAME COMMISSION –**
**DEPARTMENT OF FISH AND WILDLIFE**

**§ 53.03. Market Squid Fishery Management Plan (Market Squid FMP) Project.**
(a) The Department's Recommended Proposed Project in the Market Squid FMP involves a combination of limitations on total harvest, regulation on the use of squid fishing gear (including lights), use of time closures to allow for periods of uninterrupted spawning, restricted access and other limits on the commercial fleet capacity, mechanisms to allow for adequate squid escapement, and area closures designed to minimize impact to sensitive non-target species and habitat. These management measures described in the Market Squid FMP will be utilized in managing the squid fishery toward meeting goals and objectives of the Market Squid FMP.

**§ 120. Prawn or Shrimp Trawling-General Provisions.**
(b) Fishing Areas.
Trawling for shrimp or prawns shall be permitted only in those waters authorized by Section 8842 of the Fish and Game Code and not otherwise prohibited by other state or federal statutes or regulations. Pursuant to Subdivisions (b) and (d) of that Section, commencing January 1, 2008, trawling for shrimp or prawns is not authorized in waters lying between a line extending due west from False Cape and a line extending due west from Point Reyes, between two and three nautical miles from the nearest point of land on the mainland shore.

**§ 124. Halibut Trawling.**
(a) Areas. Section 8495 of the Fish and Game Code designates the California Halibut Trawl Grounds as certain state waters along the mainland shore between Point Arguello and Point Mugu and specifies that this area is open to trawling when the season is open. Subdivision 8495(c) specifies four sub-areas within the California Halibut Trawl Grounds that will close to trawling commencing April 1, 2008, unless the commission makes findings as defined in that subdivision.
(1) Open Areas. Because the commission has made the requisite findings for three of the aforementioned four sub-areas within the California Halibut Trawl Grounds, the commission authorizes the following waters to remain open to trawling commencing June 16, 2008, and thereafter when the season is open, notwithstanding subdivision 8495(c) of the Fish and Game Code:
(A) Rocky Point (near Point Arguello) to Point Conception: From a line extending from Rocky Point true south ($180^{o}$) and out three miles, the ocean waters extending south and east lying

between one and three nautical miles from the mainland shore to a line extending true west (270$^{o}$) from a point on land approximately one-half mile north of Point Conception at latitude 34$^{o}$ 27.5'.
(B) Santa Barbara Point to Pitas Point: The ocean waters lying between one and two nautical miles from the mainland shore lying east of a line extending true south (180$^{o}$) from Santa Barbara Point and west of a line extending true south (180$^{o}$) from Pitas Point.
(C) Hueneme Canyon to Laguna Point: From the eastern border of the IMO Vessel Traffic safety zone on NOAA/NOS Chart 18725 in Hueneme Canyon, the ocean waters extending south and east lying between one and three nautical miles from the mainland shore to a line extending true south (180$^{o}$) from Laguna Point.
(2) Closed Areas. The waters permanently closed to trawling within the California Halibut Trawl Grounds are those specified in subdivision 8495(b) of the Fish and Game Code, and the following sub-area identified in subdivision 8495(c) of the Fish and Game Code:
(A) Point Conception to Gaviota: The ocean waters between one and three nautical miles from the mainland shore lying east of a line extending true south (180$^{o}$) from a point on land approximately 1/2 mile east of Point Conception at longitude 120$^{o}$ 27.5', and west of a line extending due south from Gaviota.
(b) Gears. Special gear requirements apply while trawling for California halibut in the California Halibut Trawl grounds. Each trawl net, including trawl doors and footrope chain, shall meet the following requirements:
(1) Each trawl net shall have a headrope not exceeding 90 feet in length. The headrope is defined as a chain, rope, or wire attached to the trawl webbing forming the leading edge of the top panel of the trawl net. Headrope shall be measured from where it intersects the bridle on the left side of the net to where it intersects the bridle on the right side of the net.
(2) The thickness of the webbing of any portion of the trawl net shall not exceed 7 millimeters in diameter.
(3) Each trawl door shall not exceed 500 pounds in weight.
(4) Any chain attached to the footrope shall not exceed one quarter inch in diameter of the link material. The footrope is defined as a rope or wire attached to the trawl webbing forming the leading edge of the bottom panel of the trawl net.
(5) The trawl shall have no rollers or bobbins on any part of the net or footrope. Rollers or bobbins are devices made of wood, steel, rubber, plastic, or other hard material that encircle the trawl footrope. These devices are commonly used to either bounce or pivot over seabed obstructions, in order to prevent the trawl footrope and net from snagging on the seabed.
Note: Authority cited: Sections 8841 and 8495, Fish and Game Code. Reference: Sections 8392, 8494, 8495, 8496, 8497, 8830, 8831, 8837, 8840, 8841 and 8843, Fish and Game Code.

**§ 189. Commercial Groundfish Fishing.**
(a) General Provisions. No person shall engage in commercial groundfish fishing except as provided by the Fish and Game Code and regulations provided herein. Applicable regulations

adopted by the U.S. Secretary of Commerce pursuant to the Magnuson Fishery Conservation and Management Act and published in Title 50, Code of Federal Regulations (CFR), Parts 600 and 660 are hereby incorporated and made a part of these regulations. Federal regulations shall be made available upon request from the Department of Fish and Game, Marine Region, 1416 Ninth Street, BOX 944209, Sacramento, CA 94244-2090, phone number 916-653-6281.

**APPENDIX 2.**

Map series showing overlap of groundfish EFH proposal areas with bottom trawl fishing intensity layer (12 Jun 2006 – 31 Dec 2010). Only those areas proposed to be closed to bottom trawl or all bottom contact fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: Pacific Fisheries Information Network (PacFIN).

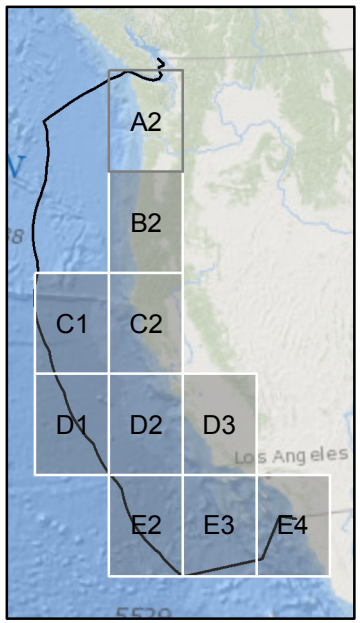
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008



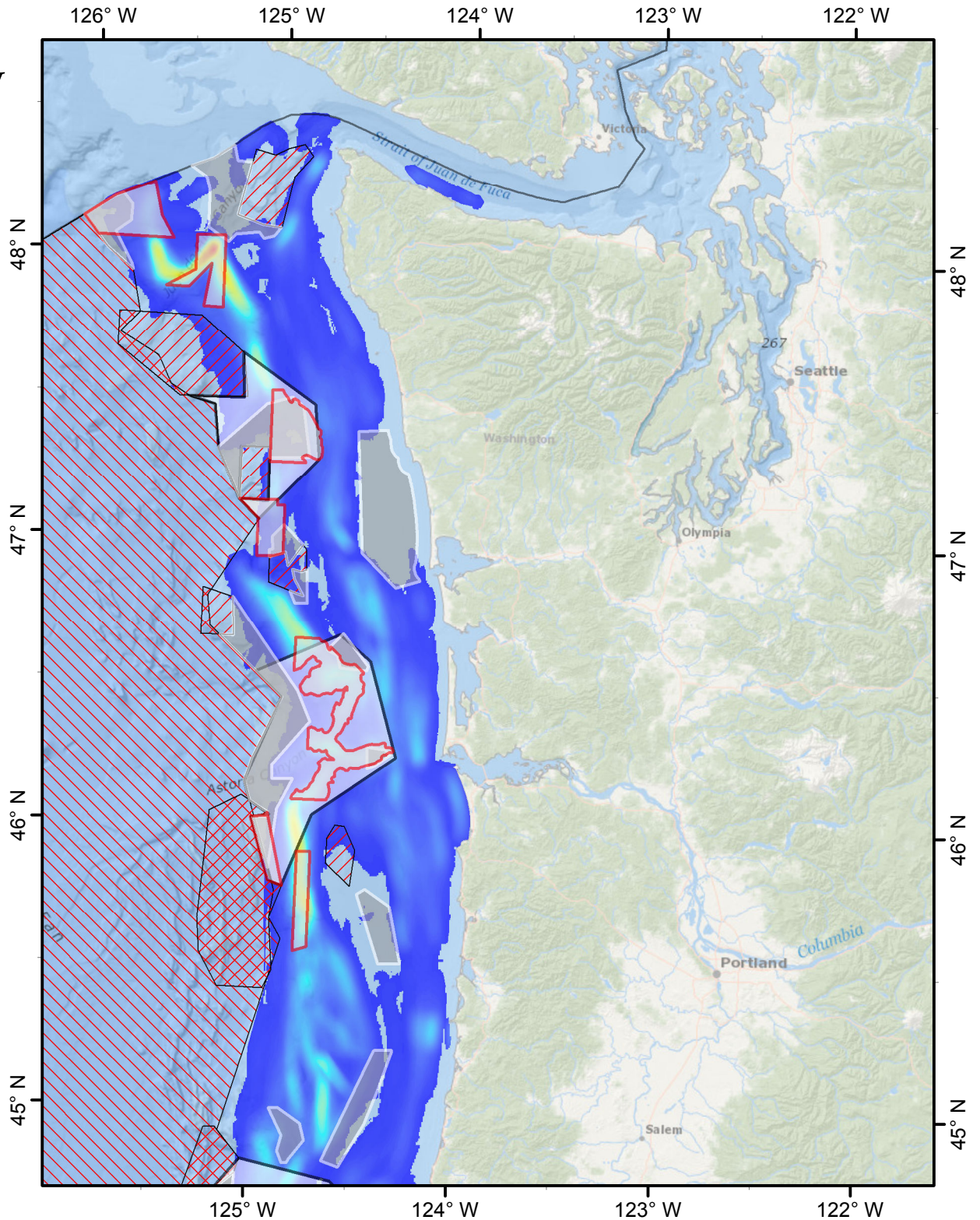

Map 1 of 10

N
W
E
S

**A2**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

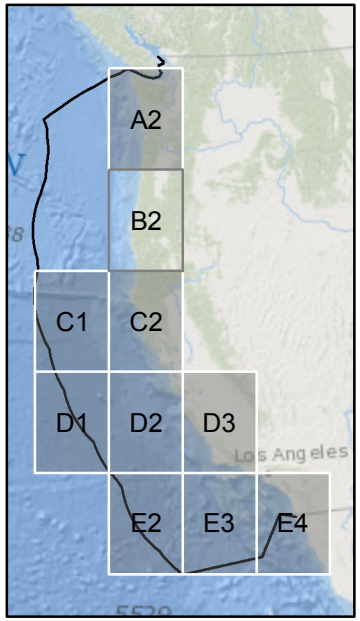
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008




Map 2 of 10

B2

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles

126° W 125° W 124° W 123° W 122° W

45° N 44° N 43° N 42° N

Salem

Medford

3225

3410

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

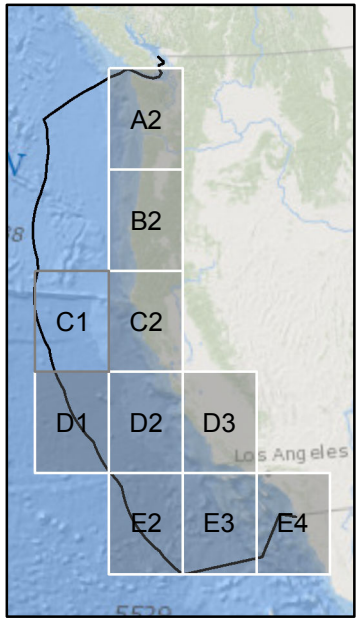
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008




Map 3 of 10

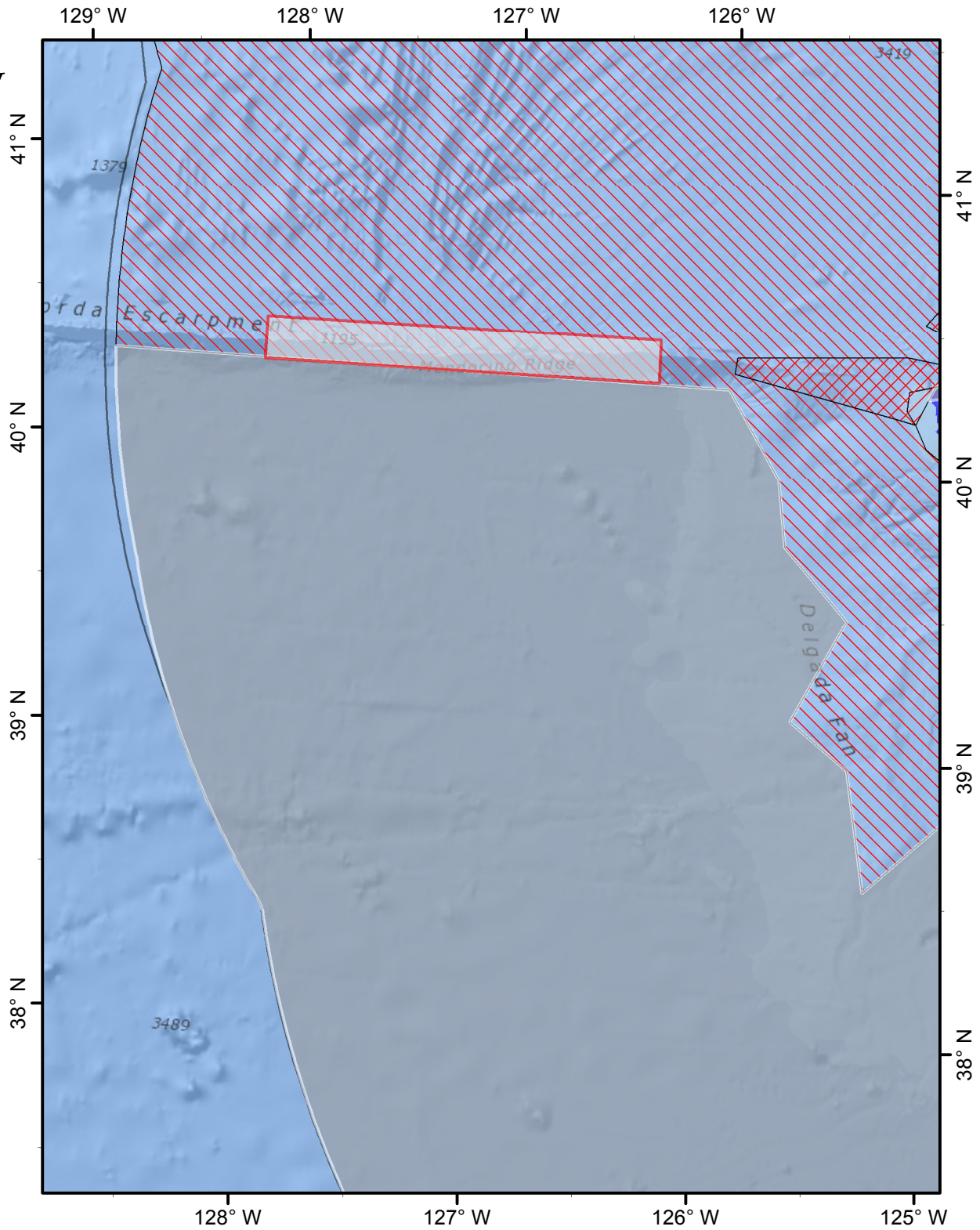
**C1**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

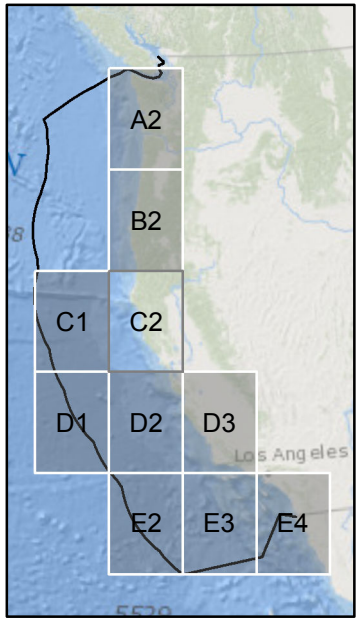
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008




Map 4 of 10

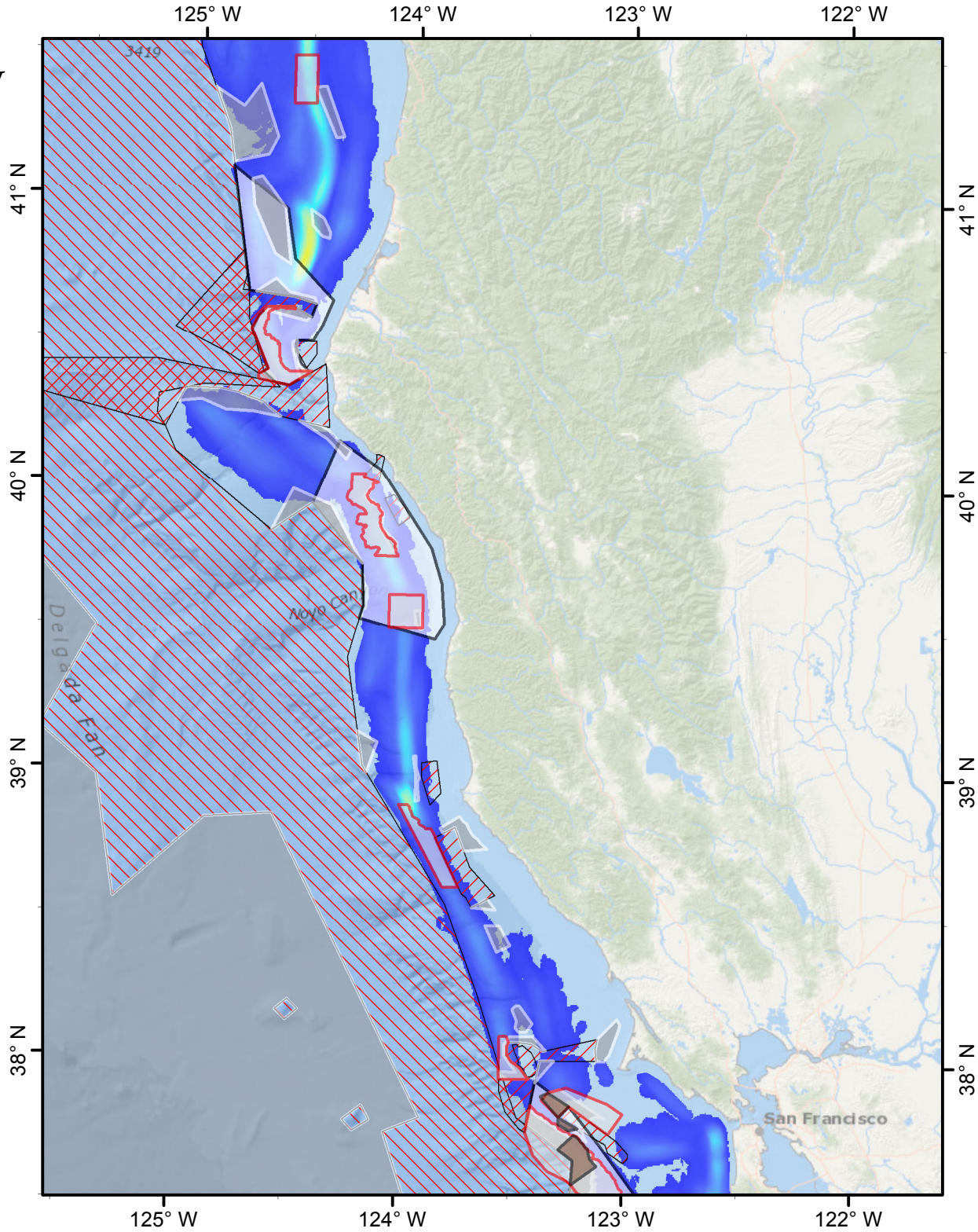
**C2**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles

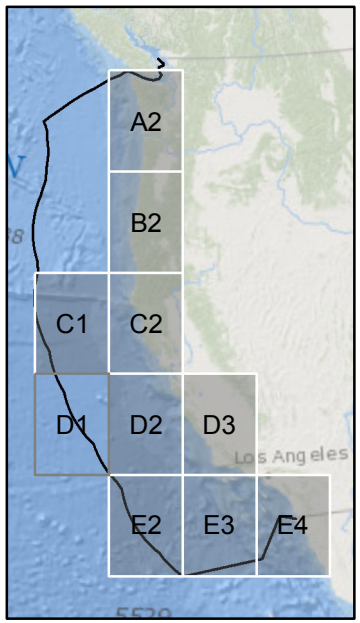



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

MBNMS (close)
GFNMS (close)
MCI (close)
Oceana/NRDC/OC (close)
Greenpeace (close)
EFH Cons. Area
700-fm Closure

**Effort (km/km²)**
High : 221.931
Low : 0.008



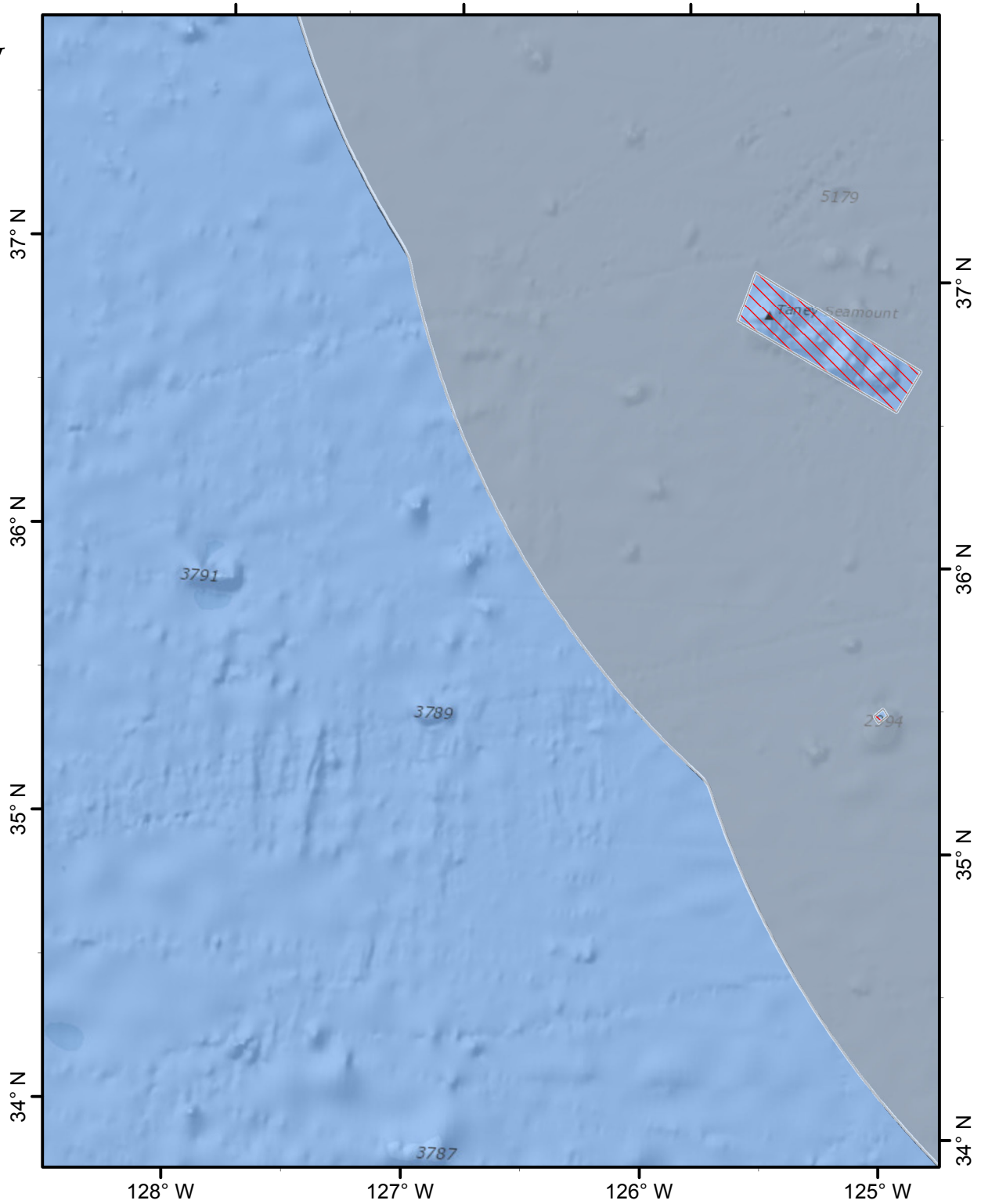

Map 5 of 10

N
W E
S

**D1**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

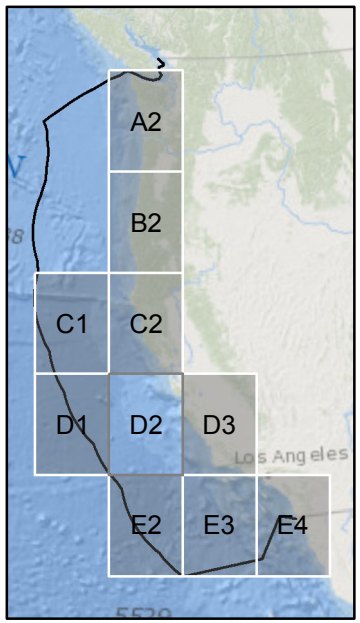
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008

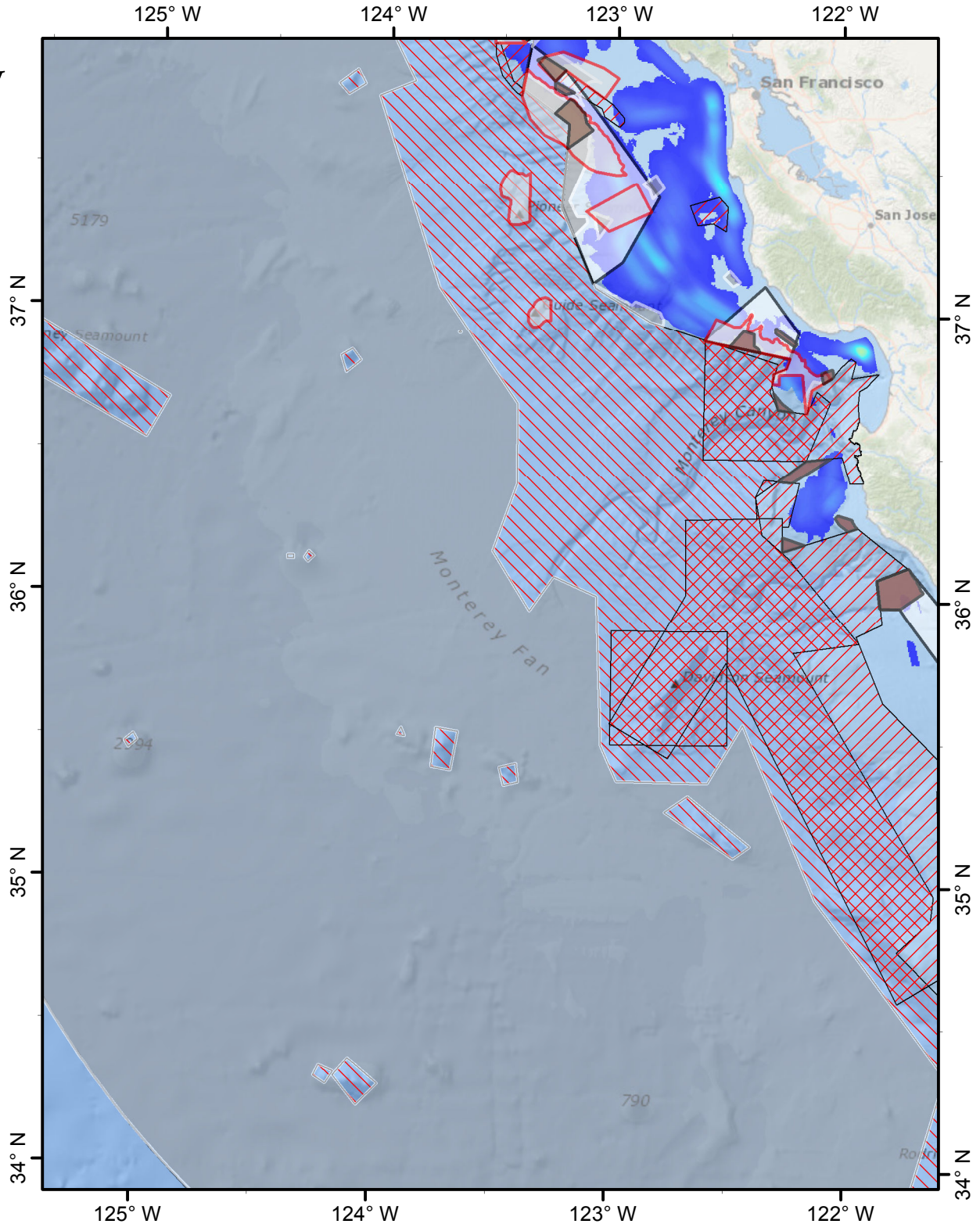



Map 6 of 10

**D2**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

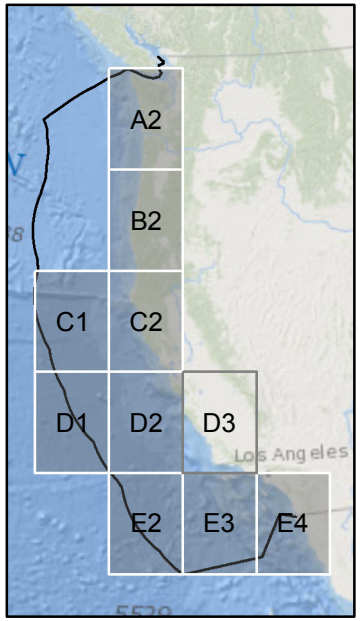
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008



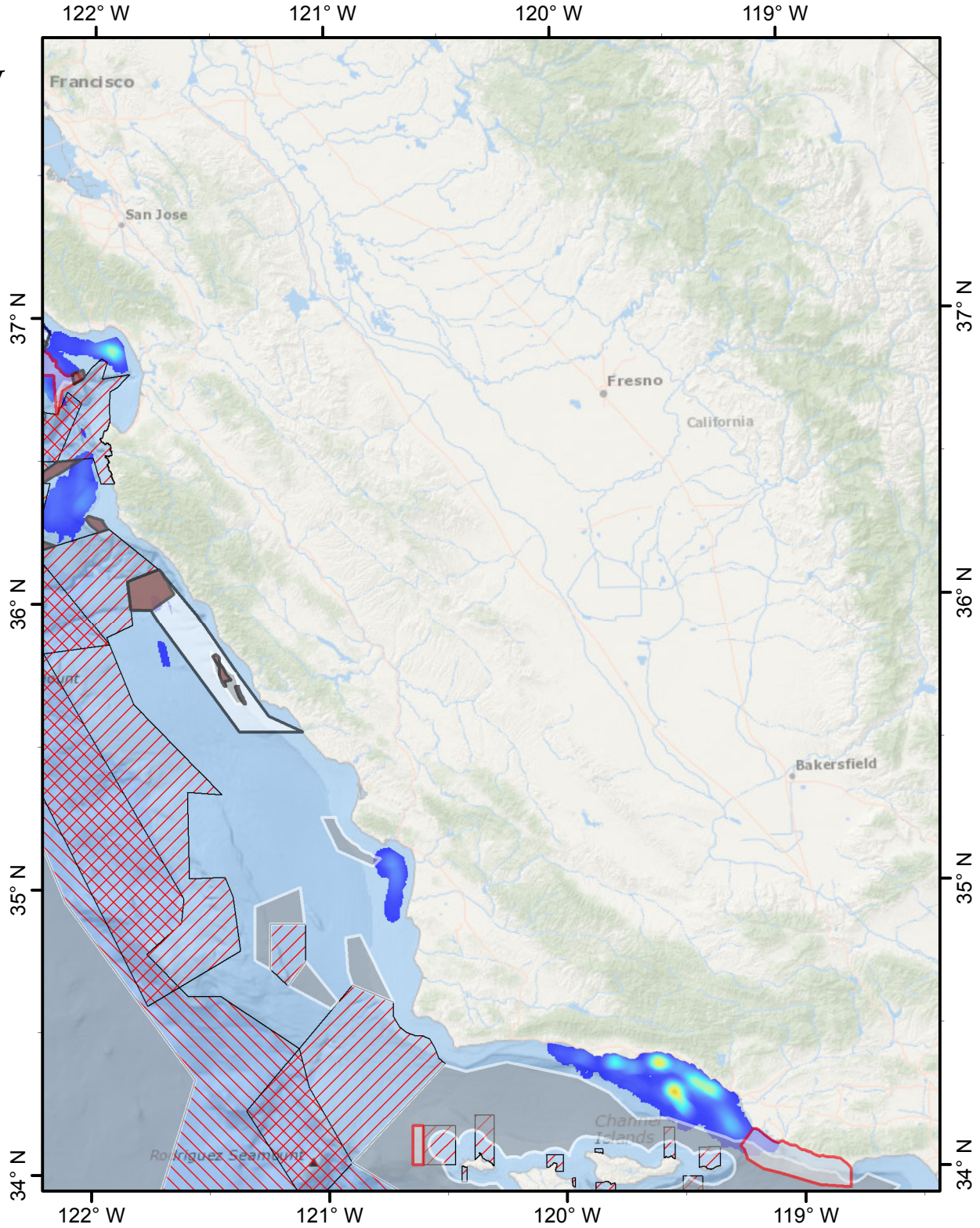

Map 7 of 10

**D3**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)



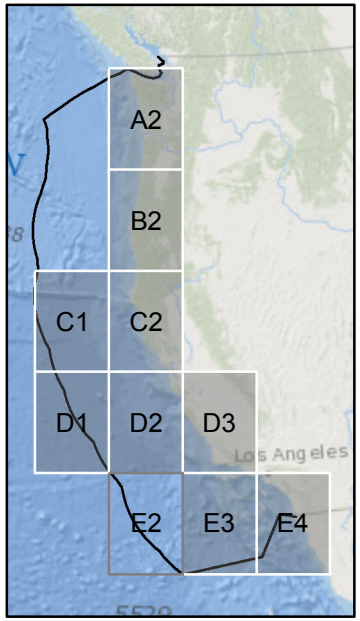
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008

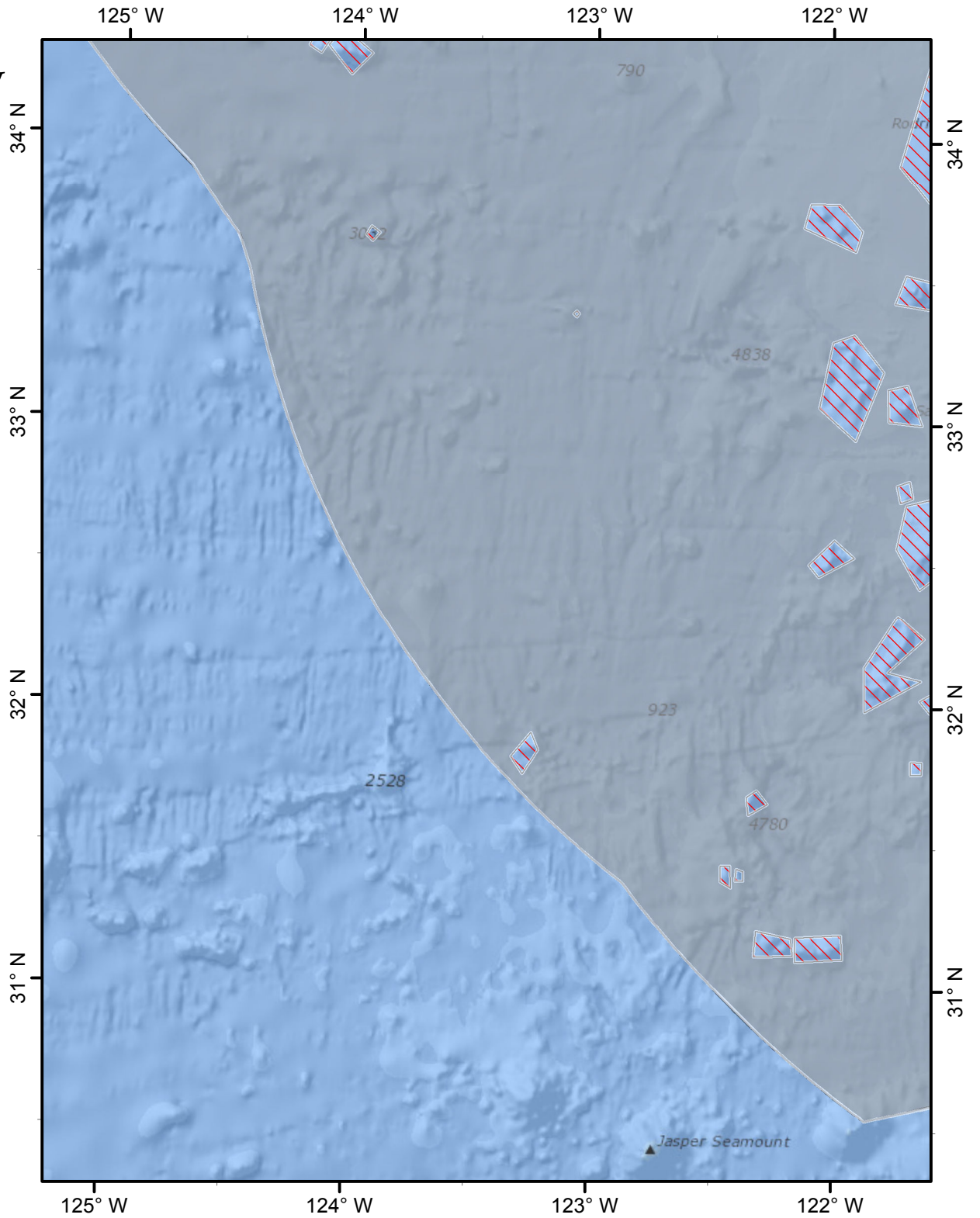



Map 8 of 10

**E2**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

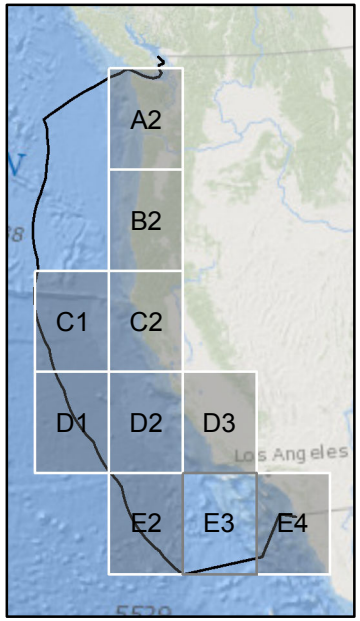
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008



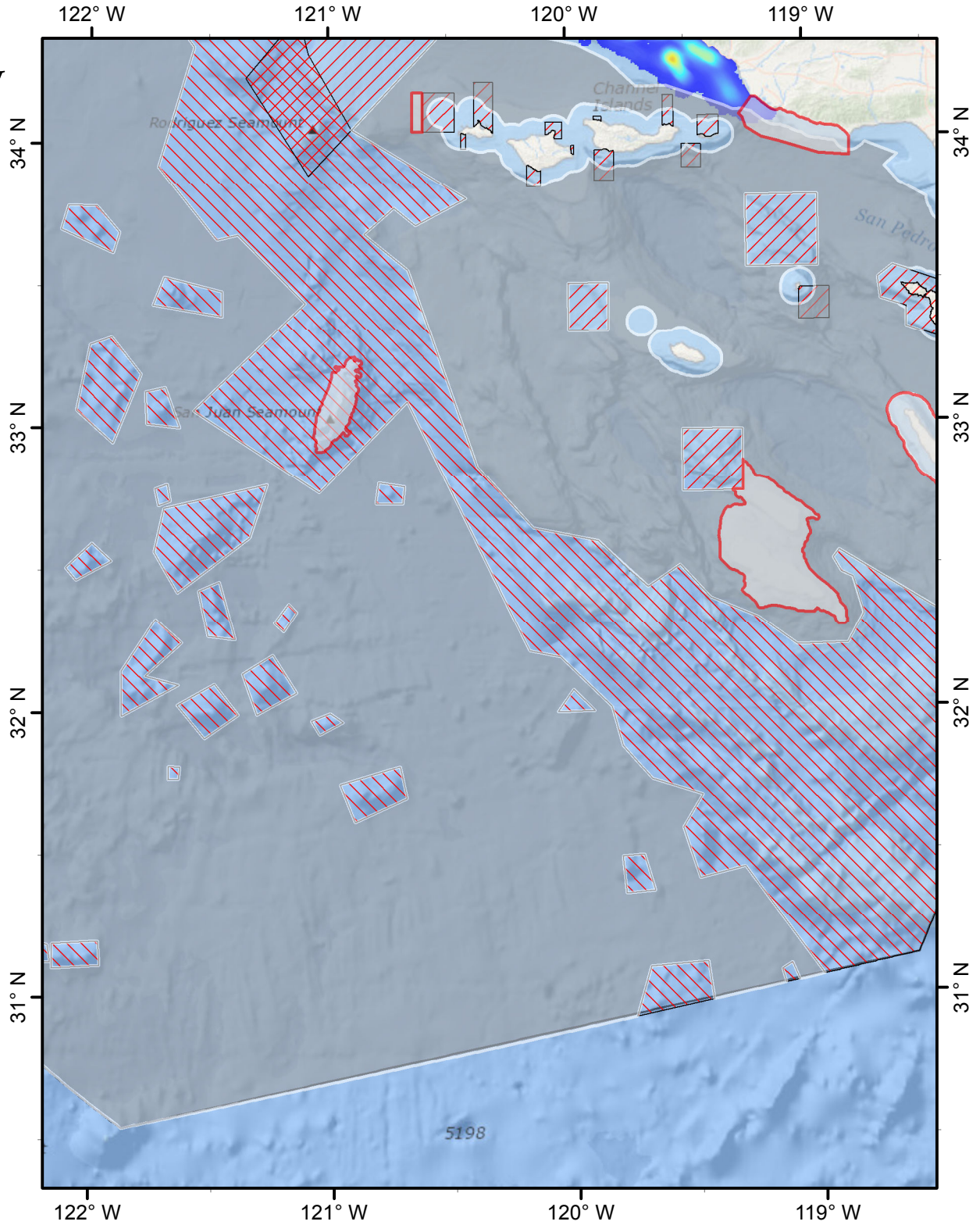

Map 9 of 10

N W E S

**E3**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

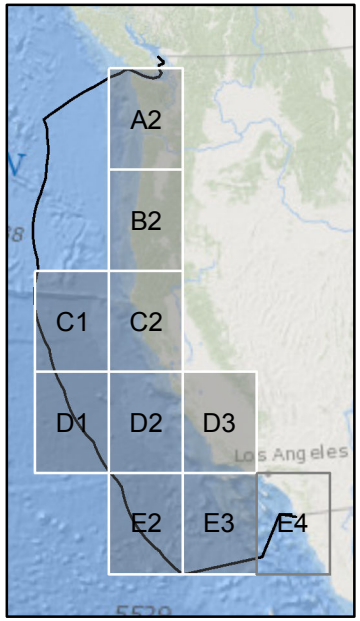
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008

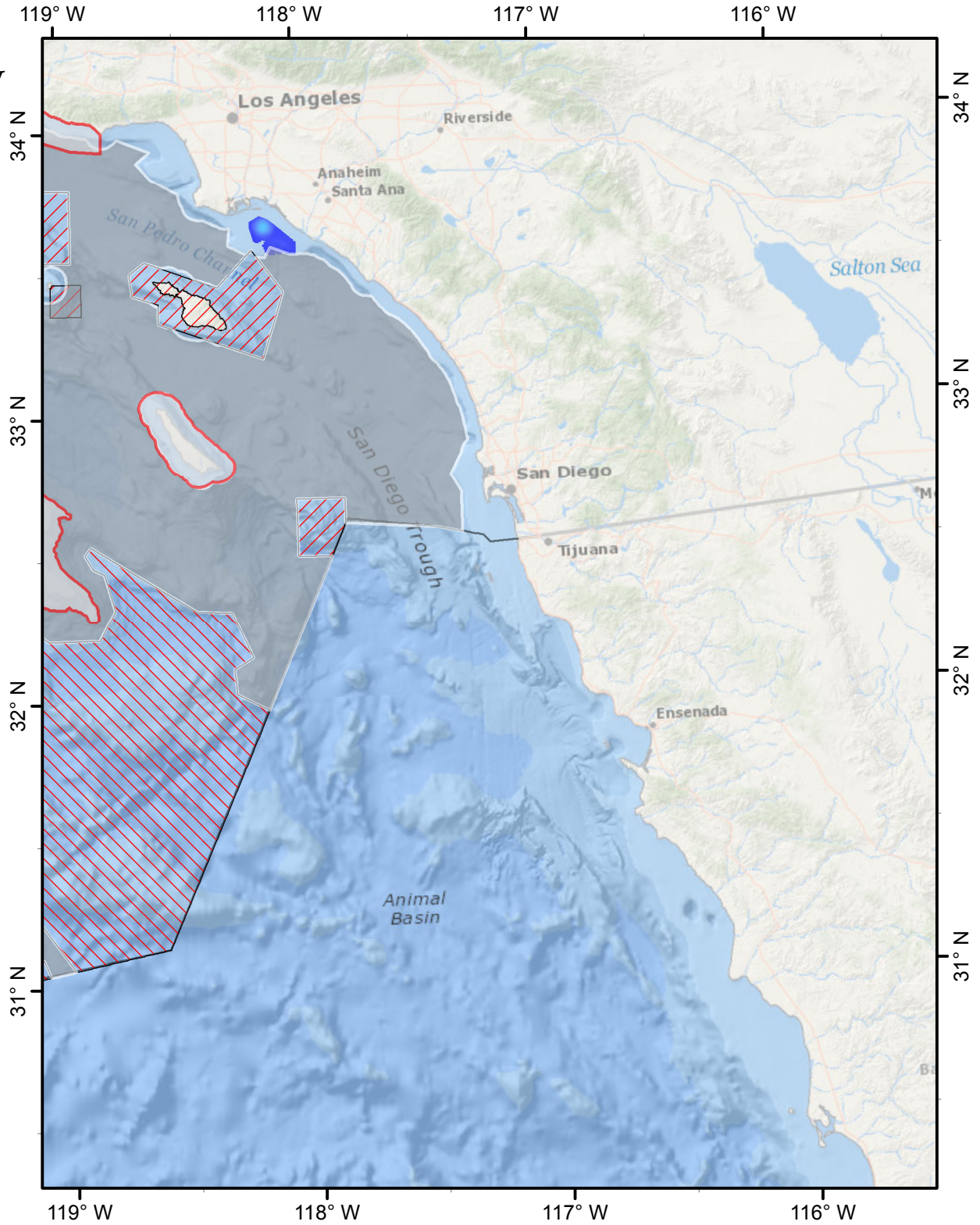



Map 10 of 10

**E4**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

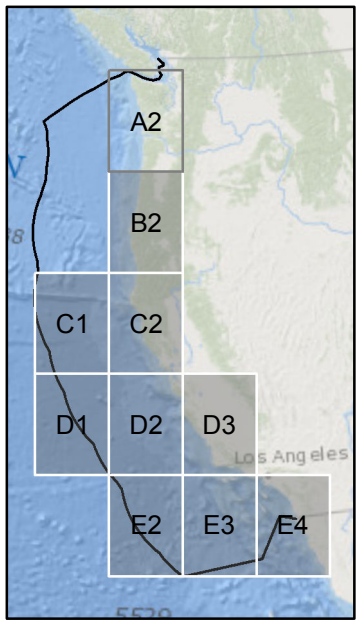
**APPENDIX 3.**

Map series showing overlap of groundfish EFH proposal areas with bottom trawl fishing intensity layer (1 Jan 2002 – 11 Jun 2006). Only those areas proposed to be reopened to bottom trawl fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: Pacific Fisheries Information Network (PacFIN).

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

**Effort (km/km²)**
High : 221.931
Low : 0.008



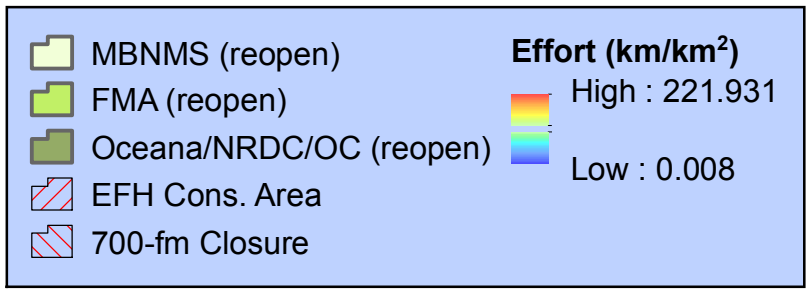

Map 1 of 10

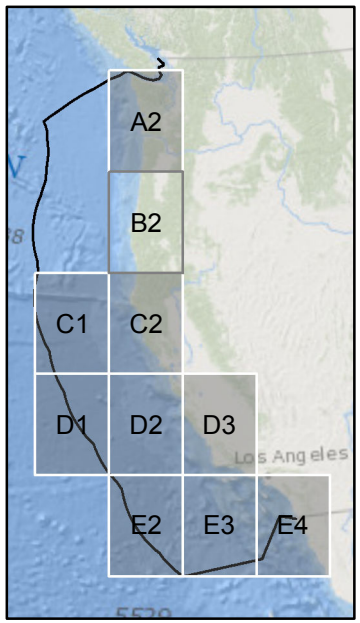
**A2**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)



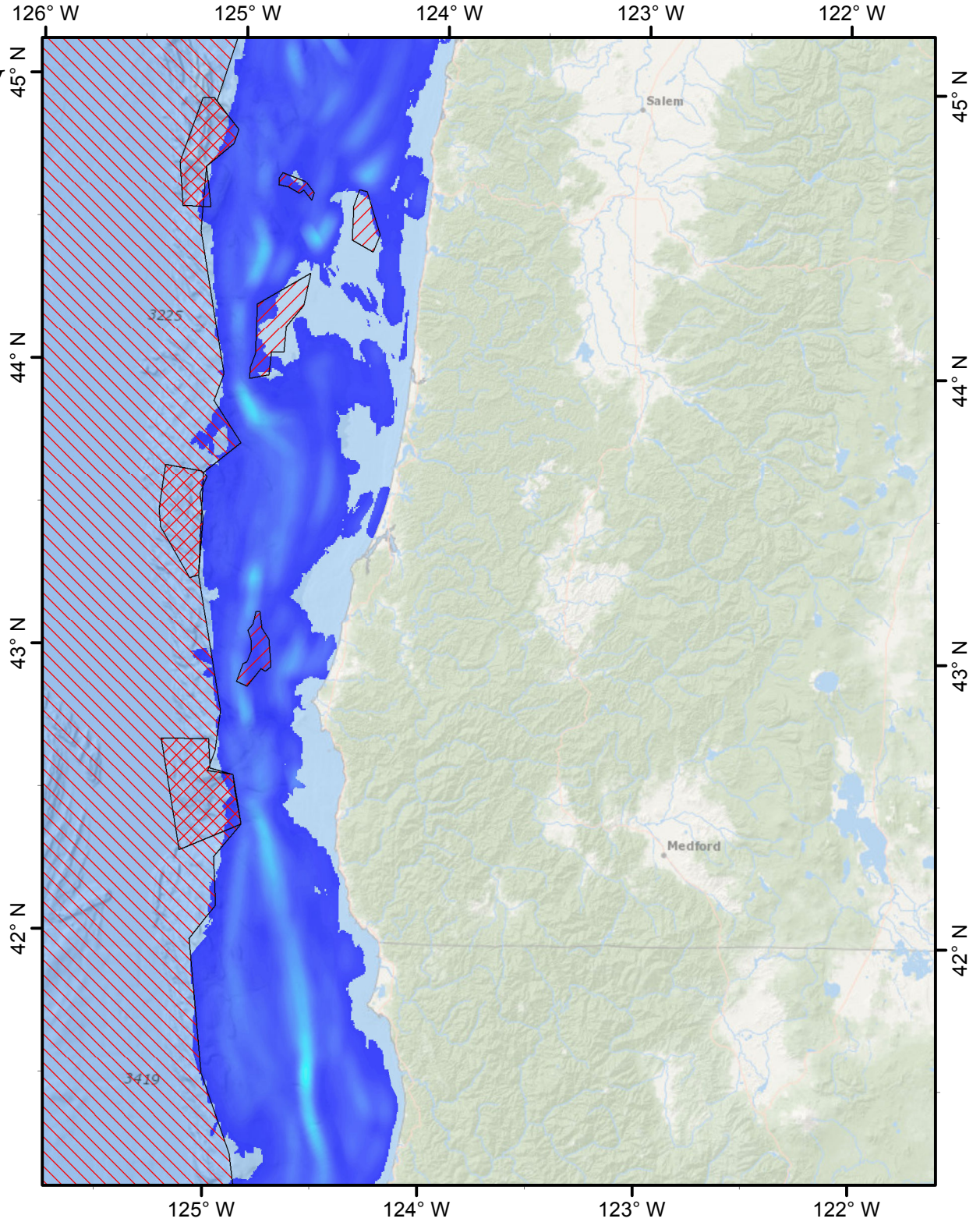

Map 2 of 10

B2

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)



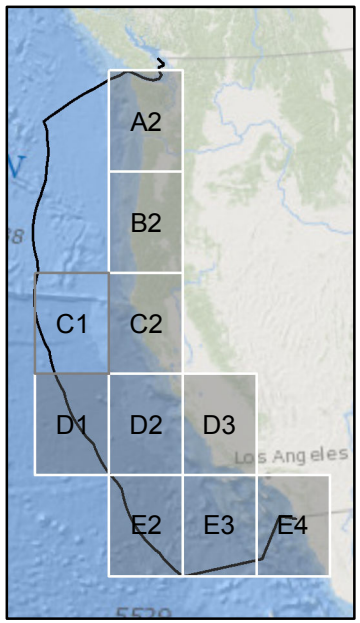
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km$^2$)**

High : 221.931

Low : 0.008




Map 3 of 10

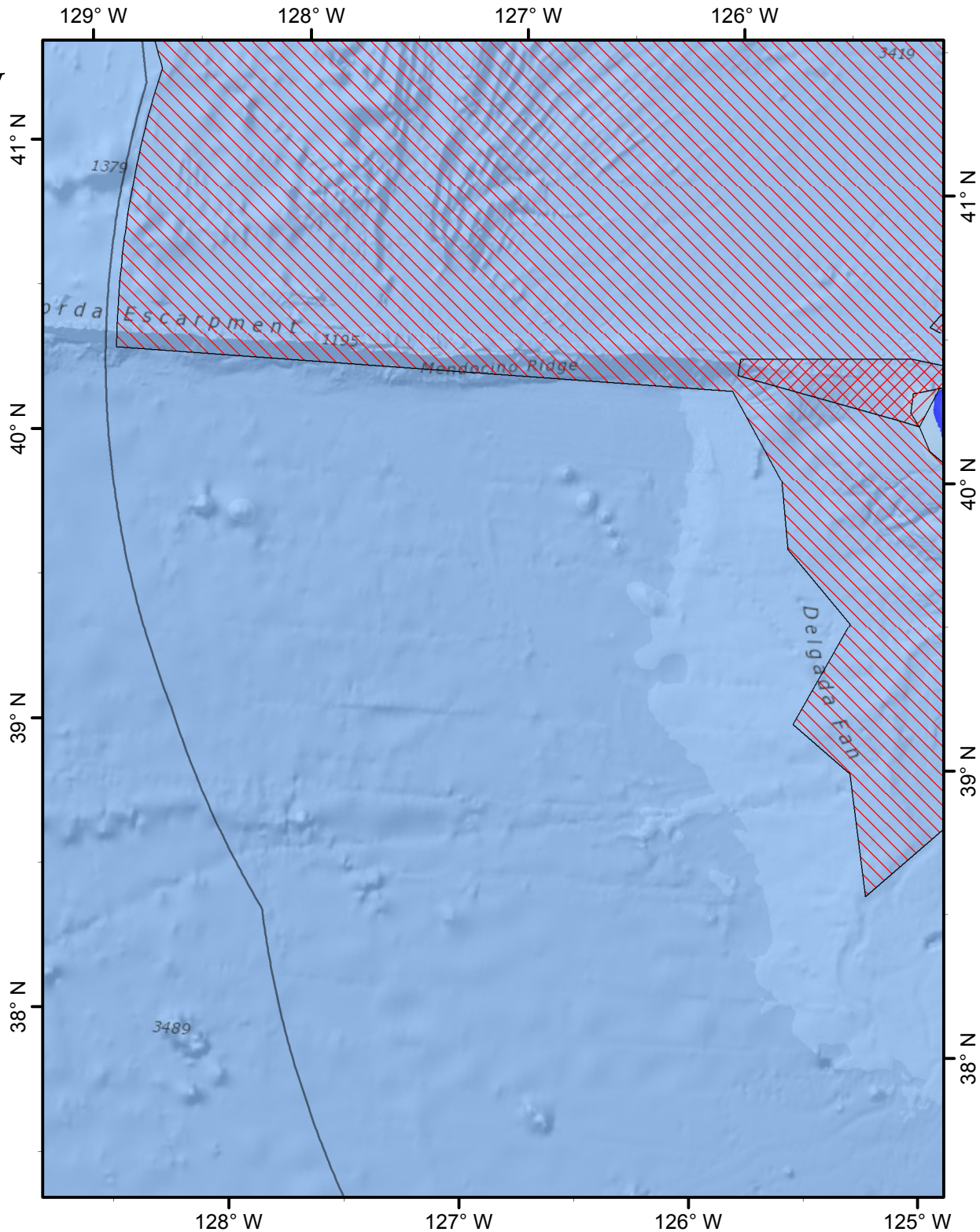
C1

0 25 50 75 100

Kilometers

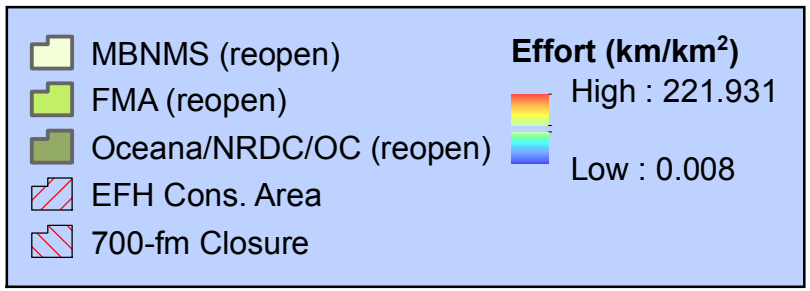
0 20 40 60

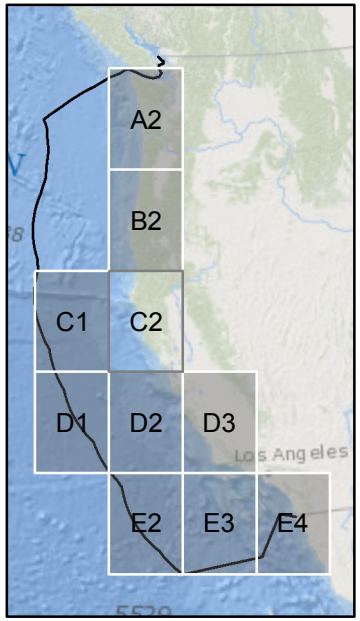
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)



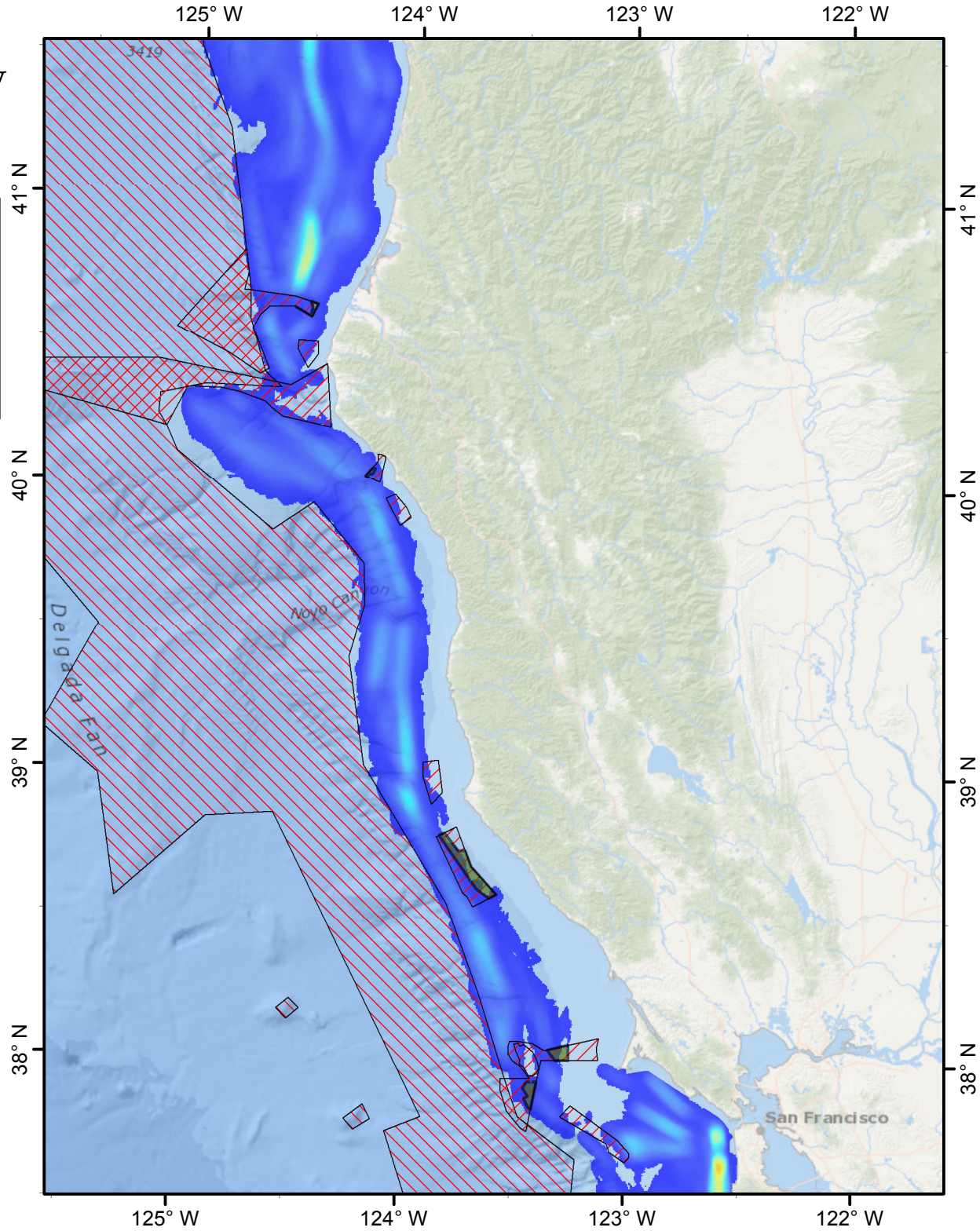




Map 4 of 10

C2

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles

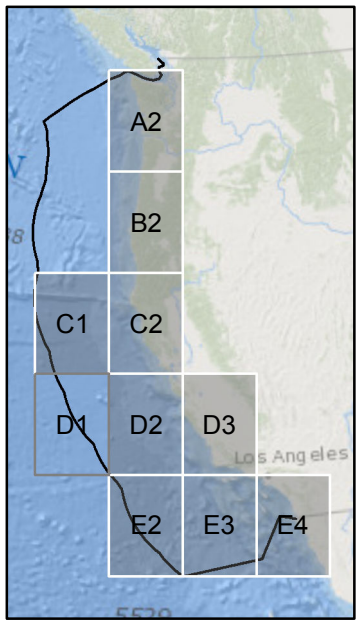



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

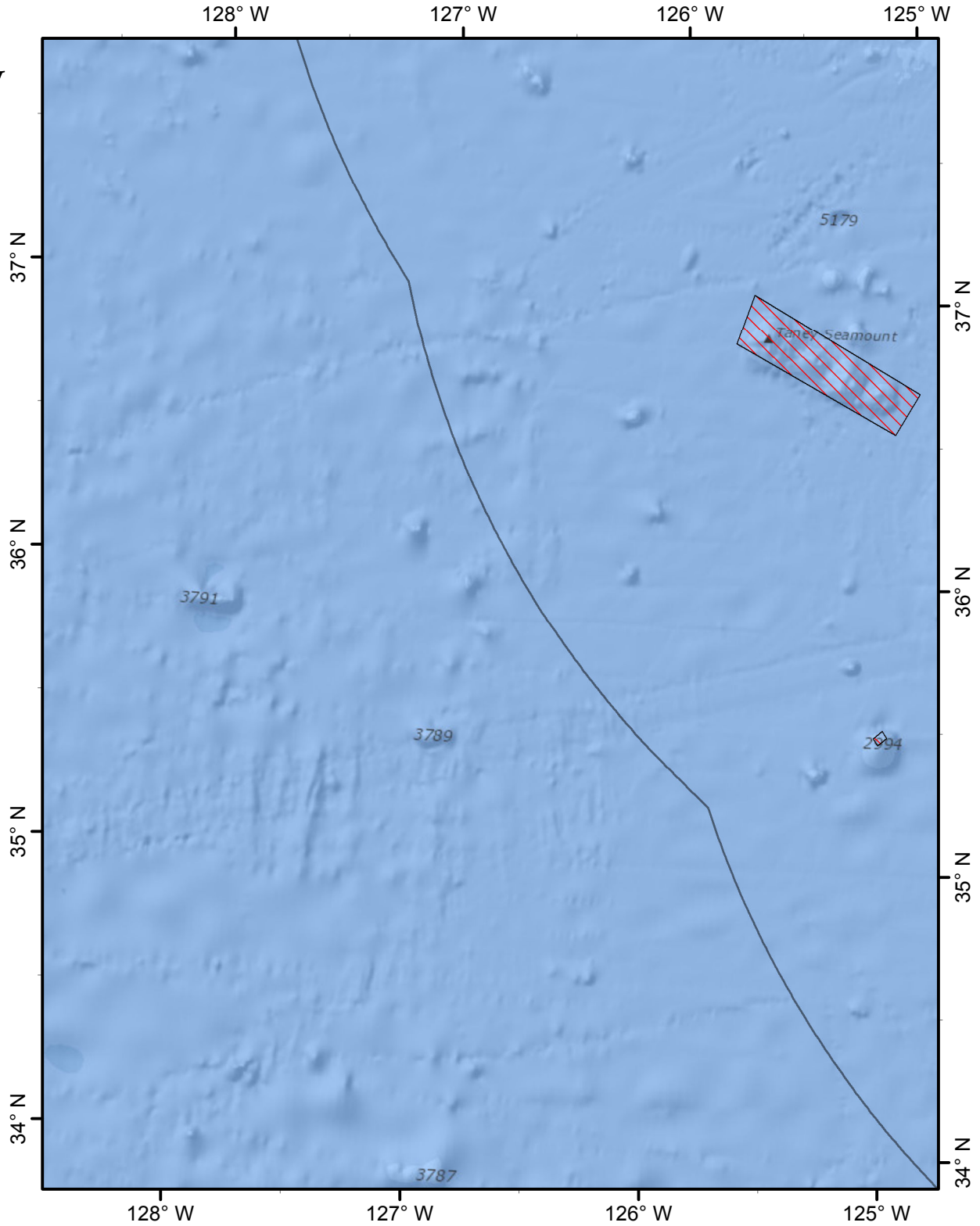
**Effort (km/km²)**
High : 221.931
Low : 0.008




Map 5 of 10

**D1**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

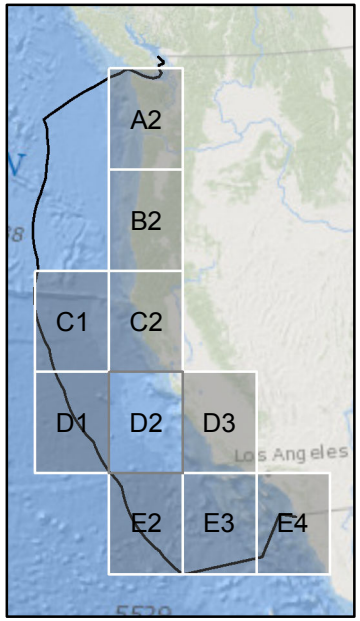



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

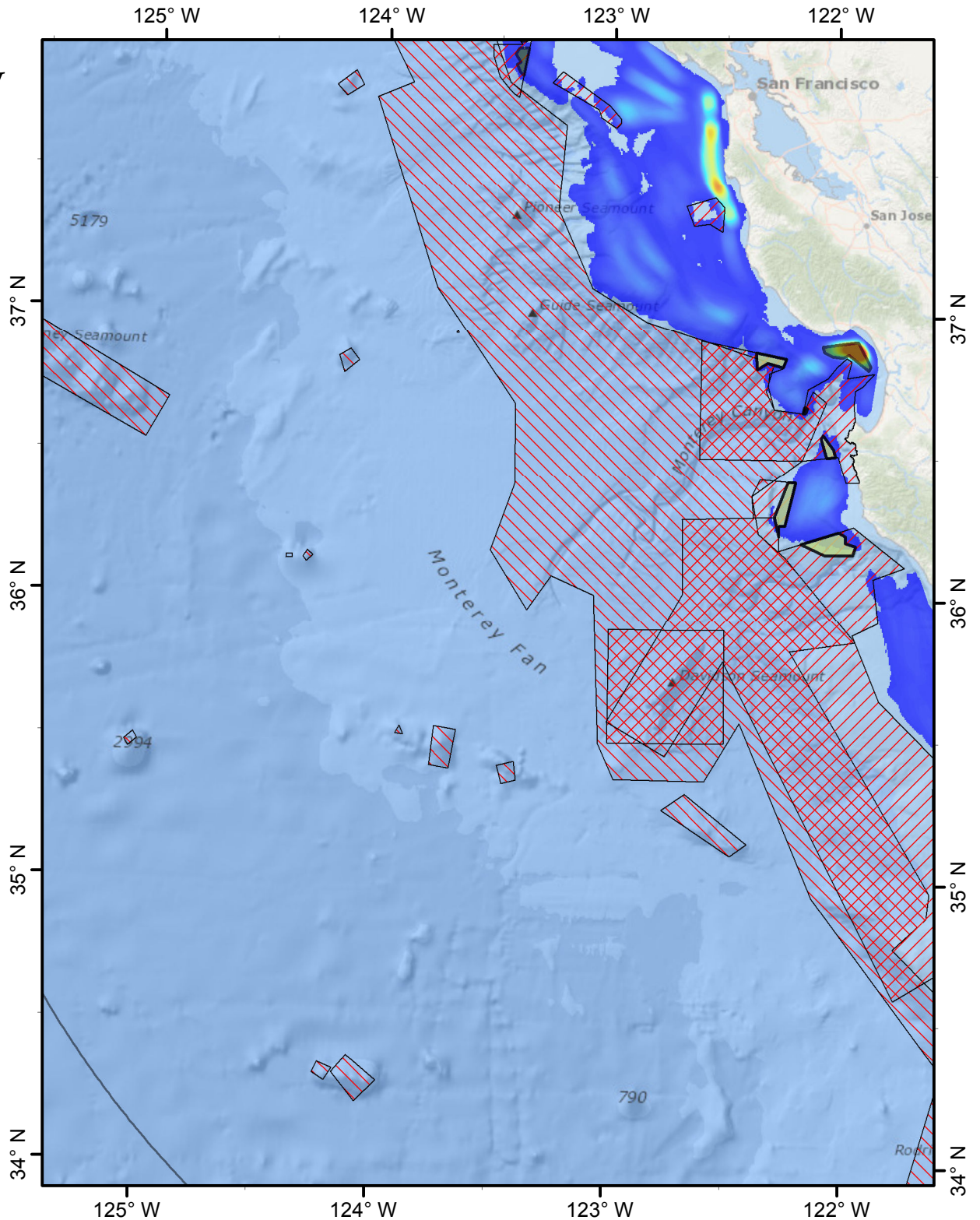
**Effort (km/km²)**
High : 221.931
Low : 0.008




Map 6 of 10

**D2**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

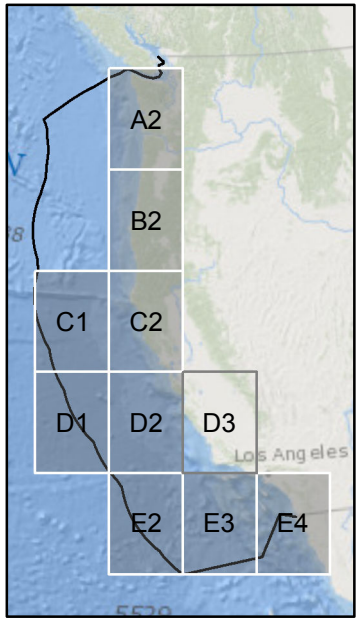



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

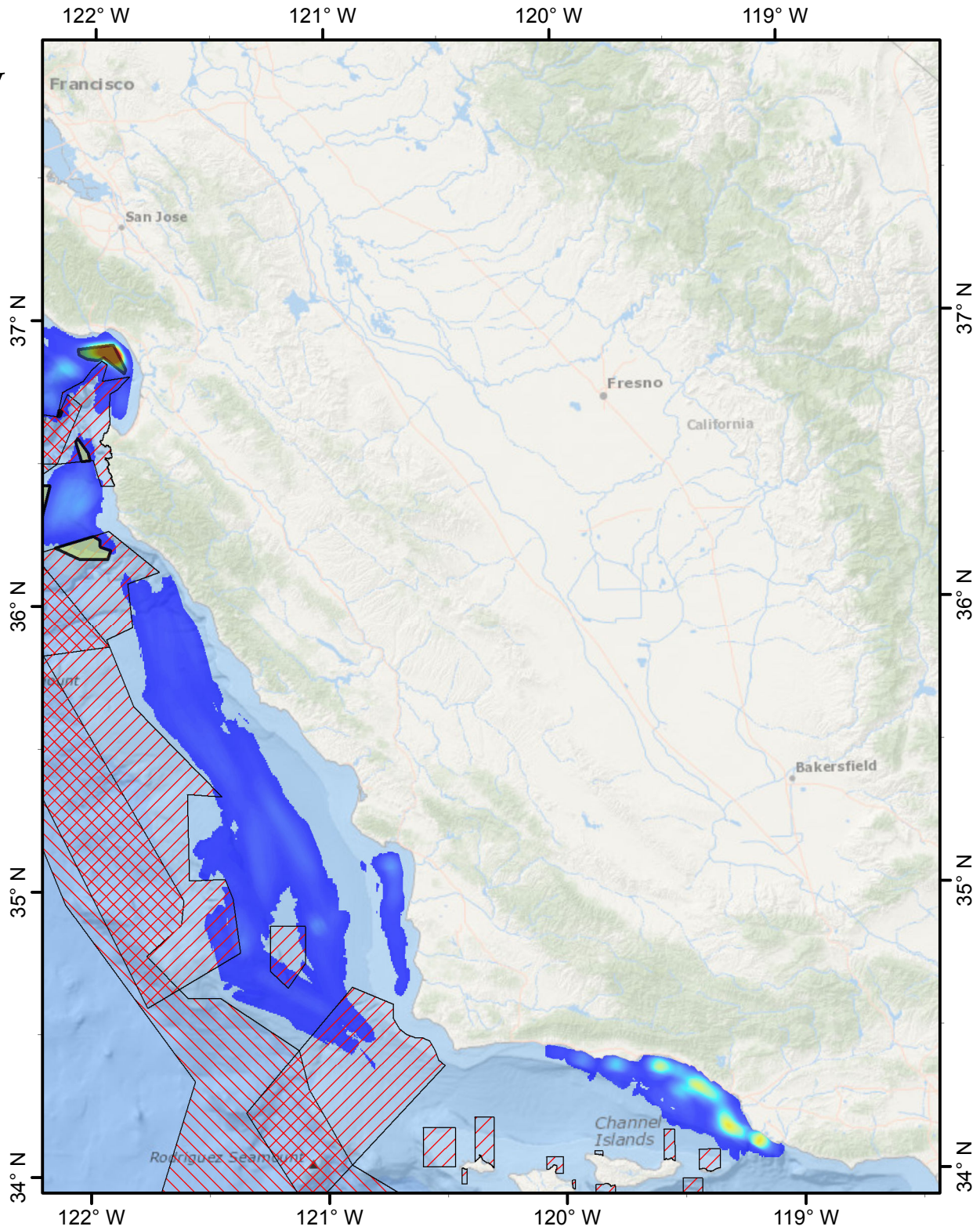
**Effort (km/km²)**
High : 221.931
Low : 0.008




Map 7 of 10

**D3**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

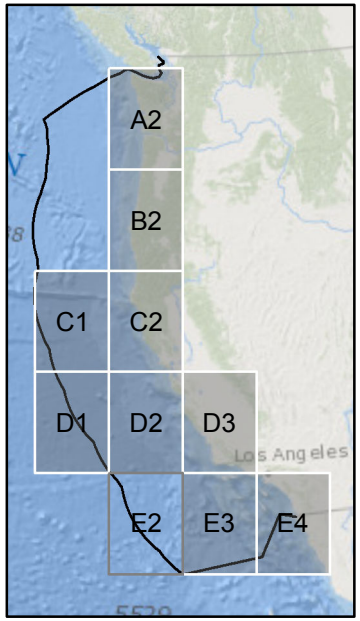



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

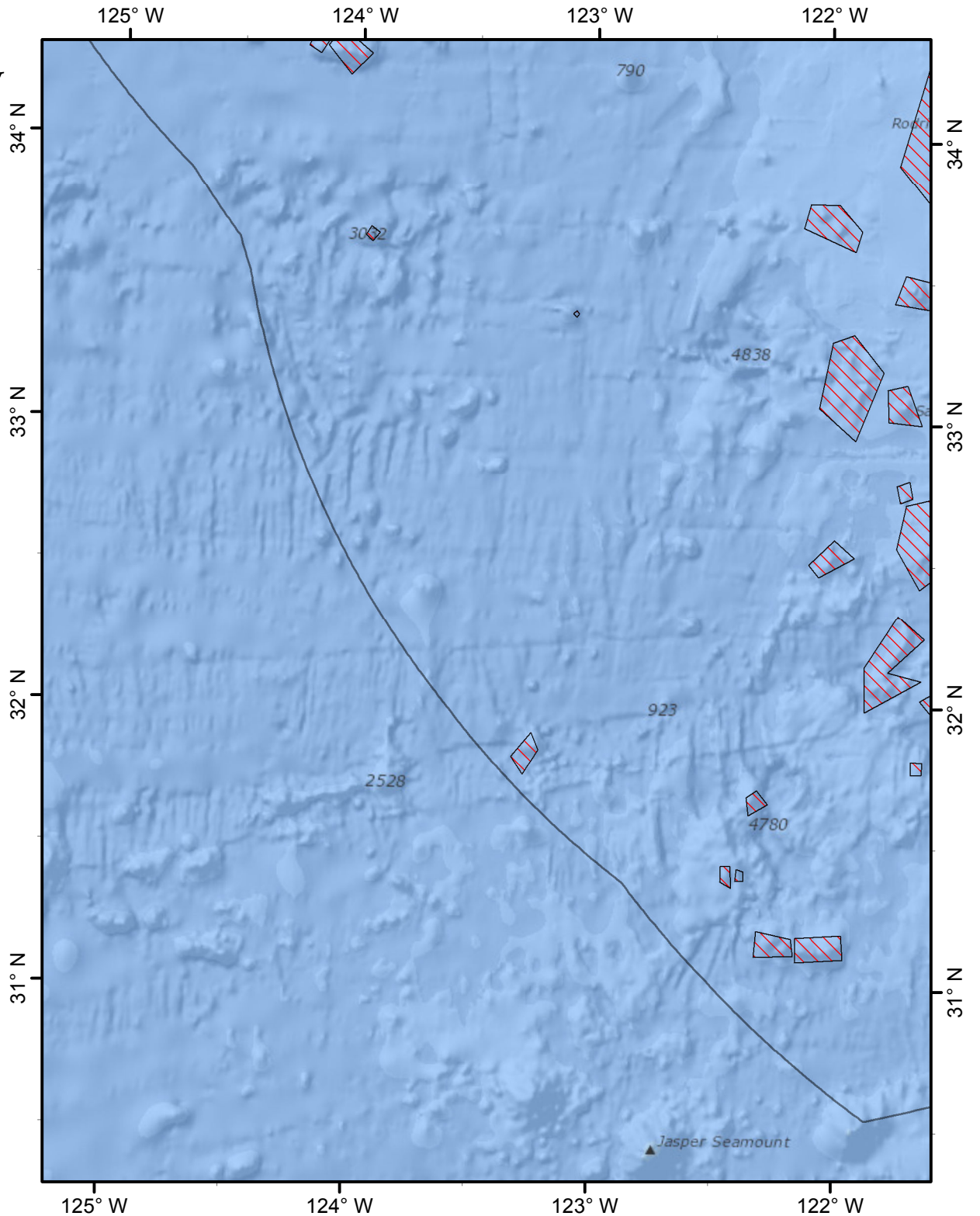
**Effort (km/km²)**
High : 221.931
Low : 0.008




Map 8 of 10

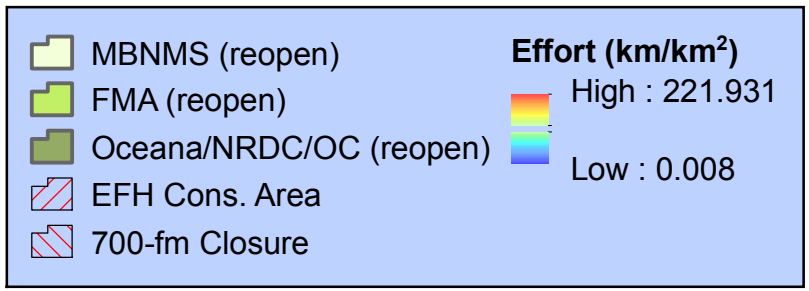
**E2**

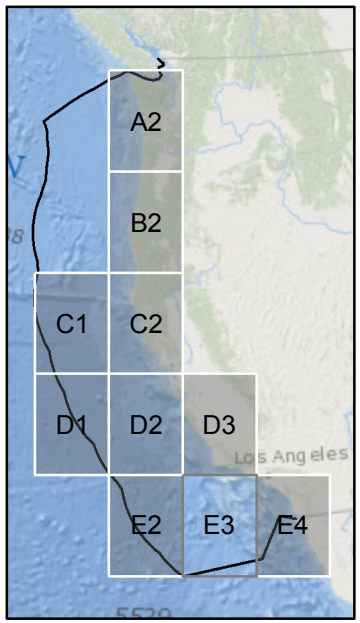
0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles



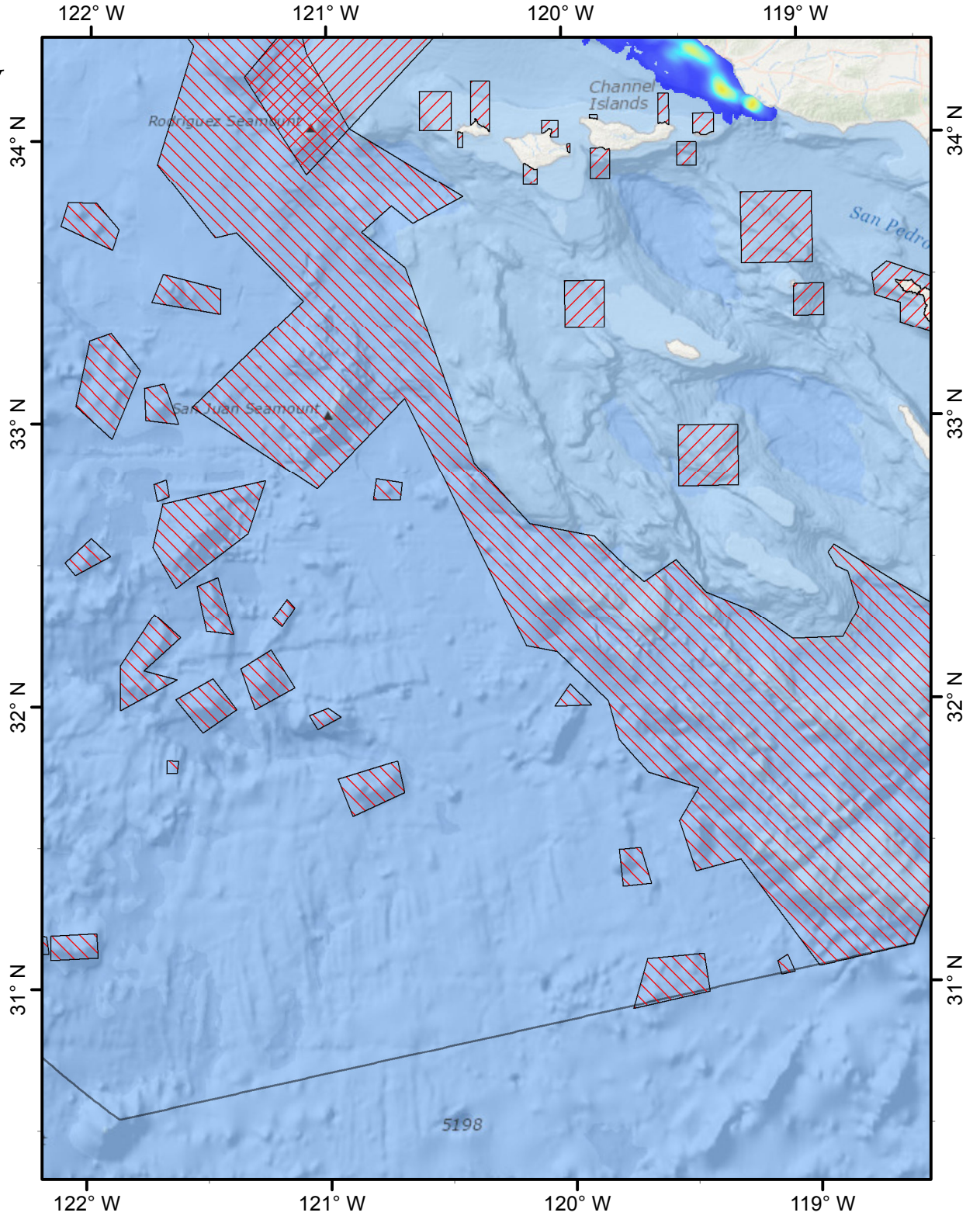

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)




Map 9 of 10


Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

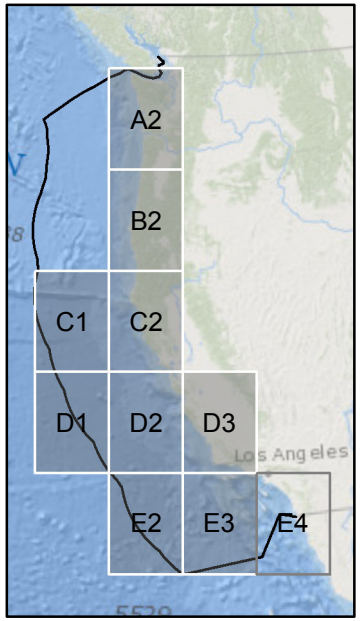
# Groundfish EFH Proposal Areas & Bottom Trawl Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- EFH Cons. Area
- 700-fm Closure

**Effort (km/km²)**

High : 221.931

Low : 0.008




Map 10 of 10

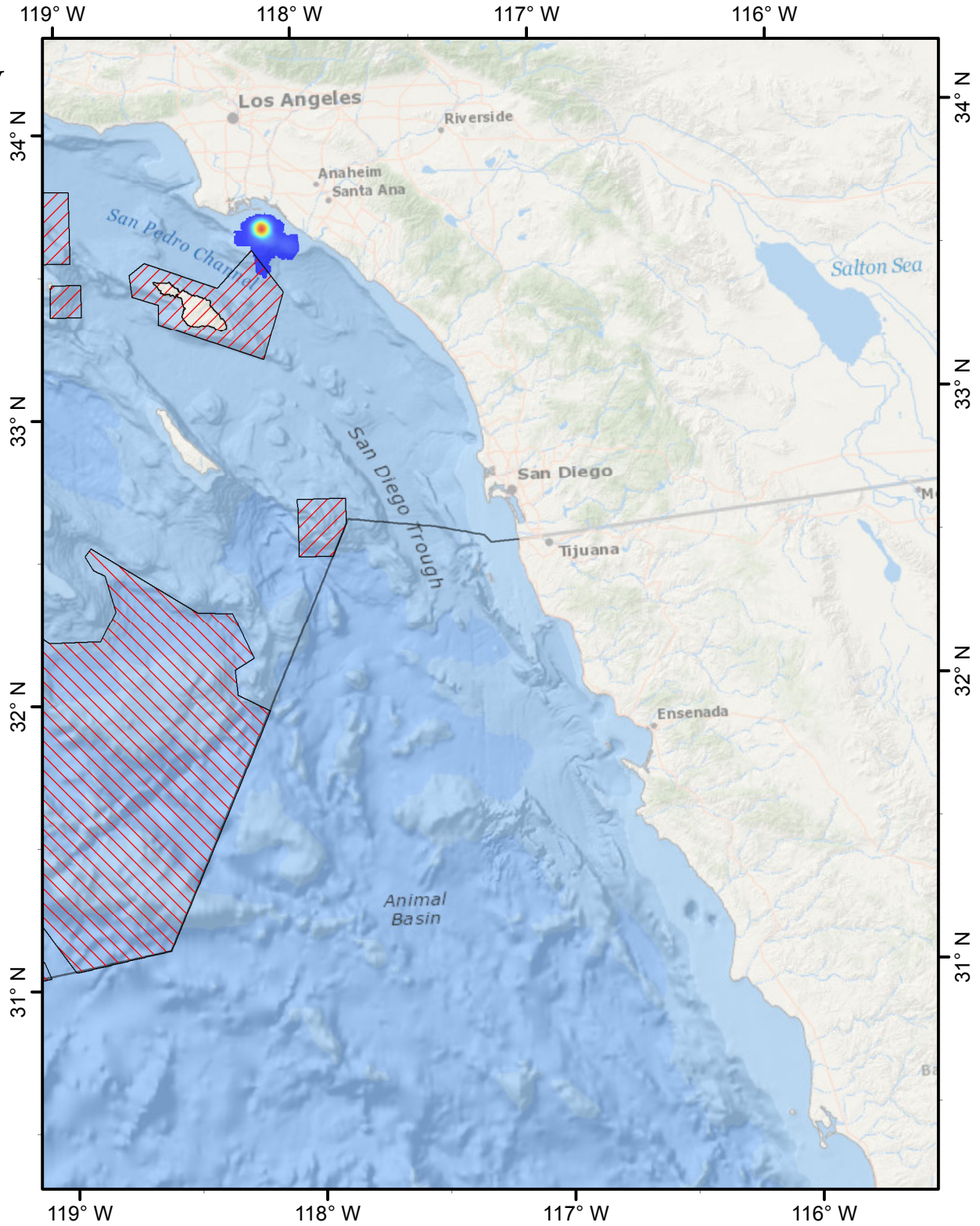
**E4**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles



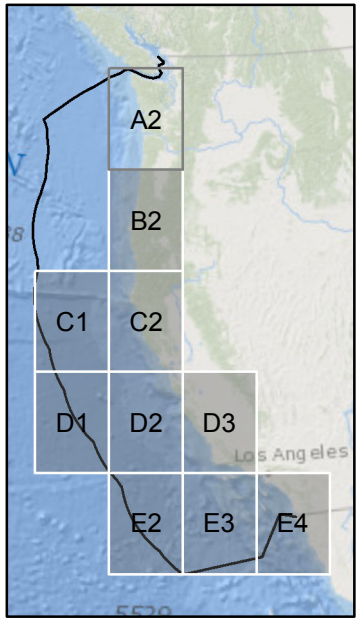

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

**APPENDIX 4.**

Map series showing overlap of groundfish EFH proposal areas. Also shown are existing groundfish EFH conservation areas (red hashing).

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

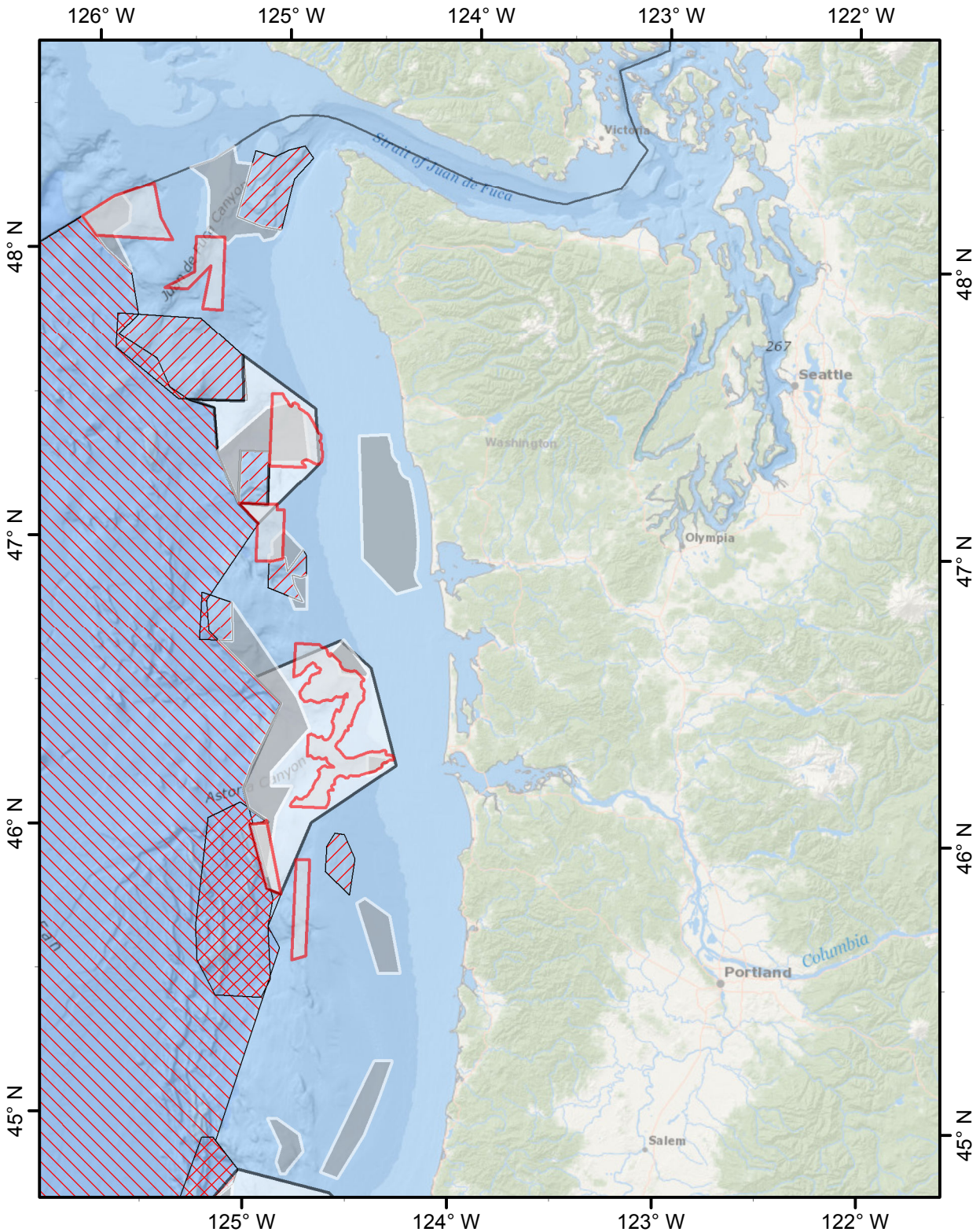



Map 1 of 10

**A2**

0 25 50 75 100
Kilometers

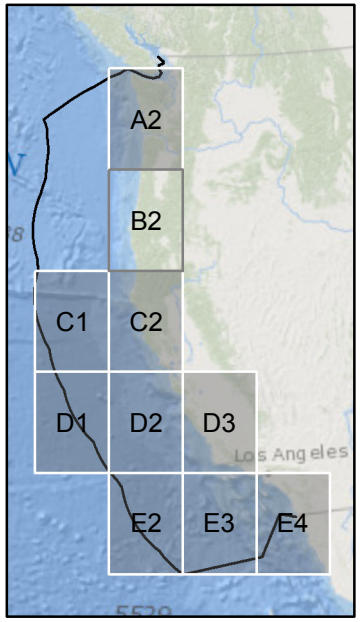
0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

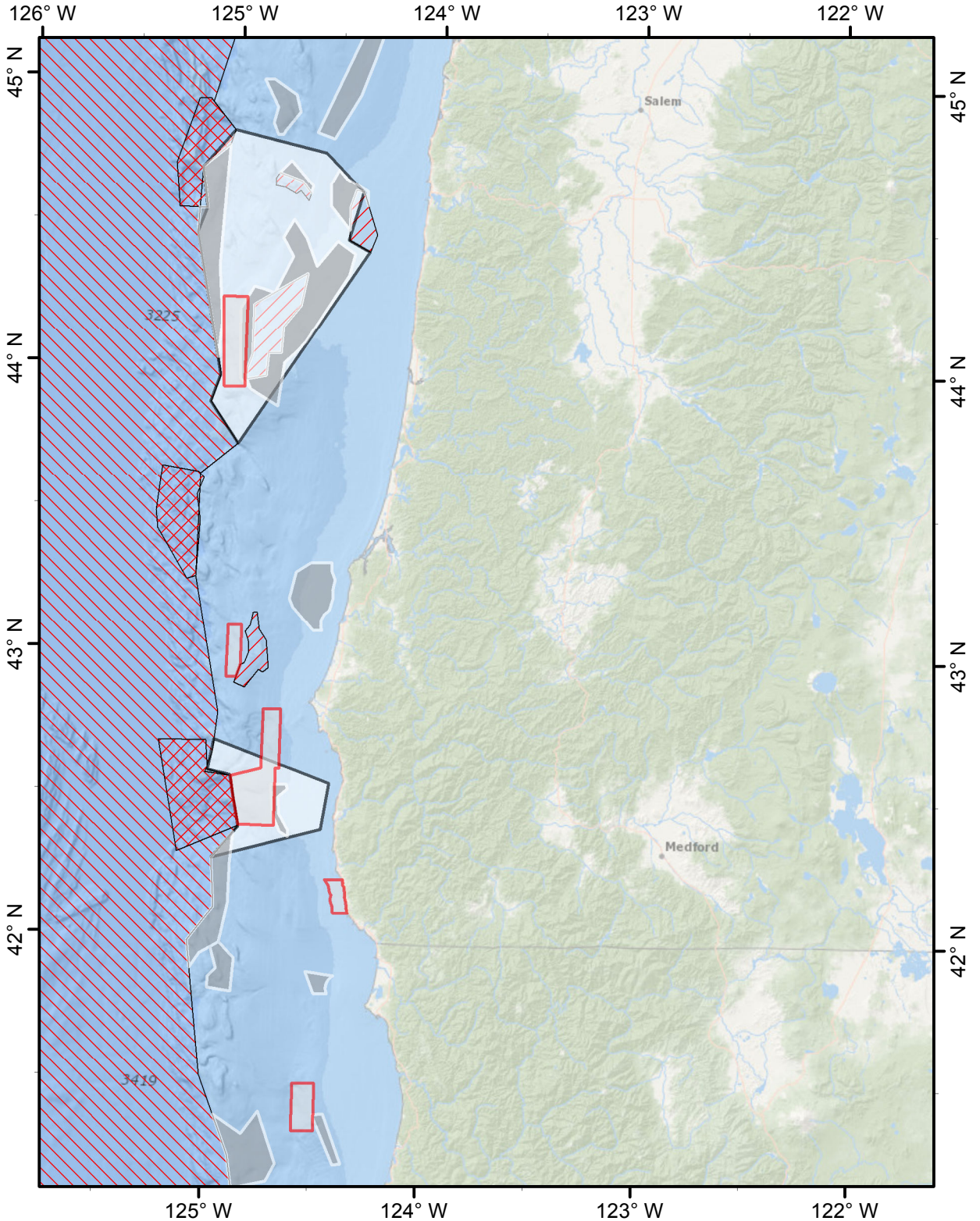



Map 2 of 10

**B2**

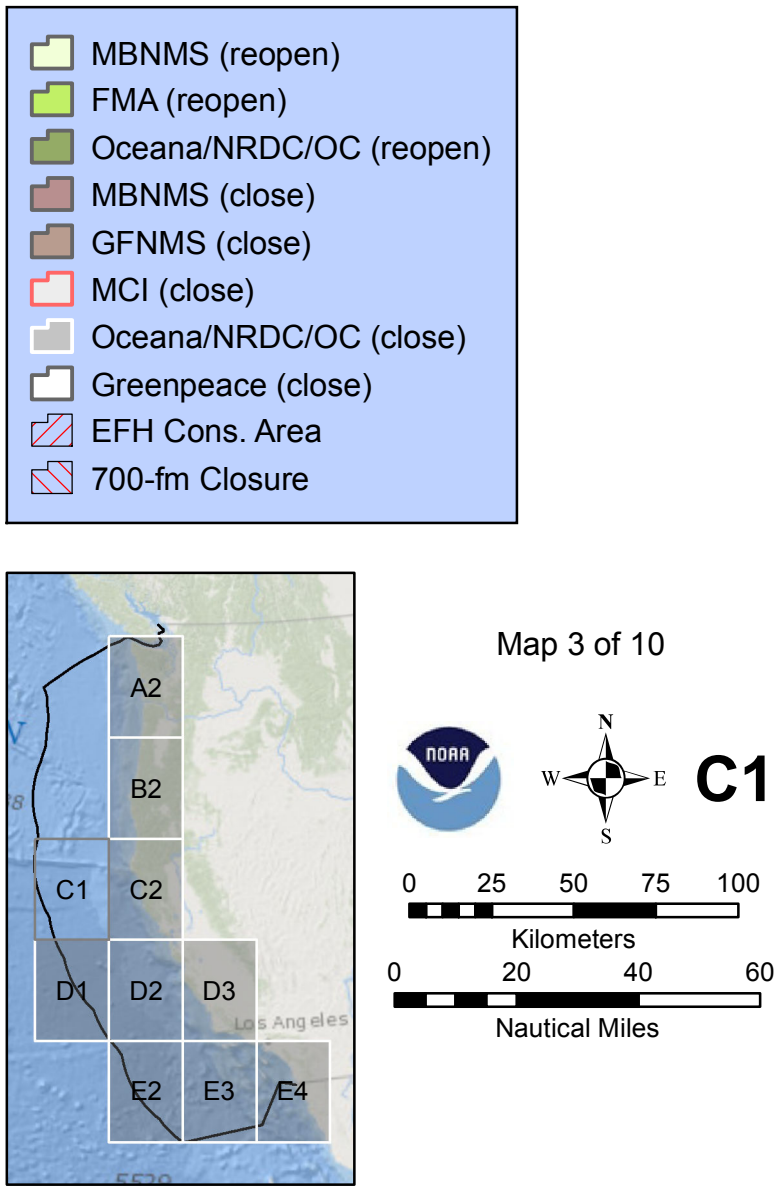
0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

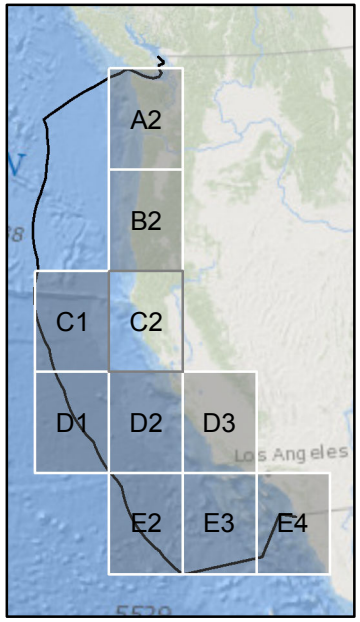
# Groundfish EFH Proposal Areas




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

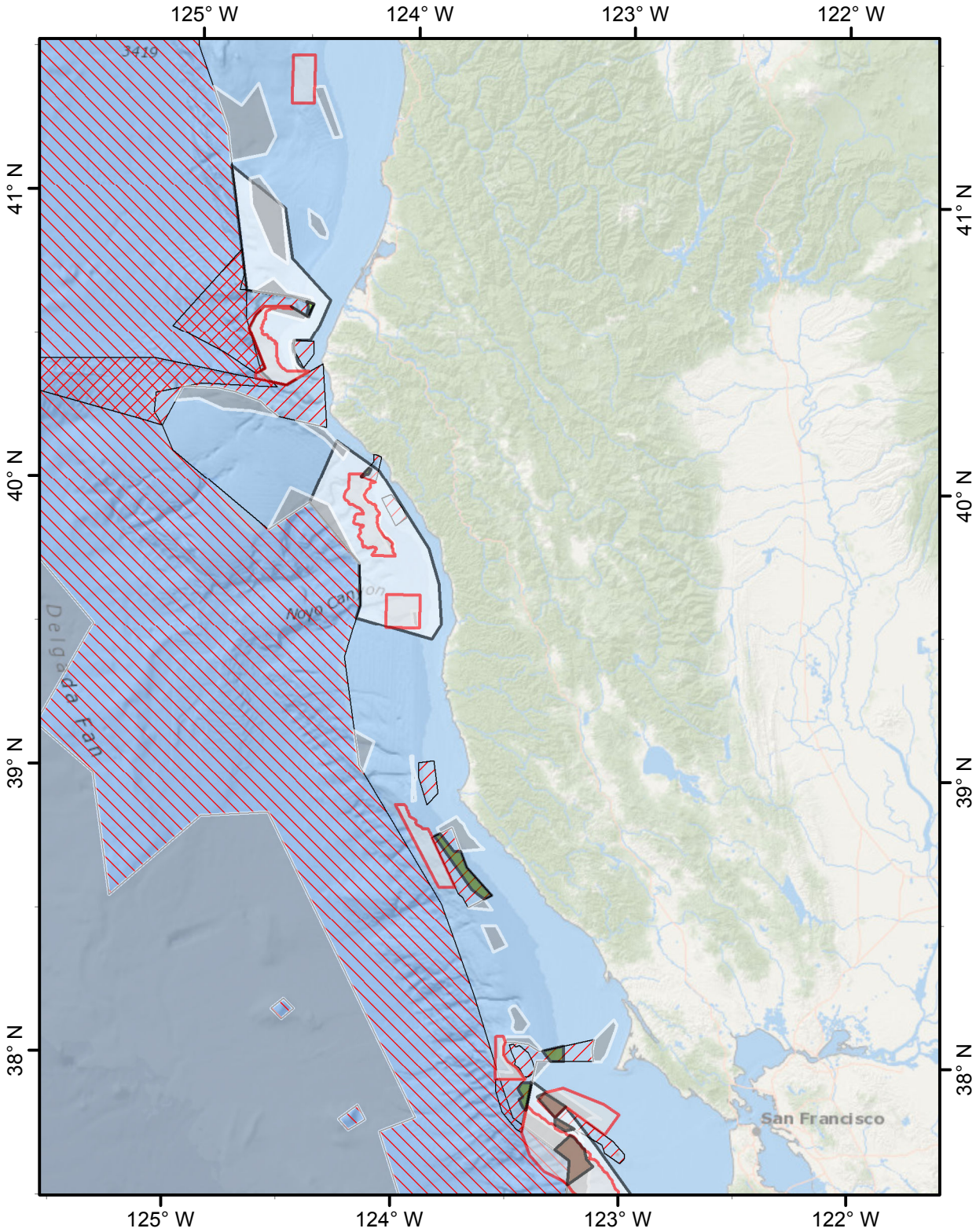



Map 4 of 10

C2

0 25 50 75 100
Kilometers

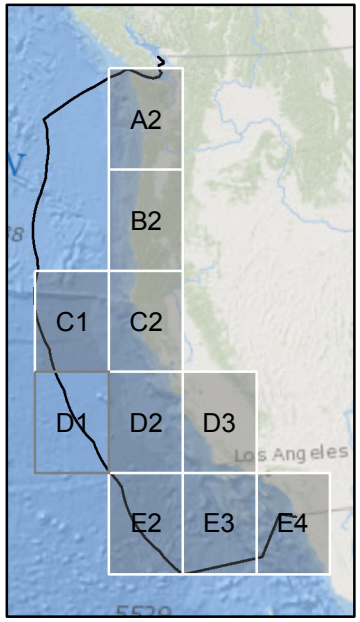
0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

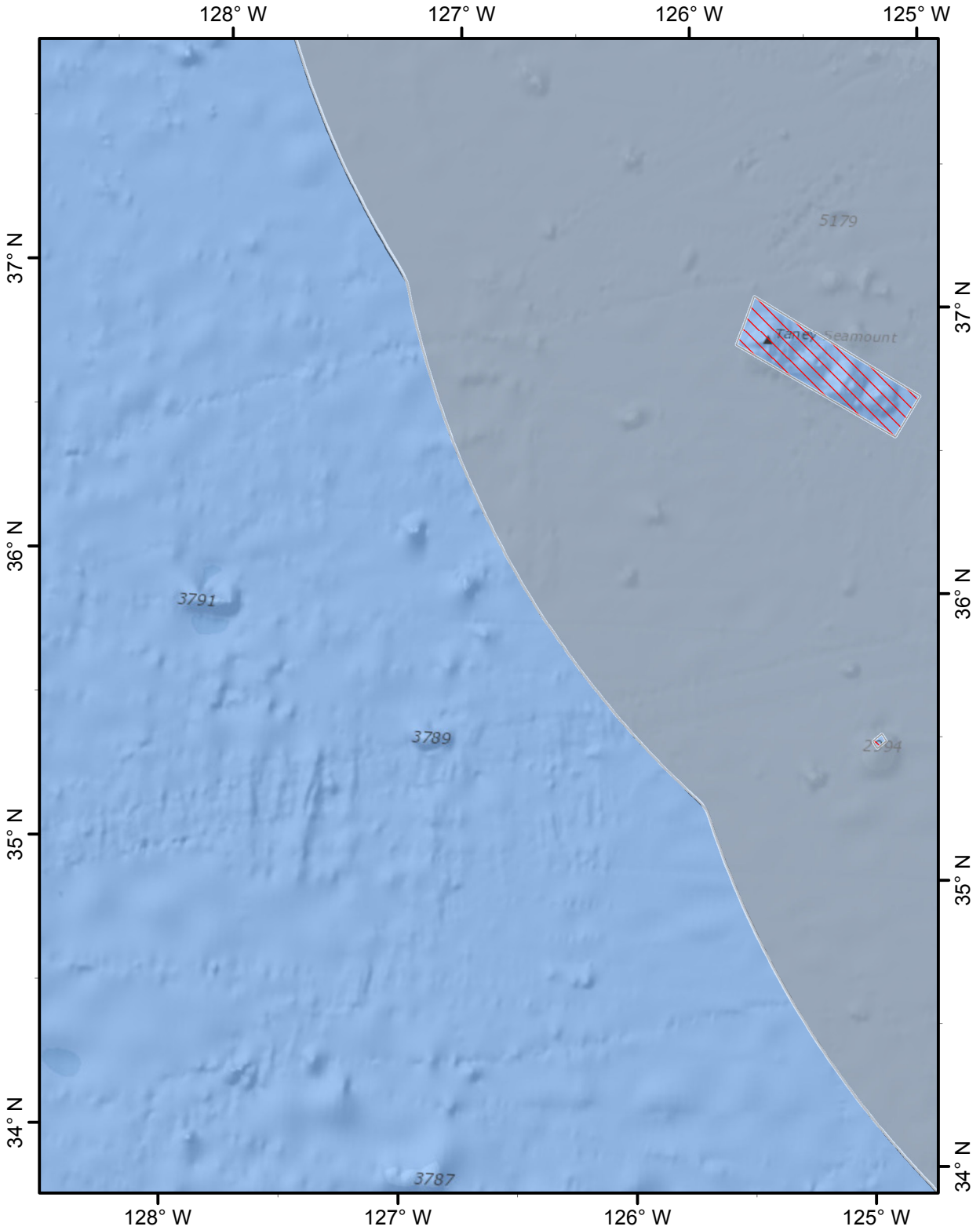



Map 5 of 10

**D1**

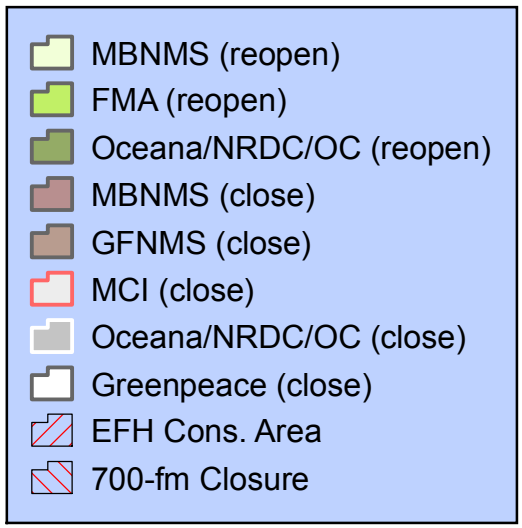
0 25 50 75 100
Kilometers

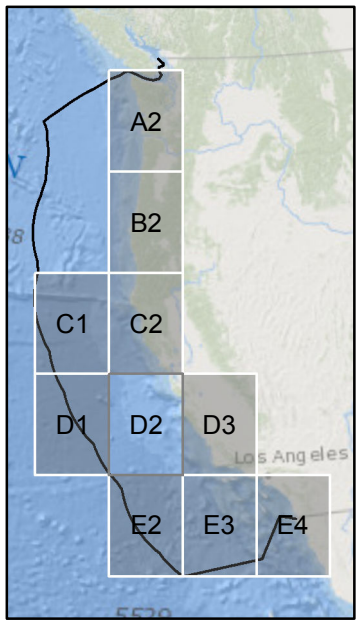
0 20 40 60
Nautical Miles



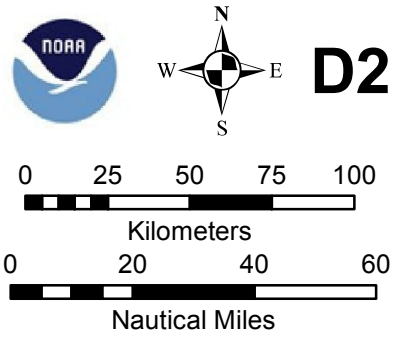

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

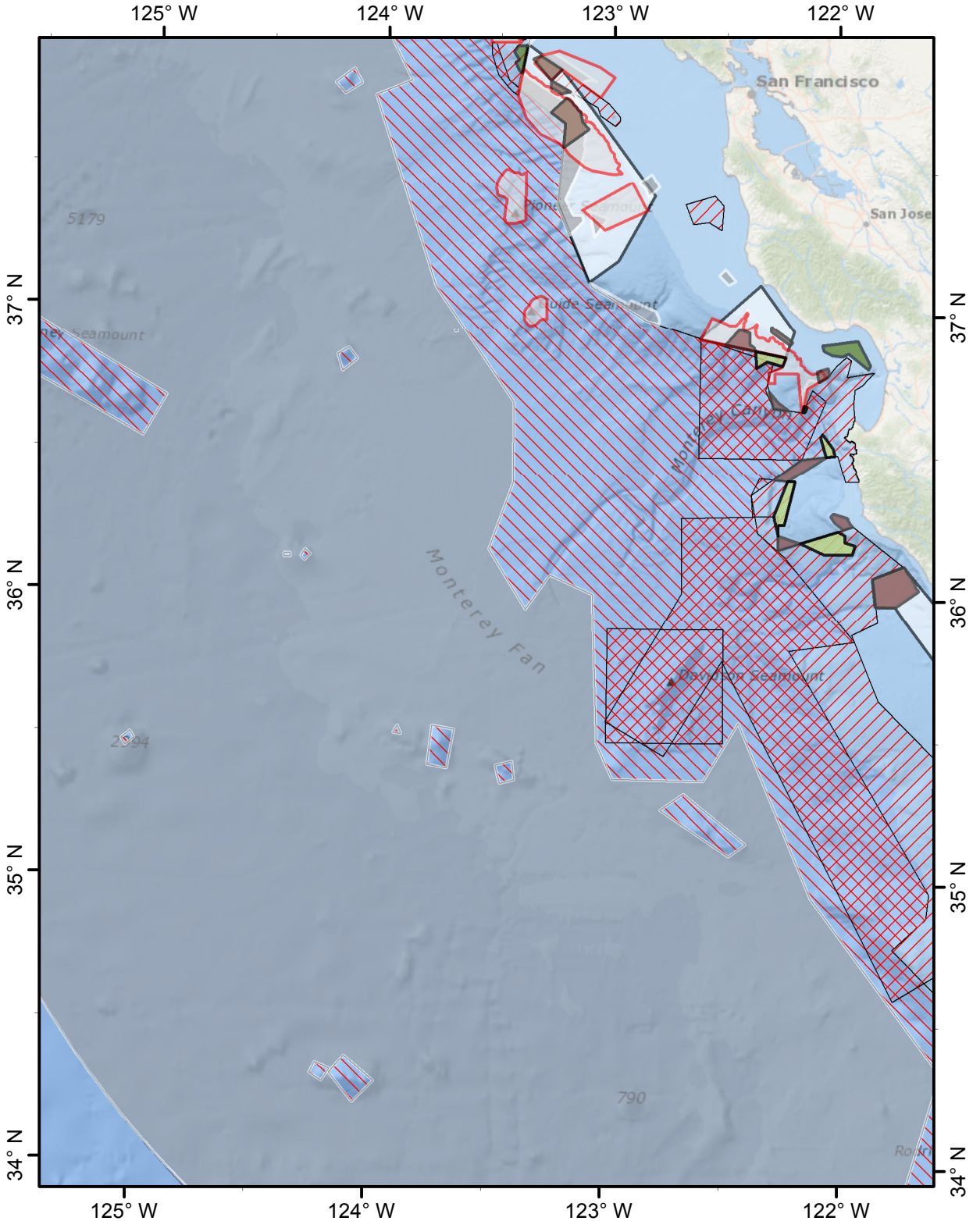
# Groundfish EFH Proposal Areas



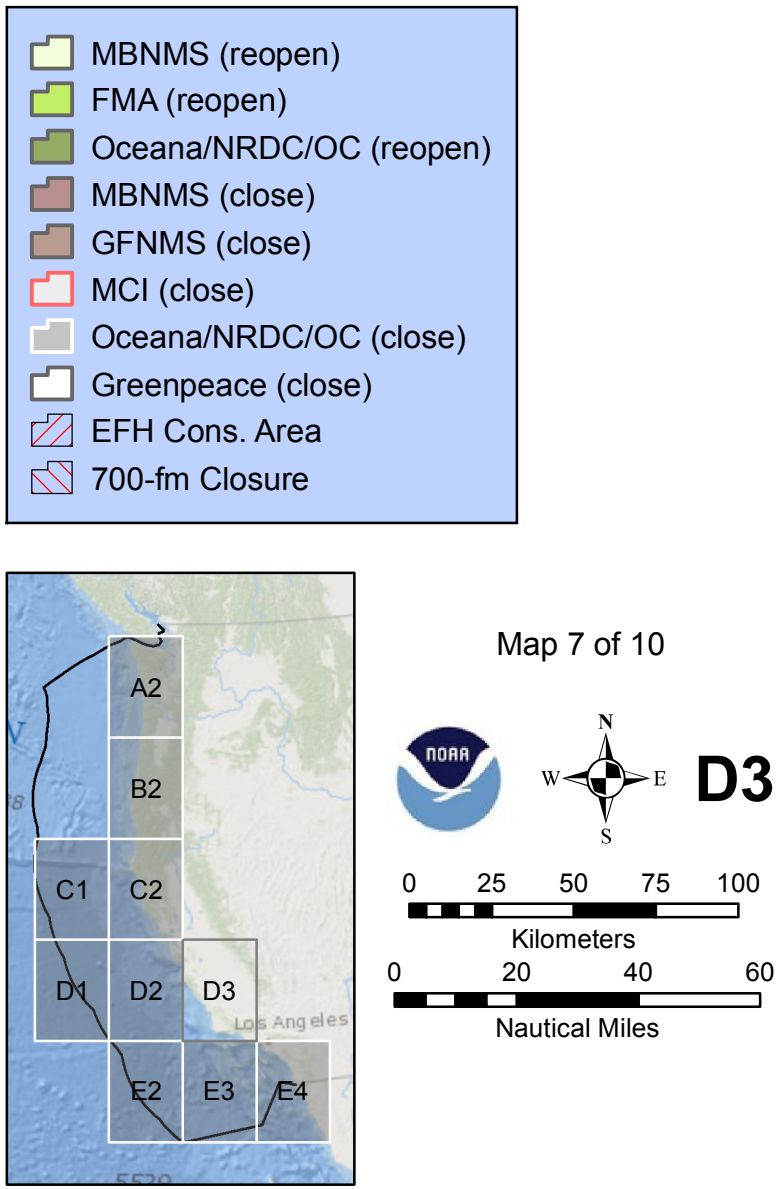

Map 6 of 10




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

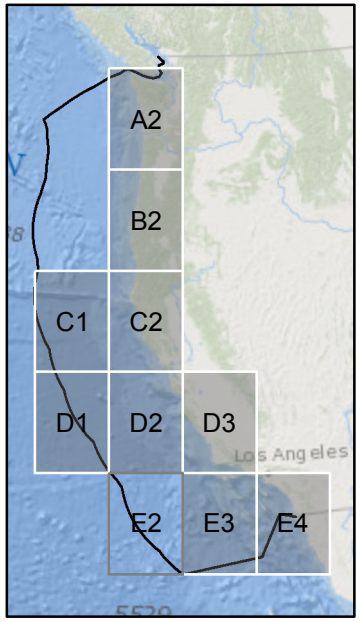
# Groundfish EFH Proposal Areas




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

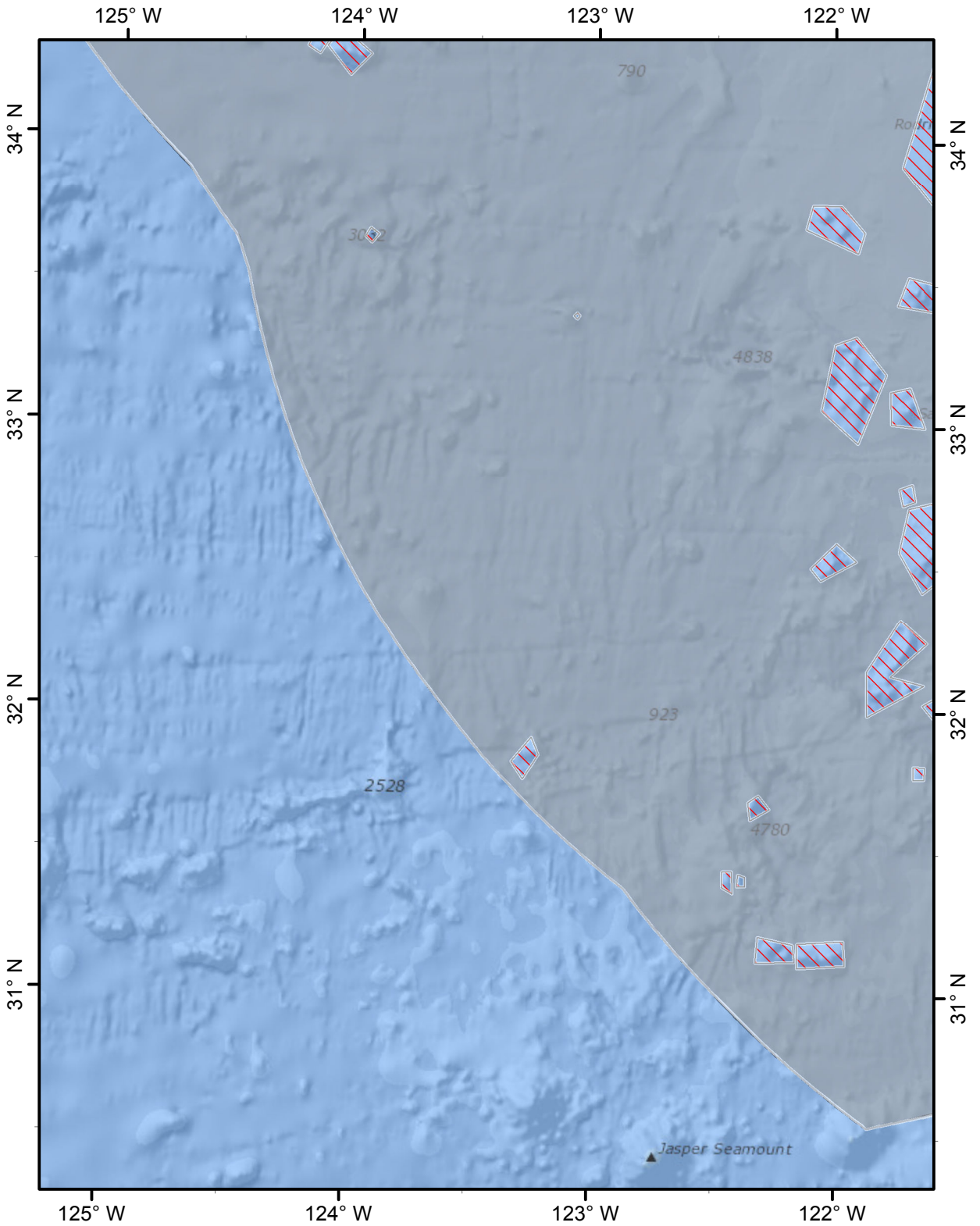



Map 8 of 10

**E2**

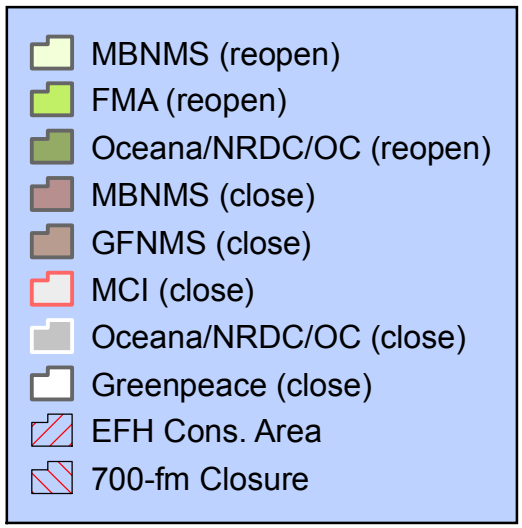
0 25 50 75 100
Kilometers

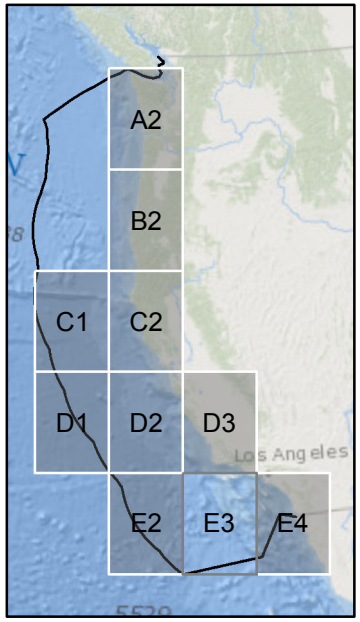
0 20 40 60
Nautical Miles



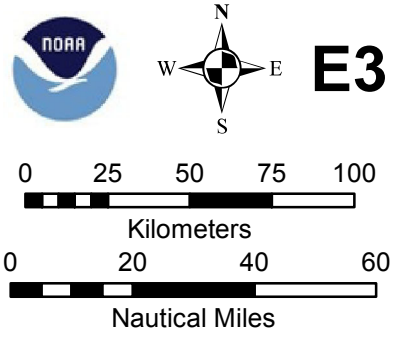

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

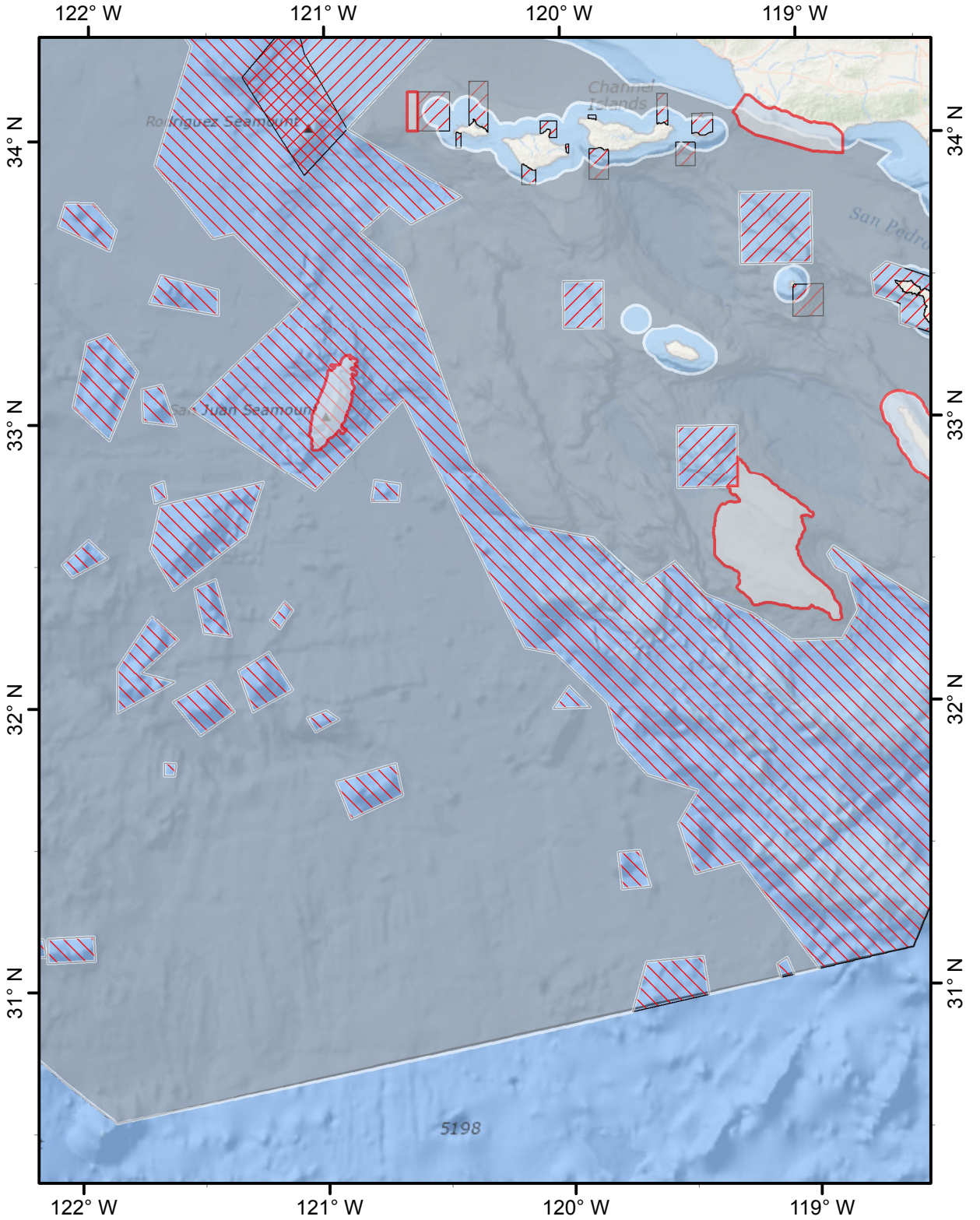
# Groundfish EFH Proposal Areas




Map 9 of 10

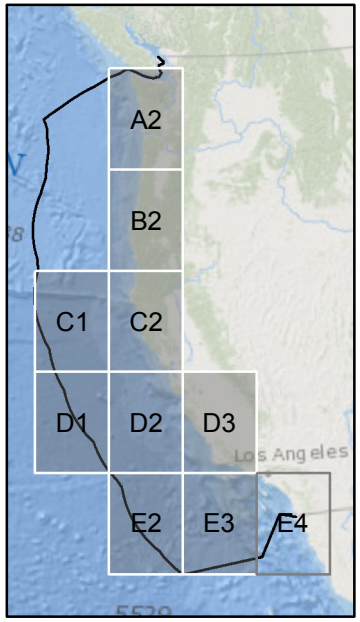



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

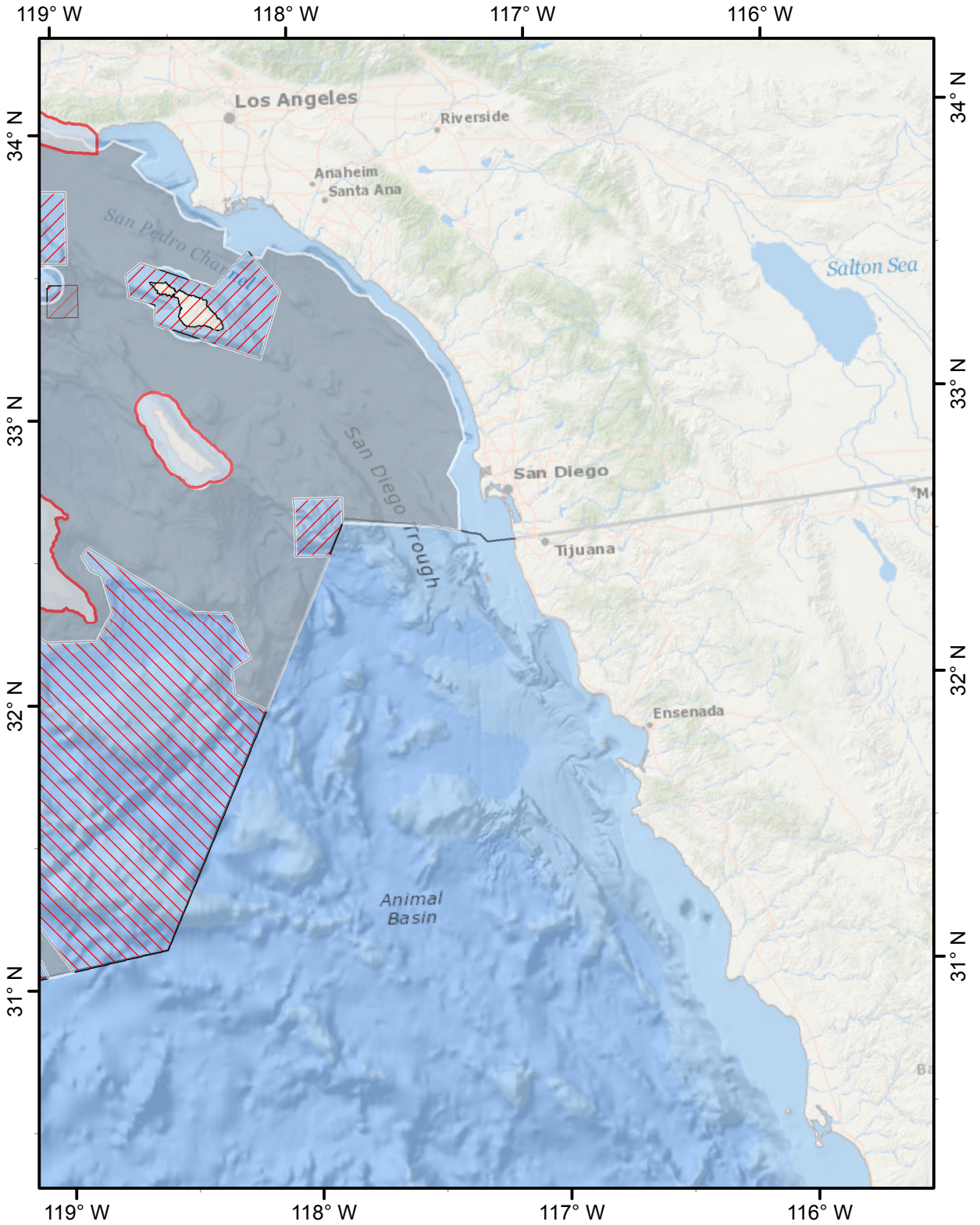



Map 10 of 10

**E4**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

**APPENDIX 5.**

Map series showing overlap of groundfish EFH proposal areas with observed fixed gear fishing intensity layer (12 Jun 2006 – 31 Dec 2010). Only those areas proposed to be closed to bottom trawl or all bottom contact fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: West Coast Groundfish Observer Program. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely.

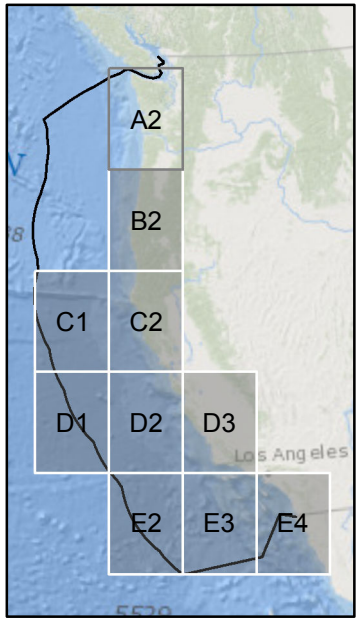
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 1 of 10

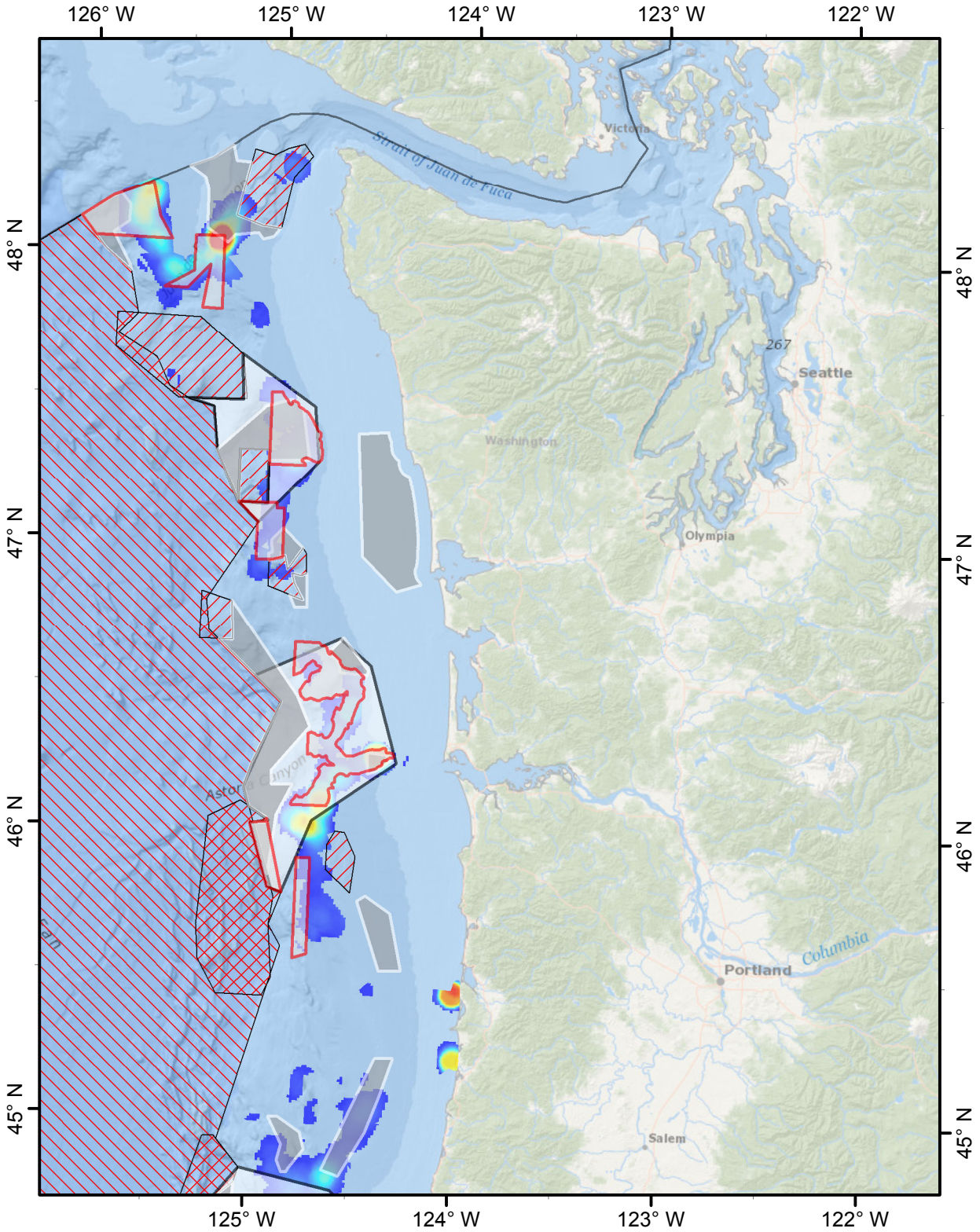
**A2**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

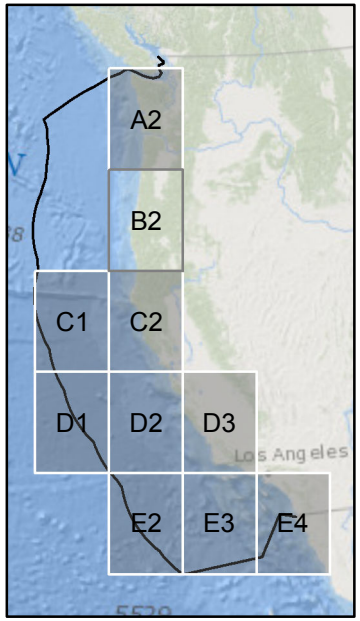
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 2 of 10

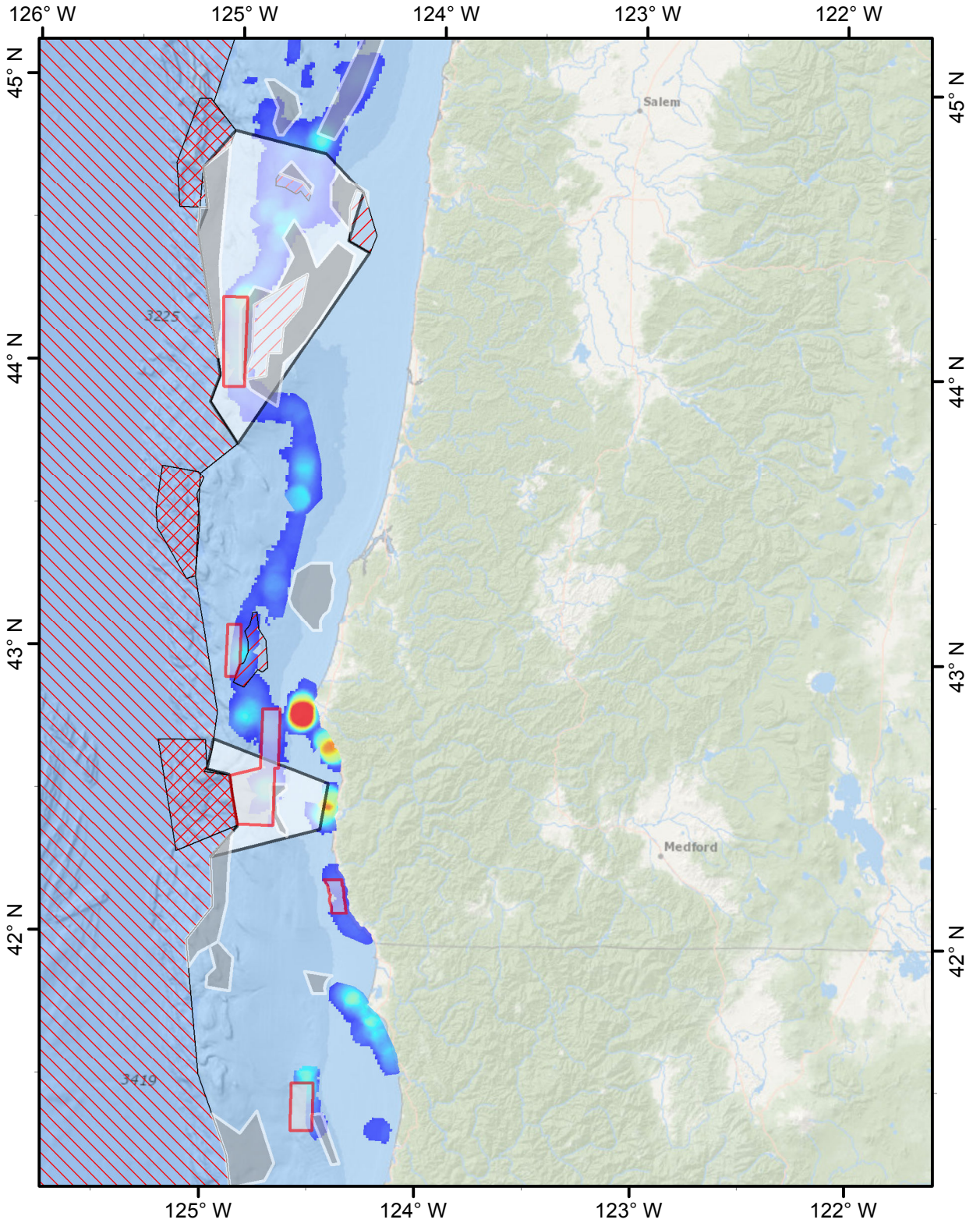
**B2**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

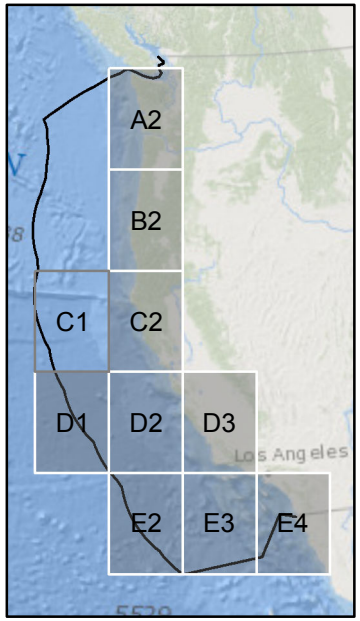
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 3 of 10

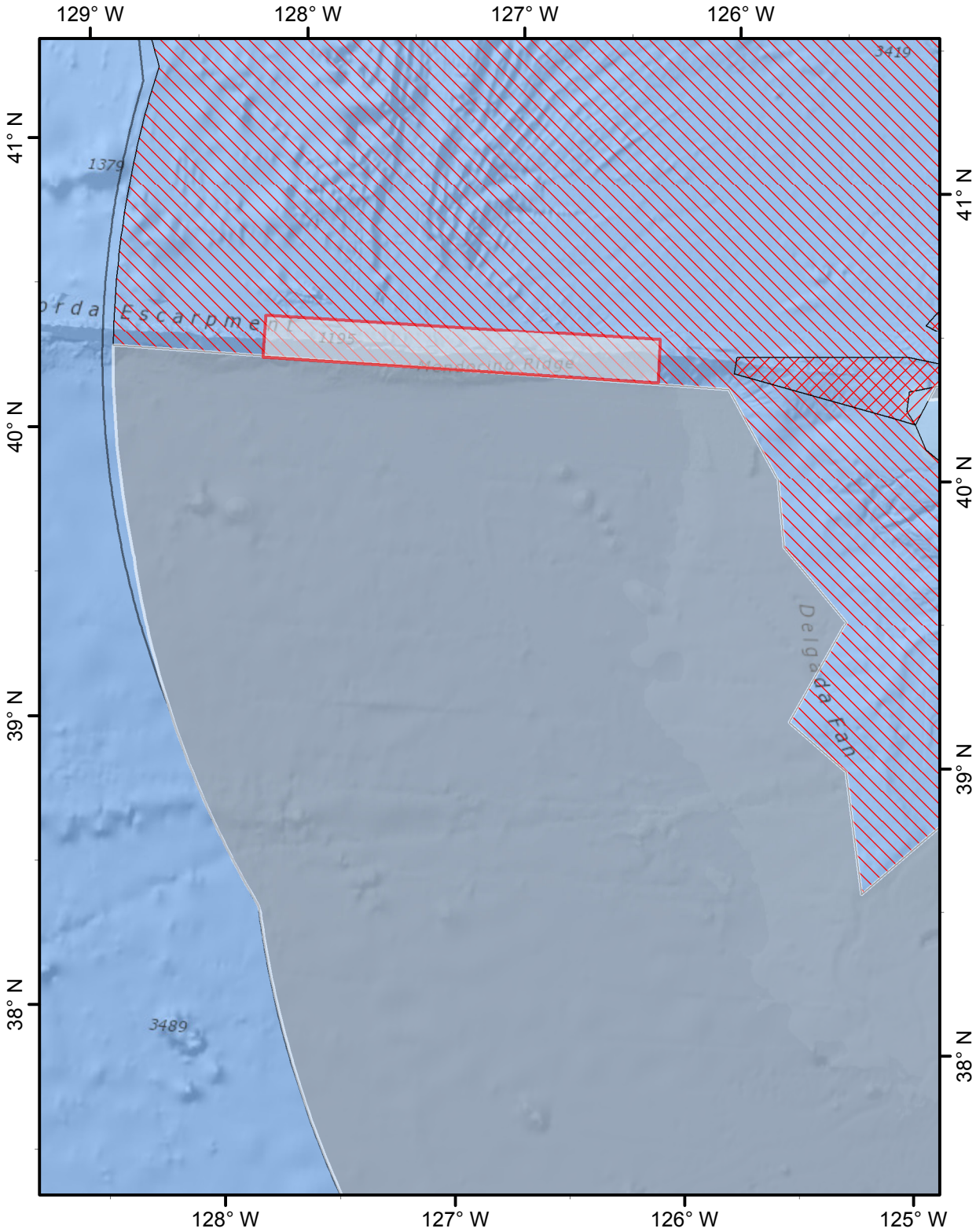
**C1**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

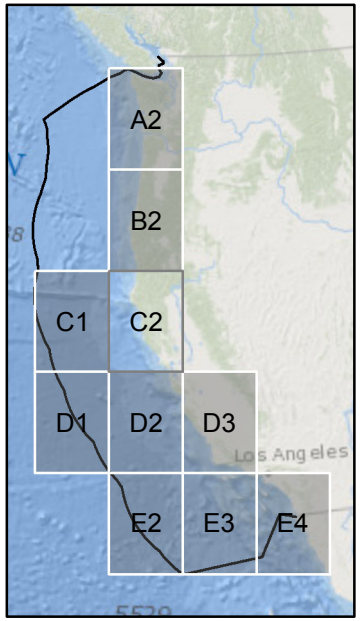
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 4 of 10

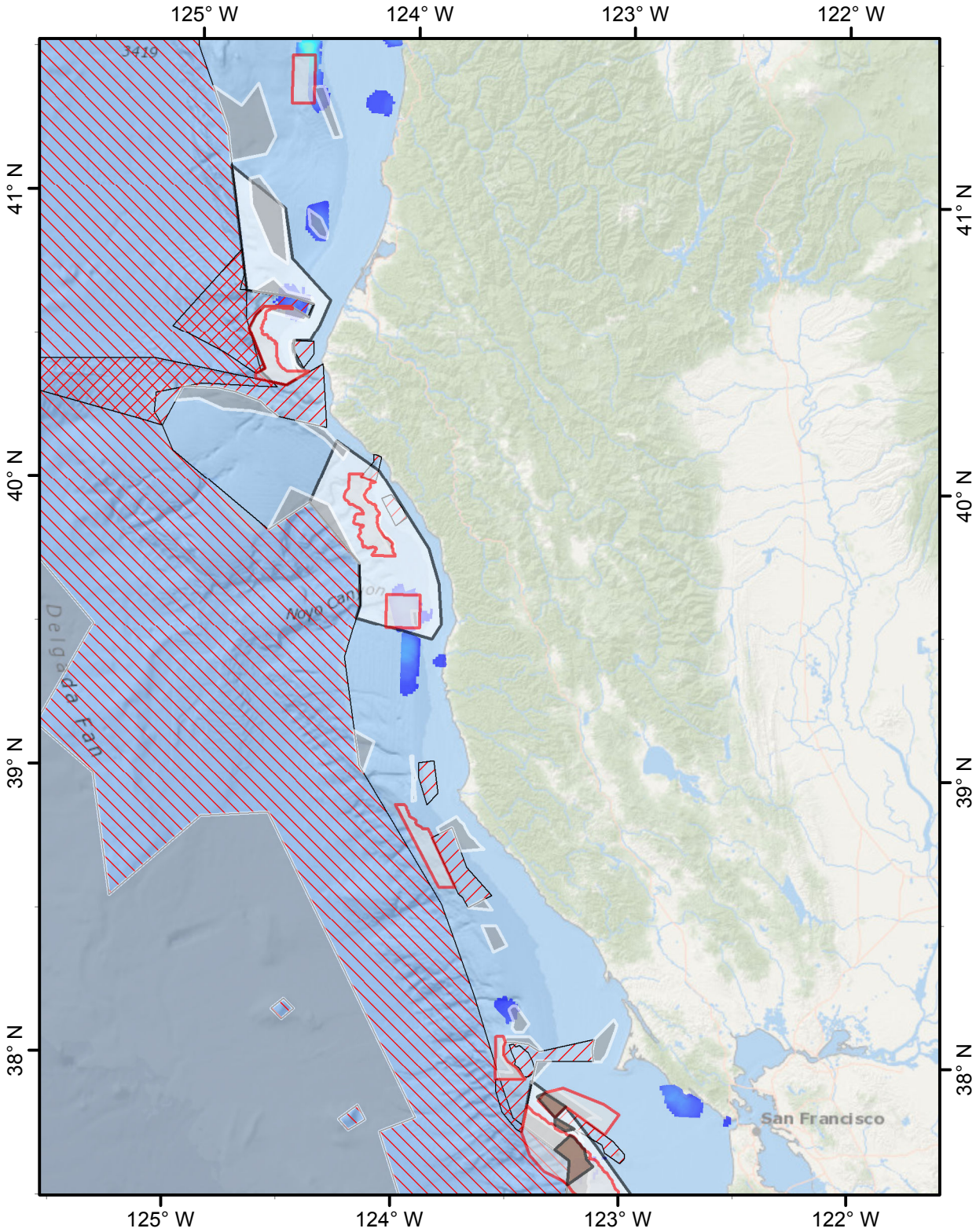
**C2**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

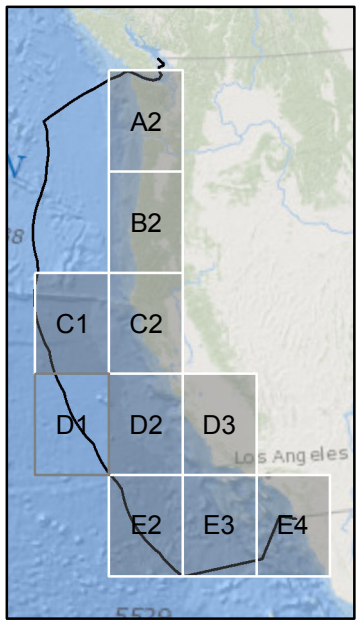
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 5 of 10

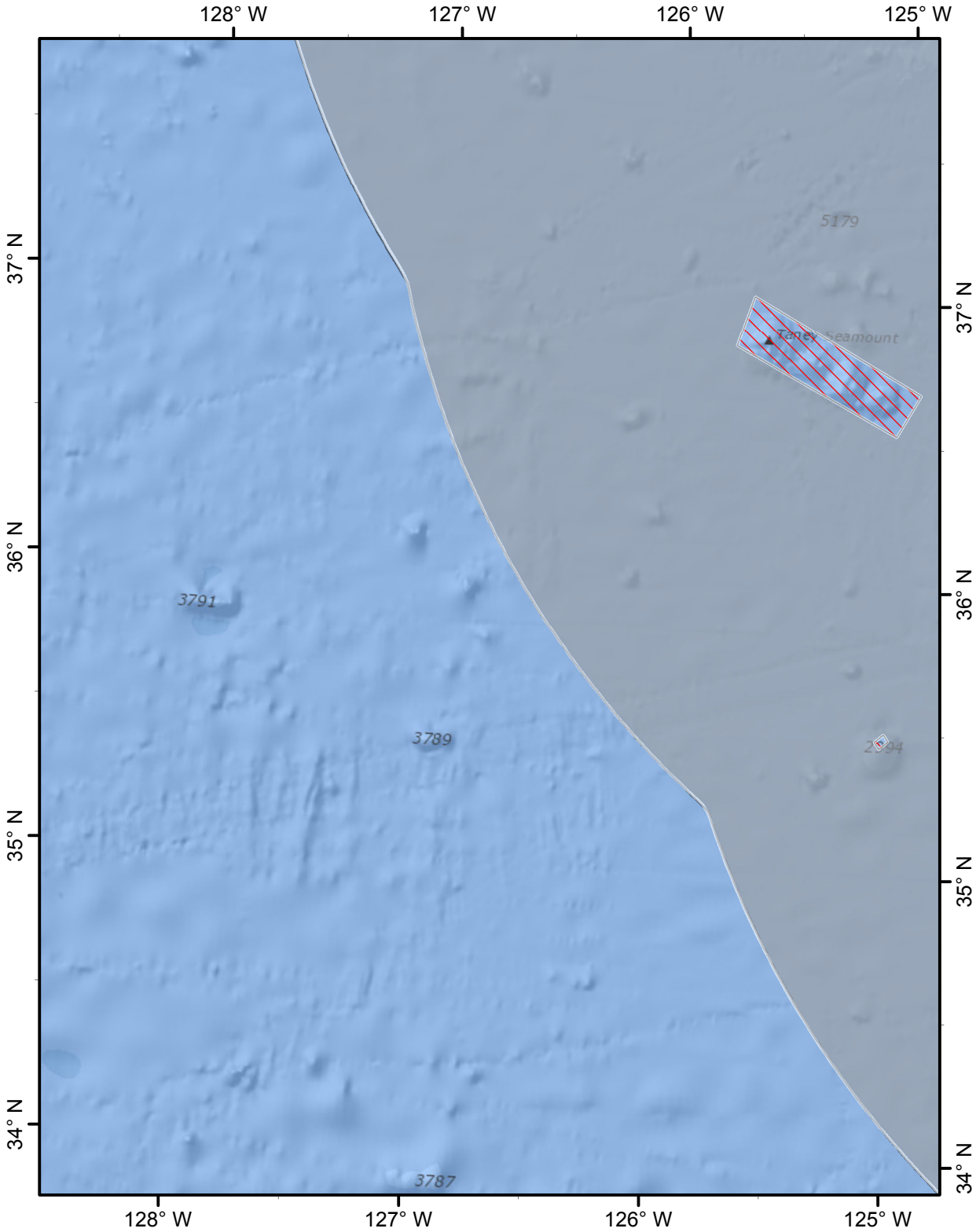
**D1**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

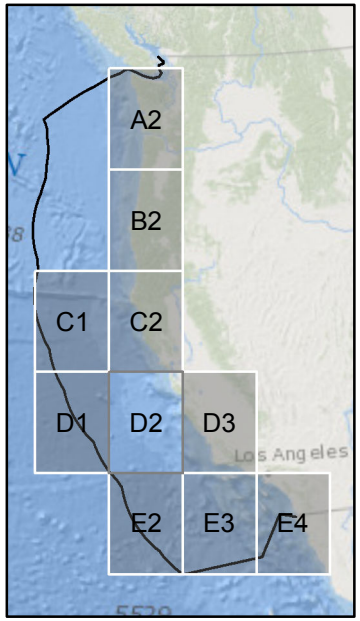
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04

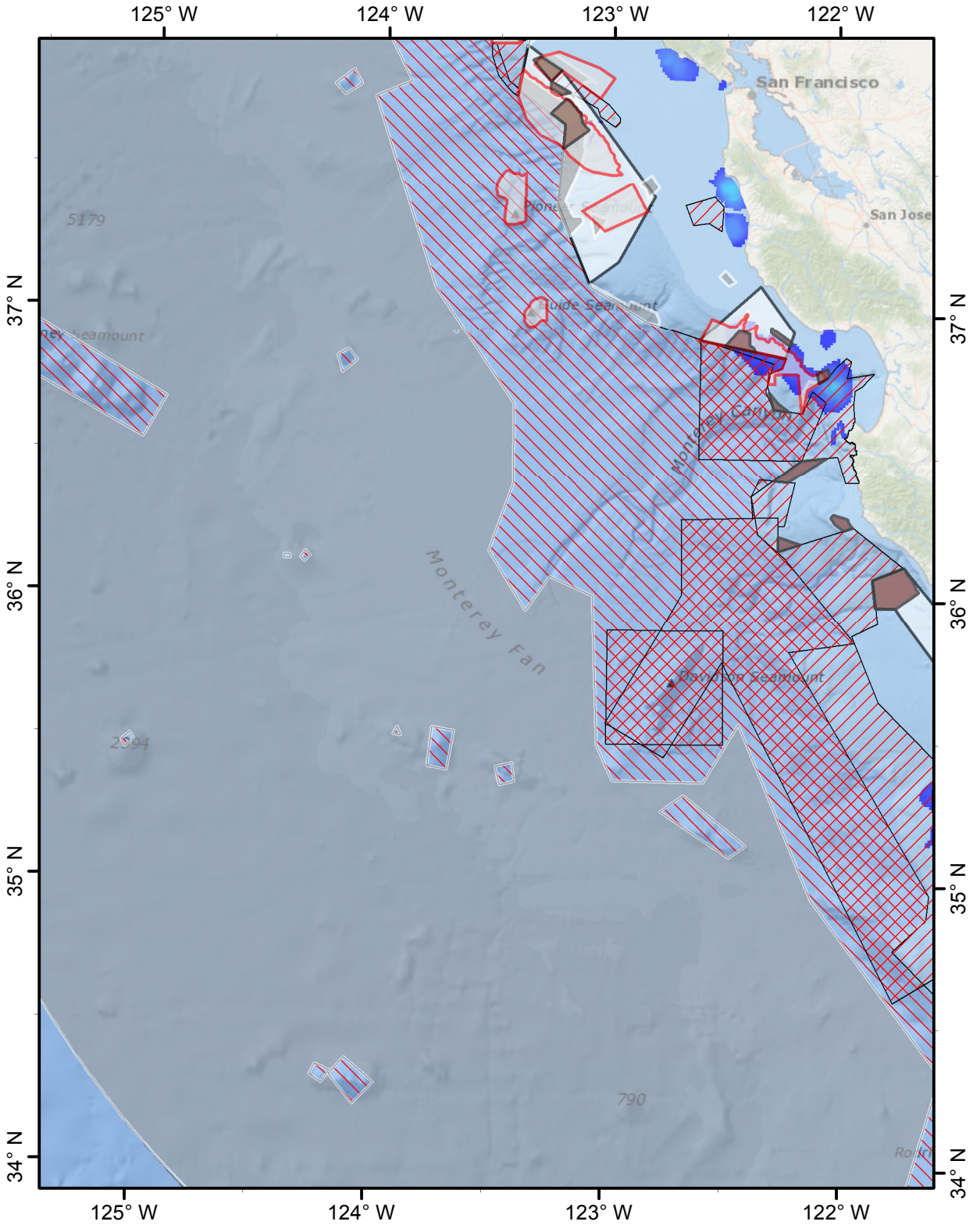



Map 6 of 10

**D2**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

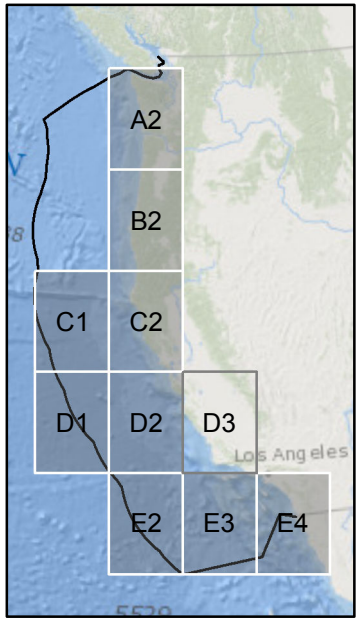
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (12 Jun 2006 - 31 Dec 2010)

- MBNMS (close)
- GFNMS (close)
- MCI (close)
- Oceana/NRDC/OC (close)
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04

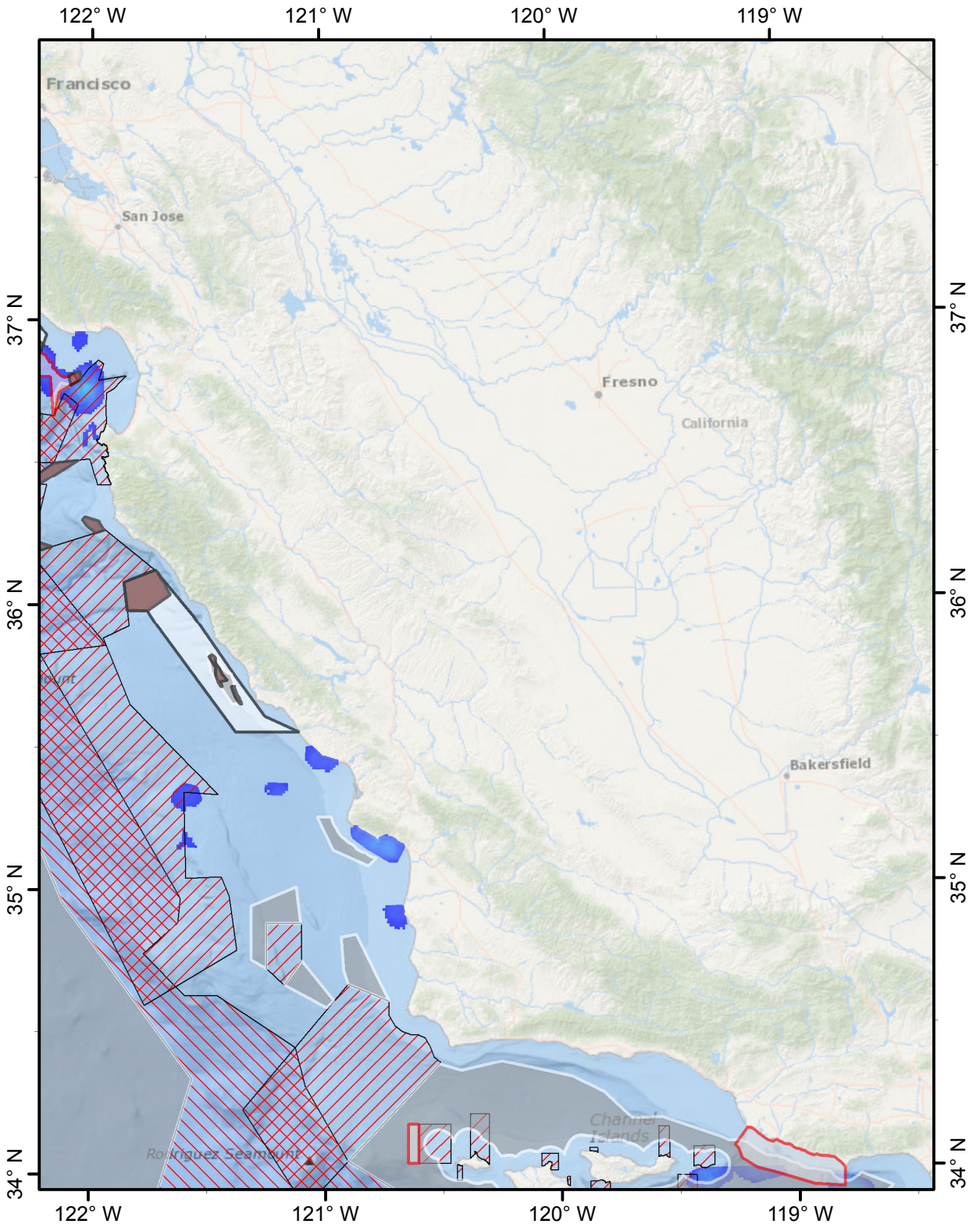



Map 7 of 10

**D3**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

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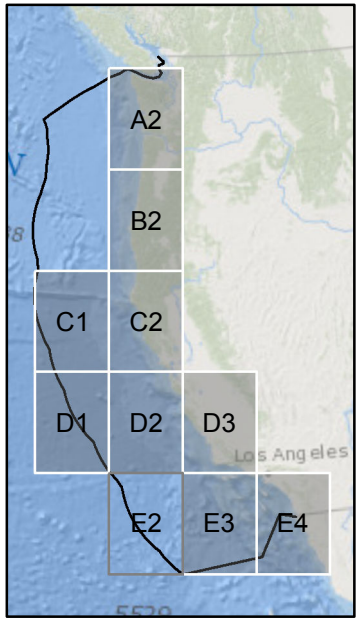
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04

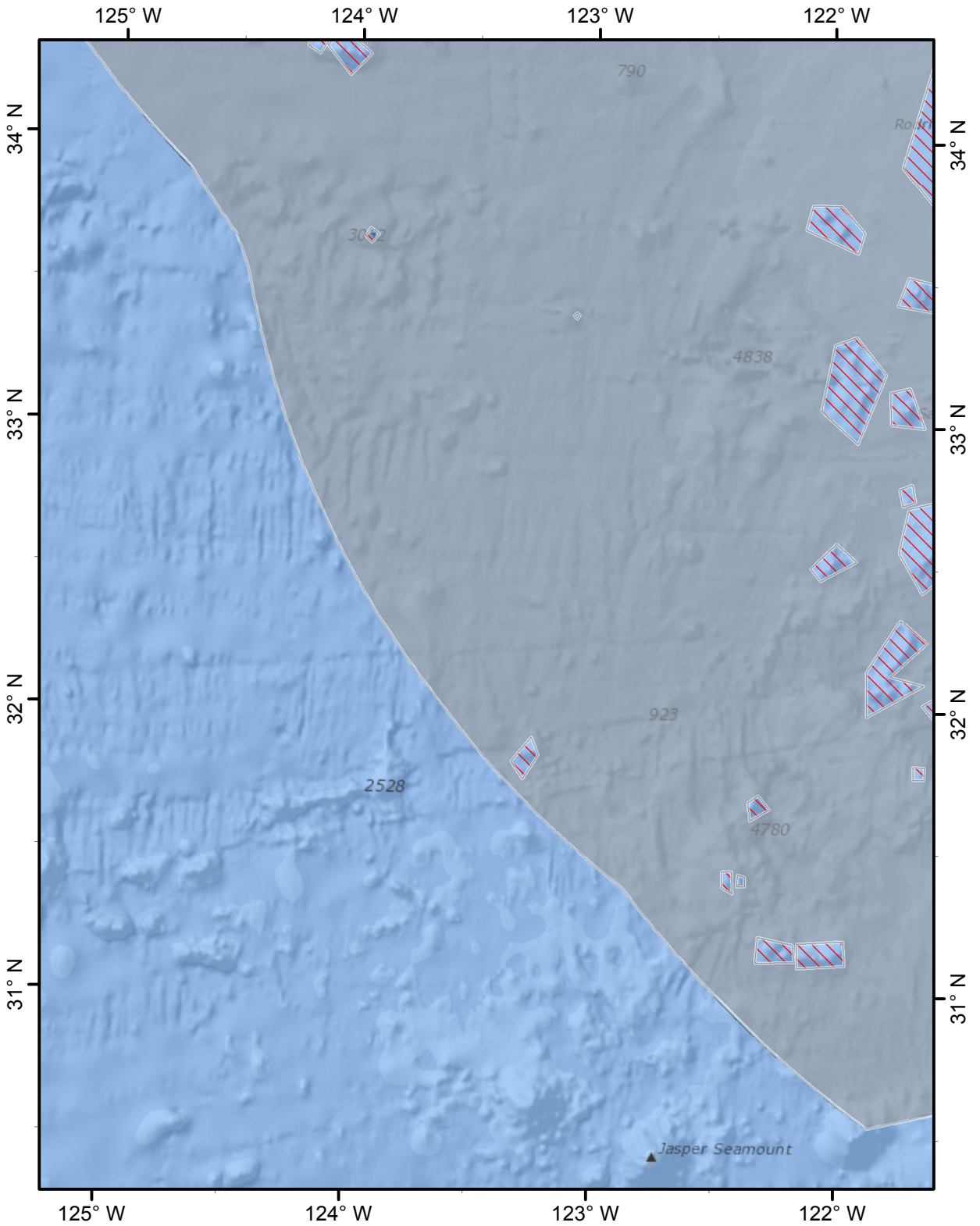



Map 8 of 10

**E2**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
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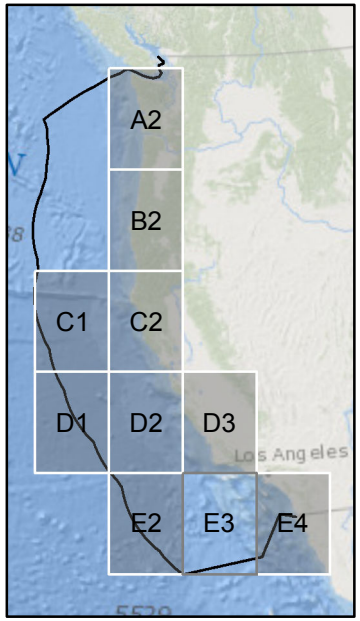
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04

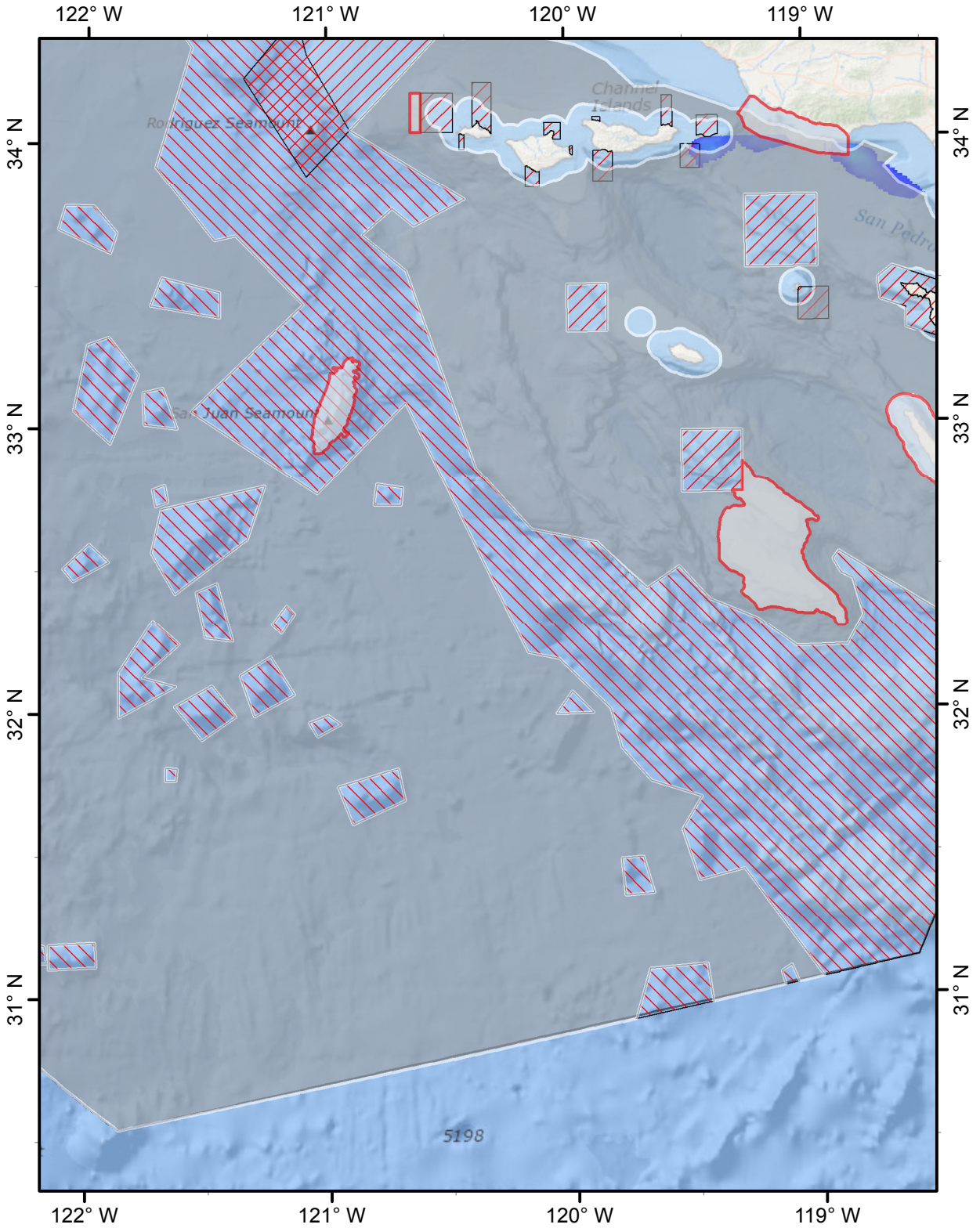



Map 9 of 10

**E3**

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

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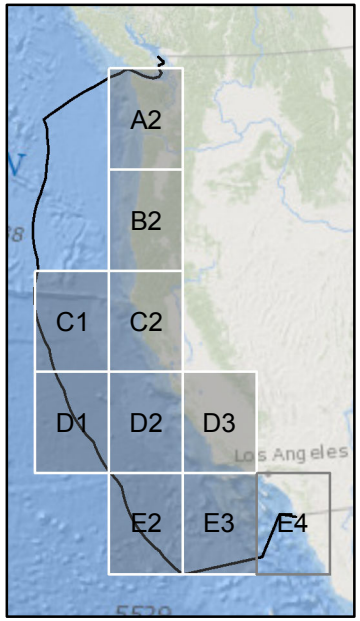
- Greenpeace (close)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 10 of 10

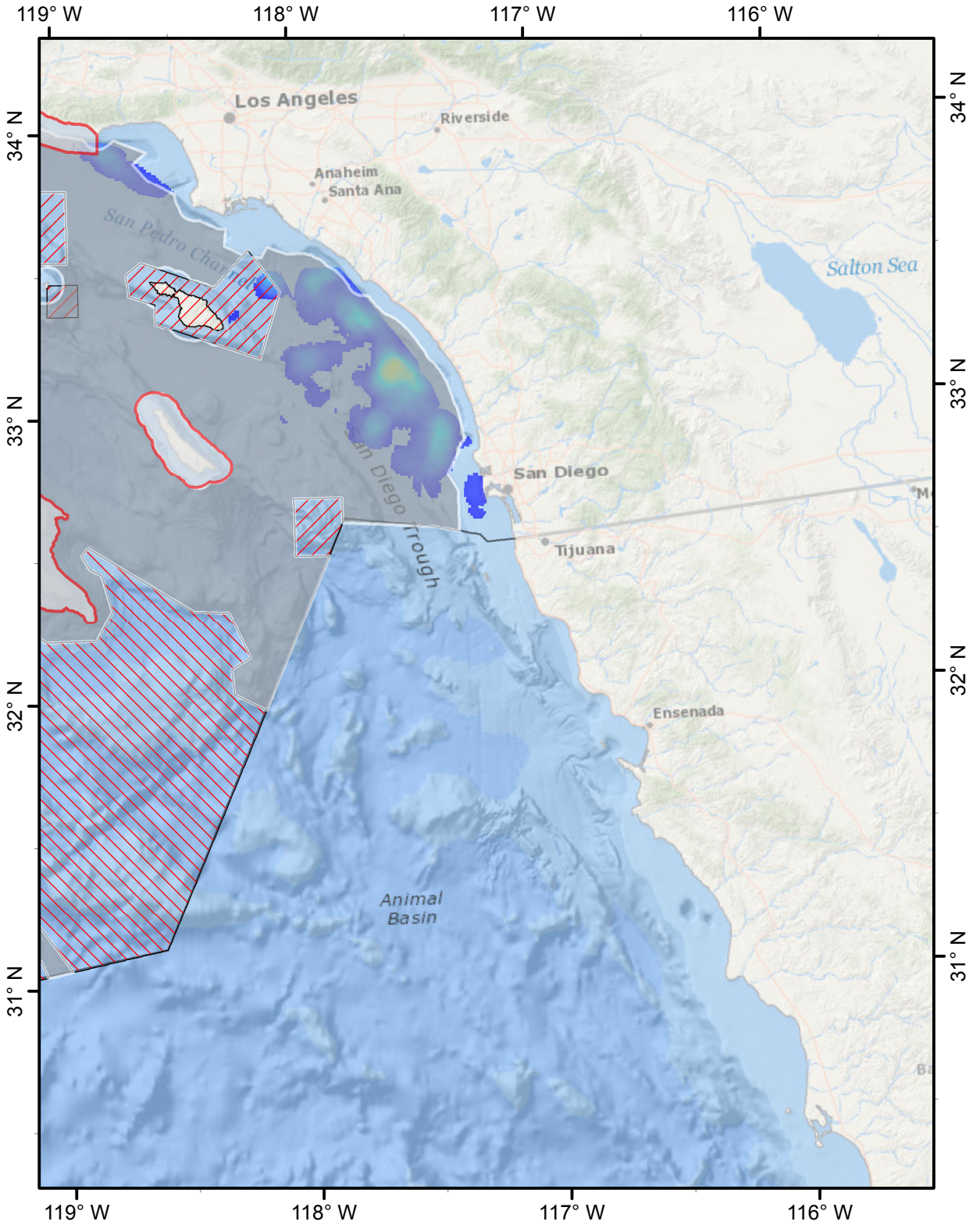
**E4**

0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

**APPENDIX 6.**

Map series showing overlap of groundfish EFH proposal areas with observed fixed gear fishing intensity layer (1 Jan 2002 – 11 Jun 2006). Only those areas proposed to be reopened to bottom trawl fishing gear are shown. Also shown are existing groundfish EFH conservation areas (red hashing). Fishing intensity layer data source: West Coast Groundfish Observer Program. Since all fishing operations are not observed, neither the maps nor the data can be used to characterize the fishery completely.

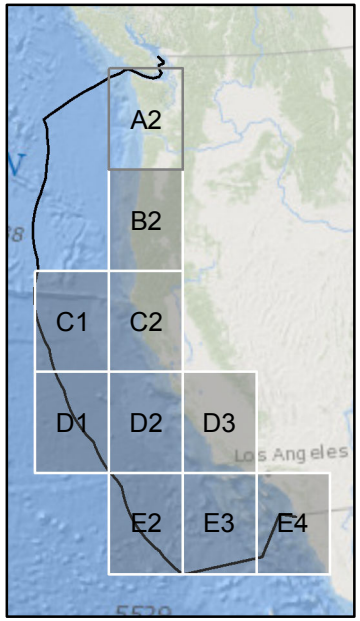
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 1 of 10

**A2**

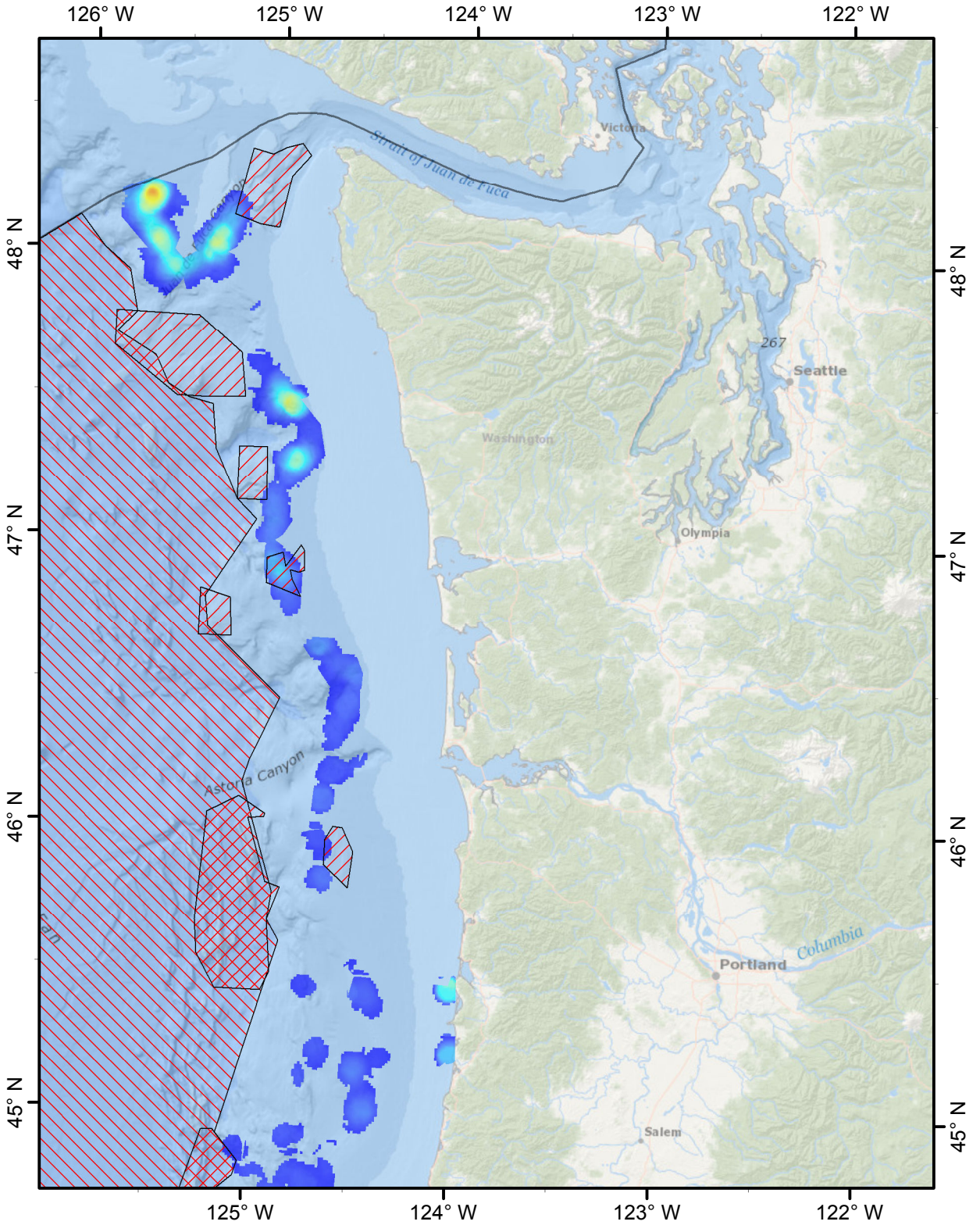
0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)



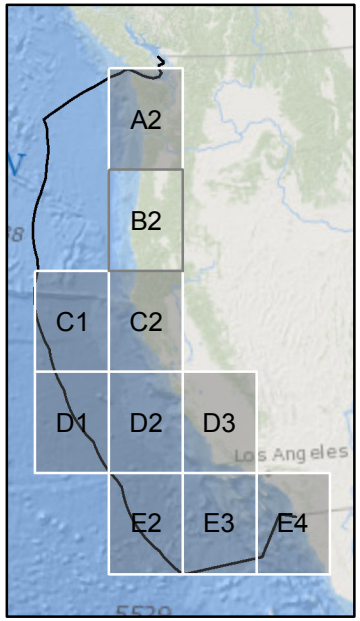
# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- EFH Cons. Area
- 700-fm Closure

**Effort (pts/km²)**

High : 4.38

Low : 0.04




Map 2 of 10

**B2**

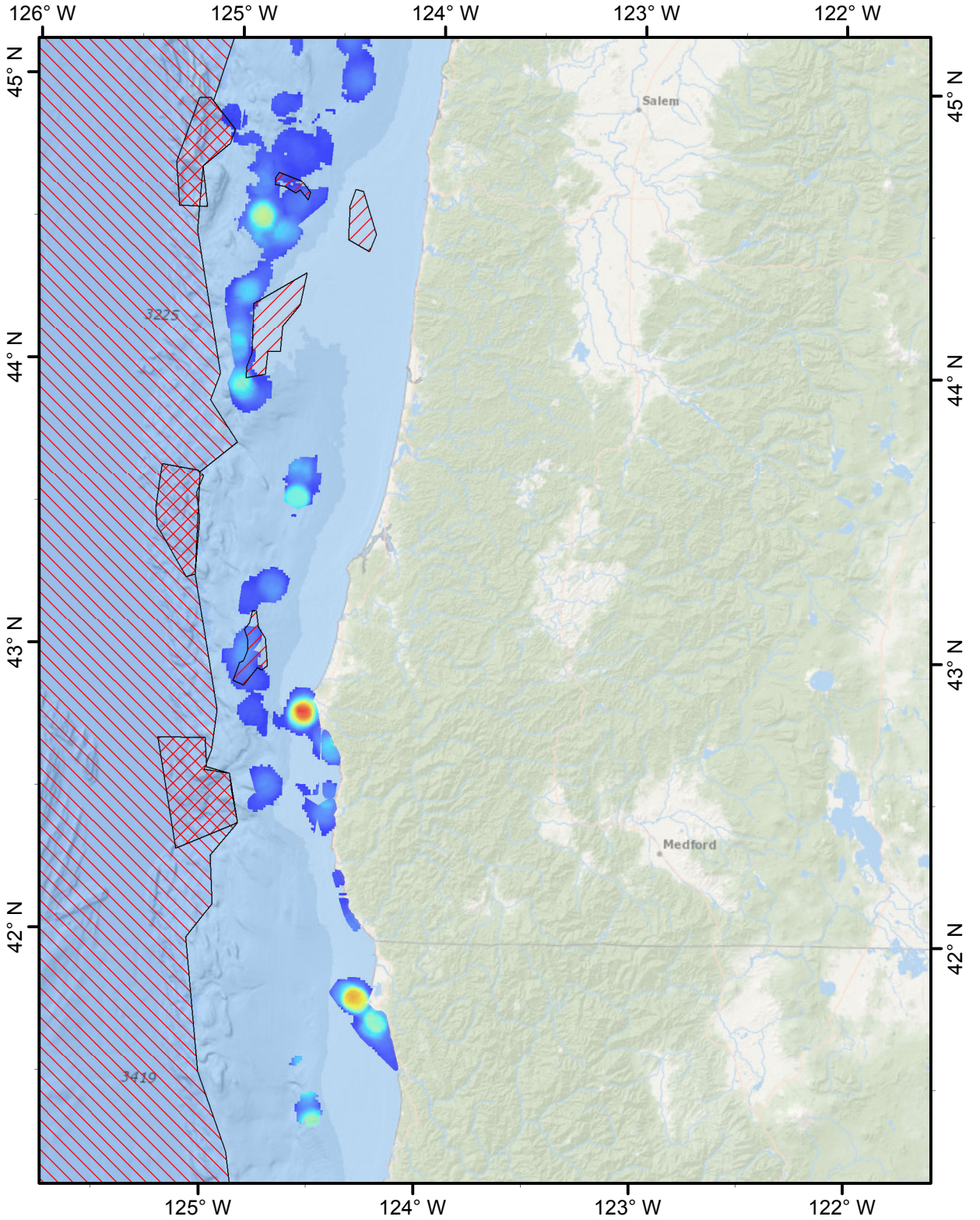
0 25 50 75 100

Kilometers

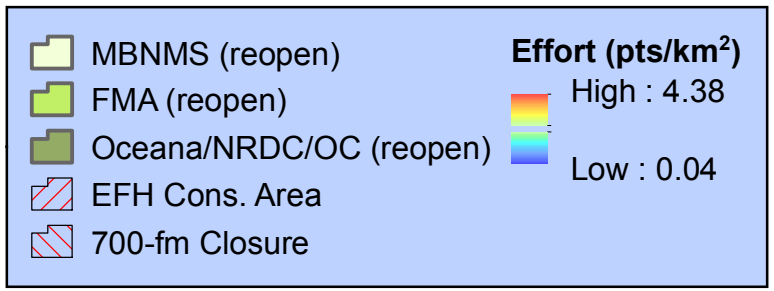
0 20 40 60

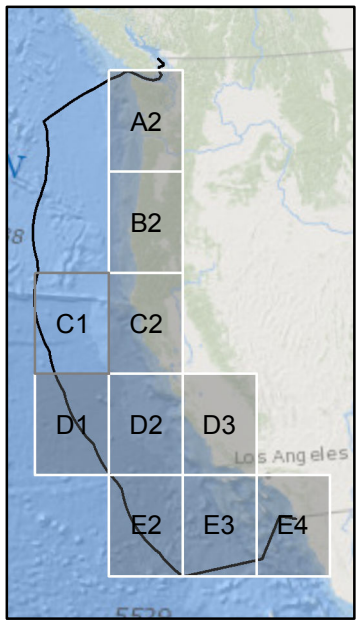
Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)



# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)



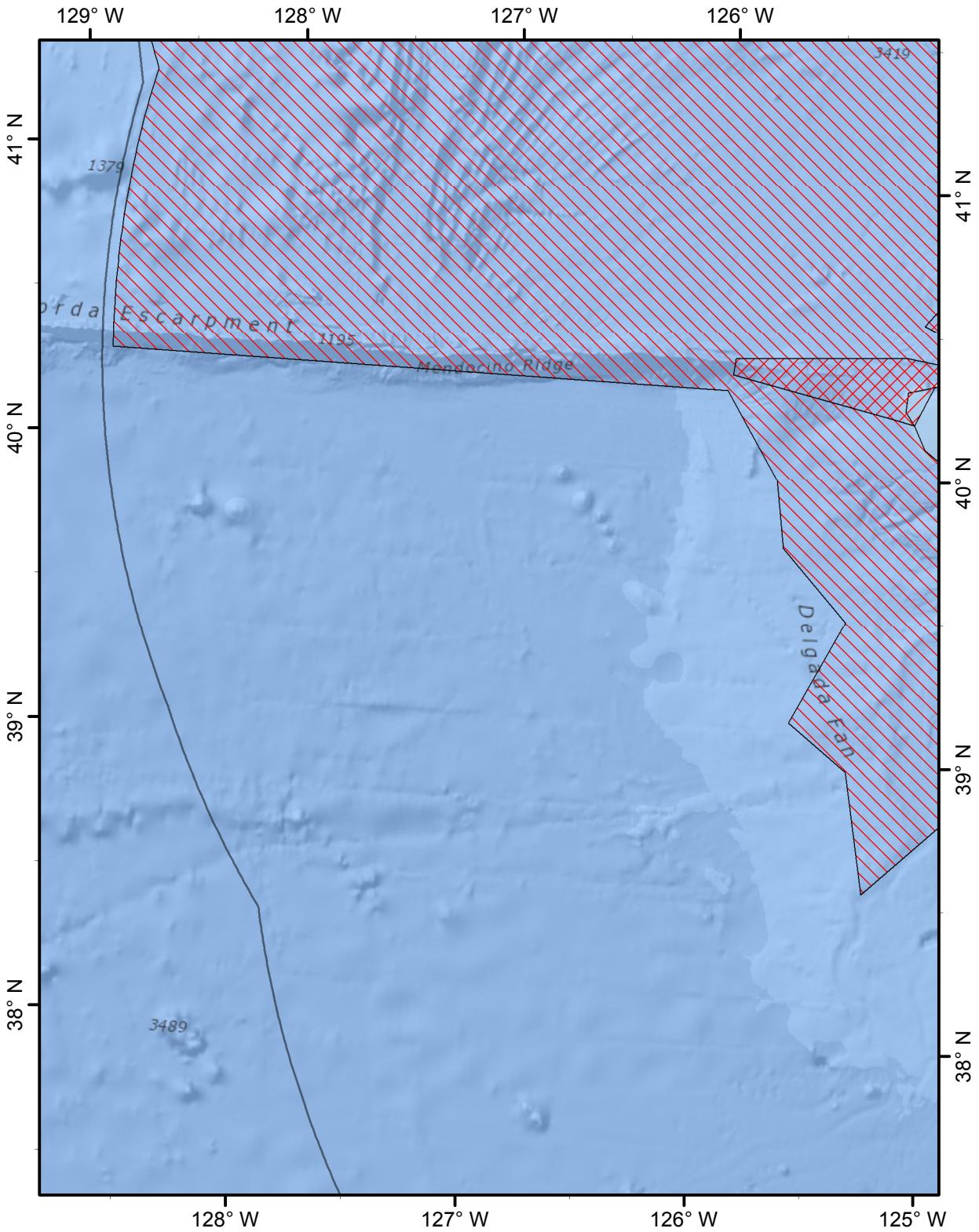




Map 3 of 10

C1

0 25 50 75 100
Kilometers

0 20 40 60
Nautical Miles

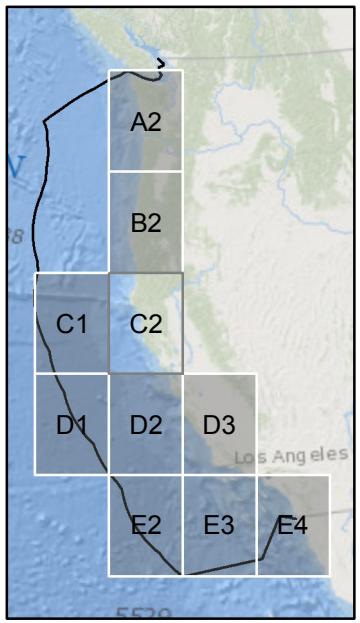



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

- MBNMS (reopen)
- FMA (reopen)
- Oceana/NRDC/OC (reopen)
- EFH Cons. Area
- 700-fm Closure

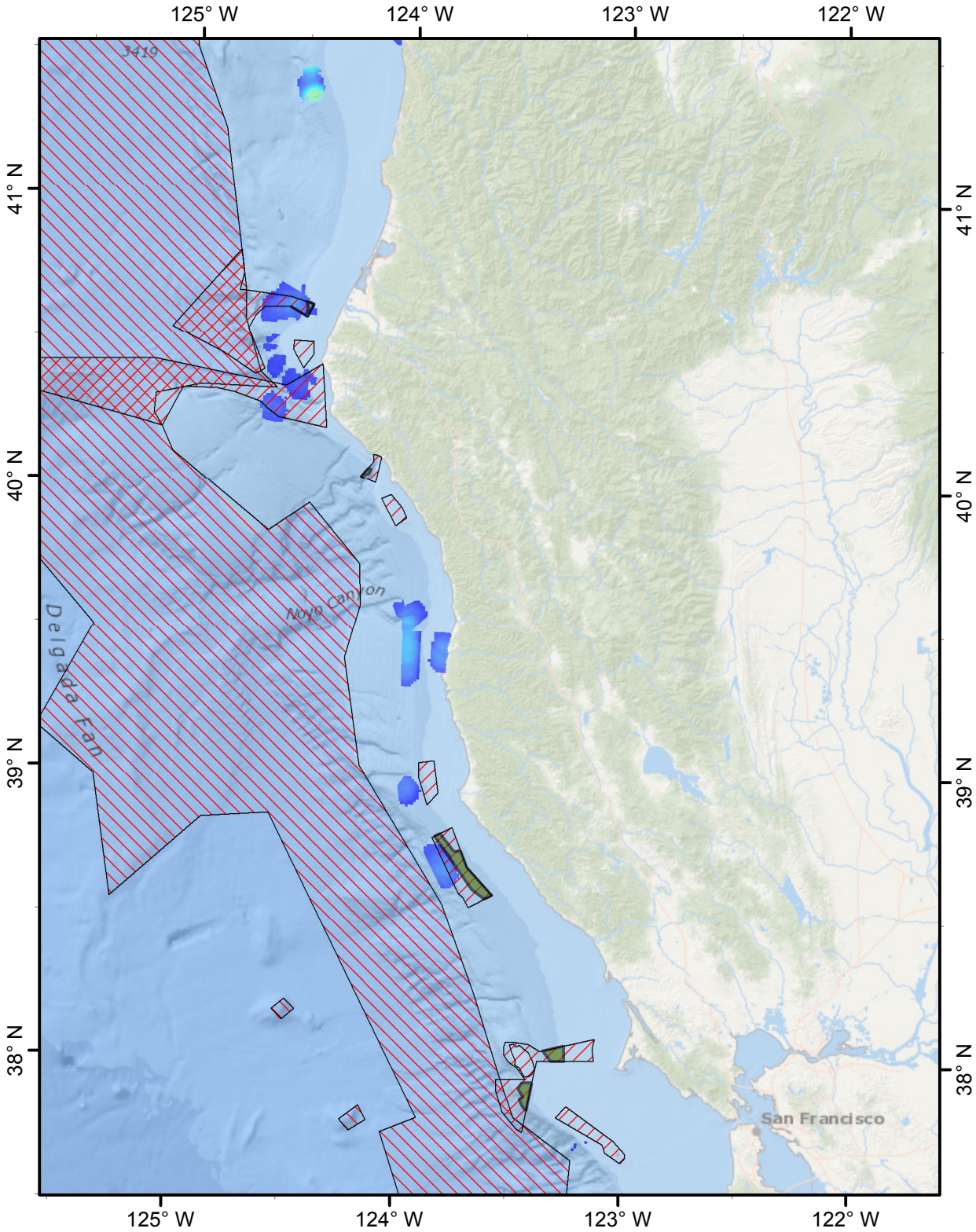
**Effort (pts/km²)**
High : 4.38
Low : 0.04




Map 4 of 10

C2

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

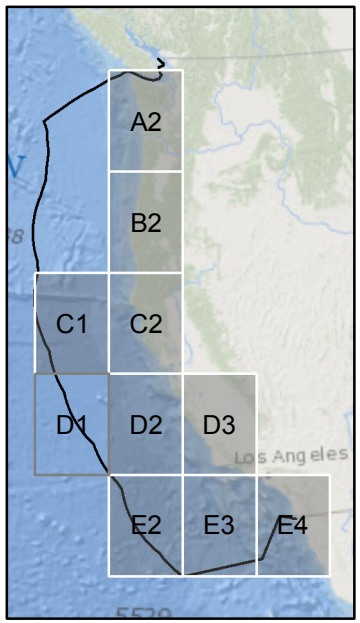



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

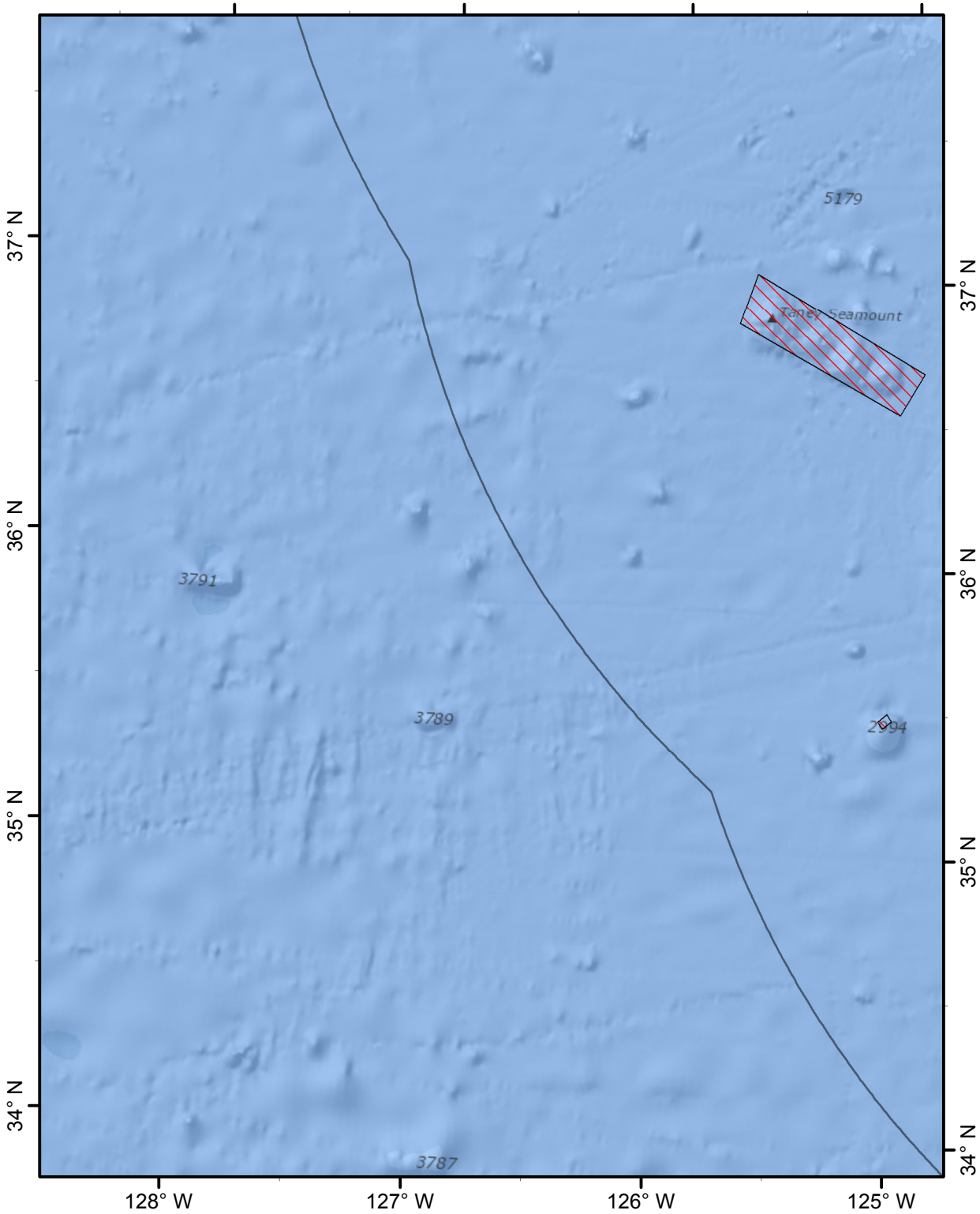
**Effort (pts/km²)**
High : 4.38
Low : 0.04




Map 5 of 10

D1

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

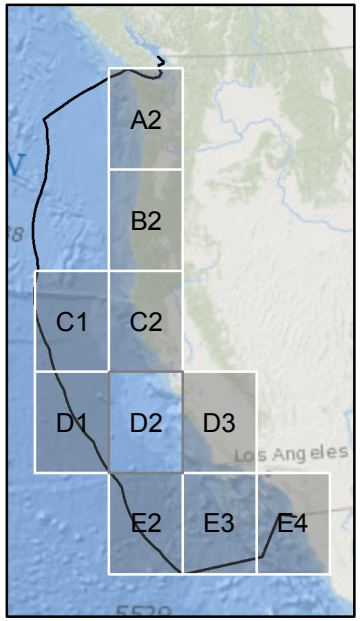



Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

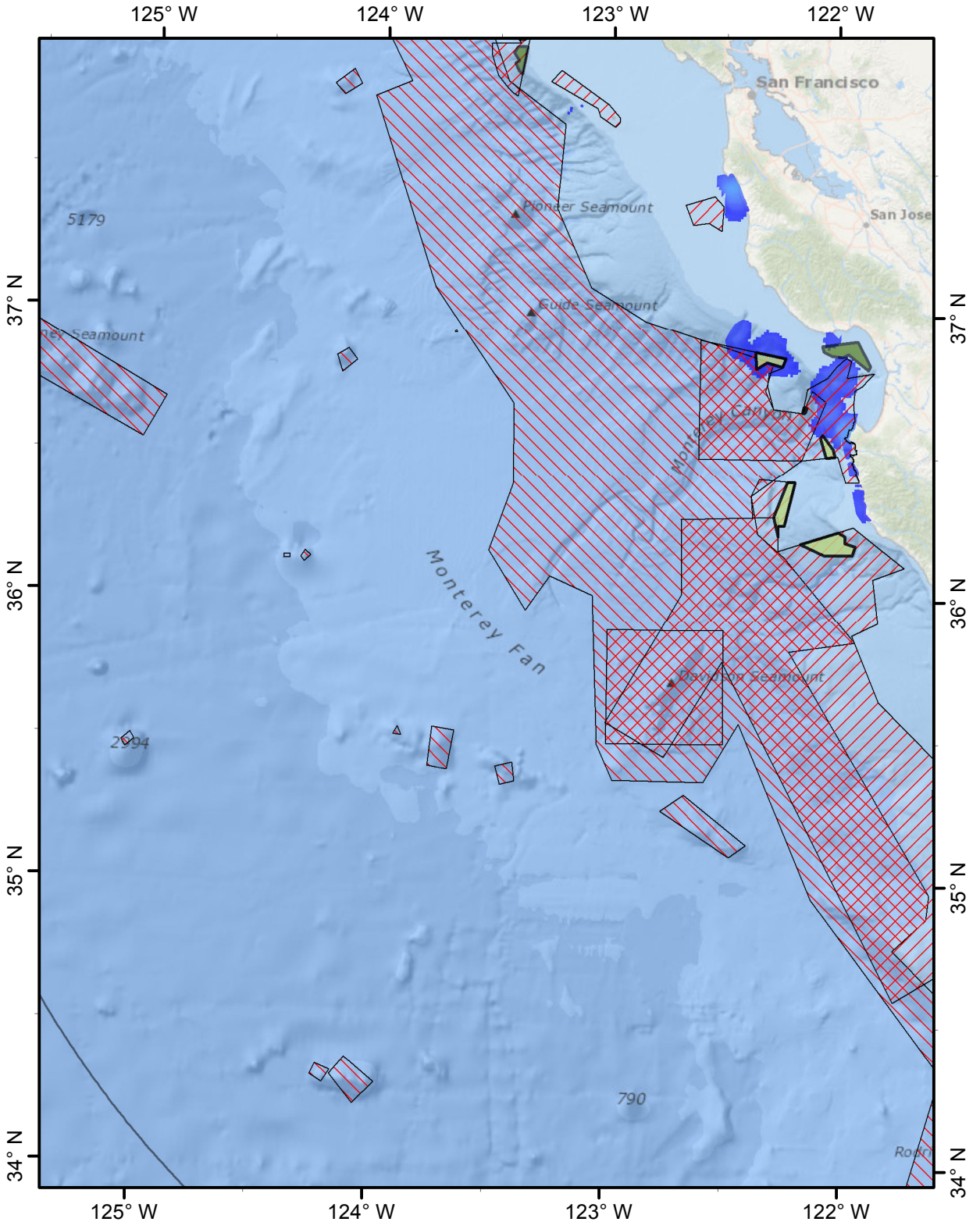
**Effort (pts/km²)**
High : 4.38
Low : 0.04




Map 6 of 10

D2

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)

# Groundfish EFH Proposal Areas & Fixed Gear Fishing Intensity (1 Jan 2002 - 11 Jun 2006)

MBNMS (reopen)
FMA (reopen)
Oceana/NRDC/OC (reopen)
EFH Cons. Area
700-fm Closure

**Effort (pts/km²)**
High : 4.38
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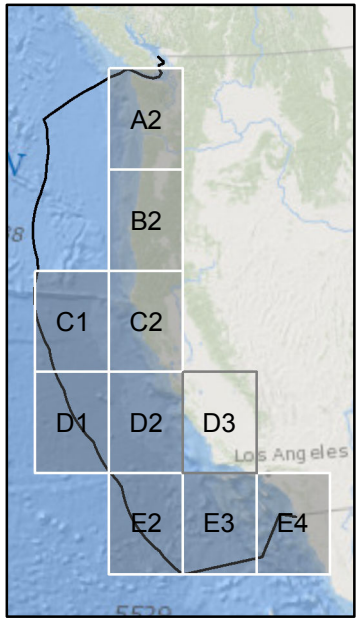
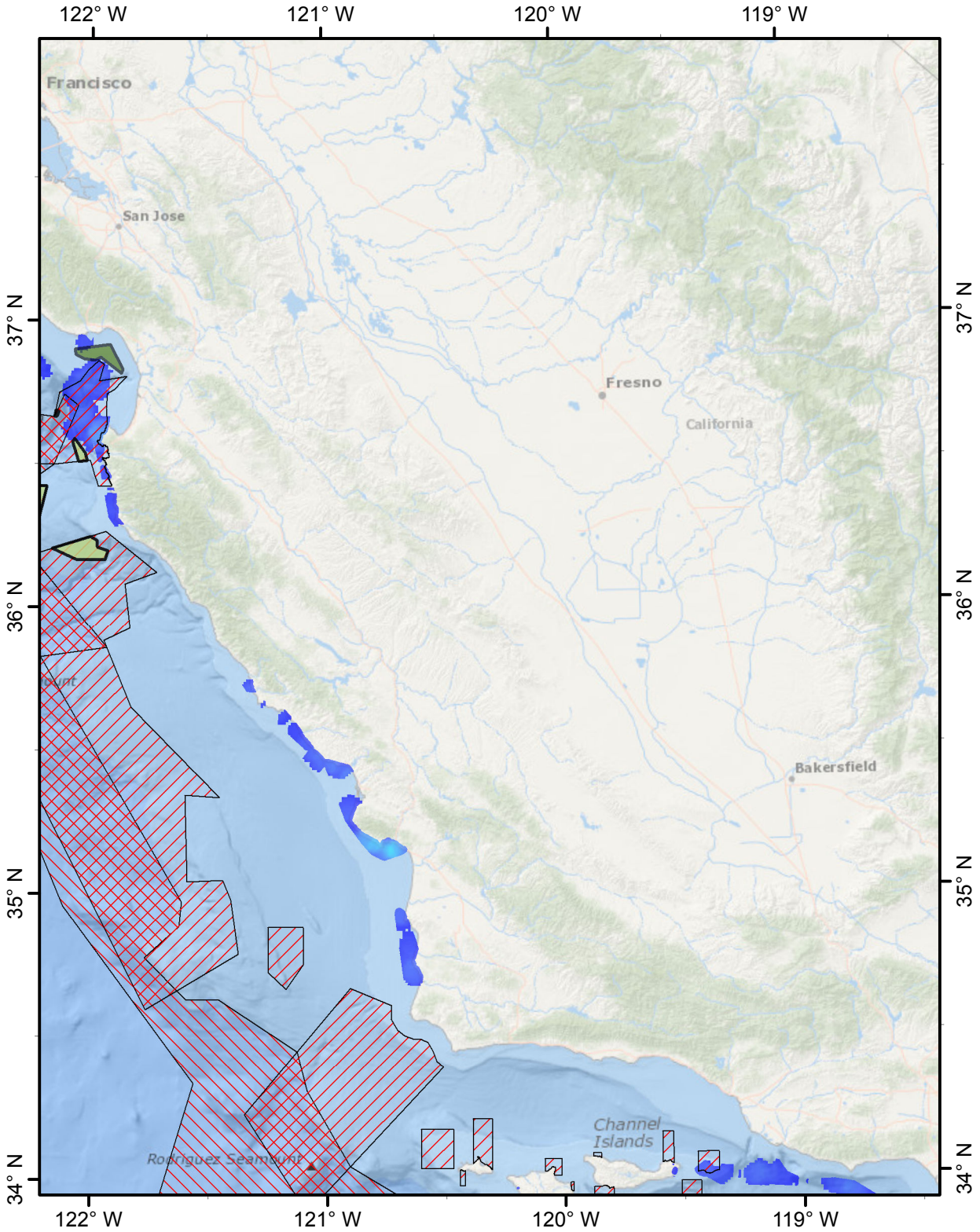



Map 7 of 10

**D3**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles




Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
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EFH Cons. Area
700-fm Closure

**Effort (pts/km²)**
High : 4.38
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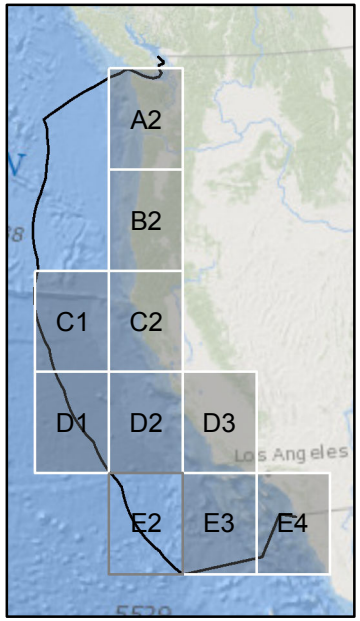
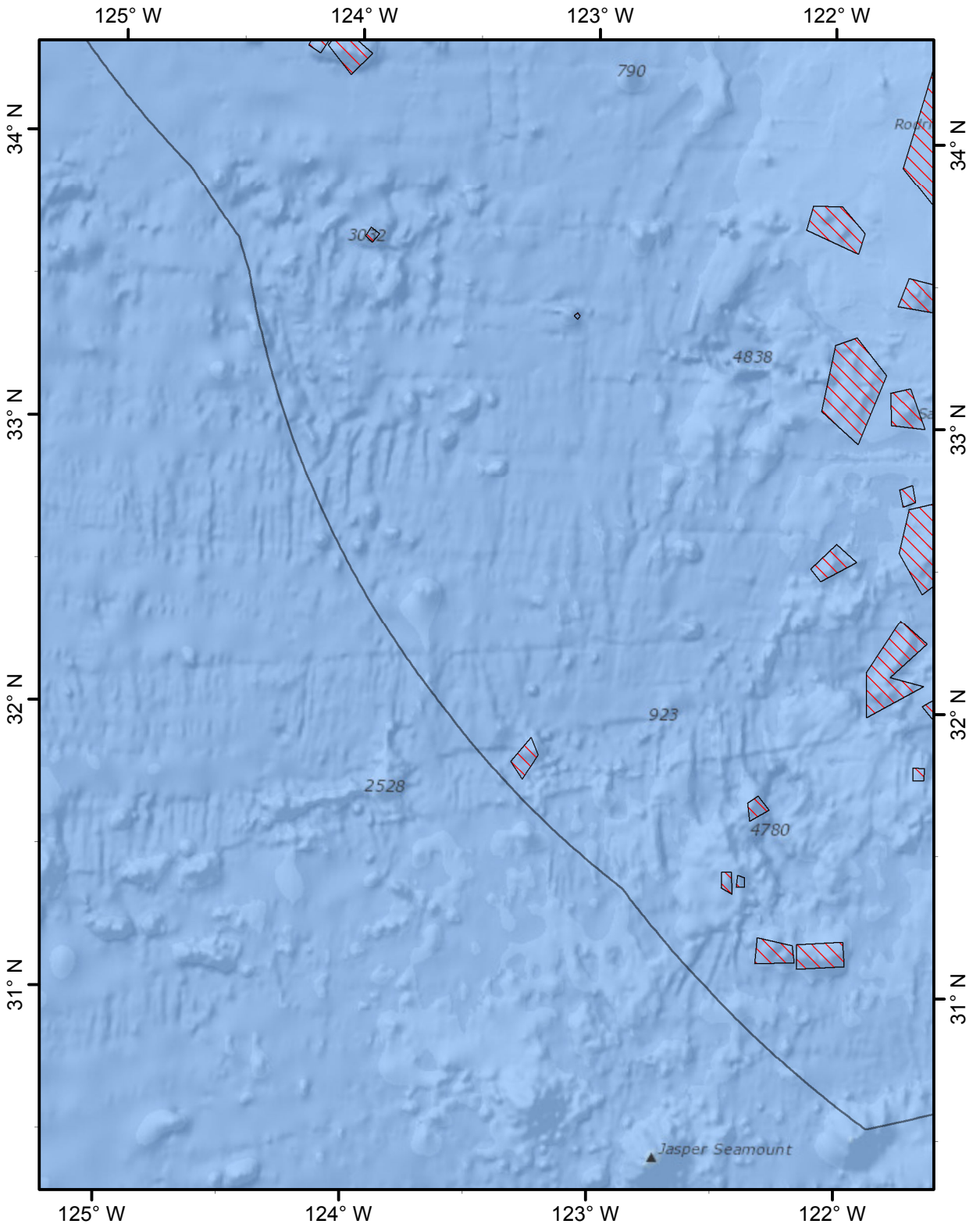



Map 8 of 10

**E2**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

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700-fm Closure

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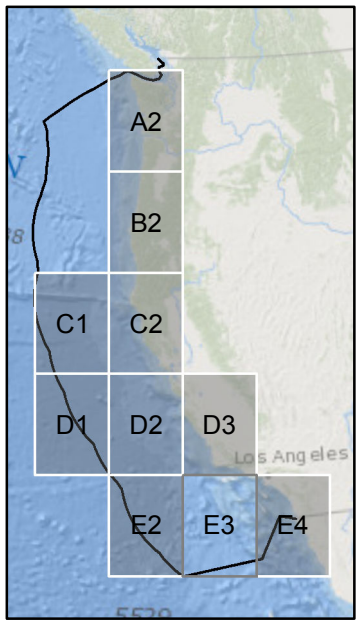
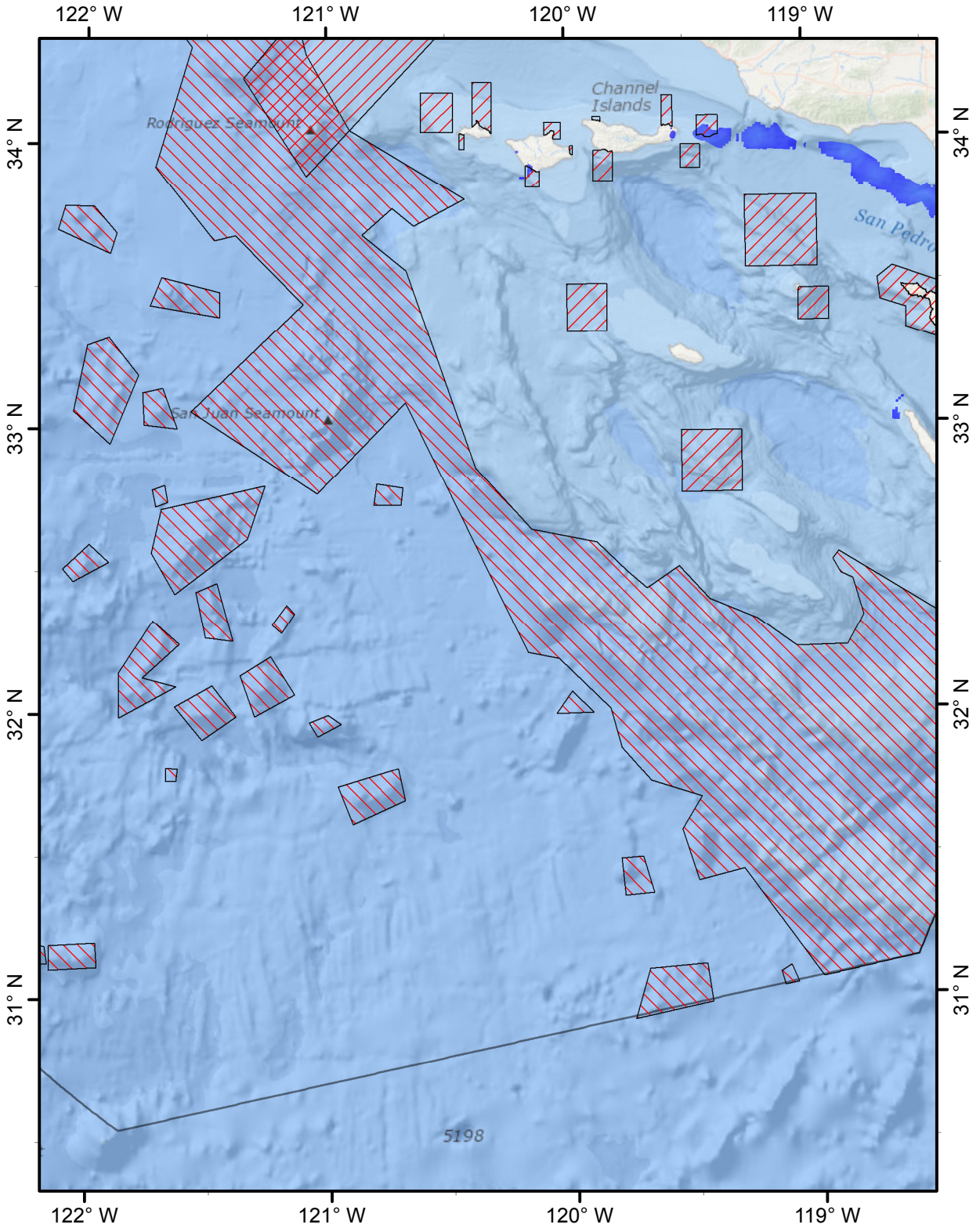



Map 9 of 10

**E3**

0 25 50 75 100
Kilometers
0 20 40 60
Nautical Miles

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**Effort (pts/km²)**

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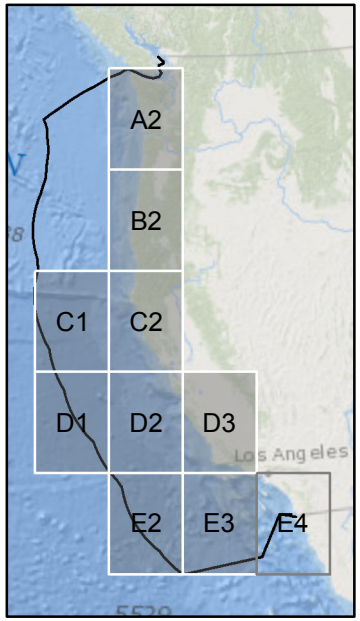



Map 10 of 10

**E4**

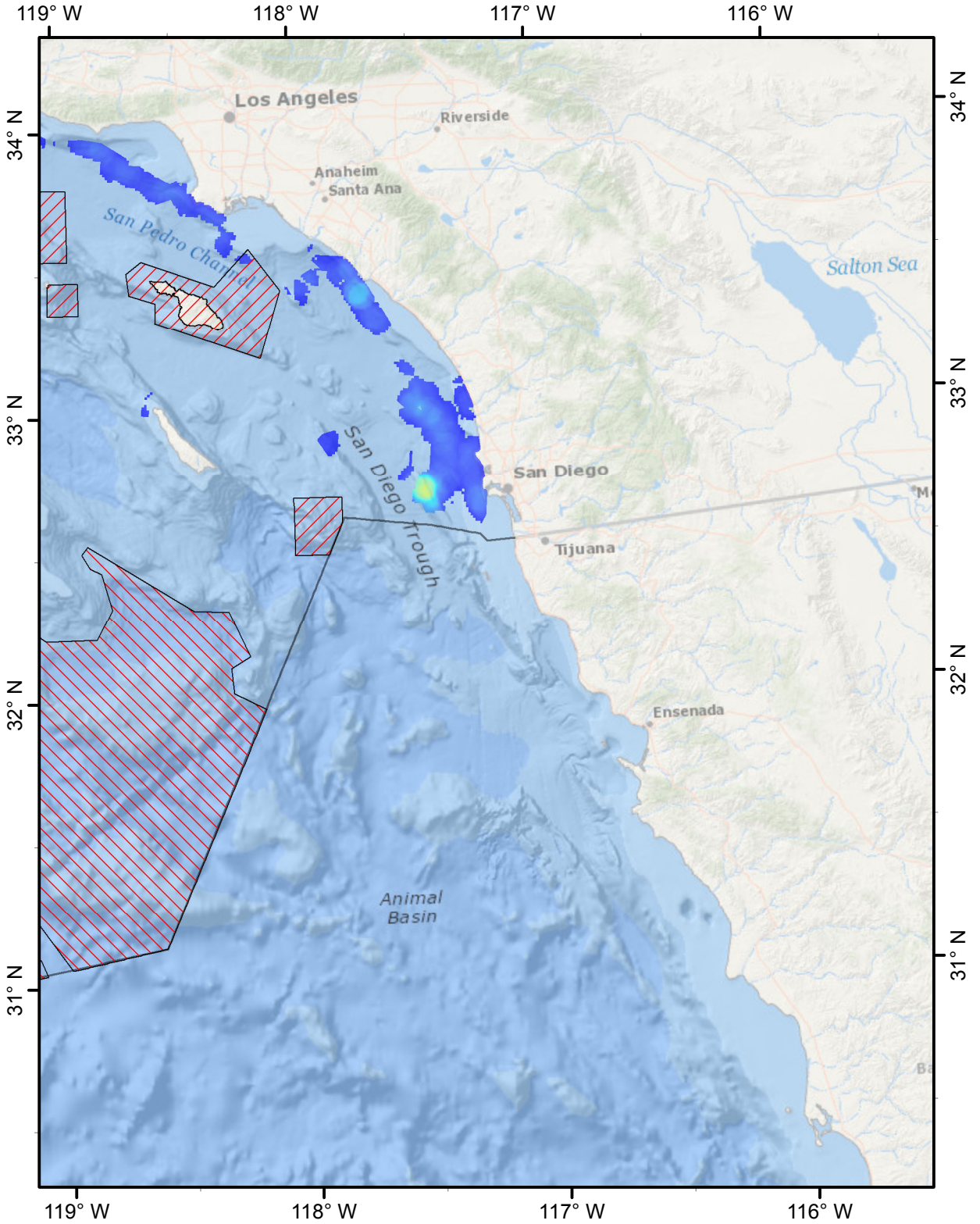
0 25 50 75 100

Kilometers

0 20 40 60

Nautical Miles

Map Scale: 1:2,300,000
Date Saved: 07 Aug 2014
Author: Curt Whitmire (NOAA Fisheries)



**STATUS REPORT OF THE 2014 OCEAN SALMON FISHERIES OFF WASHINGTON, OREGON, and CALIFORNIA.**

Preliminary Data Through August 31, 2014.[a/]

| Fishery and Area | Season Dates | Effort Days Fished | CHINOOK Catch | CHINOOK Quota | CHINOOK Percent | COHO[b/] Catch | COHO[b/] Quota | COHO[b/] Percent |
|---|---|---|---|---|---|---|---|---|
| **COMMERCIAL** | | | | | | | | |
| **Treaty Indian**[c/] | *5/1-6/30* | 479 | 29,529 | 31,250 | 94% | | Non-Retention | |
| | *7/1-9/15* | 430 | 28,890 | 32,954 | 88% | 47,809 | 57,500 | 83% |
| **Non-Indian North of Cape Falcon**[d/] | *5/1-6/30* | 1,656 | 37,295 | 37,900 | 98% | | Non-Retention | |
| | *7/1-9/16* | 955 | 16,538 | 19,000 | 87% | 15,131 | 35,200 | 43% |
| **Cape Falcon - Humbug Mt.** | *4/1-8/29* | 7,550 | 157,700 | None | NA | | Non-Retention | |
| | *9/3-10/31* | | | None | NA | | 5,300 | 0% |
| **Humbug Mt. - OR/CA Border** | *4/1-5/31* | 481 | 13,364 | NA | NA | | Non-Retention | |
| | *6/15-6/30* | 80 | 1,330 | 1,500 | 89% | | Non-Retention | |
| | *7/1-7/31*[e/] | 36 | 496 | 596 | 83% | | Non-Retention | |
| | *8/6-8/29*[f/] | 63 | 394 | 580 | 68% | | Non-Retention | |
| | *9/12-9/27* | NA | NA | 500 | NA | | Non-Retention | |
| **OR/CA Border - Humboldt S. Jetty** | *9/12-9/30* | NA | NA | 4,000 | NA | | Non-Retention | |
| **Humboldt S. Jetty - Horse Mt.** | | | | Closed | | | | |
| **Horse Mt. - Pt. Arena** | *6/19-6/30, 7/15-8/29* | 4,288 | 88,619 | None | NA | | Non-Retention | |
| | *9/1-30* | NA | NA | None | NA | | Non-Retention | |
| **Pt. Arena - Pigeon Pt.** | *5/1-6/30, 7/15-8/29* | 4,679 | 63,953 | None | NA | | Non-Retention | |
| | *9/1-30* | NA | NA | None | NA | | Non-Retention | |
| **Pt. Reyes-Pt. San Pedro** | *10/1-3, 6-10 &13-15* | NA | NA | None | NA | | Non-Retention | |
| **Pigeon Pt. - U.S./Mexico Border** | *5/1-6/30, 7/15-8/13* | 1,635 | 8,334 | None | NA | | Non-Retention | |
| **RECREATIONAL** | | | | | | | | |
| **U.S./Canada Border - Queets River**[g/] | *5/16-17, 23-24, 5/31-6/13* | 1,326 | 327 | 9,000 | 23% | | Non-Retention | |
| **Queets River - Leadbetter Point**[g/] | *5/31-6/13* | 2,646 | 1,148 | | | | Non-Retention | |
| **Leadbetter Point - Cape Falcon**[g/] | *5/31-6/13* | 1,001 | 611 | | | | Non-Retention | |
| **U.S./Canada Border - Cape Alava** | *6/14-9/2* | 13,381 | 5,584 | 7,000 | 80% | 4,152 | 19,220 | 22% |
| **Cape Alava-Queets River** | *6/14-9/2* | 3,686 | 1,350 | 2,350 | 57% | 3,287 | 4,750 | 69% |
| | *9/27-10/12* | | | 50 | 0% | | 50 | 0% |
| **Queets River - Leadbetter Pt.** | *6/14-9/30* | 43,452 | 21,273 | 27,600 | 77% | 41,363 | 68,380 | 60% |
| **Leadbetter Pt.-Cape Falcon** | *6/14-9/30* | 46,163 | 10,130 | 13,100 | 77% | 60,998 | 92,400 | 66% |
| **Cape Falcon - Humbug Mt.** | *3/15-10/31* | 66,399 | 7,321 | None | NA | Non-Retention except for periods listed | | |
| Cape Falcon to OR/CA Border | *6/21-8/10* | Included Above or Below | | NA | NA | 48,534 | 80,000 | 61% |
| Cape Falcon to Humbug Mt.[h/] | *8/30-9/30* | Included Above | | NA | NA | 7,543 | 35,000 | 22% |
| **Humbug Mt. - OR/CA Border (OR-KMZ)** | *5/10-9/7* | 12,218 | 5,685 | None | NA | Included Above | | |
| **OR/CA Border - Horse Mt. (CA-KMZ)** | *5/10-9/7* | 19,814 | 15,320 | None | NA | | Non-Retention | |
| **Horse Mt. - Pt. Arena (Ft. Bragg)** | *4/5-11/9* | 16,817 | 12,353 | None | NA | | Non-Retention | |
| **Pt. Arena - Pigeon Pt. (San Francisco)** | *4/5-11/9* | 36,045 | 20,939 | None | NA | | Non-Retention | |
| **Pigeon Pt. - U.S./Mexico Border (Monterey)** | *4/5-10/5* | 26,646 | 13,855 | None | NA | | Non-Retention | |

| TOTALS TO DATE (through 8/31) | Effort 2014 | Effort 2013 | Effort 2012 | Chinook Catch 2014 | Chinook Catch 2013 | Chinook Catch 2012 | Coho Catch 2014 | Coho Catch 2013 | Coho Catch 2012 |
|---|---|---|---|---|---|---|---|---|---|
| **TROLL** | | | | | | | | | |
| Treaty Indian | **909** | 1,172 | 1,033 | **58,419** | 49,561 | 51,175 | **47,809** | 43,553 | 21,592 |
| Washington Non-Indian | **1,836** | 2,218 | 1,852 | **37,853** | 39,361 | 34,463 | **10,850** | 5,764 | 1,887 |
| Oregon | **8,985** | 6,469 | 4,399 | **189,264** | 74,354 | 47,278 | **4,281** | 307 | 74 |
| California | **10,602** | 15,387 | 12,387 | **160,906** | 285,697 | 199,350 | **0** | 0 | 0 |
| Total Troll | **22,332** | 25,246 | 19,671 | **446,442** | 448,973 | 332,266 | **62,940** | 49,624 | 23,553 |
| **RECREATIONAL** | | | | | | | | | |
| Washington | **101,009** | 70,939 | 63,954 | **38,230** | 26,808 | 31,500 | **95,852** | 39,387 | 22,646 |
| Oregon | **89,263** | 66,007 | 46,659 | **15,199** | 26,949 | 17,017 | **70,025** | 12,209 | 8,882 |
| California | **99,322** | 135,505 | 133,561 | **62,467** | 109,506 | 114,583 | **0** | 357 | 101 |
| Total Recreational | **289,594** | 272,451 | 244,174 | **115,896** | 163,263 | 163,100 | **165,877** | 51,953 | 31,629 |
| **PFMC Total** | **311,926** | 297,697 | 263,845 | **562,338** | 612,236 | 495,366 | **228,817** | 101,577 | 55,182 |

a/ Inseason estimates are preliminary.

b/ Non-Indian coho fisheries prior to September are mark-selective and non-mark-selective recreational fisheries occur in September, (except SOF rec.) see the regulations for details.

c/ Effort is reported as landings. Chinook summer quota of 31,250 increased by rolling uncaught spring quota on an impact neutral basis by 1,704 fish.

d/ Numbers shown as Chinook quotas for non-Indian troll and rec. fisheries North of Falcon are guidelines not quotas; only the total Chinook allowable catch is a quota.

e/ 500 preseason Chinook quota plus impact neutral roll-over from June of 96 in the Humbug Mt. to OR/CA border commercial troll fishery.

f/ 500 preseason Chinook quota plus impact neutral roll-over from July of 80 in the Humbug Mt. to OR/CA border commercial troll fishery.

g/ Mark-selective fishery for Chinook

h/ 20,000 preseason quota plus 15,000 impact equivalent roll-over from the Cape Falcon to OR/CA border mark-selective recreational coho fishery.

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

September 4, 2014

Donald McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland OR 97220

RE: Notification: Release of the Columbia River Hatchery Final Environmental Impact Statement (the "Mitchell Act EIS")

Dear Director McIsaac:

This is to advise you that NOAA Fisheries has completed a final environmental impact statement (EIS) to inform its decisions regarding the funding of Columbia Basin hatchery programs under the Mitchell Act.

Under the Mitchell Act, NOAA Fisheries provides funding, annually, through grants and memoranda of understanding to tribal, federal, and state natural resource agencies. NOAA Fisheries provides these funds to support the operation and maintenance of hatchery programs and the necessary monitoring, evaluation, and reform activities. Funding under the Mitchell Act is appropriated annually, by Congress, and the distribution of these funds by NOAA Fisheries is the federal action requiring compliance with the National Environmental Policy Act and, as such, the development of this EIS.

You may recall that NOAA Fisheries released a draft EIS in 2010 that analyzed four different alternatives. At the same time, the fishery managers and others were requested to advise NOAA Fisheries on a preferred alternative. Based on the input received, NOAA Fisheries crafted the preferred alternative that now appears in the final EIS.

The final EIS discloses the impacts, both positive and negative, of five alternatives, including the preferred alternative, for dispersing funds allocated under the Mitchell Act to support hatchery programs, including associated monitoring, evaluation, and reform activities. The impacts attributable to each alternative are reported for a wide range of resources, both environmental and human, and this information will enable NOAA Fisheries to make well-reasoned and informed decisions regarding Mitchell Act hatchery funding into the future.

NOAA Fisheries greatly appreciates what your council has contributed toward completion of the final EIS. The comments and information provided have been instrumental and the EIS has benefitted greatly from it.

Included with this letter are an EIS cover letter, a set of frequently asked questions and answers, the Executive Summary, and a CD of the final EIS and Appendices. Additional information can also be found on NMFS' website at:

http://www.westcoast.fisheries.noaa.gov/hatcheries/mitchell_act/ma_feis.html

If you or your staff have any questions, please contact James Dixon at (360) 534-9329 at your earliest convenience.

Sincerely,

Rob Jones

Rob Jones
Anadromous Production and Inland
Fisheries Program
West Coast Region

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
PROGRAM PLANNING AND INTEGRATION
Silver Spring, Maryland 20910

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act (NEPA), we enclose for your review the *Final Environmental Impact Statement to Inform Columbia River Basin Hatchery Operations and the Funding of Mitchell Act Hatchery Programs*.

This final environmental impact statement (FEIS) is prepared pursuant to NEPA to assess the environmental impacts associated with National Marine Fisheries Services' (NMFS) policy development related to Mitchell Act hatchery funding decisions.

Additional copies of the FEIS may be obtained from the Responsible Program Official identified below. The document is also accessible electronically through the NMFS West Coast Region's website at http://www.westcoast.fisheries.noaa.gov/hatcheries/mitchell_act/ma_feis.html.

NMFS is not required to respond to comments received during the agency's 60-day review period as a result of the issuance of the FEIS. However comments received by **November 12, 2014,** will be reviewed and considered for their impact on issuance of a record of decision. Please send comments to the responsible official identified below. The record of decision will be made available publicly following final agency action on or after **November 12, 2014**.

Responsible Program Official: William W. Stelle, Jr.
Regional Administrator
National Marine Fisheries Service, West Coast Region
National Oceanic and Atmospheric Administration
7600 Sand Point Way NE, Building 1
Seattle, WA 98115-0070
(206) 526-6150 Telephone
(206) 526-6426 Fax
MAhatcheryEIS.wcr@noaa.gov

Sincerely,

MONTANIO.PATRICIA.A.1365839030
Digitally signed by MONTANIO.PATRICIA.A.1365839030
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=OTHER, cn=MONTANIO.PATRICIA.A.1365839030
Date: 2014.08.27 16:59:49 -04'00'

Patricia A. Montanio
NOAA NEPA Coordinator

Enclosure

Printed on Recycled Paper

# Final Environmental Impact Statement to Inform Columbia River Basin Hatchery Programs and the Funding of Mitchell Act Programs

## Questions & Answers

### What is NOAA Fisheries releasing?

NOAA Fisheries is releasing a final environmental impact statement (EIS) to inform its decisions regarding what kind of hatchery programs to fund with federal appropriations provided under the Mitchell Act. The scope of this EIS includes all of the Columbia River Basin. Under the Mitchell Act, funding is provided to produce salmon and steelhead for fishing and conservation. The EIS compares six alternatives, one no-action alternative and five action alternatives, including a preferred alternative (Alternative 6).

### Is this environmental impact statement (EIS) different than the EIS NOAA Fisheries released in July 2014?

The EIS released in July 2014 analyzed two resource management plans submitted by the Washington Department of Fish and Wildlife and the Puget Sound Treaty Tribes for the operations of their hatcheries in Puget Sound. NOAA Fisheries will use that analysis to inform its determinations of those hatcheries' compliance with the Endangered Species Act. This EIS analyzes alternatives for NOAA Fisheries' decisions on distributing Mitchell Act grant funds to hatchery programs in the Columbia River. The Puget Sound EIS is a draft and is currently open for public comment. This EIS is final; a draft of it was released for public comment in 2010.

### What is the Mitchell Act Program?

Congress passed the Mitchell Act in 1938 in response to federal projects and management that contributed to declining salmon and steelhead resources in the Columbia River Basin. A program was added in 1946 to enable federal funds to be distributed to the states. Since then, the program has evolved into two components with individual Congressional appropriations:

- Hatcheries: Operation and maintenance; and monitoring, evaluation, and reform of 62 individual hatchery programs (as of 2010) and 21 associated hatchery facilities, which release approximately 63 million juvenile salmon and steelhead in Oregon, Washington, and Idaho.

- Screening and Passage: Construction, operation, and maintenance of more than 700 fish screens for juvenile fish protection at irrigation diversions and 90 fishways enhancing adult fish passage to nearly 2,000 miles of stream habitat in Oregon, Washington, and Idaho. The screening and passage program is not evaluated in this environmental impact statement.

Historically, the majority of hatchery production funded under the Mitchell Act has provided fish for ocean and in-river non-treaty commercial and recreational harvest. The Mitchell Act has also funded hatchery production to support tribal treaty harvest in the Columbia River and hatchery programs designed specifically to conserve salmon protected under the Endangered Species Act. This EIS only addresses the hatchery programs under the Mitchell Act.

## Why is NOAA Fisheries producing an environmental impact statement (EIS) for the Mitchell Act hatchery program?

The annual funding of Mitchell Act hatcheries constitutes a major federal action and, as such, requires evaluation of the effects of this action to the environment, as guided by the National Environmental Policy Act (NEPA).

## What does the final environmental impact statement (EIS) evaluate?

The final EIS discloses the likely effects on the environment, beneficial and adverse, from the operation of Columbia River Basin salmon and steelhead hatchery programs, across a range of alternatives. This includes effects to the natural and human environment, such as: effects to animal and plant species, water quality and quantity, socioeconomics effects, environmental justice effects, and human health effects.

## What role did the public play in developing this environmental impact statement (EIS)?

The EIS process allows NOAA Fisheries to solicit input from the public in shaping the alternatives that are analyzed within the EIS. In the case of this EIS, NOAA Fisheries requested public comment in formulating several alternatives for operating Columbia River salmon and steelhead hatcheries.

Two public scoping processes, one in 2004 and another in 2009, allowed NOAA Fisheries to develop a range of alternatives for operating Columbia River Basin hatchery programs. NOAA Fisheries proceeded to analyze the impacts of each alternative and published a draft EIS for public comment in 2010. In the draft EIS, NOAA Fisheries invited the public to comment on and describe a preferred alternative for the final EIS.

## What modifications have been made between the draft and final environmental impact statement (EIS)?

NOAA Fisheries received over 400 letters containing over 1,100 comments on the draft EIS. In response to these comments, NOAA Fisheries produced a final EIS which updates relevant information, provided by the public review process, and identifies and analyzes NOAA Fisheries' preferred alternative. Other key modifications include:

- Hatchery production is updated to 2010 levels;
- Key modeling assumptions in the analysis related to hatchery program performance; hatchery effects, beneficial and adverse; and harvest rates throughout the Columbia River and Pacific Ocean have been updated; and
- The biological status of fish and wildlife species that would be affected under each alternative has been updated.

## Is there a preferred alternative identified in the final environmental impact statement (EIS)?

Yes. In the draft EIS, NOAA Fisheries informed the public that a preferred alternative would likely be developed from a combination of the alternatives presented in the draft EIS and input received during the public comment period. The final EIS includes a preferred alternative (Alternative 6) that incorporates elements from draft EIS Alternative 1, Alternative 4, and Alternative 5. Under the preferred alternative, NOAA Fisheries would fund hatchery programs that minimize the risks, associated with hatchery programs, to natural populations of salmon and steelhead. The preferred alternative also supports the initiation of new hatchery programs for conservation, harvest augmentation, or both.

## Does the preferred alternative specify production levels?

No. The preferred alternative focuses on providing greater protection for natural populations of salmon and steelhead. It acknowledges that there are various ways to accomplish this goal and does not dictate or prescribe specific hatchery actions or practices, such as production levels.

## What is the relationship between the final environmental impact statement (EIS) and the *U.S. v. Oregon* process?

*U.S. v. Oregon* was originally a combination of two cases, *Sohappy v. Smith* and *U.S. v. Oregon* (302 F. Supp. 899, 1978), which legally upheld the Columbia River Treaty Tribes' reserved fishing rights and tribal entitlement to a fair share of fish runs. Although the *Sohappy* case was closed in 1978, *U.S. v. Oregon* remains under the federal court's continuing jurisdiction. In 1977, under the jurisdiction of *U.S. v. Oregon*, the federal court ordered a five-year plan for in-river harvest sharing between non-Indian and Indian fisheries. In 1988, the Columbia River Fish Management Agreement (Management Agreement) was adopted by the federal court, and it addressed both harvest and hatchery production management. The most current Management Agreement was adopted by the federal court in 2008, and it expires in 2017. It includes goals for many hatchery programs in the Columbia River Basin, including production levels, marking strategies, and release locations. Approximately half of the production currently funded under the Mitchell Act is part of the *U.S. v. Oregon* Management Agreement.

Fisheries in the Columbia River are carefully designed to be consistent with federal court rulings related to treaty Indian fishing rights. The governing Management Agreement has been cooperatively negotiated by the federal and state governments and the involved treaty Indian tribes, under the continuing jurisdiction of the federal court, to ensure achievement of the tribe's fishing rights. The agreement includes commitments related to hatchery production that are "intended to ensure that Columbia River fish runs continue to provide a broad range of benefits in perpetuity." The Management Agreement also includes provisions to "facilitate cooperative action by the Parties with regard to fishing regulations, policy issues or disputes, and the coordination of the management of fisheries on Columbia River runs and production and harvest measures."

The purpose of this EIS is to analyze the environmental effects of a range of reasonable alternatives related to hatchery production. No specific assertions are made in this EIS about consistency between alternatives and the Management Agreement. Rather, NOAA Fisheries contends that affected parties, including NOAA Fisheries itself, will exercise their authority regarding production measures, following this environmental analysis, in a manner that is consistent with the most current Management Agreement.

## What are the next steps with this environmental impact statement (EIS)?

The final EIS is open to public review for 60 days after notice is published in the Federal Register, which is expected to occur September 12. Following public review, NOAA Fisheries will issue a record of decision describing its final decision on continued Mitchell Act hatchery funding.

## Where can I access the final environmental impact statement?

The final environmental impact statement is available on the NOAA Fisheries West Coast Region website: http://www.westcoast.fisheries.noaa.gov/hatcheries/mitchell_act/ma_feis.html

# Executive Summary

## Final Environmental Impact Statement to Inform Columbia River Basin Hatchery Operations and the Funding of Mitchell Act Hatchery Programs

## Introduction

The National Marine Fisheries Service (NMFS) has prepared a final environmental impact statement (EIS) to guide the annual funding of Mitchell Act hatchery programs in the Columbia River Basin.

NMFS began this EIS process in 2004 when it requested scoping help from the public to develop alternatives to evaluate for inclusion in the document. In 2009, NMFS again requested help from the public when it proposed to expand the scope of the EIS to not only evaluate Mitchell Act-funded hatcheries, but all hatcheries within the basin.

In August 2010, NMFS published a draft EIS for public review and comment. In this draft, NMFS evaluated the resource effects of five alternatives (one no action alternative and four action alternatives). NMFS also asked that the public provide NMFS with their ideas for a preferred alternative. The public review of the draft produced over 1,100 comments.

NMFS has been working to incorporate these comments and suggestions, as well as more recent information on the affected resources, into this final EIS. NMFS has formulated and evaluated Alternative 6, the preferred alternative, in this final EIS. This final EIS also provides an updated analysis of the original five alternatives evaluated in the draft EIS.

In addition to identifying the preferred alternative, several other updates and clarifications have been made to the EIS (for a summary of all changes from the draft to the final EIS, see the last section of this Executive Summary). Some of these updates include the following:

- Focusing the scope of the EIS on the purpose of guiding NMFS' decisions on Mitchell Act hatchery program funding

- Updating all baseline data and information in the EIS, including hatchery production, salmon and steelhead harvest, socioeconomic data, and more
- Further clarification of the alternative language, based on public comment

## Background

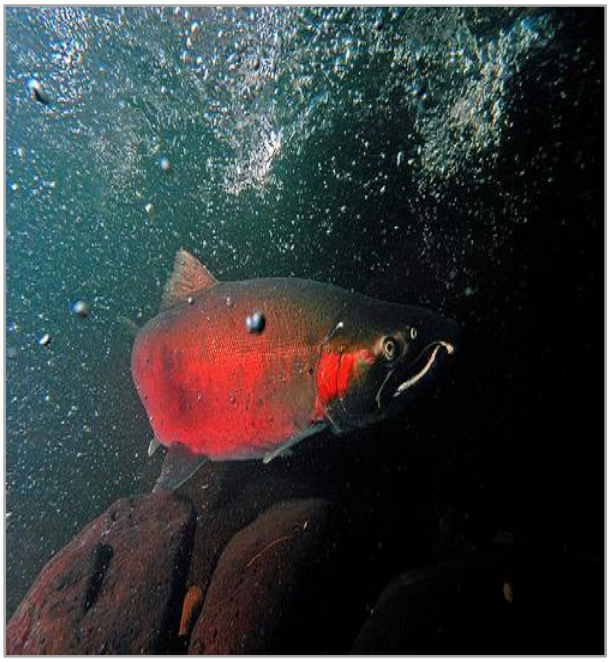
Congress enacted the Mitchell Act (16 United States Code of Federal Regulations [USC] 755 757) in 1938 for the conservation of anadromous (salmon and steelhead) fishery resources in the Columbia River Basin (defined as all tributaries of the Columbia River in the United States [U.S.] and the Snake River Basin). It authorized the establishment, operation, and maintenance of one or more hatchery facilities in the states of Oregon, Washington, and Idaho, scientific investigations to facilitate the conservation of the fishery resource, and "all other activities necessary for the conservation of fish in the Columbia River Basin in accordance with law." While the Mitchell Act provides the authority for the conservation of fishery resources in the Columbia River, Congress must appropriate funds to implement it.

Since 1946, Congress has continued to appropriate Mitchell Act funds on an annual basis. These funds have been used to support research, improve fish passage, install screens on water diversions, and build and operate more than 20 salmon and steelhead hatchery facilities (referred to in this EIS as Mitchell Act hatchery facilities). Each year, Congress allocates a specific portion of the money appropriated for the Mitchell Act to hatchery operations. For each of the past 10 years (2003 to 2012), Mitchell Act hatchery program funding has been between $12 and $22 million dollars. The National Marine Fisheries Service (NMFS), part of the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce, currently distributes these appropriations to the operators of 62 hatchery programs that annually produce more than 63 million fish. Historically, Mitchell Act production levels have been as high as 129 million juvenile fish annually, but these levels have been substantially reduced as inflation, budget reductions, maintenance, and other costs have eroded the amount of funding available for fish production.

During the same time that production levels were reduced at hatchery facilities funded under the Mitchell Act, NMFS listed eight evolutionarily significant units (ESUs) of salmon and five distinct population segments (DPSs) of steelhead in the Columbia River Basin under the Endangered Species Act (ESA) (i.e., 13 ESUs/DPSs total). When listing both salmon and steelhead under ESA, NMFS cited the adverse effects of hatchery operations as one of the factors for the decline of most of these listed ESUs/DPSs.

## Purpose and Need

The combination of continued funding pressures under the Mitchell Act and the ESA listing of 13 salmon and steelhead ESUs/DPSs in the Columbia River Basin have resulted in the need for NMFS' proposed action. NMFS' purpose for the action is to develop a policy direction to guide its decisions about the distribution of funds for hatchery production under the Mitchell Act.



The review of hatchery programs in this EIS is comprehensive because information on the effects of all Columbia River Basin hatchery programs throughout the basin and across a full range of alternatives is presented in the EIS. Each alternative identifies a different policy direction that would be used to guide NMFS' decisions on Mitchell Act hatchery production.

### What is NMFS' Proposed Action?

The proposed action is to develop a NMFS policy direction that will guide NMFS' annual distribution of Mitchell Act hatchery funds.

### What is a policy direction?

A policy direction guides and shapes decisions NMFS makes related to Mitchell Act hatchery production in the Columbia River Basin. It is formed by a series of goals and/or principles (Section 2.4.2, Alternative Performance Goals).

## What is the relationship between ESA and the National Environmental Policy Act (NEPA)?

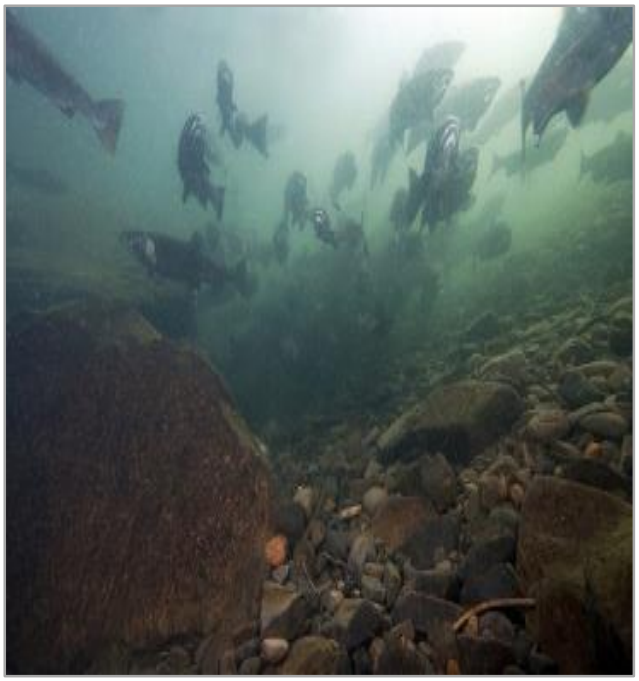
The relationship between the ESA and NEPA is complex, in part because both laws address environmental values related to the impacts of a proposed action. However, each law has a distinct purpose, and the scope and standards of review under each statute are different. This EIS analysis under NEPA should not be viewed as contributing to a conclusion about whether an alternative meets or does not meet ESA requirements.

The purpose of an EIS under NEPA is to promote disclosure, analysis, and consideration of the broad range of environmental issues surrounding a proposed major Federal action by considering a full range of reasonable alternatives, including a no-action alternative. Public involvement promotes this purpose.

ESA's purpose is to conserve listed species and the ecosystems upon which they depend. Determinations about whether Mitchell Act hatchery programs meet ESA requirements will be made independent of this EIS, under ESA section 4(d), section 7, or section 10. Each of these ESA sections has its own substantive requirements, and the documents that reflect the analysis and decisions are different than those related to a NEPA analysis.

It is not the purpose of this EIS to suggest to the reader any conclusions relative to ESA. While the Record of Decision (ROD) identifies the selected NEPA alternative, the ROD does not determine whether that alternative complies with ESA.

NMFS acknowledges that the analyses of environmental effects on listed species under ESA and under NEPA are similar and can lead to confusion; however, the analyses under these separate statutes are not functionally equivalent. Language in this final EIS has been chosen in an effort to minimize the confusion between a NEPA analysis and an ESA analysis. For instance, "jeopardize," "endanger," "recover," and similar terms are commonly used to describe the effect of actions under an ESA analysis. This EIS avoids using these terms, using instead, terms and phrases such as "performance goals" and "performance metrics."



## Project Area

The project area covered in this EIS includes rivers, streams, and hatchery facilities where hatchery-origin salmon and steelhead occur or may occur in the Columbia River Basin, including the Snake River and all other tributaries of the Columbia River in the United States (Figure S-1). The project area also includes the Columbia River estuary and plume. The project area comprises two salmon recovery domains (the Willamette/Lower Columbia and the Interior Columbia) as established by NMFS under its ESA recovery planning responsibilities. The project area also contains 7 ecological provinces and more than 37 subbasins (i.e., tributaries to the Columbia or Snake Rivers). There are 177 salmon and steelhead hatchery programs in the Columbia River Basin. These hatchery programs originate from more than 80 hatchery facilities, and they produced over 140 million salmon and steelhead in 2010 (Table S-1).

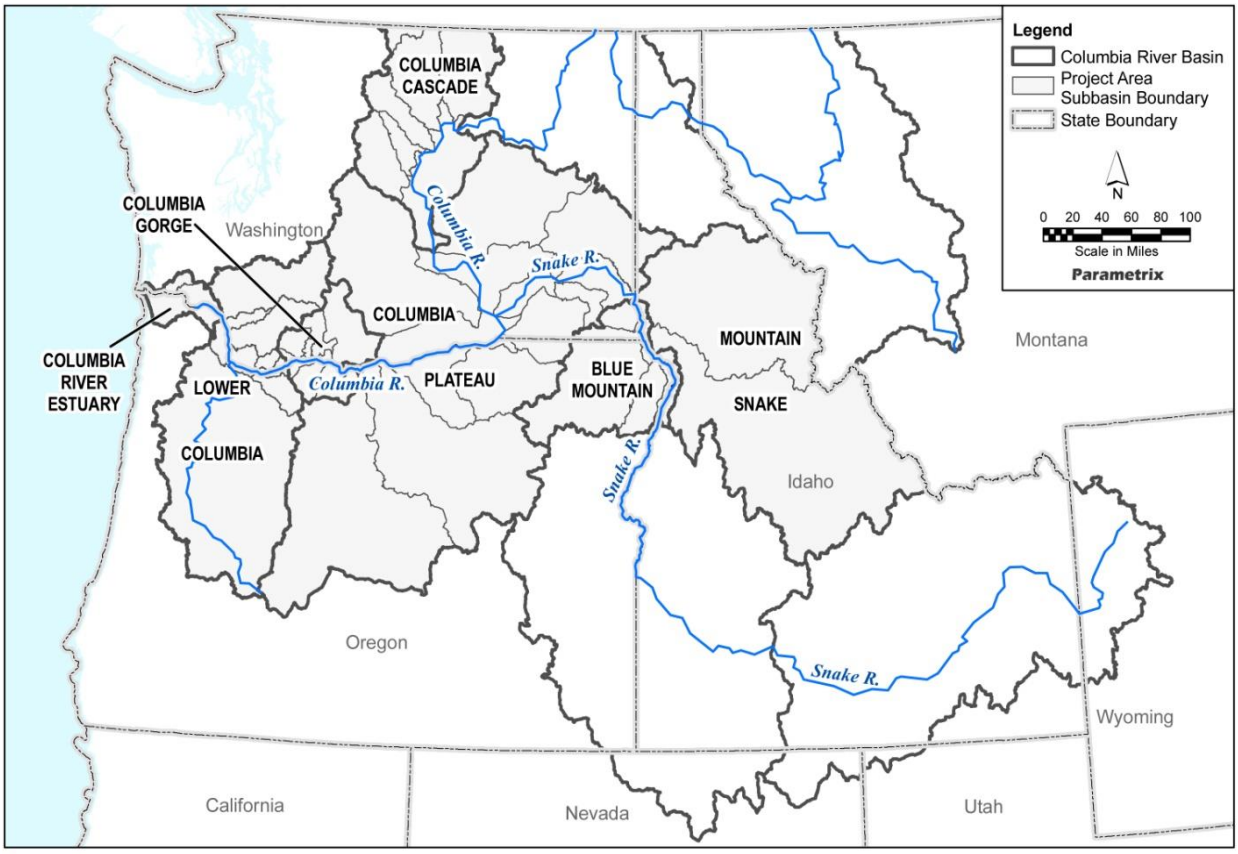



**Figure S-1. Project Area by Ecological Province**

**Table S-1. Total Hatchery-origin Salmon and Steelhead Production within the Columbia River Basin (X 1,000).**

| Recovery Domain | Fall Chinook Salmon | Spring Chinook Salmon | Summer Chinook Salmon | Coho Salmon | Winter Steelhead | Summer Steelhead | Chum Salmon | Sockeye Salmon | Total |
|---|---|---|---|---|---|---|---|---|---|
| Willamette / Lower Columbia | 45,855 | 13,595 | 0 | 15,441 | 2,011 | 2,049 | 250 | 0 | 79,201 |
| Interior Columbia | 23,129 | 19,303 | 3,742 | 4,299 | 20 | 10,537 | 0 | 362 | 61,392 |
| **Total** | **68,984** | **32,898** | **3,742** | **19,740** | **2,031** | **12,586** | **250** | **362** | **140,593** |

Source: Appendix C through Appendix F. Numbers based on production levels in 2010.

Activities that are not considered to be within a reasonable range of potential funding or operational opportunities and that are not, therefore, envisioned within the alternatives in this draft EIS, include the following:

- **Construction of New Hatchery Facilities with Mitchell Act Funds.** Decisions regarding the scope of review in this EIS would not preclude the construction of new or expanded hatchery facilities in the Columbia River Basin. However, current and reasonably foreseeable appropriations under the Mitchell Act for hatchery production would preclude the option to construct new hatchery facilities in the project area (http://www.whitehouse.gov/omb/budget/Overview).

- **Fish Screens and Fishways.** The Mitchell Act Screens and Fishways Program is a separate program with separate congressionally appropriated funding.

- **Habitat Restoration.** While Congress clearly has the discretion to direct Mitchell Act funds toward habitat restoration, it has not done so. Congress consistently and specifically has directed funds to hatchery production (and related monitoring, evaluation, and reform) and to screens and fishways. This EIS is directed at the use of the funds Congress specifically directs towards hatcheries. Through 2014, NMFS has funded habitat restoration through the Pacific Coastal Salmon Recovery Fund, created by Congress in 2000, to address the need to protect, restore, and conserve salmon, steelhead, and their habitat.

- **Hatchery Practices that Increase Adverse Effects.** While not all salmon ESUs or steelhead DPSs in the Columbia River Basin are listed under ESA, there is at least one salmon or steelhead population that is a member of a listed ESU or DPS in each of the major subbasins within the project area. Hatchery practices have been identified as a factor for the decline of most listed salmon and steelhead. Because of these factors, the purpose and need for this action is to establish a policy direction that, among other things, includes information on the effects of alternative hatchery performance goals on natural-origin fish. Implementation of hatchery practices that would likely increase risks to listed species, when compared to existing practices, are not considered in this final EIS.

It is not the purpose of this EIS to determine whether specific actions or hatchery programs meet ESA requirements. These ESA decisions will be made in separate processes consistent with applicable regulations as required by ESA.

## Alternatives Analyzed in Detail

In general, the alternatives analyzed in the EIS are designed to reduce or minimize the adverse effects or increase the benefits of hatchery operations on natural-origin salmon and steelhead populations. Hatchery operators will continue to pursue not only the conservation or harvest goals that currently apply to each hatchery program, but also different or additional conservation and harvest goals NMFS anticipates that the resource effects analyzed in this EIS will be informative for policy decisions for approximately 10 years.

The alternatives are varying applications of two hatchery performance goals, *intermediate* and *stronger*. These goals are relative to baseline conditions, e.g., *stronger than baseline*.

### What are Hatchery Performance Goals?

The EIS uses the terms *stronger performance goal* (i.e., stronger than baseline conditions) and *intermediate performance goal* (i.e., a level between baseline conditions and stronger performance) to indicate different levels of effects reduction or benefits that hatchery programs can have on natural-origin populations of salmon and steelhead. This EIS avoids terms that may be found in an ESA-related analysis, such as *jeopardy*, *recovery*, or similar concepts. These performance goals are not intended to infer compliance with any legal standard, nor are they intended to be analogous to ESA terminology or threshold standards, but they are helpful in aggregating and describing the effect of multiple hatchery programs on natural-origin populations of salmon and steelhead.

Hatcheries operated using stronger performance goals would maintain or promote beneficial effects (benefits) and minimize adverse effects (risks) of hatchery programs on salmon and steelhead populations when compared to baseline conditions.

Hatcheries operated under intermediate performance goals would, in most cases, reduce the adverse effects (risks) of many hatchery programs on salmon and steelhead populations when compared to baseline conditions.

## Alternative 1 (No Action)

Under Alternative 1, there would not be a defined policy direction, and Columbia River Basin hatchery production would continue baseline conditions. Based on NMFS' observations, the following describe the baseline conditions:

- Hatchery operators (both Mitchell Act-funded and other) have made substantial improvements to both programs and facilities to reduce the impacts on ESA-listed and non-listed salmon and steelhead populations in the Columbia River Basin.
- Hatchery programs (both Mitchell Act-funded and other) are used primarily to contribute to harvest (Section 2.3.2, Purpose of Hatchery Programs), although some hatchery programs are designed to help conserve natural-origin salmon and steelhead populations.
- Many hatchery programs are used to meet mitigation agreements. Most mitigation occurs to reduce the effects from hydro development on the fisheries resource.
- Monitoring, evaluation, and reform (MER) activities occur, but they are not guided by a comprehensive basinwide plan. MER plans, where they occur, are usually developed at the individual program level.
- Adaptive management of hatchery programs occurs, but it is usually directed at the performance of the program, i.e., survival of juveniles to adult recruits, and it is not necessarily directed at risk reduction on natural populations.

- Best management practices (BMPs) for hatchery facilities are widely applied, but their application is not universal. In many cases, application is based on available funding and/or whether the BMP is a regulatory requirement.
- The amount of Mitchell Act hatchery funding can vary annually (Table 1-3). Hatchery operators generally receive a consistent proportion of the total funding each year.

## Alternative 2 (No Mitchell Act Funding)

Under Alternative 2, the policy direction would be defined by the following goals and/or principles:

- All Mitchell Act-funded hatchery programs and facilities would be closed.
- The intermediate performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to the remaining non-Mitchell Act-funded hatchery programs that affect primary and contributing salmon and steelhead populations. Application of the intermediate performance goal would, in most cases, reduce the risks of hatchery programs on natural-origin salmon and steelhead populations.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.
- Production levels would be reduced from levels under Alternative 1 in hatchery programs designed to meet mitigation requirements only when those production levels conflicted with the ability of a hatchery program to meet performance goals.
- Conservation hatchery programs would be operated at a level determined by conservation need. Benefits of the conservation hatchery program must outweigh the risks (Section 3.2.3.1, General Risks and Benefits of Hatchery Programs to Salmon and Steelhead Species).
- Many hatchery programs are used to meet mitigation agreements. These programs would be aligned with the performance goals for the alternative.
- No new hatchery programs would be initiated.
- Monitoring, evaluation, and reform would be guided by a comprehensive basinwide plan.
- Adaptive management planning related to risk reduction would be required for all programs that affect ESA-listed primary and contributing populations.
- BMPs for facilities would be applied to all remaining hatchery facilities.
- Mitchell Act hatchery funding would be eliminated.

## Alternative 3 (All Hatchery Programs Meet Intermediate Performance Goal)

Under Alternative 3, the policy direction would be defined by the following goals and/or principles:

- The intermediate performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations. Application of the intermediate performance goal would, in most cases, reduce the risks of hatchery programs on natural-origin salmon and steelhead populations.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.
- Conservation hatchery programs would be operated at a level determined by conservation need. Benefits of the conservation hatchery program must outweigh the risks (Section 3.2.3.1, General Risks and Benefits of Hatchery Programs to Salmon and Steelhead Species).
- Many hatchery programs are used to meet mitigation agreements. These programs would be aligned with the performance goals for the alternative.
- No new hatchery programs would be initiated.
- Monitoring, evaluation, and reform would be guided by a comprehensive basinwide plan.
- Adaptive management planning related to risk reduction would be required for all programs that affect ESA-listed primary and contributing populations.
- BMPs for facilities would be applied to all hatchery facilities.
- Adaptive management planning related to risk reduction would be required for all programs that affect ESA-listed primary and contributing populations.
- Mitchell Act funds would be disbursed in support of the above goals and/or principles.

## Alternative 4 (Willamette/Lower Columbia River Hatchery Programs Meet Stronger Performance Goal)

Under Alternative 4, the policy direction would be defined by the following goals and/or principles:

- The intermediate performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain. Application of the intermediate performance goal would, in most cases, reduce the risks of hatchery programs on natural-origin salmon and steelhead populations.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.

- The stronger performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain. Application of the stronger performance goal would minimize the risks of hatchery programs on natural-origin salmon and steelhead populations more than the intermediate performance goal.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.
- Production levels would be reduced from levels under Alternative 1 in hatchery programs designed to meet mitigation requirements only when those production levels conflicted with the ability of a hatchery program to meet performance goals.
- Conservation hatchery programs would be operated at a level determined by conservation need. Benefits of the conservation hatchery program must outweigh the risks (Section 3.2.3.1, General Risks and Benefits of Hatchery Programs to Salmon and Steelhead Species).
- BMPs for facilities would be applied in all hatchery facilities.
- Many hatchery programs are used to meet mitigation agreements. These programs would be aligned with the performance goals for the alternative.
- New conservation hatchery programs could be initiated in the Willamette/Lower Columbia Recovery Domain for populations deemed at high risk of extinction.
- New harvest hatchery programs could be initiated, and/or existing hatchery programs would be changed to better support harvest opportunities below Bonneville Dam, including ocean fisheries.
- Monitoring, evaluation, and reform would be guided by a comprehensive basinwide plan.
- Adaptive management planning related to risk reduction would be required for all programs that affect primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain.
- Mitchell Act funds would be disbursed in support of the above goals and/or principles.

## Alternative 5 (Interior Columbia River Hatchery Programs Meet Stronger Performance Goal)

Under Alternative 5, the policy direction would be defined by the following goals and/or principles:

- The intermediate performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain. Application of the intermediate performance goals would, in most cases, reduce the risks of hatchery programs on natural-origin salmon and steelhead populations.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.

- The stronger performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations in the Interior Columbia Recovery Domain. These stronger performance goals would minimize the risks of hatchery programs on natural-origin salmon and steelhead populations more than the intermediate performance goal.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.
- Conservation hatchery programs would be operated at a level determined by conservation need. Benefits of the conservation hatchery program must outweigh the risks (Section 3.2.3.1, General Risks and Benefits of Hatchery Programs to Salmon and Steelhead Species).
- Many hatchery programs are used to meet mitigation agreements. These programs would be aligned with the performance goals for the alternative.
- BMPs for facilities would be applied in all hatchery programs.
- New conservation hatchery programs could be initiated in the Interior Columbia Recovery Domain for populations deemed at high risk of extinction.
- New harvest hatchery programs may be initiated, and/or existing hatchery programs would be changed to better support harvest opportunities above Bonneville Dam, including treaty Indian commercial fisheries.
- Monitoring, evaluation, and reform would be guided by a comprehensive basinwide plan.
- Adaptive management planning related to risk reduction would be required for all programs that affect primary and contributing salmon and steelhead populations in the Willamette/Lower Columbia Recovery Domain.
- Mitchell Act funds would be disbursed in support of the above goals and/or principles.

## Alternative 6 (Preferred Alternative - All Hatchery Programs Meet Stronger Performance Goal)

Under Alternative 6, the policy direction would be defined by the following goals and/or principles:

- The stronger performance goal (Section 2.4.2.1, Performance Goals Defined) would be applied to all Columbia River Basin hatchery programs that affect primary and contributing salmon and steelhead populations. These stronger performance goals would minimize the risks of hatchery programs on natural-origin salmon and steelhead populations.
  - Integrated hatchery programs would be better integrated than under Alternative 1.
  - Isolated hatchery programs would be better isolated than under Alternative 1.
- Conservation hatchery programs would be operated at a level determined by conservation need. Benefits of conservation hatchery programs must outweigh their risks (Section 3.2.3.1, General Risks and Benefits of Hatchery Programs to Salmon and Steelhead Species).

- Many hatchery programs are used to meet mitigation agreements. These programs would be aligned with the performance goals for the alternative.
- BMPs for facilities would be applied to all hatchery facilities.
- New programs (for conservation, harvest, or both purposes) could be initiated throughout the Columbia River Basin, where appropriate.
- Monitoring, evaluation, and reform would continue to occur. NMFS would continue to work with hatchery operators, basinwide, to develop priorities and strategies for monitoring, evaluation, and reform.
- Adaptive management planning, related to risk reduction, would be required for all programs that affect ESA-listed primary and contributing salmon and steelhead populations in the Columbia River Basin.
- Mitchell Act funds would be disbursed in support of the above goals and/or principles.

Table S-2 summarizes hatchery performance goals for each alternative. Information in the table covers the Willamette/Lower Columbia Recovery Domain and the Interior Columbia Recovery Domain.

**Table S-2. Hatchery Performance Goals Identified for Each Alternative's Policy Direction.**

| Recovery Domain | Population Type* | - - Hatchery Performance Goals by Alternative - - | | | | | |
|---|---|---|---|---|---|---|---|
| | | Alternative 1 | Alternative 2** | Alternative 3 | Alternative 4 | Alternative 5 | Alternative 6 (Preferred Alternative) |
| **Willamette/ Lower Columbia** | Primary | Baseline conditions | Intermediate | Intermediate | Stronger | Intermediate | Stronger |
| | Contributing | Baseline conditions | Intermediate | Intermediate | Stronger | Intermediate | Stronger |
| | Stabilizing | Baseline conditions | Intermediate | Baseline conditions | Baseline conditions | Baseline conditions | Baseline Conditions |
| **Interior Columbia** | Primary | Baseline conditions | Intermediate | Intermediate | Intermediate | Stronger | Stronger |
| | Contributing | Baseline conditions | Intermediate | Intermediate | Intermediate | Stronger | Stronger |
| | Stabilizing | Baseline conditions | Intermediate | Baseline conditions | Baseline conditions | Baseline conditions | Baseline Conditions |

* Each population's role in recovery was designated as primary, contributing, or stabilizing. These designations were used by the Lower Columbia River Fish Recovery Board (LCFRB) in the development of the Lower Columbia Fish Recovery Plan (LCFRB 2004). The Hatchery Scientific Review Group (HSRG) adapted these designations throughout the basin after discussions with the hatchery operators, and they are applied in this EIS (Appendix C through Appendix F). Not all recovery plans for salmon and steelhead utilize this same hierarchical structure to identify recovery goals for listed populations.

** Under Alternative 2, Mitchell Act hatchery funding is assumed to be eliminated. The remaining non-Mitchell Act hatchery programs would be managed to meet the intermediate performance goal.

## Summary of Resource Effects

The policy directions that are associated with each of the action alternatives (Section 2.5, Alternatives Analyzed in Detail) are goal-oriented and do not identify specific actions that would be taken under each alternative. This is because the National Marine Fisheries Service (NMFS) understands that specific hatchery actions should be determined on a hatchery-program-by-hatchery-program basis. To analyze, illustrate, and compare the potential environmental effects of each alternative, however, an implementation scenario was developed for the policy direction under each alternative. Each implementation scenario is one example of how each hatchery program could be operated to meet the policy direction of the alternative.

Table S-3 summarizes predicted effects from application of implementations scenarios for the No-action Alternative (Alternative 1) and action alternatives (Alternative 2 through Alternative 6). The summary reflects the detailed resource discussions in Chapter 4, Environmental Consequences.

**Table S-3. Summary of Environmental Consequences for Each Alternative's Implementation Scenario by Resource.**

| Resource | Indicator | Alternative 1 (No Action) | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 | Alternative 6 (Preferred Alternative) |
|---|---|---|---|---|---|---|---|
| **Fish** | **VSP Indicator**[1]: Increase in estimated natural-origin spawner abundance (all ESUs/DPSs) | 342,772 (baseline total estimated abundance) | Increase of 15% compared to Alternative 1 | Increase of 11% compared to Alternative 1 | Increase of 11% compared to Alternative 1 | Increase of 10% compared to Alternative 1 | Increase of 7% compared to Alternative 1 |
| | **VSP Indicator**[1]: Increase in ESU/DPS estimated mean adjusted productivity | Estimated baseline productivity for the 17 existing ESUs/DPSs | 15 of the 17 ESUs/DPSs with increased productivity compared to Alternative 1 | 15 of the 17 ESUs/DPSs with increased productivity compared to Alternative 1 | 15 of the 17 ESUs/DPSs with increased productivity compared to Alternative 1 | 15 of the 17 ESUs/DPSs with increased productivity compared to Alternative 1 | 11 of the 17 ESUs/DPSs with increased productivity compared to Alternative 1 |
| | **VSP Indicator**[1]: Estimated increase of primary[2] and contributing[2] salmon and steelhead populations with stronger performance for genetic diversity | Estimated baseline number of populations meeting stronger performance | Increase of 48% compared to Alternative 1 | Increase of 26% compared to Alternative 1 | Increase of 35% compared to Alternative 1 | Increase of 37% compared to Alternative 1 | Increase of 13% compared to Alternative 1 |

**Table S-3. Summary of Environmental Consequences for Each Alternative's Implementation Scenario by Resource (continued).**

| Resource | Indicator | Alternative 1 (No Action) | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 | Alternative 6 (Preferred Alternative) |
|---|---|---|---|---|---|---|---|
| **Socio-economics** | Commercial gross ex-vessel value (2009 U.S. dollars [$]) in the Columbia River Basin | $5,591,040 ex-vessel value | Ex-vessel value reduction of 51% compared to Alternative 1 | Ex-vessel value reduction of 12% compared to Alternative 1 | Ex-vessel value reduction of 5% compared to Alternative 1 | Ex-vessel value reduction of 3% compared to Alternative 1 | Ex-vessel value increase of 14% compared to Alternative 1[3] |
| | Total (direct and secondary) economic benefit to income (2009 U.S. dollars [$]) in the Columbia River Basin | $173,564,549 total personal income | Reduction in total income benefit of 33% compared to Alternative 1 | Reduction in total income benefit of 7% compared to Alternative 1 | Reduction in total income benefit of 4% compared to Alternative 1 | Same as Alternative 1 | Increase in total income benefit of 8% compared to Alternative 1 |
| | Total (direct and secondary) economic impacts on jobs in the Columbia River Basin | 4,503 jobs | 32% reduction in jobs compared to Alternative 1 | 8% reduction in jobs compared to Alternative 1 | 5% reduction in jobs compared to Alternative 1 | Less than 1% reduction in jobs compared to Alternative 1 | 7% increase in jobs compared to Alternative 1 |
| | Recreational expenditures (2009 U.S. dollars [$]) in the Columbia River Basin | $125,136,636 in recreational expenditures | 31% reduction in recreational expenditures compared to Alternative 1 | 10% reduction in recreational expenditures compared to Alternative 1 | 8% reduction in recreational expenditures compared to Alternative 1 | 3% reduction in recreational expenditures compared to Alternative 1 | 3% increase in recreational expenditures compared to Alternative 1 |
| **Environmental Justice** | Total tribal fish harvests (commercial, ceremonial, and subsistence) by number of fish in the Columbia River Basin | 216,800 fish harvested | 42% reduction in fish harvests compared to Alternative 1 | 11% reduction in fish harvests compared to Alternative 1 | 10% reduction in fish harvests compared to Alternative 1 | 5% reduction in fish harvests compared to Alternative 1 | 3% increase in fish harvests compared to Alternative 1[4] |
| | Tribal fishing revenue in the Columbia River Basin (2009 U.S. dollars [$]) | $2,952,345 tribal fishing revenue | 44% decrease in tribal fishing revenue compared to Alternative 1 | 10% decrease in tribal fishing revenue compared to Alternative 1 | 9% decrease in tribal fishing revenue compared to Alternative 1 | 6% increase in tribal fishing revenue compared to Alternative 1 | 18% increase in tribal fishing revenue compared to Alternative 1[3] |
| **Wildlife** | Caspian terns and bald eagles | Populations likely to increase | Potential reductions in abundance, distribution, and fitness relative to Alternative 1 | Same as Alternative 2 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |

**Table S-3. Summary of Environmental Consequences for Each Alternative's Implementation Scenario by Resource (continued).**

| Resource | Indicator | Alternative 1 (No Action) | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 | Alternative 6 (Preferred Alternative) |
|---|---|---|---|---|---|---|---|
| **Wildlife (continued)** | Southern Resident killer whale (listed) | 80 individuals are currently in Southern Resident stock; populations would continue to fluctuate | Potential reductions in abundance relative to Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| | California sea lions | Populations likely increasing | Abundance in Columbia River would probably decline relative to Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| | Steller sea lions (Eastern) | Populations likely increasing | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 | Same as Alternative 1 |
| **Water Quality and Quantity** | NPDES permit compliance and water use | NPDES permits and changes in water quality | Continued compliance with NPDES permits | Continued compliance, potential improvements in water quality, and reduction in water use | Same as Alternative 2 | Same as Alternative 2 | Same as Alternative 2 |
| **Human Health** | Hatchery chemical safety and use | Continued chemical and antibiotic use consistent with Federal and state guidelines; potential pathogen exposure | Potential decrease in use of chemicals and antibiotics; no change in exposure to pathogens | Same as Alternative 2 | Same as Alternative 2 | Same as Alternative 2 | Same as Alternative 2 |

[1] Viable Salmonid Population (VSP), based on McElhany (2000), is a conceptual framework for evaluation of the viability of salmonid populations based on four measurable indicators of population health: abundance, productivity, diversity, and spatial structure (See Section 3.2.3.1.1, Effects on the Viable Salmonid Population Concept). The EIS only summarizes effects on abundance, productivity, and diversity here. See Section 4.2.2.1, Methods for Determining Effects on VSP for Salmon and Steelhead, for more information.

[2] "Primary" and "contributing" populations are terms that were used by LCFRB in the development of the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan (LCFRB 2004), adapted throughout the basin by HSRG (2009) after discussions with the Columbia River fish managers. They are applied in this final EIS (Section 2.4, Alternative Development). Not all recovery plans for salmon and steelhead utilize this same hierarchical structure to identifying recovery goals for listed populations.

[3] Changes in commercial gross ex-vessel value result from a combination of modifications in the total number of fish harvested and variations in the composition of the fish harvest, based on alterations in the hatchery production in the alternative implementation scenario.

[4] Increase in total tribal fish harvested results from changes to hatchery program production numbers and the composition of the species and run-type released, i.e., a higher proportion of upriver bright (URB) Chinook salmon than tule Chinook salmon. These changes can result in more of these fish available for harvest under the EIS harvest rate assumptions.

# SUMMARY OF CHANGES FROM DRAFT EIS TO FINAL EIS

This final EIS incorporates many updates to the information presented in the draft EIS, as well as revisions to the document based on comments submitted during the public review period and the inclusion of an additional alternative, Alternative 6, the preferred alternative. Below is a summary of changes made to the document.

**General Changes that Apply to all Final EIS Chapters**

1) **Terminology.** The terminology used in the final EIS is updated for consistency throughout the document (e.g., isolated hatcheries replace segregated hatcheries). Changes in terminology used for the final EIS are described in the Glossary of Key Terms.

2) **Alternative 6.** A new alternative (Alternative 6) is added to the final EIS, which is described in Chapter 2, Alternatives, and analyzed for all resources in Chapter 4, Environmental Effects. Alternative 6 is developed based on NMFS' response to public comments, and it includes goals and principles that also occur in the other four action alternatives.

3) **Hatchery Production Levels.** The final EIS is updated to reflect hatchery production levels from 2010 (The draft EIS used 2007 production levels). These production levels are shown in Chapter 2, Alternatives; in alternative comparison tables in Chapter 4, Environmental Effects; and in the species-specific appendices (Appendix C through Appendix F).

4) **Response to draft EIS Comments.** Additional information and/or corrections are made in this final EIS to respond to draft EIS public comments. Comments and NMFS' responses to comments are provided in a new appendix (Appendix L).

5) **Information Sources and Uniform Reference Locators (URLs).** Where references that are more current are available, rather than those used in the draft EIS, the current references are used for the final EIS. The URLs for references in the EIS are also updated as needed. URLs are the global addresses of documents and other resources on the World Wide Web.

6) **Grammatical, Numerical, and Editing Changes.** Grammatical, numerical, and editing errors are corrected where observed.

7) **Change from draft EIS to final EIS.** Where applicable, language pertinent to the draft EIS is revised to represent the final EIS.

8) **Table Numbers.** New tables are added to the final EIS. This results in an update to many of the table numbers from that shown in the draft EIS.

**Chapter 1**

1) **New Information.** Additional historical and background information regarding the Mitchell Act and associated funding is added or updated in the final EIS to improve project understanding. Additional detailed information is provided on Mitchell Act hatchery programs.

2) **Table Revisions.** Draft EIS tables are updated to reflect the updated baseline information and other additional current information.

3) **Purpose and Need.** The purpose and need for the EIS are updated to better reflect how NMFS will use the information analyzed and reviewed herein for future decision-making related to Mitchell Act hatchery funding.

4) **Mitchell Act Hatchery Production.** The Mitchell Act Artificial Production Program description is revised to provide a clearer understanding of the program applications.

5) **Relationship of the EIS to ESA.** Chapter 1 provides further clarification of how NEPA and the analysis in the final EIS relates to ESA and future actions NMFS may take relative to proposed hatchery actions under ESA sections 10, 7, and 4(d).

6) **Non-Mitchell Act-funded Programs.** Further clarification is provided describing the relationship between NMFS and non-Mitchell Act hatchery operators.

7) **Updates on Hatchery Programs.** The hatchery programs and primary hatchery facilities are updated to include the primary facility, program name, program purpose, and funding source.

8) **Draft EIS Public Comment Period.** The date of the draft EIS publication and associated public comment period is added to Chapter 1.

9) **Applicable Plans, Policies, Regulations, Agreements, Laws, and Executive Orders.** This section is revised, based on public comment, to update existing information and include additional background information where needed. Additional applicable plans, policies, regulations, agreements, laws and policies added to this section are as follows:

    - Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments)
    - Columbia Basin Fish Accords
    - Lower Snake River Compensation Plan
    - John Day Mitigation
    - Salmon and Steelhead Recovery Plan

The Washington State's Wildlife Salmonid Policy section (draft EIS) is updated and revised to reflect the current policy entitled "Washington State's Hatchery and Fishery Reform Policy."

**Chapter 2**

1) **Columbia River Hatchery Programs.** Information on the hatchery programs evaluated in this EIS has been updated and corrected (e.g., number and relative location of hatchery and operational strategies are provided).

2) **Other Factors Affecting Salmon and Steelhead Populations. Harvest, Habitat, and Hydro—the other H's.** Other factors that affect listed salmon in addition to hatchery programs are summarized, along with NMFS' actions to address these factors.

3) **Hatchery Operations.** Additional information is added to the final EIS in recognition that flexibility in NMFS policy is needed for hatchery program operations due to long-term hatchery investments of time, effort, and resources, as well as the site-specific conditions that each hatchery program operates in.

4) **Geographic Scope.** Additional text is provided describing the need for a broad geographic scope of analysis to fully inform NMFS for future hatchery funding actions.

5) **Performance Goals.** The reasoning guiding the need for performance goals for all hatcheries in the Columbia River Basin is provided, along with further clarification and description of the different performance goals (i.e., stronger and intermediate performance goals). The definitions for stronger and intermediate metrics are revised, based on public comment, compared to the definitions presented in the draft EIS.

6) **All Alternatives.** Chapter 2, Alternatives, contains detailed information that describes each of the alternatives analyzed in detail.

7) **New Alternative.** A new alternative (Alternative 6) is added to this chapter. Performance goals are provided for this alternative, along with a detailed description of the associated goals and principles.

8) **Preferred Alternative.** The preferred alternative is identified and described. The draft EIS did not propose a preferred alternative for consideration. Instead, the draft EIS stated that NMFS "will formulate and identify a preferred policy direction [alternative], informed by public comment on the draft EIS, in the final EIS. The preferred policy direction could be one of the alternative policy directions considered in the draft EIS, or it could consist of a combination or blend of the alternative policy direction evaluated in the draft EIS."

9) **Alternatives Not Analyzed in Detail.** Three additional alternatives that are not further evaluated in the EIS are described. Where needed, further description of other alternatives not analyzed in detail is provided.

## Resource Analyses in Chapter 3 and Chapter 4

### Chapter 4 Introduction

1) **Implementation Scenarios.** The alternative implementation scenarios provided in Chapter 2 of the draft EIS are moved to this section. New text added, informed by public comment, explains that the implementation scenarios are intended to represent generalized examples of how each alternative's policy goal could be implemented. This section further clarifies that the programs developed under each alternative's implementation scenarios should not be viewed as necessarily consistent with application of ESA since ESA determinations are made during program-specific consultations, which are external to the NEPA process. The implementation scenario for Alternative 6 is also added to this section.

2) **Implementation Measures.** Further clarification is provided stating that NMFS applies these measures within the implementation scenarios to illustrate and disclose the potential effects of applying each alternative's policy direction.

3) **Performance Metrics.** Performance metrics used in the implementation scenarios are further described in this section. The difference between a hatchery performance goal and a performance metric is also described.

4) **Hatchery Practices.** Updates include recognition that hatchery operators use unique approaches to maximize benefits and minimize risks to natural-origin fish.

5) **All-H Analyzer.** More information is provided about the model, reasons for using it for the EIS analysis, and how readers should consider the information produced from the model.

6) **Watersheds and Hatchery Programs.** The table showing Columbia River subbasins or major watersheds where hatchery fish are assumed to not be released, based on each alternative's implementation scenario is revised to reflect the watersheds associated with hatchery programs within each alternative.

7) **New Weirs.** The number of new weirs associated with each alternative implementation scenario is updated for Alternative 3, Alternative 4, and Alternative 5 based on the updated baseline information. Box 4-3 on weirs is corrected to reflect that a permanent weir would be operated with a trapping efficiency needed to achieve the necessary performance goal, but not greater than 95 percent effective.

8) **Populations meeting Performance Metrics.** The number of populations that would meet performance metrics is revised for each alternative to reflect the hatchery programs that are analyzed for each alternative.

9) **Terminated Hatchery Programs.** Hatchery programs assumed to be terminated under the Alternative 6 implementation scenario are added to this section, as well as updated lists of programs assumed to be terminated under Alternative 2 through Alternative 5.

10) **New Hatchery Programs.** The new hatchery programs assumed to be initiated under one or more alternative implementation scenarios are updated for this section.

**Fish**

**Chapter 3**

1) **Implementation Scenarios.** Additional information is added, based on public comments, explaining the need for implementation scenarios in order to inform and disclose the potential effects of the action alternatives.

2) **VSP.** The use and value of the VSP concept (see Notes, Table S-3) are described as indicators of salmon population health. The VSP parameter includes abundance, productivity, diversity, and spatial structure. Each of these indicators is described in this section. Additional references are provided as appropriate.

3) **Risks from Disease Transfer.** Recent information on disease outbreaks that have occurred in coastal Washington steelhead hatcheries is provided.

4) **Listed Fish Species.** The Federal and state listing status for fish reviewed in this section is updated.

5) **Lower Columbia River Chinook Salmon ESU.** The current status and trends for this species are updated.

6) **Mid-Columbia River Spring-run Chinook Salmon ESU.** Added to this section is the effort to reintroduce spring-run Chinook salmon into the Walla Walla and Umatilla Basins.

7) **Upper Columbia River Spring-run Chinook Salmon ESU.** The current status and trends for this species are updated.

8) **Upper Willamette River Chinook Salmon ESU.** The current status and trends for this species are updated.

9) **Snake River Spring/Summer-run Chinook Salmon ESU.** More information is provided on the populations at risk.

10) **Snake River Fall-run Chinook Salmon ESU.** The current status and trends for this species are updated.

11) **Lower Columbia River Steelhead DPS.** The current status and trends for this species are updated.

12) **Middle Columbia River Steelhead DPS.** Additional information on the effects of the Pelton Round Butte hydro-complex on this species is added.

13) **Snake River Basin Steelhead DPS.** The current status and trends for this species are updated.

14) **Upper Columbia River Steelhead DPS.** Information on historical releases of hatchery-origin steelhead is revised, along with updates to the current status and trends for this species.

15) **Columbia River Cum Salmon ESU.** The current status and trends for this species are updated.

16) **Snake River Sockeye Salmon ESU.** The current status and trends for this species are updated.

17) **Other Fish Species.** More description is provided that describes the other fish species selected for review in the EIS.

18) **Eulachon.** NMFS' designation of critical habitat for this species is added to this section.

19) **Green Sturgeon.** Additional information on fisheries bycatch of green sturgeon is added to this section.

20) **Nonindigenous Fish Species.** This is a new section added to the final EIS.

**Chapter 4**

1) **All-H Analyzer.** Information is provided about the model, reasons for using it for the EIS analysis, and how readers should consider the information produced from the model.

2) **BMPs for Hatchery Facility Effects.** The reader is referred to tables where the BMPs are located in the final EIS.

3) **Genetic Diversity.** The methods used to describe genetic diversity are provided.

4) **Effects on VSP Parameters.** Additional information is provided for the salmon and steelhead abundance and productivity VSP parameters.

5) **Populations Meeting Performance Metrics.** All tables describing the number of populations that meet stronger, intermediate, and/or weaker performance goals by alternative are revised based on the hatchery programs evaluated by alternative and modified definitions in the final EIS for stronger and intermediate performance metrics. The text associated with these tables is modified to reflect the table changes.

6) **New Weirs.** The number of new weirs associated with each alternative is revised, along with weir effectiveness estimates for achieving performance metrics.

7) **Other Fish Species.** A description of how the alternative analysis is conducted for other fish species is provided.

8) **Eulachon.** Additional information is provided on this species' known distribution.

9) **Nonindigenous Fish Species.** An environmental effects analysis is provided for nonindigenous fish species that are added to Chapter 3 of the final EIS.

10) **Alternative 6.** Effects on fisheries from the implementation scenario under Alternative 6 are described.

11) **Hatchery Production.** All tables and text that rely on hatchery production numbers are revised based on updated hatchery production numbers developed for this final EIS.

**Socioeconomics**

**Chapter 3**

1) **Hatchery Production.** All tables and text that rely on hatchery production numbers, costs, and revenues are revised based on updated hatchery production numbers developed for this final EIS and updated costs.

2) **Historical Overview.** The source of background information for the final EIS is added to this section, which includes comments received during review of the draft EIS.

3) **Commercial Harvest and Economic Value.** Additional information on the location of commercial fisheries for tribes and other users is provided. The catch of salmon and steelhead is further described to better understand differences in catch by species.

**Chapter 4**

1) **Hatchery Smolt Production by Funding Source.** This section states that assignment of hatchery smolt production to either Mitchell Act-funded hatchery programs or to other hatchery program funding is estimated for alternative comparison purposes only.

2) **Alternative Comparisons.** Although the text for this section has numerous changes, they are primarily from quantitative catch and monetary variations based on modifications in hatchery production, more recent available data, and updated costs.

3) **Alternative 6.** Effects on socioeconomic conditions from the implementation scenario under Alternative 6 are described.

**Environmental Justice**

**Chapter 3**

1) **Fishing Communities.** Additional reference information is provided on how communities are selected for analysis as environmental justice communities.

2) **Demographic Data.** References are updated for methods used to determine recreational anglers, environmental justice thresholds, and minority and low-income groups. Based on these updated references, which include data from the 2010 census, the table that identifies environmental justice communities of concern is revised.

3) **Nez Perce Tribe.** Updated and corrected information, based on public comment, is provided for this tribe.

4) **Coastal Tribes.** Information is provided on fishing use of the project area by coastal tribes, including their fishing rights.

5) **Importance of Salmon to Tribes.** Additional information is provided in this section that describes the importance of salmon to tribes, as well as how tribes historically and currently use and value salmon within their culture.

6) **Ceremonial and Subsistence Harvests.** Additional information is provided that describes how tribes use salmon for ceremonial use and subsistence. Additionally, the extent of information available quantifying both the tribes' use by salmon species and the relative locations where tribes catch these fish on the Columbia and Snake Rivers is provided.

7) **Tribal Revenues and Hatchery Production.** Tribal revenues and hatchery production by tribes are updated based on most recent available information.

8) **Descriptions of Environmental Justice Groups.** The text for each of the user groups and communities of concern is updated to reflect information obtained from the 2010 census.

9) **Public Outreach.** This section is updated from the draft EIS.

**Chapter 4**

1) **Hatchery Production.** All tables and text that rely on hatchery production numbers, costs, and revenues are revised based on corrected hatchery production numbers and updated costs.

2) **Fish Harvests and Tribal Values.** Methods to determine tribal fish harvest are further described. Information is provided stating that the economic effects described in this section do not account for the additional social and cultural effects on the tribal way of life and culture.

3) **Ceremonial and Subsistence Harvests.** The additional ceremonial and subsistence harvest information provided in Chapter 3 for environmental justice is further evaluated by alternative in this revised section.

4) **Tribal Salmon Fishing and Hatchery Program Revenue.** Additional information recognizes that spending on tribal hatchery programs provides an indirect source of income to tribal communities where hatcheries are located.

5) **Non-tribal Users of Concern.** Information is provided describing that the EIS analysis for environmental justice focuses primarily on those communities and tribal fishing areas at and north of Astoria, Oregon.

6) **Alternative 6.** Effects on environmental justice user groups and communities of concern from the implementation scenario under Alternative 6 are described.

**Wildlife**

**Chapter 3**

1) **Listed Wildlife Species.** The Federal and state listing status for wildlife is updated as needed.

2) **Southern Resident Killer Whale.** This section is revised to further describe the location and use of the project area by Southern Resident killer whales, as well as their most recent documented diet on a seasonal basis.

3) **Steller Sea Lion.** Updates to this section are based on most recent published information regarding Steller sea lion, including the ESA listing status, use of the project area, and its diet.

4) **Gulls, Terns, Cormorants, and Pelicans.** Additional information on gulls, terns, cormorants, and pelicans as predators of salmon and their use of the project area is provided.

5) **Hatchery Predator Control Programs and Weirs.** This section is revised to provide updated information on how hatchery predator control programs and weirs affect wildlife.

6) **California Sea Lion.** Updated information on the presence of California sea lions in the Columbia River and their consumption of salmon, particularly at Columbia River dams, is provided.

7) **Effects of Hatchery Facilities on Wildlife.** More detailed information is provided on the direct and indirect effects of hatchery facilities on wildlife.

8) **Salmon Carcass Benefits.** More detailed information is provided on the value of salmon carcasses for wildlife.

**Chapter 4**

1) **Salmon and Steelhead Abundance.** Estimated adult and smolt salmon and steelhead abundance is revised for each action alternative based on revised hatchery production numbers. This revision affects those wildlife species that prey on salmon. As a result, the description of the effects of implementation scenarios from the various alternatives for all wildlife species is revised based on the importance of salmon and steelhead in the diet of wildlife for each of the species and wildlife groups reviewed.

2) **Effects of Salmon Carcasses to Wildlife.** This section is revised for consistency with revised Section 3.5.6.5, Nutrients/Distribution of Salmon Carcasses.

3) **Southern Resident Killer Whale.** Based on the updated Southern Resident killer whale information provided under Section 3.5.3, ESA-listed Species, and revised hatchery production numbers, the effects of the alternatives on this species are revised.

4) **Steller Sea Lion.** Based on the updated Steller sea lion description provided under Section 3.5.5, Marine Mammals, and the revised hatchery production numbers, the effects of the alternatives on this species are revised.

5) **All Wildlife Species.** Further clarification is provided for all wildlife that may feed on salmon and steelhead as part of their varied and diverse diet, recognizing that effects on wildlife from changes in hatchery production under several alternatives may be difficult to differentiate from other sources of natural variability in their prey base.

6) **California Sea Lion.** Based on the updated California sea lion information under Section 3.5.5, Marine Mammals, and the revised hatchery production numbers, the effects of the alternatives on this species are revised.

7) **Alternative 6.** Effects on wildlife species from the implementation scenario under Alternative 6 are described.

**<u>Water Quality</u>**

**Chapter 3**

1) **Federal Regulations Applicable to Water Quality at Hatcheries.** Further clarification, based on public comment, is provided regarding the Federal regulatory requirements and permits necessary for hatchery facilities.

2) **State Water Quality Compliance for Hatcheries.** Water quality regulatory compliance requirements for hatcheries in Washington and Idaho are revised and updated as needed.

3) **Hatcheries and Pollutants.** The table identifying pollutants potentially associated with hatchery facilities is updated.

**Chapter 4**

1) **All Alternatives.** This section is updated, based on public comment, to recognize that reductions in pollutant discharge levels would likely occur over time under all alternatives, including the no-action alternative, when hatcheries are required to meet new or renewed National Pollutant Discharge Elimination System (NPDES) permits or total maximum daily load (TMDL) regulations.

2) **Periodic Effluent Exceedances.** Revisions to the text, based on public comment, indicate that periodic effluent water quality permit exceedances may occur on a temporary basis, but would continue to be reported to the appropriate permitting agency.

3) **Permit Status.** Based on public comment, revised language recognizes that some permits (i.e., NPDES permits) still in effect may not reflect current water quality conditions and available technologies, since these conditions change over time.

4) **Alternative 6.** Effects on water quality from the implementation scenario under Alternative 6 are described.

**Human Health**

**Chapter 3**

1) **Chemical Properties.** Based on updated information, the table describing properties of chemicals commonly used at hatchery facilities is updated.

2) **Contaminated Fish Feed.** Updated information regarding research on contaminated fish feed at U.S. Fish and Wildlife Service fish hatcheries is provided.

3) **NPDES Reporting Requirements.** Information is provided on NPDES requirements that hatcheries report whether painted and caulked surfaces may come into contact with process water.

**Chapter 4**

1) **All Alternatives.** This section is updated to note that reductions in pollutant discharge levels would likely occur under all alternatives, including the no-action alternative, when hatcheries are required to meet new or renewed NPDES permits or TMDLs.

2) **Alternative 6.** Effects on human health from the implementation scenario under Alternative 6 are described.

**Chapter 5**

1) **Projects Identified as Potential Future Actions.** Each of these projects identified in the draft EIS is revised based on current known information.

2) **Tribal Fish Harvest and Tribal Hatchery Revenue.** This section is revised to recognize the potential for cumulative adverse tribal effects from climate change and future development.

**Other EIS Chapters and Sections**

1) **Glossary.** The glossary is updated to define new terms.

2) **Chapter 7, Distribution List.** This list is updated to reflect the mailing list for the final EIS.

3) **Chapter 8, List of Preparers.** This list is updated to reflect additional NMFS staff and contracted employees who helped prepare the final EIS.

4) **Chapter 9, Index.** An index is added to the final EIS.

**Appendices**

**Appendix A, Hatchery Programs and Facility Information**, is updated to reflect 2010 baseline hatchery production and natural-origin population effects.

**Appendix C through Appendix F, Species-specific Tables.** All tables are updated to reflect 2010 baseline conditions, reapplication of draft EIS alternatives, and the addition of Alternative 6, the preferred alternative.

**Appendix G, Overview of the All-H Analyzer**, is updated based on comments on the draft EIS.

**Draft EIS Appendix I, Socioeconomics Report by the Research Group.** This appendix is removed from the final EIS and is used as a reference where needed.

**Final EIS Appendix I, The Recovery Implementation Science Team**, Hatchery Reform Science, 2009, is added, based on public comment, to give context to some of the methods and principles associated with application of the implementation measures, metrics, and models used in the EIS, relative to hatchery program operations.

**Appendix J, Socioeconomic Impact Methods**, is updated to reflect recent information available since the draft EIS was published and to incorporate information received during the public review period.

**Appendix K, Chinook and Coho Salmon Fishery Modeling Approach for Application to the Mitchell Act FEIS,** is updated to incorporate recent relevant changes in fisheries structure, based on comments received during the public review, as well as updates on managed fisheries in the Columbia River; marine areas of Washington, Oregon, and California; and marine fisheries in British Columbia, Canada, and Southeast Alaska.

**Draft EIS Appendix L, Supporting Demographic and Socioeconomic Data for the Analysis of Environmental Justice Impacts**, is removed from the final EIS. Relevant data from this appendix is updated and incorporated into the final EIS.

**Final EIS Appendix L, Responses to Public Comments**, is added to the final EIS. This appendix consists of public comments on the EIS and NMFS' responses to these comments.

# West Coast Region Report on Salmon Related Management Items

## Joint Workshop on California Coastal Chinook

A joint NMFS/CDFW workshop focused on future prospects for California coastal Chinook fishery management was held in Santa Rosa on September 3-4. The overarching goals of the workshop were to (1) identify a level of information necessary to allow for development of an abundance-based management approach, and (2) evaluate whether it would be feasible to collect that level of data in the CC-Chinook ESU. NMFS and CDFW scientists made ten presentations followed by extensive discussions related to the workshop goals. NMFS will provide a report on information considered and recommendations from the workshop and will provide a progress report to the Council at the November 2014 meeting.

## Puget Sound Draft EIS

NOAA Fisheries has released for public review a draft environmental impact statement (EIS) for two resource management plans that were submitted by the Washington Department of Fish and Wildlife and the Puget Sound Treaty Tribes. One resource management plan discusses hatchery programs that produce Chinook salmon. The other plan describes steelhead, coho, pink, chum, and sockeye hatchery programs. The draft EIS will be available for public comments through Thursday, October 23, 2014.

The resource management plans are the proposed frameworks through which the co-managers would jointly manage salmon and steelhead hatchery programs in Puget Sound while meeting conservation requirements specified under the Endangered Species Act (ESA). Individual hatchery and genetic management plans (HGMPs) for each of the hatchery programs are appended to the plans.

## Mitchell Act Final EIS

NOAA Fisheries has released a final environmental impact statement (EIS) to guide the annual funding of Mitchell Act hatchery programs in the Columbia River Basin. Under the Mitchell Act, funding is provided to produce salmon and steelhead for fishing and conservation.

The hatchery production of salmon and steelhead in the Columbia River provides benefits to the tribal and non-tribal commercial and recreational fishers in the basin itself and also contributes to ocean fisheries from Northern California to Southeast Alaska. The Mitchell Act, which was passed in 1938, supports roughly 45 percent of all of the hatchery production in the Columbia River. The final EIS evaluates the resource effects of implementing alternative hatchery management strategies, throughout the Columbia River Basin.

While this is a final EIS, NOAA Fisheries will review comments received by November 12, 2014, and consider them for their impact on issuance of a record of decision.

## Recreational Fisheries Coordinator

NOAA Fisheries WCR is pleased to announce that Craig Heberer has accepted the offer to serve as the new West Coast Region Recreational Fisheries Coordinator. Craig will continue to serve as co-chair of the HMSMT and as the lead biologist for the HMS FMP until the end of September when he will transition into the new position.

**The White House**

Office of the Press Secretary

For Immediate Release September 09, 2014

# President Obama Announces More Key Administration Posts

WASHINGTON, DC – Today, President Barack Obama announced his intent to nominate the following individuals to key Administration posts:

- **Michele Thoren Bond –** Assistant Secretary for Consular Affairs, Department of State
- **Michael Young** – Member, Federal Mine Safety and Health Review Commission

President Obama also announced his intent to appoint the following individuals to key Administration posts:

- **Donna L. Brazile** – Member, J. William Fulbright Foreign Scholarship Board
- **Maneesh K. Goyal –** Member, J. William Fulbright Foreign Scholarship Board
- **Dorothy M. Lowman –** United States Commissioner, Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean
- **Russell F. Smith III** – United States Commissioner, International Whaling Commission
- **G.P. "Bud" Peterson –** Member, National Science Board, National Science Foundation
- **Diane L. Souvaine –** Member, National Science Board, National Science Foundation
- **Virgil Trujillo** – Member, Board of Directors of the Valles Caldera Trust

**President Obama** said, "These men and women have demonstrated knowledge and dedication throughout their careers. I am grateful they have chosen to take on these important roles, and I look forward to working with them in the months and years to come."

**President Obama announced his intent to nominate the following individuals to key Administration posts:**

**Michele Thoren Bond, Nominee for Assistant Secretary for Consular Affairs, Department of State**

Michele Thoren Bond is the Principal Deputy Assistant Secretary in the Bureau of Consular Affairs at the Department of State (DOS), a position she has held since December 2012. Since April 2014, she has also served as Acting Assistant Secretary for Consular Affairs at DOS. From 2010 to 2012, she served as the Ambassador to the Kingdom of Lesotho and from 2007 to 2010, she served as Deputy Assistant Secretary for Overseas Citizens Services at DOS. From 2006 to 2007, Ms. Bond was the

Director of the Office of Policy Coordination and Public Affairs in the Bureau of Consular Affairs at DOS. From 2003 to 2006, she served as a Principal Officer at the U.S. Consulate General in Amsterdam, Netherlands, and she was Managing Director for Overseas Citizens Services at DOS from 2001 to 2003. From 1999 to 2001, Ms. Bond was the Director of Consular Training at the Foreign Service Institute. Since joining the Foreign Service in 1977, she has also served in Guatemala City, Guatemala; Belgrade, Serbia; Prague, Czech Republic; and Moscow, Russia. Ms. Bond received a B.A. from Wellesley College, an M.A. from Georgetown University School of Foreign Service, and an M.A. from the National War College.

**Michael Young, Nominee for Member, Federal Mine Safety and Health Review Commission**

Michael Young most recently served as a Member of the Federal Mine Safety and Health Review Commission (FMSHRC) from 2008 to 2014. He previously served as a Member of FMSHRC from 2003 to 2008. Prior to joining the Commission, he served as Director of Regulatory Affairs for the Pennsylvania Coal Association from 1997 to 2003. Previously, Mr. Young was a trial lawyer at the firm McElwee and McElwee from 1995 to 1997. From 1993 to 1995, he was a litigator for Buchanan Ingersoll, P.C. Mr. Young served in the United States Air Force in various public affairs officer roles from 1985 to 1990 and was a Legislative Assistant to Representative Nick Rahall from 1981 to 1982. Mr. Young received a B.S. from West Virginia University and a J.D. from Wake Forest University.

**President Obama announced his intent to appoint the following individuals to key Administration posts:**

**Donna L. Brazile, Appointee for Member, J. William Fulbright Foreign Scholarship Board**

Donna L. Brazile is the Founder and Managing Director of Brazile & Associates LLC. She is a Democratic political strategist, author, syndicated columnist, and an adjunct professor at Georgetown University. She is a regular political analyst and commentator on CNN, a consultant to ABC News, and has lectured at a number of colleges, including Harvard University and the University of Maryland. Ms. Brazile is also Vice Chair of Voter Registration and Participation at the Democratic National Committee. She was the Campaign Manager for Vice President Al Gore's presidential campaign in 2000. Ms. Brazile received a B.A. from Louisiana State University.

**Maneesh K. Goyal, Appointee for Member, J. William Fulbright Foreign Scholarship Board**

Maneesh K. Goyal is Founder and President of MKG, an event marketing agency he started in 2001. In 2013, he co-founded Live in the Grey, a resource and consultancy focused on workplace culture. From 1999 to 2001, he was a Program Officer at the Dyson Foundation, where he built a national program to train pediatricians. He serves on the U.S. Advisory Council for the American India Foundation. He previously served on the Boards of the Empire State Pride Agenda, LifeBeat, the South Asian American Forum, and the Stonewall Community Foundation. Mr. Goyal received a B.A. from Duke University and an M.P.H. from Yale University.

**Dorothy M. Lowman, Appointee for United States Commissioner, Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean**

Dorothy M. Lowman is the sole proprietor of Lowman and Associates, where she has served as a fishery consultant since 2000. She was appointed to the Pacific Fishery Management Council in 2009 and has served as its Chair since 2013. Previously, Ms. Lowman served as a Staff Economist for the Pacific and Western Pacific Fishery Management Councils and as a Special Advisor for the North Pacific Fishery Management Council. Ms. Lowman has also served on the Council's Trawl Individual Quota Committee and on the Marine Fisheries Advisory Committee at the Department of Commerce. She has also held positions at University of Washington Oceanography Department. Ms. Lowman received a B.S. and an M.S. from the University of Washington.

**Russell F. Smith III, Appointee for United States Commissioner, International Whaling Commission**

Russell F. Smith III is the Deputy Assistant Secretary for International Fisheries at the National Oceanic and Atmospheric Administration at the Department of Commerce (DOC), a position he has held since 2010. He concurrently serves as a United States Commissioner on the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Mr. Smith is also a United States Commissioner on the International Commission for the Conservation of Atlantic Tunas. Prior to his position at DOC, Mr. Smith held various positions in the Office of the United States Trade Representative between 2002 and 2010, including Director for International Environmental Policy and Multilateral Environmental Agreements and Director for the Free Trade Area of the Americas and the Caribbean. He was an attorney in the Environment and Natural Resources Division at the Department of Justice from 1995 to 2002. Prior to joining the government, Mr. Smith was an Associate at Spiegel & McDiarmid. Mr. Smith received a B.A. from Yale University and a J.D. from the University of Michigan Law School.

**Dr. G.P. "Bud" Peterson, Appointee for Member, National Science Board, National Science Foundation**

Dr. G.P. Peterson is currently the President of the Georgia Institute of Technology, where he also serves as a Professor of Mechanical Engineering, positions he has held since 2009. Prior to this, Dr. Peterson served from 2006 to 2009 as the Chancellor and Professor of Mechanical Engineering at the University of Colorado – Boulder. He worked at the Rensselaer Polytechnic Institute as Provost, Officer of the Institute, and Professor of Mechanical Engineering from 2000 to 2006. Dr. Peterson served in a variety of positions at Texas A&M University from 1981 to 2000, culminating in his role as the Associate Vice-Chancellor and Executive Associate Dean of Engineering from 1996 to 2000. He worked as a Research Scientist at NASA from 1981 to 1982. From 1979 to 1981, Dr. Peterson served as an Associate Professor and Department Head of General Engineering Technology at Kansas Technical Institute. From 1978 to 1979, he was a Mathematics teacher at Shawnee Mission South High School. From 1977 to 1978, he was a Mathematics, Physics, and Chemistry teacher at

Wabaunsee County High School. Dr. Peterson was an Associate Engineer for Black & Veatch Consulting Engineers in 1975. He was first appointed as a Member of the National Science Board in 2008. Dr. Peterson received two B.S.s and an M.S. from Kansas State University, and a Ph. D. from Texas A&M University.

**Dr. Diane L. Souvaine, Appointee for Member, National Science Board, National Science Foundation**

Dr. Diane L. Souvaine is currently Vice Provost for Research, Professor of Computer Science, and Adjunct Professor of Mathematics at Tufts University, positions she has held since 2012, 1999, and 2002, respectively. From 1986 to 2000, Dr. Souvaine served as an Assistant Professor and then Associate Professor within the Department of Computer Science at Rutgers University. From 1992 to 1994 she served in the directorate of the National Science Foundation Science and Technology Center for Discrete Mathematics and Theoretical Computer Science. Dr. Souvaine worked as a Research Assistant within the Department of Computer Science at Princeton University from 1985 to 1986. She served as a Member of the National Science Board from 2008 to 2014 and was elected Fellow of the Association for Computing Machinery in 2011. Dr. Souvaine received an A.B. from Harvard University, an A.M.L.S from Dartmouth College, and a M.A., M.S.E. and Ph.D. from Princeton University.

**Virgil Trujillo, Appointee for Member, Board of Directors of the Valles Caldera Trust**

Virgil Trujillo is a life-long resident of the Genizaro Pueblo, located in Abiquiu, New Mexico. He is a livestock producer and runs livestock on a number of properties, including the Santa Fe National Forest, Bureau of Land Management areas, and the Merced del Pueblo Abiquiu. Mr. Trujillo has also held various natural resource management positions. He was first appointed to the Board of Directors of the Valles Caldera Trust in 2009. Mr. Trujillo is a member of the Santo Tomas El Apostol Parish, Merced del Pueblo Abiquiu, Northern New Mexico Livestock Association, Quivira Coalition, and New Mexico Cattle Growers.

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
7600 Sand Point Way N.E.
Seattle, Washington 98115

September 12, 2014
Supplemental Informational Report 12
September 2014

Ms. Dorothy Lowman, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Dear Ms. Lowman:

By this letter, I am approving Amendment 18 to the Pacific Coast Salmon Fishery Management Plan (FMP). The purpose of Amendment 18 is to revise the description and identification of essential fish habitat (EFH) for Pacific salmon, designate habitat areas of particular concern (HAPC), modify the current information on fishing activities and potential measures to minimize their effects on EFH, and update the list of fishing and non-fishing related activities that may adversely affect EFH and potential conservation and enhancement measures to minimize those effects.

The Pacific Fishery Management Council (Council) prepared Amendment 18 to the FMP under provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and transmitted it to the National Marine Fisheries Service (NMFS) for approval by the Secretary on June 10, 2014. A notice of availability for Amendment 18 was published in the *Federal Register* on June 16, 2014. The *Federal Register* notice for the notice of availability also notified the public of the availability of the draft environmental assessment (EA) for review and comment. The public comment period on Amendment 18 and the EA closed on August 15, 2014. A proposed rule to implement Amendment 18 will be published in the *Federal Register* shortly, and will provide the public with a 30-day comment period on the implementing regulations. A final rule will publish after public comments have been considered; the final rule will amend Federal regulations at 50 CFR 660.412.

NMFS has determined that Amendment 18 is consistent with provisions of the MSA and other applicable laws.

Following transmittal of Amendment 18, Council and NMFS staff identified technical edits that would improve the readability of the Amendment. NMFS staff will work with Council staff to ensure that these edits are completed prior to the incorporation of the Amendment into the FMP.

NMFS appreciates the Council's close cooperation and assistance in completing Amendment 18 and we look forward to ongoing work with the Council to support the best possible fishery management decisions.

Sincerely,

William W. Stelle, Jr.
Regional Administrator

cc: F/WCR – P. Mundy, R. Schumacher, J. Stadler
F/GCNW – S. Lynch