FINAL FISHERY ECOSYSTEM PLAN

The Pacific Fishery Management Council (Council) is considering ecosystem-based approaches to fishery management and is in the process of developing a Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem (FEP) as a vehicle for bringing ecosystem-based principles into the Council decision-making process under its existing Fishery Management Plans (FMPs).

The Council last reviewed the FEP in November of 2012 and provided guidance on further FEP development in advance of final adoption. Per Council guidance, the Ecosystem Plan Development Team (EPDT) has compiled a revised public review draft of the FEP (Agenda Item H.1.a, Attachment 1) including an Ecosystem Initiatives Appendix A (Agenda Item H.1.a, Attachment 2). Both of these public review drafts as well as a recorded reader's guide to the FEP webinar were posted to the Council's Ecosystem-Based Management web page in February 2013.

The Council has scheduled an informational briefing in the FEP on Saturday April 6 that is intended to help the Council, its advisory bodies, and the public understand the various issues and objectives associated with the scheduled final adoption of the Council's Fishery Ecosystem Plan (FEP). Those interested in providing comments intended to influence Council action on the FEP should do so under this agenda item, not at the informational briefing.

At the November 2012 Council meeting, the Council recommended that ecosystem science considerations, both cross-FMP and specific FMP considerations, be removed from the FEP and placed in the Council's Research and Data Needs document. At the March 2013 Council meeting, the Council reviewed and approved a final Research and Data Needs document that reflected this recommendation. Additionally, the Council recommended that the FEP section on ecosystem initiatives be placed in its own appendix. The resulting Public Review Draft Ecosystem Initiatives appendix (Appendix A): 1) provides the public with an opportunity to review and comment on a potential FEP initiative process; 2) provides a fleshed-out example FEP Initiative 1 that, if forwarded by the Council, would begin a process to prohibit fishing for unfished lower trophic level (forage) fish species within the U.S. West Coast Exclusive Economic Zone (EEZ); and 3) provides additional potential cross-FMP initiatives for review and consideration by the Council and the public.

At this meeting, the Council is scheduled to consider adoption of a final FEP. It is envisioned that the FEP will then become a "living document" that evolves in response to changing Council needs and the availability of new information. The Section 1.3 of the draft FEP proposes that the main body of the FEP be revised on no more that a six-year cycle while the Ecosystem Initiatives could be revisited annually in November to revise, add to, or prioritize the list of initiatives for the coming year.

Council Action:

1. **Consider adopting a final FEP.**
2. **Consider adopting a final Ecosystem Initiatives Appendix.**
3. **Provide guidance on priority tasks for future work on ecosystem initiatives.**

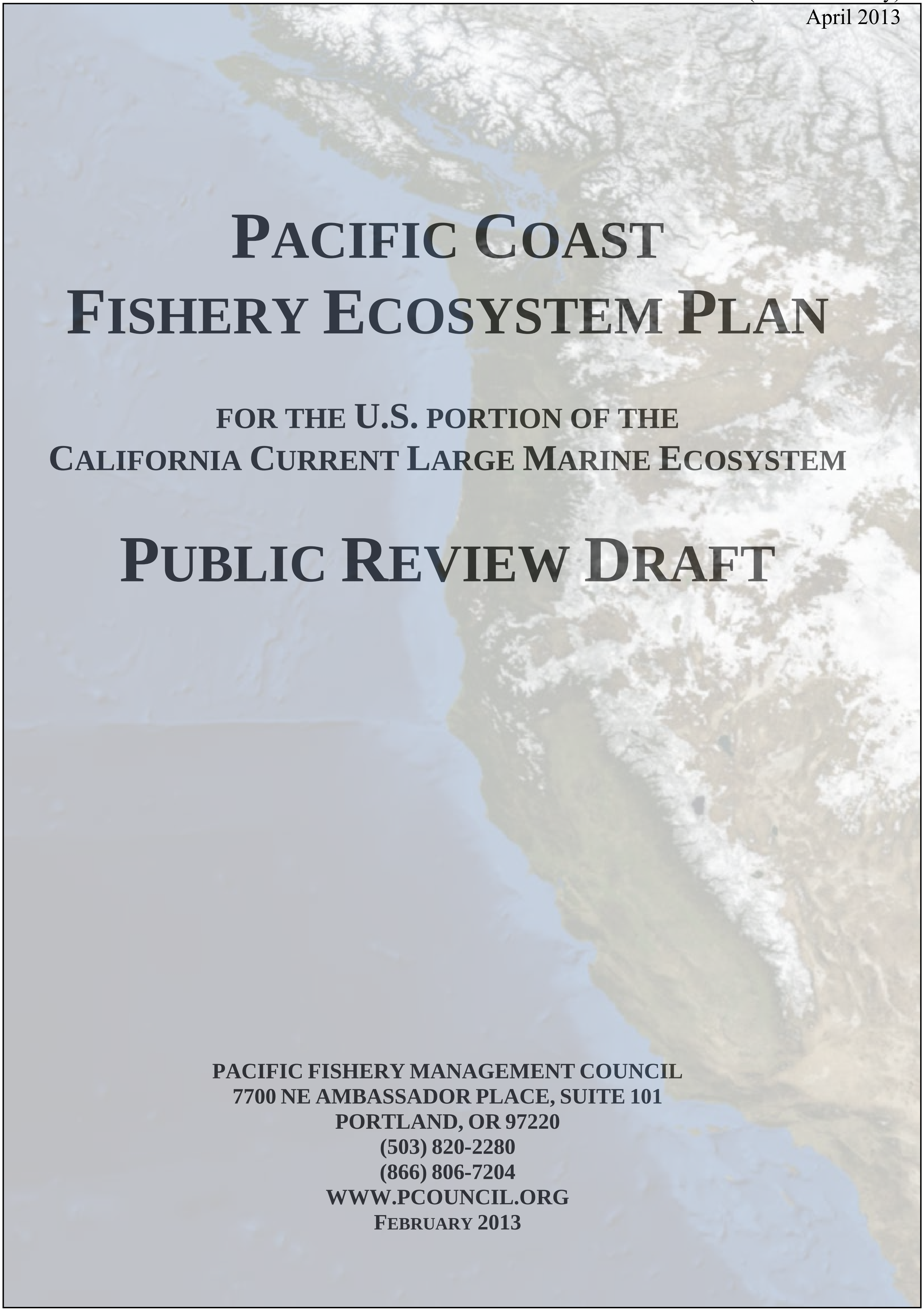
Reference Materials:

1. Agenda Item H.1.a, Attachment 1: Public Review Draft Pacific Coast Fishery Ecosystem Plan for the U.S. Portion of the California Current Large Marine Ecosystem (**electronic only, on the Council web page and the April 2013 Briefing Book CD**).
2. Agenda Item H.1.a, Attachment 2: Public Review Draft Ecosystem Initiatives Appendix to the Pacific Coast Fishery Ecosystem Plan (**electronic only, on the Council web page and the April 2013 Briefing Book CD**).
3. Agenda Item H.1.b, Habitat Committee Report.
4. Agenda Item H.1.b, CPSMT Report.
5. Agenda Item H.1.c, Public Comment.

Agenda Order:

a. Agenda Item Overview Mike Burner
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Adopt Final Pacific Coast Fishery Ecosystem Plan

PFMC
03/25/13



PACIFIC COAST FISHERY ECOSYSTEM PLAN

FOR THE U.S. PORTION OF THE CALIFORNIA CURRENT LARGE MARINE ECOSYSTEM

PUBLIC REVIEW DRAFT

PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 101
PORTLAND, OR 97220
(503) 820-2280
(866) 806-7204
WWW.PCOUNCIL.ORG
FEBRUARY 2013

ACKNOWLEDGMENTS

ECOSYSTEM PLAN DEVELOPMENT TEAM

Ms. Yvonne deReynier, Chair (NMFS/NWR, Seattle, WA); Dr. John Field, Vice-Chair (NMFS/SWFSC, Santa Cruz); Mr. Michael Burner (Council Staff, Portland, OR); Dr. Larry Gilbertson, Quinault Fisheries, Taholah, WA); Dr. Melissa Haltuch (NMFS/NWFSC, Seattle, WA); Dr. Samuel Herrick (NMFS/SWFSC, La Jolla, CA); Dr. Phil Levin (NMFS/NWFSC, Seattle, WA); Mr. Joshua Lindsay (NMFS/SWR, Long Beach, CA); Dr. Andrew Leising (NMFS/SWFSC, Pacific Grove, CA); Mr. Corey Niles (WDFW, Montesano, WA); Ms. Cyreis Schmitt (ODFW, Newport, OR); Dr. Richard Scully (IDFG, Lewiston, ID); Ms. Deborah Wilson-Vandenberg (CDFW, Monterey, CA); Dr. Lisa Wooninck (ONMS, Monterey, CA); with legal counsel from Mr. Judson Feder (NOAA/GC, Long Beach, CA).

The Ecosystem Plan Development Team and the Council staff express their thanks for the expert assistance provided by: Ms. Anna Holder, Ms. Caroline McKnight, Ms. Melanie Parker, and Mr. Eric Wilkins of CDFW; Mr. Peter Hassemer of IDFG; Mr. Colby Brady, Dr. Peter Dygert, Dr. James Hilger, Dr. Isaac Kaplan, Ms. Debra Lambert, Ms. Elizabeth Petras, Dr, Lauren Saez; Ms. Barbara Seekins, Mr. Jerry Sutton, Ms. Sarah Towne, Dr. Waldo Wakefield, Dr. Brian Wells, and Dr. Mary Yoklavich of NMFS; Mr. Robert Jones and Ms. Sandra Zeiner of NWIFC; Ms. DeAnna Erickson, Ms. Arlene Merems, Mr. Patrick Myrick, and Mr. Derek Wiley of ODFW; Mr. Edward Hibsch of PSMFC; Ms. Heather Reed and Mr. Eric Kraig of WDFW; Mr. Brian Corrigan, Mr. Daniel Hardin, and Ms. Peggy Murphy of USCG; Mr. Dave Hillemeier of Yurok Tribe Fisheries; and numerous other agency and tribal personnel in completing this report.

The Ecosystem Plan Development Team and the Council staff also express their thanks for the expertise and guidance provided by the 2010-2013 members of the Ecosystem Advisory SubPanel: Mr. Merrick Burden, Mr. Paul Dye, Mr. Ben Enticknap, Ms. Kathy Fosmark, Mr. Steven Fukuto, Dr. Terrie Klinger, Mr. Geoff LeBon, Mr. Don Maruska, Mr. Scott McMullen, Mr. Nate Stone, Mr. Dan Waldeck, and Mr. Frank Warrens.

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A report of the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award Number FNA10NMF4410014.

LIST OF ACRONYMS AND ABBREVIATIONS

ACL	annual catch limit
AM	accountability measure
AP	advisory panel
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CCE	California Current Ecosystem, or California Current Large Marine Ecosystem
CDFW	California Department of Fish and Wildlife (formerly CDFG, for ". . . and Game"
CFGC	California Fish and Game Commission
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
Council	Pacific Fishery Management Council
CPS	Coastal Pelagic Species
CZMA	Coastal Zone Management Act
DLCD	Oregon Department of Land Conservation and Development
DPS	Distinct Population Segment (under the Endangered Species Act)
EAS	Ecosystem Advisory SubPanel
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
ENSO	El Niño/Southern Oscillation
EPDT	Ecosystem Plan Development Team
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit (under the Endangered Species Act)
FAO	Food and Agriculture Organization (of the United Nations)
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plan
HAB	Harmful algal bloom
HAPC	Habitat Area of Particular Concern
HCR	Harvest control rule
HMS	Highly Migratory Species
ICES	International Council for the Exploration of the Sea
IATTC	Inter-American Tropical Tuna Commission
INPFC	International North Pacific Fisheries Commission
IPHC	International Pacific Halibut Commission
ISC	International Scientific Committee (of the WCPFC process)
JMC	Joint Management Committee (of the U.S./Canada Pacific Whiting Treaty process)
JTC	Joint Technical Committee (of the U.S./Canada Pacific Whiting Treaty process)
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NOAA	National Oceanic and Atmospheric Administration
NPAFC	North Pacific Anadromous Fish Commission
OCN	Oregon coastal natural (coho salmon)
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Deparment of State Lands
OFWC	Oregon Fish and Wildlife Commission
OPRD	Oregon Parks and Recreation Department
PacFIN	Pacific Fisheries Information Network
PDO	Pacific Decadal Oscillation
PICES	Pacific ICES; formally, the North Pacific Marine Science Organization
PSMFC	Pacific States Marine Fisheries Commission
RCA	Rockfish Conservation Area
RecFIN	Recreational Fisheries Information Network
SAFE	Stock Assessment and Fishery Evaluation (Reports for Council FMPs)
SMCA	State Marine Conservation Area (of California)
SONC	Southern Oregon and Northern California (salmon complex)
SRG	Scientific Review Group (of the U.S./Canada Pacific Whiting Treaty process)
SSC	Scientific and Statistical Committee
U & A	Usual and Accustomed (fishing areas, of Treaty tribes)
U.S.	United States of America
USFWS	United States Fish and Wildlife Service
WCPFC	Western and Central Pacific Fisheries Commission
WDFW	Washington Department of Fish and Wildlife
WFWC	Washington Fish and Wildlife Commission

Contents

1 Introduction

1.1 Purpose and Need

The purpose of the Fishery Ecosystem Plan (FEP) is to enhance the Council's species-specific management programs with more ecosystem science, broader ecosystem considerations and management policies that coordinate Council management across its Fishery Management Plans (FMPs) and the California Current Ecosystem (CCE). An FEP should provide a framework for considering policy choices and trade-offs as they affect FMP species and the broader CCE.

The needs for ecosystem-based fishery management within the Council process are:

1. Improve management decisions and the administrative process by providing biophysical and socio-economic information on CCE climate conditions, climate change, habitat conditions and ecosystem interactions.
2. Provide adequate buffers against the uncertainties of environmental and human-induced impacts to the marine environment by developing safeguards in fisheries management measures.
3. Develop new and inform existing fishery management measures that take into account the ecosystem effects of those measures on CCE species and habitat, and that take into account the effects of the CCE on fishery management.
4. Coordinate information across FMPs for decision-making within the Council process and for consultations with other regional, national, or international entities on actions affecting the CCE or FMP species.
5. Identify and prioritize research needs and provide recommendations to address gaps in ecosystem knowledge and FMP policies, particularly with respect to the cumulative effects of fisheries management on marine ecosystems and fishing communities.

The FEP is meant to be an informational document. It is not meant to be prescriptive relative to Council fisheries management. Information in the FEP, results of the Integrated Ecosystem Assessment (IEA), and the Annual State of the California Ecosystem Report may be available for consideration during the routine management processes for fisheries managed in each FMP. How exactly these items will affect fishery management decisions is at the discretion of the Council.

1.2 How this Document is Organized

This FEP takes its organization from the Council's Purpose and Need statement, in Section 1.1. Chapter 2 provides the FEP's Objectives, a more detailed exploration of what the FEP would do to meet its Purpose and Need. Chapter 3 provides an overview of the CCE from a variety of physical, biological, and socio-economic perspectives and disciplines. Chapter 4 discusses the cumulative effects and uncertainties of environmental shifts and human activities on the marine environment. Chapter 5 discusses Council CCE policy priorities across its FMPs, so that ocean resource management and policy processes external to the Council (e.g. West Coast Governors' Alliance on Ocean Health, National Ocean Council, international fishery and ocean resource management bodies) may be made aware of and may better take into account those priorities. Chapter 6 broadly discusses processes for bringing ecosystem science into the Council process. In addition to this main FEP, there is an FEP Appendix A that proposes an ecosystem-based fishery management initiative process for the FEP's use into the future.

1.3 Schedule and Process for Developing and Amending the FEP and the Ecosystem Initiatives Appendix

In November 2009, the Council appointed two new ad hoc advisory bodies, the Ecosystem Plan Development Team (EPDT) and the Ecosystem Advisory SubPanel (EAS). Throughout 2010-2012, these advisory bodies, with review and cooperation from the Council and its permanent advisory bodies, developed a draft FEP for public review. At its November 2012 meeting in Costa Mesa, CA, the Council provided the EPDT with instructions for revising the draft FEP in preparation for sending the FEP out for a public review period. This Public Review Draft FEP, plus the Public Review Draft FEP Ecosystem Initiatives Appendix are together provided for public review, in compliance with Council direction from November 2012. The Council is scheduled to consider adopting a final FEP at its April 6-11, 2013 meeting in Portland, Oregon.

Once the Council has adopted a final FEP, the main body of the FEP will not be amended until the Council determines that an FEP review and revision process is necessary. At that time, the Council may consider appointing new ad hoc advisory bodies to review and recommend revisions to the FEP. The Council does not anticipate initiating an FEP review process until at least 2018. In addition to the main body of the FEP, which consists of Chapters 1-6, the Council may choose to add one or more appendices to the FEP without opening the main body of the FEP to revision.

Appendix A to the FEP is the Public Review Draft Ecosystem Initiatives appendix that: 1) provides the public with an opportunity to review and comment on a potential FEP initiative process; 2) provides a fleshed-out example FEP Initiative 1 that, if forwarded by the Council, would begin a process to prohibit fishing for unfished lower trophic level (forage) fish species within the U.S. West Coast Exclusive Economic Zone (EEZ); and 3) provides additional potential cross-FMP initiatives for review and consideration by the Council and the public.

At its November 2012 meeting, the Council directed the EPDT to specify a draft process by which the Council would consider modifying the Ecosystem Initiatives Appendix. The EPDT proposes that each year at the Council's November meeting, the Council and its advisory bodies:

- review progress to date on any ecosystem initiatives the Council already has underway;
- review the list of potential ecosystem initiatives provided in Appendix A to the FEP and determine whether any of those initiatives merit Council attention in the coming year;
- if new initiatives are chosen for Council efforts, request background materials from the appropriate entities; and
- beginning in November 2017, assess whether to initiate a review and update of the FEP.

Each initiative in Appendix A includes suggestions for background information needed to support consideration of the initiative and suggestions for the expertise needed on an ad hoc team to develop the initiative. If the Council determines that it wishes to address a new ecosystem initiative, it would begin by requesting relevant background information from the appropriate agencies and other entities, which would then be made available to the Council and its advisory bodies at a subsequent Council meeting, scheduled at the Council's discretion. Upon review of the background informational materials, the Council will decide whether to further pursue that initiative, and request nominations for appointments to an ad hoc team to be tasked with developing the initiative. Any materials developed through the ad hoc team process would, as usual with Council advisory body materials, be made available for review and comment by all of the Council's advisory bodies and the public during the Council's policy assessment and development process.

1.4 State-of-the-Ecosystem Reporting

At its November 2011 meeting, the Council expressed support for an annual state-of-the-ecosystem report to the Council. The Council suggested that the report should:

- Be bounded in terms of its size and page range to about 20 pages in length;
- Not wait for the "perfect" science to become available, that there may be scientific information that does not come with definitive answers and numbers, but which may be useful for the Council to consider.

At its November 2012 meeting, the Council received a draft Annual State of the California Current Ecosystem Report. That report was intended as an example to the Council and the public of a summary report that would briefly synthesize those results of the California Current IEA that might be most useful to the Council's major decisions on potential harvest levels for its managed species groups. The Council and its advisory bodies reviewed the draft report, provided suggestions for future reports by commenting on the information in the report that appeared to be most useful to the Council process, and asked if NOAA Fisheries Northwest and Southwest Fisheries Science Centers might collaborate on developing the report annually into the future. The Council re-iterated its guidance that report not exceed 20 pages in length, and be tailored to providing information on indicators directly relevant to Council decision-making. Information in the report is intended to improve the Council and public's general understanding of the status and functions of the CCE and is not tied to any specific management measures or targets for Council managed species. When the Council received future annual ecosystem reports, it anticipates continuing to review the reports contents so that they may be tailored to best meet management needs. The Council requests that NOAA Fisheries provide annual reports on the state of the CCE at the Council's November meetings. Further discussion of the annual ecosystem report is provided in Section 6.2 of the FEP.

Oregon coast. Photo credit: NOAA

2 Objectives

The FEP objectives, listed below, are intended to address the purpose and need statement in Section 1.1. This FEP and related activities are together expected to further integrate management across all Council FMPs, while recognizing that the Council's authority is generally limited to managing fisheries and the effects of fisheries on the marine ecosystem, protected species, and to consultations on the effects of non-fishing activities on essential fish habitat (EFH). The Council's work often requires Council members to think about their larger goals for the CCE, including and beyond goals they may have for managing fisheries. Chapter 5 of this FEP, *PFMC Policy Priorities for Ocean Resource Management*, discusses the Council's CCE policy priorities as they apply to ocean resource management and policy processes external to the Council. Thus, Chapter 2 provides Council objectives for Council work, while Chapter 5 provides the Council's aspirations for the work of others within the CCE, given Council priorities for the fish stocks and fisheries it manages.

The Council's four existing FMPs each have suites of goals and objectives that differ in their precise language, but have five common themes consistent with an ecosystem approach to fishery management: avoid overfishing, minimize bycatch, maintain stability in landings, minimize impacts to habitat, and accommodate existing fisheries sectors. The Coastal Pelagic Species (CPS) FMP has an additional goal of providing adequate forage for dependent species. The following FEP objectives are intended to build upon the Council's four FMPs by recognizing that, through the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the United States supports the ongoing participation of its citizens in commercial and recreational fisheries off its coasts, while also requiring that fish stocks be conserved and managed for optimum yield.

1. Improve and integrate information used in Council decision-making across the existing FMPs by:

    a. Describing the key oceanographic, physical, biological, and socioeconomic features of the CCE and dependent fishing communities;
    b. Identifying measures and indicators, and informing reference points to monitor and understand trends and drivers in key ecosystem features;
    c. Identifying and addressing gaps in ecosystem knowledge, particularly with respect to the cumulative and longer-term effects of fishing on marine ecosystems;
    d. Examining the potential for a science and management framework that allows managing fish stocks at spatial scales relevant to the structure of those stocks.

2. Build toward fuller assessment of the greatest long-term benefits from the conservation and management of marine fisheries, of optimum yield, and of the tradeoffs needed to achieve those benefits while maintaining the integrity of the CCE through:

    a. Assessing trophic energy flows and other ecological interactions within the CCE;
    b. Assessing the full range of cultural, social, and economic benefits that fish and other living marine organisms generate through their interactions in the ecosystem;
    c. Improving assessment of how fisheries affect and are affected by the present and potential future states of the marine ecosystem.

3. Provide administrative structure and procedures for coordinating conservation and management measures for the living marine resources of the U.S. West Coast EEZ:

    a. Guiding annual and regular reporting of status and trends to the Council;
    b. Providing a nexus to regional, national, and international ecosystem-based management endeavors, particularly to address the consequences of non-fishing activities on fisheries and fish habitat;
    c. Identifying ecological relationships within the CCE to provide support for cross-FMP work to conserve non-target species essential to the flow of trophic energy within the CCE.

Kelp and sardines. Photo credit: CDFW

3 California Current Ecosystem Overview

3.1 Geography of the Ecosystem

The geographic range for this FEP is the entire U.S. West Coast EEZ, shown in Figure 3.1.1. The Council recognizes that the EEZ does not encompass all of the CCE, nor does it include all of the waters and habitat used by many of the Council's more far-ranging species. The Council also recognizes the importance of freshwater and estuarine ecosystems to the CCE and may expand this intitial effort to include these ecoregions in the future. The Council also does not believe that designating the EEZ as the FEP's geographic range in any way prevents it from receiving or considering information on areas of the CCE or other ecosystems beyond the EEZ.

3.1.1 General Description and Oceanographic Features of the CCE

The CCE is comprised of a major eastern boundary current, the California Current, which is dominated by strong coastal upwelling, and is characterized by fluctuations in physical conditions and productivity over multiple time scales (Parrish et al. 1981, Mann and Lazier 1996). Food webs in these types of ecosystems tend to be structured around coastal pelagic species that exhibit boom-bust cycles over decadal time scales (Bakun 1996, Checkley and Barth 2009, Fréon et al. 2009). By contrast, the top trophic levels of such ecosystems are often dominated by highly migratory species such as salmon, tuna, billfish and marine mammals, whose dynamics may be partially or wholly driven by processes in entirely different ecosystems, even different hemispheres. Ecosystems analogous to the CCE include other shelf and coastal systems, such as the currents off the western coasts of South America and Spain.

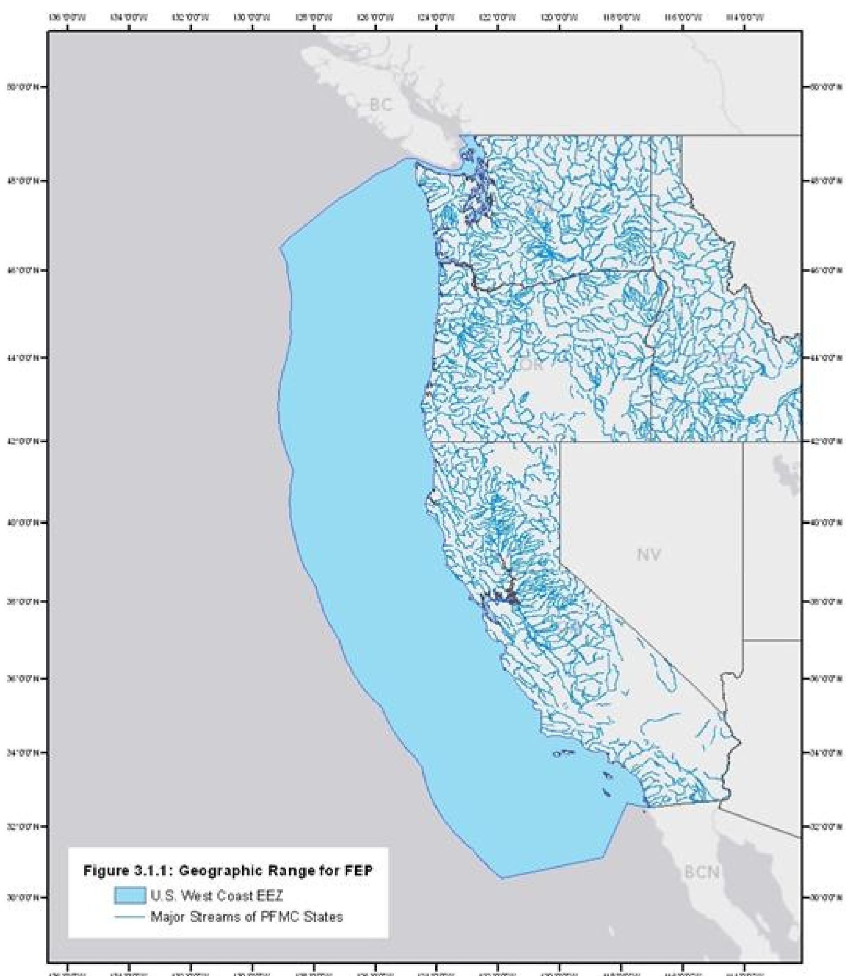


Figure 3.1.1: Geographic Range for FEP

The CCE essentially begins where the west wind drift (or the North Pacific Current) reaches the North American continent. The North Pacific Current typically encounters land along the northern end of Vancouver Island, although this location varies latitudinally from year to year. This current then splits into the southward-flowing California Current heading south (shown in Figure 3.1.2) and the northward-flowing Alaska Current. The "current" in the California Current is a massive southward flow of water ranging from 50 to 500 kilometers offshore (Mann and Lazier, 1996). Beneath this surface current, flows what is known as the California Undercurrent in the summer, which then surfaces and is known as the Davidson current in winter. This current moves water poleward from the south in a deep yet more narrow band of water typically close to and offshore of the continental shelf break (Hickey 1998, Checkley and Barth 2009). The southward-flowing California Current is typically considered distinct from the wind-driven coastal upwelling jets that develop over the continental shelf during the spring and summer, which tends to be driven by localized forcing and to vary on smaller spatial and temporal scales than offshore processes (Hickey, 1998). Jets result from intensive wind-driven coastal upwelling, and lead to higher nutrient input and productivity; they in turn are influenced by the coastal topography (capes, canyons and offshore banks), particularly the large capes such as Cape Blanco, Cape Mendocino and Point Conception. The flow from the coastal upwelling jets can be diverted offshore, creating eddies, fronts and other mesoscale changes in physical and biological conditions, and even often linking up to the offshore California Current (Hickey, 1998).

Superimposed on the effects of these shifting water masses that drive much of the interannual variability of the CCE, are substantive changes in productivity that often take place at slower rates, during multi-year and decadal periods of altering ocean condition and productivity regimes. Climatologists and oceanographers have identified and quantified both the high and low frequency variability in numerous ways. The El Niño/Southern Oscillation (ENSO) is the dominant mode of interannual variability in the equatorial Pacific, with impacts throughout the rest of the Pacific basin (including the California Current) and the globe (Mann and Lazier 1996). During the negative (El Niño) phase of the ENSO cycle, jet stream winds are typically diverted northward, often resulting in increased exposure of the West Coast of the U.S. to subtropical weather systems (Cayan

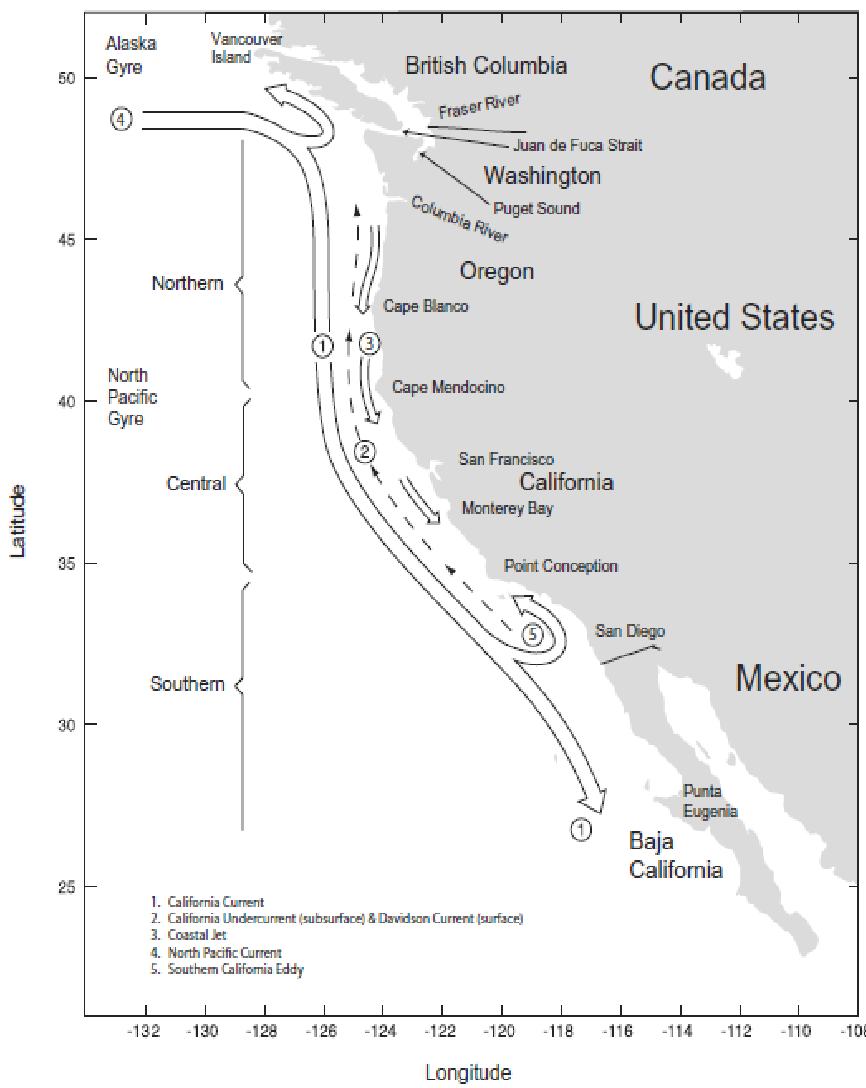


Figure 3.1.2: Dominant current systems off the U.S. West Coast

and Peterson 1989). Concurrently in the coastal ocean, the effects of these events include reduced upwelling winds, a deepening of the thermocline, intrusion of offshore (subtropical) waters, dramatic declines in primary and secondary production, poor recruitment, growth and survival of many resident species (particularly salmon and groundfish), and northward extensions in the range of many tropical species.

While the ENSO cycle is generally a high-frequency event (taking on the order of three to seven years to complete a cycle), lower frequency variability has been associated with what is now commonly referred to as the Pacific (inter)Decadal Oscillation, or PDO (Mantua et al. 1997). The PDO is the leading principal component of North Pacific sea surface temperatures (above 20° N. lat.), and superficially resembles ENSO over a decadal time scale. During positive regimes, coastal sea surface temperatures in both the Gulf of Alaska and the California Current tend to be higher, while those in the North Pacific Gyre tend to be lower; the converse is true in negative regimes. The effects of the PDO have been associated with low frequency variability in over 100 physical and biological time series throughout the Northeast Pacific, including time series of recruitment and abundance for commercially important coastal pelagics, groundfish and invertebrates (Mantua and Hare 2002).

3.1.2 Major Bio-Geographic Sub-Regions of the CCE

Although there are many ways of thinking about dividing the CCE into sub-regions, Francis et al. (2008) have suggested three large-scale CCE sub-regions:

- Northern sub-region extending from the northern extent of the CCE off Vancouver Island to a southern border occurring in the transition zone between Cape Blanco, OR and Cape Mendocino, CA;
- Central sub-region extending southward from that transition zone to Point Conception, CA; and
- Southern sub-region from Point Conception to Punta Baja, on the central Baja Peninsula.

Francis and co-authors suggested these three sub-regions based on various oceanographic and ecological characteristics with a focus on the Council's Groundfish FMP. A different set of sub-regions may be more appropriate in the context of other issues and analyses, such as sub-regions tailored to reflect the population structures of various fish species and stocks.

Tazzi Sablan (Quileute Tribe) hauling coho near mouth of Quillayute River, WA. Photo credit: Debbie Ross-Preston, NWIFC

Each of these three major CCE sub-regions experiences differences in physical and oceanographic features such as wind stress and freshwater input, the intensity of coastal upwelling and primary productivity, and in the width and depth of the continental shelf. Regional scale features like submarine ridges and canyons add to the distinct character of each sub-region. These physical and oceanographic differences then translate into differences in the ecosystem structure of each sub-region. The portions of the three CCE sub-regions lying within the U.S. EEZ are discussed in more detail, below.

3.1.2.1 Northern sub-region: Strait of Juan de Fuca, WA to Cape Blanco, OR

This sub-region is approximately 375 miles long, extending from its northernmost point at Cape Flattery, WA to Cape Blanco, OR. The upwelling winds for which the CCE is known are relatively weak in this sub-region, yet at the same time, some of the CCE's most productive areas are found within this region (Hickey and Banas 2008). The southward flowing California Current is also relatively weak in this sub-region and the flow can even shift poleward off the Washington coast when the bifurcation of the North Pacific current shifts southward.

A key feature of this sub-region is the abundant freshwater input from the Straits of Juan de Fuca and the Columbia River, which provide a steady supply of terrestrial nutrients to the euphotic zone. In the absence of all other forces, a large freshwater discharge like that observed at the Columbia River mouth behaves as a "buoyancy flow," where a buoyant freshwater jet rides over the dense saline oceanic water and moves poleward (Wiseman and Garvine 1995). Two generalized flow regimes have been observed with the Columbia River freshwater plume: (1) southward upwelling-favorable wind stress causes the Columbia River plume to meander southward and offshore and (2) northward downwelling-favorable wind stress causes the plume to meander poleward and along the coastline.

Island within Olympic Coast NMS. Photo credit: NOAA

The Columbia River Estuary and its seaward-extending plume is a zone of highly mixed river and ocean water and high primary productivity. Although most plume nitrate originates from coastally upwelled water, river-supplied nitrate can help maintain ecosystems during delayed upwelling (Hickey et al. 2010). Phytoplankton biomass concentrations are generally higher off the Washington coast than off the Oregon coast despite mean upwelling-favorable wind stress averaging three times stronger off the Oregon coast (Banas et al. 2008). Since phytoplankton flourish in the nutrient-rich environment of upwelled water, it would be expected that Oregon would have higher biomass concentrations. Banas et al. (2008) provides evidence that the high concentrations of biomass off Washington are due to the Columbia River plume.

The U.S./Canada border divides this sub-region artificially. Based on biological and oceanographic features, the Northern sub-region extends northward to Brooks Peninsula on Vancouver Island. Brooks Peninsula is generally considered to mark the rough border between the CCE and the Gulf of Alaska marine ecosystems (Lucas et al. 2007). The continental shelf is relatively wide in this sub-region and broken up by numerous submarine canyons and oceanic banks. Hickey (1998) describes two major canyons, Astoria and Juan de Fuca and one major bank, Heceta Bank, all of which are important both oceanographically and for fisheries productivity.

Features like the Juan de Fuca eddy and Heceta Bank also help retain nutrients and plankton in coastal areas. The many submarine canyons in this region can also intensify upwelling, adding to primary productivity. These and other factors combine to produce chlorophyll concentrations in this sub-region that can be five times higher than off Northern California, despite the weaker upwelling winds (Hickey and Banas 2008).

3.1.2.2 Central sub-region: Cape Blanco to Point Conception

In the region just north of Cape Blanco, the shelf begins to narrow, winds and upwelling intensify, and coastal waters move offshore. At or near Cape Blanco, what had been a simple, lazy southward current becomes a maze of swirling eddies and turbulent coastal flows that continue approximately 170 miles southward to Cape Mendocino (Botsford and Lawrence 2002). The area between Cape Blanco and Cape Mendocino experiences the strongest winds and upwelling in the CCE. This transition area also includes the southern boundary of oil rich, subarctic zooplankton. This sub-region then continues southward for another approximately 465 miles to Point Conception.

The Mendocino Escarpment is another key geological feature of this region, the largest east-west submarine ridge within the U.S. West Coast EEZ, extending westward from Cape Mendocino to just beyond the 200 nm EEZ boundary, as if pointing toward the Steel Vendor Seamount at 40°21.30’ N. lat., 129°27.00’W. long. South of the Mendocino Escarpment, the continental shelf narrows, creating notably different habitat ranges for bottom-dwelling organisms (Williams and Ralston 2002). This area south of Cape Mendocino also features several submarine canyons

Juvenile rockfish (multiple spp.) over Cordell Bank.
Photo credit: Greg McFall, NOAA/CBNMS

(Vizcaino Canyon, Noyo Canyon, Bodega Canyon, Monterey Canyon, and Sur Canyon) that enhance the high relief shelf and slope structure and demersal fish habitats. Biogeographic barriers extend out to sea because of strong winds related to the high relief coastal mountains and the funneling of air at high speeds from the Klamath and Sacramento basins to the coast. There are several distinct upwelling zones in this sub-region near major points, such as Point Reyes, northern Monterey Bay, and Point Sur. Outflow from the Sacramento River system through the San Francisco Bay Delta region is a significant source for freshwater input into the CCE in this sub-region.

3.1.2.1 Southern sub-region: Point Conception to Mexico border


Santa Barbara Island. Photo credit: U.S. National Park Service

This approximately 236 mile long sub-region is substantially different from the north and central areas. The topography is complex, the shelf is typically more narrow and shallow than to the north, and the coastline suddenly changes from a north-south to an east-west orientation at Point Conception. This area of the coast is also sheltered from large-scale winds and is a transition point between large-scale wind-driven areas to the north and the milder conditions of the Southern California Bight. There is also a cyclonic gyre in the Bight area that mixes cooler CCE water with warmer waters from the southeast (Hickey and Banas 2003). To the east of a line running south of Point Conception, winds are weak, while further offshore, to the west, wind speeds are similar to those along the continental shelf of the central sub-region. The Santa Barbara Channel remains sheltered from strong winds throughout the year.

In contrast to the relatively contiguous continental shelf in the central sub-region, the offshore region from Port San Luis to the Mexican border encompasses some of the most diverse basin and ridge undersea topography along the U.S. West Coast. Islands top many marine ridges and some of the most southerly topographical irregularities are associated with the San Andreas Fault. This complex topography, in combination with the influence of sub-tropical waters from the south, results in a marine community very different from more northern sub-regions.

Like in the Northern sub-region, the international boundary divides what could be considered a common region. Based on ecology and oceanography, the Southern sub-region extends south to Punta Baja, Mexico (30° N. latitude). A fourth sub-region of the CCE exists in Mexican waters, reaching from Punta Baja to the tip of the Baja Peninsula at Cabo San Lucas (U.S. GLOBEC 2004).

3.1.3 Political Geographic and Large-Scale Human Demographic Features of the CCE

From north to south, the CCE includes waters offshore of Canada's province of British Columbia, the U.S. states of Washington, Oregon, and California and Mexico's states of Baja California and Baja California Sur. This FEP is a product of a U.S. fishery management process, which means that it focuses on the effects of U.S. citizens, government entities, businesses, and economies on the U.S. portion of the CCE.

The Council has 14 voting members and five non-voting members. The voting Council members include:

- The directors of state fish and wildlife departments from California, Oregon, Washington, and Idaho, or their designees.
- The Regional Director of the National Marine Fisheries Service or his or her designee.
- A representative of a federally-recognized West Coast Native American tribe.
- Eight private citizens who are familiar with the fishing industry, marine conservation, or both. These citizens are appointed by the Secretary of Commerce from lists submitted by the governors of the member states. These eight members include one obligatory member from each state and four at-large members who may come from any state.

There are also five non-voting members who assist Council decision-making. They represent: the Pacific States Marine Fisheries Commission (PSMFC), which coordinates data and research for the Pacific states; the U.S. Fish and Wildlife Service (USFWS), which serves in an advisory role; the State of Alaska, because both fish and the people who fish for them migrate to and from Alaskan waters; the U.S. Department of State, which is concerned with management decisions with international implications; and the U.S. Coast Guard, which is concerned with enforcement and safety issues.

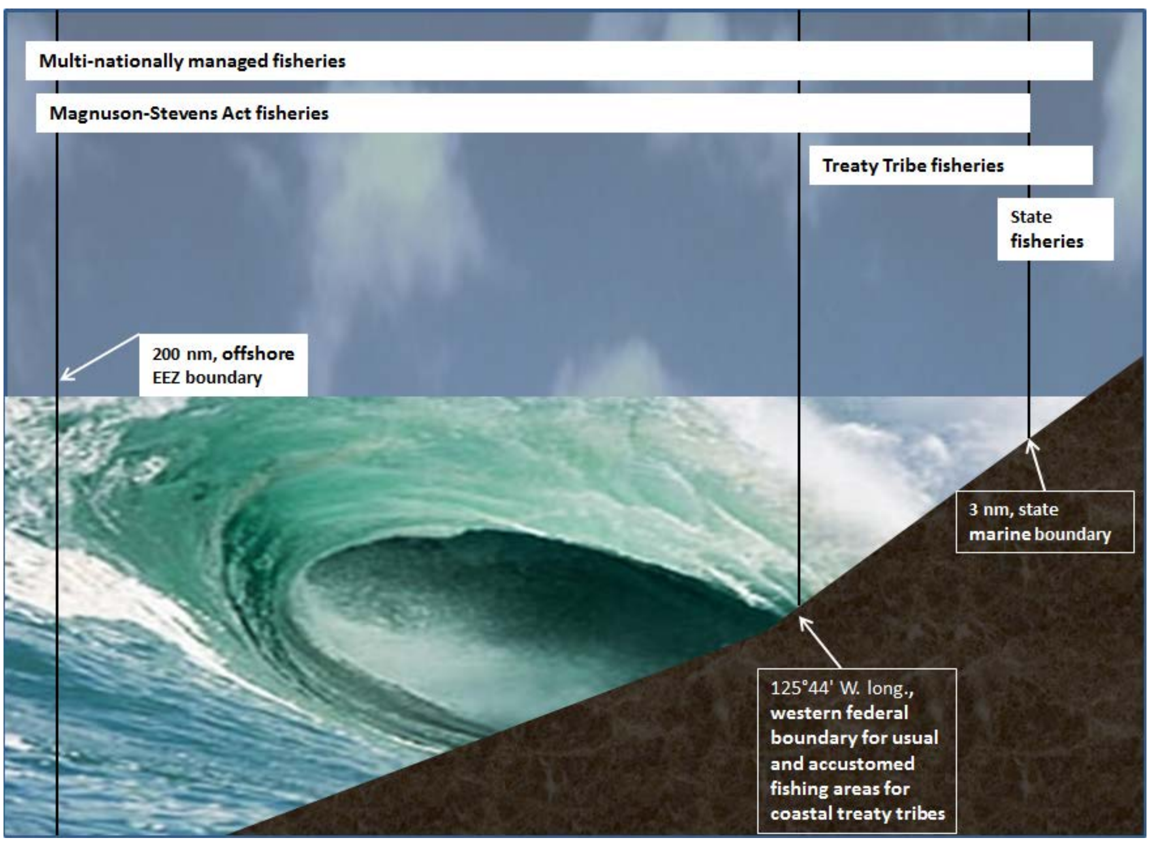


Figure 3.1.3: West Coast EEZ Fishery Management Authorities

Marine waters off the U.S. are divided into an array of jurisdictions (Figure 3.1.3) under a host of laws. West Coast states have management responsibility for those ocean fisheries targeting species that primarily occur inshore of the state marine boundary of 3 nm. Off the northern Washington coast, four treaty Indian tribes have Usual and Accustomed fishing areas that include marine waters out to 40 nm offshore. Domestically, inter-state coordination for state fisheries managed separately from the Council process is facilitated by the PSMFC. The federal government has explicitly extended non-tribal management authority over Dungeness crab, which occurs in both state and federal waters, to the states of Washington, Oregon and California (16 U.S.C. §1856).

The Council is responsible for managing fisheries that primarily occur within federal waters, 3-200 nm offshore, and separates management for those fisheries into four fishery management plans: coastal pelagic species, groundfish species, highly migratory species, and salmon species. Tribes and states that participate in the Council process also participate in U.S.-Canada bi-national management processes for Pacific halibut, Pacific whiting (also known as hake), Pacific salmon, and albacore. The Council shares management of highly migratory species with the Western Pacific Fishery Management Council, and both councils and their member states and territories together participate in international management bodies for the central Pacific Ocean. More detailed information on Council, state, tribal, and international fisheries and management processes is available in Section 3.4.

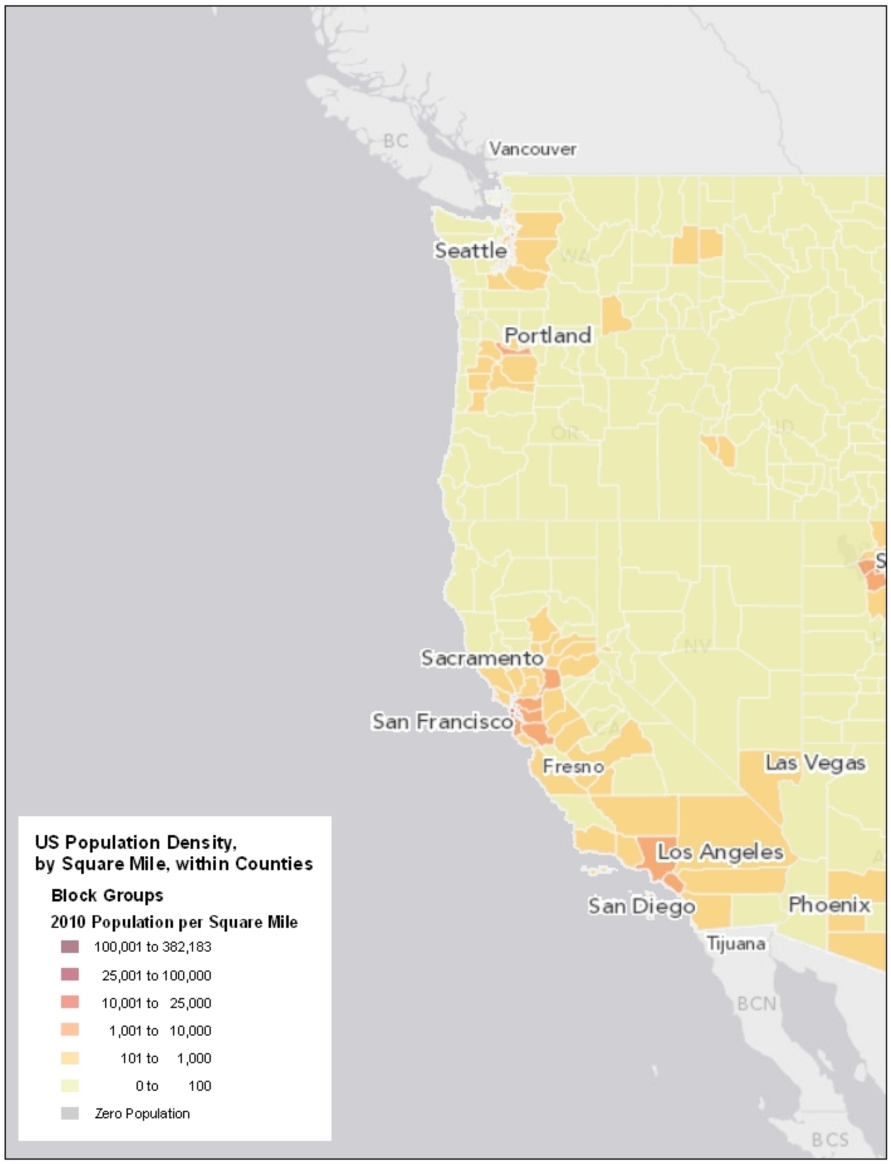


Figure 3.1.4: Human Population Density in the Western U.S.

Major West Coast commercial fishing ports over the 2000-2011 period, by volume, include: ports in the Southern California port area, mainly San Pedro, Terminal Island, Port Hueneme and Ventura; northern Oregon ports, mainly Newport and Astoria; and southern Washington ports of Chinook and Westport. Major West Coast recreational fishing areas over the 2004-2011 period include southern California, north-central California, central Oregon, and the Washington coast off Grays Harbor, although recreational fisheries are generally more active off California than off Washington or Oregon. For more detailed information, see Section 3.4.

West Coast urban areas, those with human populations greater than 1,000 people per square mile, include: the eastern and southern shore of Puget Sound, Washington; metropolitan areas of Oregon's Willamette Valley; California's capital in Sacramento, connecting into the counties surrounding San Francisco Bay; and the southern California metropolitan areas surrounding Los Angeles and San Diego. Figure 3.1.4 shows U.S. population density by square mile, from the 2010 U.S. census data.

Human activities that compete with fishing for ocean space include: non-consumptive recreation, dredging and dredge spoil disposal, military exercises, shipping, offshore energy installations, submarine telecommunications cables, mining for minerals, sand and gravel, and ocean dumping and pollution absorption. See Section 3.3.4 for additional discussion. In addition to human activities within the ocean, human institutions have created a host of different types of marine protected areas off the West Coast, many of which are closed to some or all fishing activities. The largest West Coast EEZ marine protected areas with fisheries restrictions or prohibitions are the Council's group of EFH Conservation Areas – also see Section 3.3.4. Also significant in size, and with varying types of protections, are the five West Coast National Marine Sanctuaries (NMSs): Channel Islands NMS, Cordell Bank NMS, Gulf of the Farallones NMS, Monterey Bay NMS, and Olympic Coast NMS. The Council works with the West Coast NMSs to develop EFH conservation areas within sanctuary boundaries (Figure 3.1.5). There are numerous additional state marine protected Areas (MPAs,) which are discussed in more detail in Section 3.3.4.

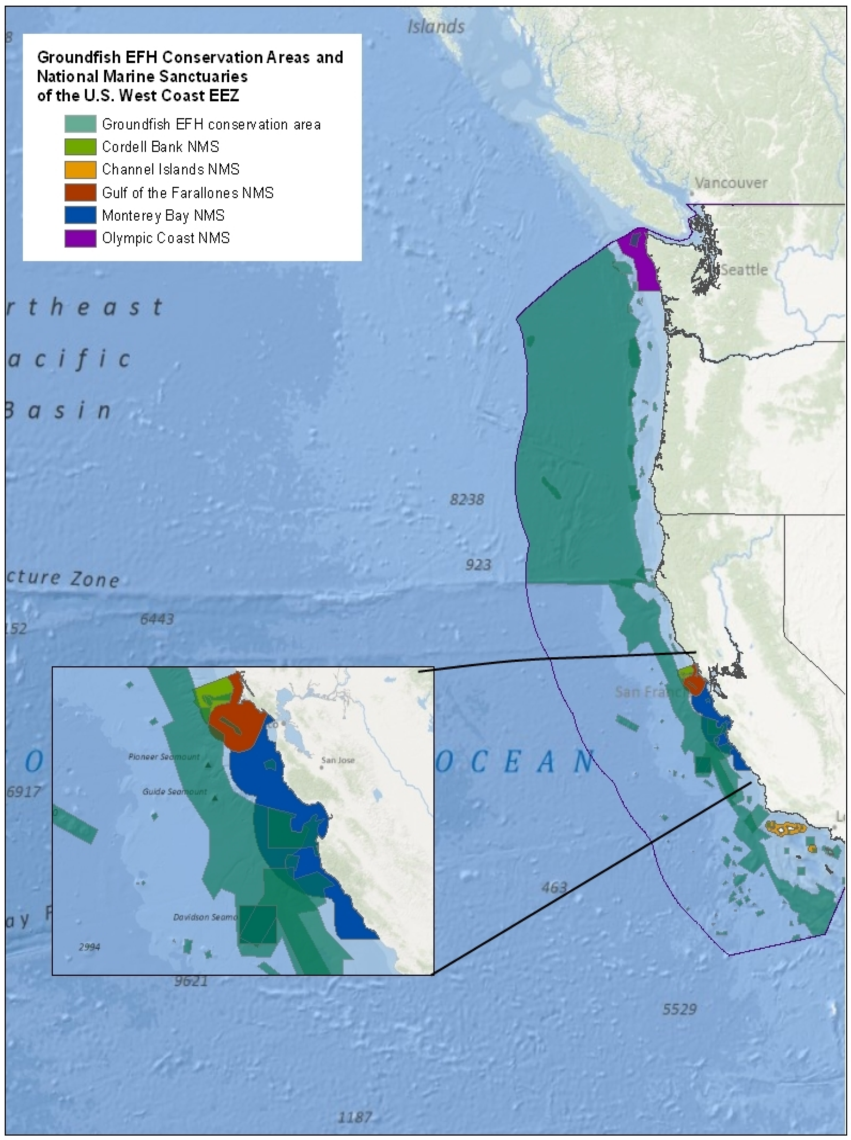


Figure 3.1.5: West Coast EFH Conservation Areas and National Marine Sanctuaries

3.2 Biological Components and Relationships of the CCE

3.2.1 Biological Components

This section defines the major biological components of the CCE in terms of trophic levels – a biological component's position within the larger food web. A biological component's trophic level is roughly defined by its position in the food chain. Lower trophic level species consist of or feed predominantly on primary producers (phytoplankton, etc.) Higher trophic level species are largely top predators such as marine mammals, birds, sharks and tunas.

As shown in Figure 3.2.1 from Field et al. (2006), the CCE contains a diverse array of species, most of which make a relatively modest contribution to the energy flow within the ecosystem. Because the flow of energy is more of a "food web" than a "food chain", the species of the CCE do not neatly divide into clearly delineated trophic levels (for example, an organism may eat a prey item and also eat items that its prey eats), except at the highest and lowest levels. This FEP, below, discusses CCE species within broad trophic level categories, while recognizing that most CCE species do not occupy a single trophic level and may occupy multiple trophic levels, particularly when considering changes that occur over the course of their life as they change both their size and feeding preferences.

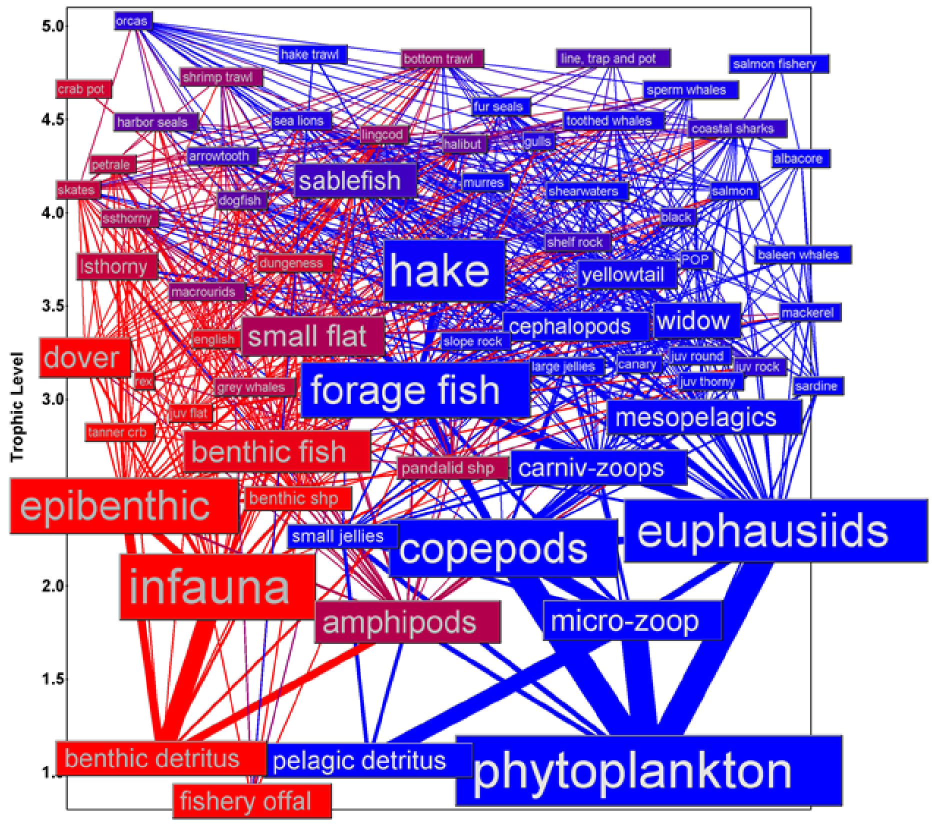


Figure 3.2.1: The significant food web of the Northern CCE. Height of boxes is scaled to standing biomass of species or groups names, width of lines between groups represents biomass flux of prey to predators. Benthic energy pathways are shown in red, while pelagic energy pathways are shown in blue. This "snapshot" represents the model values for the 1960 time period, as reported in Field et al. (2006).

3.2.1.1 High trophic non-fish species: mammals, birds, and reptiles of the CCE

Marine mammals, seabirds and marine reptiles of the CCE tend to occupy the system's mid- to higher trophic levels, and are generally protected species, although many were also historically targeted for harvest. Many of the largest populations forage in the CCE seasonally, and breed elsewhere, such as fur seals (breed in the Bering Sea), Humpback whales (breed off Mexico or central America) sooty shearwaters (breed in New Zealand), and leatherback turtles (breed in the western tropical Pacific). Similarly, top predators that do breed in the CCE, such as sea lions and elephant seals, often migrate or forage elsewhere seasonally, although most of the larger seabird populations that breed within the CCE (such as common murres, auklets and gulls) typically do not have extensive foraging ranges. The literature on movements and migrations for any given population is substantial, but Block et al. (2011)

provide an excellent synthesis of the range of movements for many of these (and highly migratory fish) populations based on a concerted effort to tag top ocean predators over the past decade as part of the Tagging of Pacific Predators program. Additionally, Block et al. (2011) describe the seasonal patterns of productivity, thermal variability and other ocean processes that drive many of these movements. Seasonal patterns appear to be the greatest drivers of migrations and variable distributions, although inter-annual and longer term climate variability also shapes the distribution and abundance of many of these higher trophic level species. The response of populations that breed in the CCE to such variability is often difficult to determine, although high sea lion pup mortalities have clearly been associated with El Niño events.

Sooty shearwater. Photo credit: NOAA

Both migrant (such as sooty shearwater and black-footed albatross) and resident seabirds (such as common murres and rhinoceros auklets) have been described as having either warm or cool water affinities, and vary their distribution, abundance, productivity and even diet accordingly (Sydeman et al. 2001; Sydeman et al. 2009). One of the most abundant migratory seabirds in the CCE, sooty shearwaters (*Puffinus griseus*), declined by as much as 90% immediately following the 1977 regime shift (Veit et al. 1996), although numbers have been variable since that time and it remains unclear whether there was an actual decline in population or a shift in distribution (Bjorksted et al. 2010). Understanding such changes in the population dynamics of sea birds is increasingly essential for effective fisheries management, providing the means to minimize interactions between fisheries and threatened or endangered species (Crowder and Norse 2008, Howell et al. 2008). Large-scale seasonal area closures to West Coast large mesh drift gill-net fishery of the HMS FMP is an example of a measure implemented to minimize interactions with leatherback sea turtles that forage intensively on jellyfish, particularly in Central California, from late spring through the fall (Benson et al. 2007). Since sea turtles likely represent one of the most vulnerable taxa in the CCE, and much of this vulnerability lies beyond the control of the PFMC and other U.S. management entities, issues relating to turtle conservation tend to be a high priority with respect to minimizing turtle-fisheries interactions.

CDFW samplers Megan DuVernay and Chris Read measuring fin-clipped Chinook salmon at Eureka Marina, with brown pelican on-looker. Photo credit: Edgar Roberts, CDFW

Although the historical removals described earlier collectively kept most pinniped and whale populations at low to moderate levels until the middle to late 20th century, most populations have increased, many dramatically, over the last several decades. Humpback whales in the CCE are now thought to number over 2000, blue whales nearly 2500, elephant seals approximately 124,000, California sea lions on the order of 270,000, and short-beaked common dolphins over 400,000 animals (Carretta et al. 2012). Appreciation for the cumulative historical impacts of whaling and sealing, and the potential cascading impacts to marine ecosystems, has grown as many marine mammal populations have recovered (NRC 1996, Estes et al. 2006). Currently, many mammal populations appear to be approaching some level of carrying capacity, and there is no substantive evidence for indirect competition with fisheries for prey resources. Increasing mammal populations have direct impacts on many salmonid populations and have indirect impacts when combined with human alterations to habitat, such as dams, that serve to aggregate salmonids where they are easy prey for some marine mammals. Although most mammal populations experience some incidental mortality as a consequence of fishing operations, mortality sources generally do not exceed estimates of potential biological removals. One of the goals of the MMPA is that the incidental mortality or serious injury of marine mammals in fisheries should be reduced to insignificant levels approaching zero. All FMP are managed to be consistent with this goal. One fishery, the HMS drift gillnet fishery, has specific management measures to reduce marine mammal interactions in accordance with the MMPA. In recent years there has been concern regarding high mortality rates for some cetaceans, particularly blue and humpback whales, caused by large ship strikes within and outside of fisheries (Berman-Kowalewski et al. 2010).

California sea lion at Bonneville fish ladder. Photo credit: NOAA

Humpback whales in Olympic Coast NMS. Photo credit: NOAA

Higher trophic level mammals, birds and reptiles represent important sources of predation mortality and energy flow in the CCE. Estimates of the role of cetaceans in the CCE suggest that they annually consume on the order of 1.8 to 2.8 million tons of prey (primarily krill, but also coastal pelagic fishes, squids, groundfish and other prey; Carretta et al. 2008), and simple bioenergetic estimates suggest that pinnipeds may consume as much as an additional million tons (Hunt et al. 2000), mostly fish and squid. Comparable estimates for seabirds are limited; Roth et al. (2008) estimated total annual consumption by common murres (the most abundant resident species in the CCE) at approximately 225,000 tons; however, Hunt et al. (2000) estimated summer consumption by all seabirds throughout the CCE at considerably lower levels. There have been few efforts to explicitly model interactions between fisheries and marine mammal population dynamics (although, see Yodzis et al. 2001 and Bundy et al. 2009). However, there is a rich body of literature linking seabird productivity to prey availability that helped guide the development of harvest control rules for some of the earliest CPS fisheries (e.g., Anderson et al. 1980).

Much of the literature is synthesized in a recent manuscript that indicates a commonality in the non-linear response of seabirds to empirical changes in prey abundance, in which seabird productivity declines gradually at low to moderate levels of reduced prey availability, but declines steeply when prey abundance is below approximately one third of the maximum prey biomass observed in long-term studies (Cury et al. 2011). The Cury et al. (2011) results could be used to guide appropriate management limits or thresholds when managing high biomass forage species that seabirds depend upon. However, the question of what constitutes a baseline level was not explicitly addressed, and is a key factor for consideration in the management of stocks that undergo substantial low frequency variability such as coastal pelagic species. Smith et al. (2011) evaluated a similar question, using ecosystem models and altering harvest rates (rather than using empirical data and evaluating functional relationships). Substantial impacts on food webs and higher trophic level predators were found when fishing at maximum sustainable yield (MSY) levels, but impacts on marine ecosystem indicators were relatively modest given reduced exploitation rates (despite catches remaining at close to 80% of the maximum achievable levels). Although additional empirical analyses and modeling efforts will improve our understanding of trade-offs between high trophic level predator population dynamics and fisheries, it is clear that such trade-offs exist, can be estimated for a multi-species system, and can be considered in the context of strategic decision making – as opposed to in tactical decision-making, such as setting harvest quotas, for which such models are generally considered inappropriate.

3.2.1.2 Mid to High Trophic Level Fishes and Invertebrates

High trophic level fishes typically represent highly valued fisheries targets, rather than protected resources subject to take restrictions. A generalized breakdown would suggest three major communities of mid to high trophic level fish assemblages; highly migratory species (HMS,) groundfish, and anadromous fishes (principally salmonids, but including sturgeon and other species as well). A large number of invertebrate species might be included at mid- to high trophic levels, however in considering invertebrates it is important to recognize that in many complex or biologically diverse communities (such as intertidal, kelp forest ecosystems, planktonic

Pacific shortfin mako shark. Photo credit: NOAA

communities), small and generally overlooked species often represent high trophic levels and key roles that are well beyond the scope of this evaluation (such as various species of predatory copepods or jellyfish in pelagic ecosystems, or the predatory sun star, *Pycnopodia* spp., in intertidal ecosystems). Other mid- to high- trophic level invertebrates are more conspicuous elements of the ecosystem, such as predatory squids and various larger crab species (including Dungeness). The competitive and predatory impacts of nonindigenous crab species on juvenile Dungeness crab survival may negatively impact recruitment into the fishery (McDonald et al. 2001). Changes in physical forcing in the CCE have driven the recent poleward expansion of jumbo squid into the CCE increasing the potential for high levels of squid predation for several fish species, many that are commercially important, and potentially resulting in changes across trophic levels (Field et al. 2007). Seasonal patterns appear to be the greatest drivers of migrations and variable distributions for most mid- to higher trophic level species, both pelagic and benthic, although interannual and longer term climate variability also shapes the distribution and abundance of many of the pelagic species in particular. For example, warm years (and regimes) have long been known to bring desirable gamefish such as tunas and billfish farther north and inshore (MacCall 1996, Pearcy 2002).

The highly migratory species include swordfish, albacore and other tunas, several species of sharks (thresher, mako, blue, soupfin and salmon key among them; although great white, basking and sleeper sharks are also of high ecological and conservation concern) and a variety of (generally southern) large coastal piscivores such as black sea bass, white sea bass and yellowtail are all key targets for both commercial and recreational fisheries with long histories of exploitation. The PFMC's HMS FMP is unique in that the relative impact and role of fishing activities under the jurisdiction of the PFMC for most HMS are generally modest, since many HMS species spend limited time subject to fisheries within the EEZ. Exceptions include north Pacific albacore, Pacific thresher sharks, and shortfin mako shark, where West Coast vessels harvest a significant fraction of North Pacific catches. The principle challenges associated with HMS resources (and the HMS FMP) are collaborating between the broad assemblage of nations and regulatory entities that are involved in HMS exploitation and management (See Section 3.5.4.3)

Although generalized to the entire North Pacific, Sibert et al. (2006) summarizes the variability and differences in tuna population trajectories, with western Pacific yellowfin and bigeye declining steadily to near target levels, skipjack and blue shark populations increasing, and albacore fluctuating in both directions. Importantly, Sibert et al. noted that increases in the biomass of some species are consistent with predictions by simple ecosystem models (e.g., Kitchell 1999, Cox 2002) as a result of declines in predation mortality that is consistent with a recent comparison of empirical data from fisheries statistics in the Central North Pacific region (Polovina et al. 2009). Specifically, with increasing fishing pressure,

Albacore tuna. Photo credit: NOAA

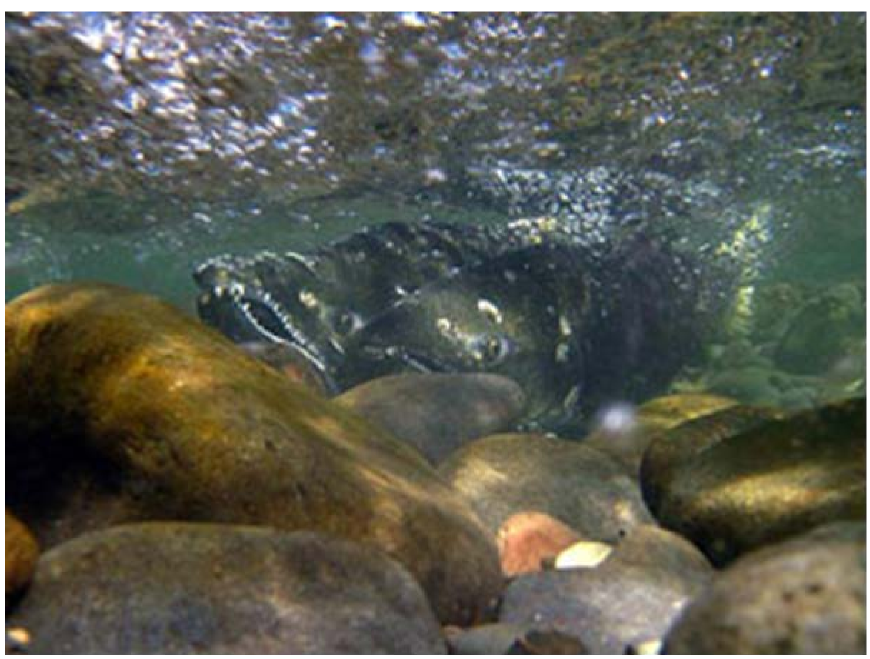
catch rates (and presumably biomass) of top predators such as marlin, spearfish, sharks, and large tunas (bigeye and yellowfin) declined, while the catch rates of mid-trophic level species such as mahi mahi, pomfret and escolar increased. Polovina et al. (2009) suggested that the cumulative effect of fishing on high trophic levels and consistent response by mid trophic level predators indicates that the longline fishery may function as a keystone species in this system. The CCE portion of these stocks may have similar dynamics to those in the Eastern Tropical Pacific for some stocks, and those of the Central Northern Pacific for others. However, in the foreseeable future the key ecosystem issues associated with HMS population dynamics are primarily associated with high and low frequency changes in the availability of target stocks in response to changes in climate conditions, as manifested by seasonal changes in water masses, changes in temperature fronts or other boundary conditions, and changes in prey abundance. Management of the directed fishery also requires minimizing the bycatch of high profile species, such as sea turtles, seabirds and marine mammals. A greater appreciation of the relationships among climate variables, gear selectivities and the spatial distributions of both target and bycatch species will continue to improve management of HMS resources, and will be key to both “single species” and ecosystem based management approaches.

Cowcod. Photo credit: NOAA

Groundfish and salmon occupy a range of trophic niches and habitats, but most species are considered to be at either middle or higher trophic levels. Large groundfish, such as cowcod, bocaccio, yelloweye and shortraker, as well as Pacific halibut, California halibut, arrowtooth flounder, Petrale sole, sablefish, lingcod, cabezon, shortspine thornyheads, several of the skates and a handful of other species are almost exclusively piscivorous, and feed largely on juvenile and adult stages of other groundfish, as well as forage fishes, mesopelagic fishes, and squid. A broader range of species, including most rockfish, are ominovorous mid-trophic level predators that may be piscivorous at times but also feed on krill, gelatinous zooplankton, benthic invertebrates and other prey. Pacific hake, the most abundant groundfish in the CCE, shows strong ontogeny in food habits, since younger, smaller hake feed primarily on euphausiids and shrimps, switching to an increasing proportion of herring, anchovies and other fishes (as well as other hake) as they reach 45-55 cm length, and are almost exclusively piscivorous by 70-80 cm.

Higher trophic level predators have a potential to play a structuring role in the ecosystem, particularly over smaller spatial scales (e.g., individual reefs or habitat areas). Despite the rarity of piscivorous rockfish relative to more abundant omnivorous or planktivorous rockfish, visual surveys have shown that the piscivorous species can be relatively abundant in many isolated and presumably lightly fished rocky reef habitats (Jagielo, et al. 2003; Yoklavich, et al. 2002; Yoklavich, et al. 2000). In rocky reefs, concentrations of smaller, fast-growing rockfish are considerably lower, while reefs thought to have undergone heavier fishing pressure tend to have greater numbers of smaller, fast-growing, and early-maturing species. Similar large-scale community changes are described by Levin et al. (2006), who found broad-scale changes in CCE groundfish assemblages sampled by the triennial bottom trawl surveys on the continental shelf between 1977 and 2001. Levin et al. (2006) found declining rockfish catches, from over 60 percent of the catch in 1977 to less than 17 percent of the catch in 2001, with greater declines of larger species, while flatfish catches increased by a similar magnitude. The potential for intra-guild competition or top-down forcing, in both small-scale rocky reef systems and throughout the larger ecosystem, is also supported by theoretical considerations and simulation models. For example, Baskett et al. (2006) developed a community interactions model that incorporated life history characteristics of pygmy and yelloweye rockfish to consider community dynamics within a marine reserve. Without interspecific interactions, the model predicted that larger piscivores would recover given minimal levels of dispersal and reserve size. However, when community interactions were taken into account, initial conditions like the starting abundance of the piscivores and the size of the reserve became more important with respect to the ultimate stable state, such that under some circumstances (low piscivore biomass, or high planktivore biomass) recovery could be unlikely. Such results are consistent with similar simulations of the potential consequences of community interactions in marine systems (MacCall 2002, Walters and Kitchell 2001), and speak to the importance of considering such interactions in the design, implementation and monitoring of recovery efforts for rebuilding species.

Anadromous species such as salmonids and sturgeon, spend their early life stages in freshwater rivers and streams, then out-migrate to the ocean, where they mature before returning to their natal streams to spawn. Large variation in the abundance and life history characteristics of many anadromous fish populations have been attributed to climatic conditions (e.g. PDO or ENSO; Mantua et al. 1997, Finney et al. 2000, Peterson and Schwing 2003, Wells et al. 2006), although this relationship is not always strong for all salmonids populations (Botsford and Lawrence 2002). The fresh and saltwater ecosystems off central California are generally the southernmost marine habitat occupied by Chinook and coho salmon. Climate fluctuations may exacerbate stressors on low abundance stocks, or on stocks with reduced life-history or habitat diversity (Lindley et al. 2009, Carlson and Satterthwaite 2011). Salmonids prey upon an array of lower trophic levels species including juvenile and adult stages of numerous fishes, squid, euphausiids, and various other invertebrates; in general, salmon tend to forage on larger prey items as they reach larger sizes (Daly et al. 2009).



Chinook salmon. Photo credit: NOAA

The effects of climate variability on the feeding ecology and trophic dynamics of adult Pacific salmon (*Oncorhynchus* spp.) have shown that salmon are extremely adaptable to changes that occur in the ocean environment and their forage base (Kaeriyama et al. 2004). However, Pacific salmon populations can experience persistent changes in productivity, possibly due to climatic shifts, necessitating rapid and reliable detection of such changes by management agencies to avoid costly suboptimal harvests or depletion of stocks (Peterman et al. 2000, Dorner et al. 2008, Lindley et al. 2009). Changes in salmon productivity have been hypothesized to be a function of early natural mortality that is mostly related to predation, followed by a physiologically-based mortality when juvenile salmon fail to reach a critical size by the end of their first marine summer and do not survive the following winter (Beamish and Mahnken 2001). This growth-related mortality provides a link between total mortality and climate that could be operating via the availability of nutrients regulating the food supply and hence competition for food (i.e. bottom–up regulation) (Beamish and Mahnken 2001). Strong evidence of positive spatial covariation among salmon stocks within Washington, British Columbia, and Alaska and between certain adjacent regions, with no evidence of covariation between stocks of distant regions, suggests that environmental processes that affect temporal variation in survival rates operate at regional spatial scales (Pyper et al. 2001).

Some subpopulations of green sturgeon (*Acipenser medirostris*) are listed as threatened (71 FR 17757, April 7, 2006) under the Endangered Species Act (ESA). This determination was based on the reduction of potential spawning habitat, severe threats to the spawning population, the inability to alleviate these threats with the conservation measures in place, and the decrease in observed numbers of juvenile green sturgeon collected in the past two decades compared to those collected historically (NMFS 2006). Other subpopulations are listed as NMFS Species of Concern, since insufficient information is available to indicate a need to list the species under the ESA. Little is known about green sturgeon life history, particularly at sea. Adult green sturgeon inhabit estuaries during the summer (ODFW 2005), feeding upon amphipods, isopods, shrimps, clams, crabs, and annelid worms (Ganssle 1966, Radtke 1966). Temperature has been shown to affect both green sturgeon embryos (Van Eenennaam et al. 2005), as well as juvenile sturgeon (Allen et al. 2006) suggesting a possible sensitivity to climate change. Bycatch of green sturgeon in the California halibut fishery is of management concern.

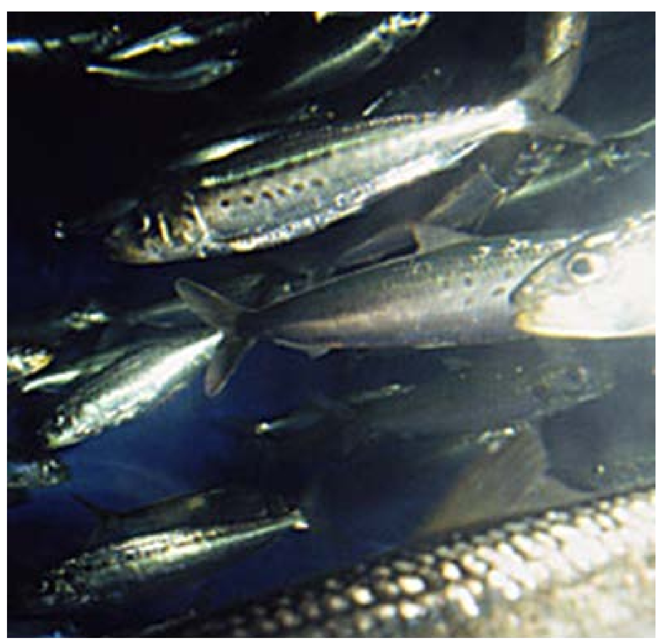
Oregon anglers and sturgeon. Photo credit: NOAA Historic Fisheries Collection

3.2.1.3 Low Trophic Level

Low trophic level species (secondary producers) are defined as species that feed either primarily or partially on the lowest trophic level and includes the following groups ordered roughly from largest to smallest by individual body size:

- Small pelagic fish -- includes baitfish and other forage fish, such as sardine, anchovy, smelts, etc., which are relatively small as adults and feed on phytoplankton and/or zooplankton
- Ichthyoplankton – small larval stages of fish that feed on both phytoplankton and zooplankton, including the larvae of the small pelagics listed above, plus the larval stages of large pelagic fish and groundfish, such as Pacific hake, jack mackerel, and rockfish
- Euphausiids – krill, relatively large, often swarm- or school-forming crustacean zooplankton that feed on both phytoplankton and zooplankton
- Gelatinous zooplankton- soft-bodied zooplankton, such as jellyfish, pelagic gastropods (primarily pteropods), salps, doliolids and apendicularians
- Other crustacean zooplankton – this group includes shrimps, mysids, and other less numerically dominant, but important organisms that consume both other zooplankton, phytoplankton, and microzooplankton
- Copepods – smaller crustacean zooplankton, often the numerically dominant multi-cellular organism in many areas of the CCE that feed on both phytoplankton, other zooplankton, and microzooplankton
- Microzooplankton – uni-cellular zooplankton that feed at high rates on phytoplankton, other microzooplankton, and bacteria

Small pelagic fish, such as sardine and anchovy, comprise an integral part of the CCE, feeding nearly exclusively on phytoplankton (typically diatoms), small pelagic crustaceans, and copepods (Emmett et al., 2005). A large portion of what are known as the "forage fish" of the CCE are comprised of small pelagic fish; this group functions as the main pathway of energy flow in the CCE from phytoplankton to larger fish and the young life stages of larger predators (Crawford, 1987; Cury et al., 2000). Thus, small pelagic fish form a critical link in the strong, upwelling-driven high production regions of the CCE. Ichthyoplankton, the larvae of larger fish, are also a key prey resource for larger fish and other marine organisms. A summary of over 50 years of the ichthyoplankton community gives some sense of the relative abundance of various ecologically important species in the CCE (Moser et al. 2001). Six of the top 10 most abundant species throughout this long time period are northern anchovy, Pacific hake, Pacific sardine, jack mackerel, and rockfish (shortbelly rockfish and unidentified Sebastes, as most species are not identifiable to the species level). The persistent dominance of the icthyoplankton of relatively few CCE species



Sardines. Photo credit: NOAA

indicates that the relative abundance and importance, at least in the southern part of the CCE, of these key species is far greater than most other lower trophic level species. Notably, the remaining four species in the top 10 are mesopelagic species that further account for 12 of the top 20 most abundant species. There are considerably fewer ichthyoplankton data for central and northern California, although survey data suggest that anchovy, herring, sardine and whitebait smelt have been the most abundant and important forage species in this region over the past 13 years (Orsi et al. 2007, Bjorkstedt et al. 2010). Ichthyoplankton data are more limited for the CCE north of Cape Mendocino, but existing studies suggest that off Washington and Oregon, Osmeridae (smelts, typically not identified to the species level) are often highly abundant in the nearshore shelf waters, and that tomcod and sandlance are often fairly abundant (see Richardson and Pearcy 1977, Kendall and Clark 1982 and Brodeur et al. 2008).

Euphausiids, primarily the species *Euphausia pacifica* and *Thysanoessa trispinosa*, are another key link in the trophic web of the CCE (Brinton and Townsend, 2003). These species primarily eat phytoplankton (diatoms) and small zooplankton, and in turn are the food for many species of fish, birds, and marine mammals. Euphausiids can form large conspicuous schools and swarms that attract larger predators, including whales. Due to their high feeding rates, fast growth rates, and status as a key prey for many species, Euphausiids play a critical role in the overall flow of energy through the CCE.

Euphausiid. Photo credit: NOAA

When prevalent, gelatinous zooplankton provides an alternate pathway for energy flow that may or may not lead to production in higher trophic levels (Brodeur et al. 2011). Gelatinous zooplankton include a variety of forms, from free-floating jellyfish that passively ambush zooplankton and small larval fish prey, to apendicularians that build large gelatinous "houses" used to filter large quantities of the smallest phytoplankton classes from the water column. While gelatinous zooplankton grow at high rates, and have high feeding rates, their bodies are mostly composed of water; as a result, gelatinous zooplankton are not typically a good food source for larger organisms, with the exception of certain turtles that specialize in gelatinous prey. Thus, systems dominated by gelatinous zooplankton as the primary predators of phytoplankton tend to have limited production of fish species, and are generally considered "dead-end" ecosystems. Typically, gelatinous zooplankton blooms are found offshore in oligotrophic regions, although blooms occasionally predominate nearshore during warmer periods. An exception are pteropods, pelagic gastropods that form large gelatinous nets, much larger than their body size, used to capture falling detritus in the water column. Unlike the other taxa in this group, pteropods are known to be an important food source for at least salmon, and possibly other fish species (Brodeur, 1990).

Copepods and other small crustacean zooplankton have similar roles to krill within the CCE. However, copepods and small crustacean zooplankton do not tend to form large dense schools, although at time for brief periods (a few hours to a few days), they may be found at locally higher densities as they aggregate near physical (e.g. horizontally along physical fronts, or vertically near the main thermocline) or biological discontinuities (e.g. phytoplankton “thin layers”). Copepods eat phytoplankton, microzooplankton, and other smaller crustacean zooplankton, and in turn are food for krill, fish larvae, and small pelagic fish. An important feature of many of the larger crustacean zooplankton is that they undergo daily vertical migrations from depths as deep as several hundred meters during the day, up to near the surface at night, primarily as a means to avoid visual predators, such as fish. Other small crustaceans, such as shrimps and mysids, tend to be less abundant, but can be important in some areas. Mysids often form swarms in shallow nearshore waters, and may be an important food source for outmigrating smolts (Brodeur, 1990). Unlike many other zooplankton, several of the dominant species of copepods, those of the genus *Calanus* and *Neocalanus* in particular, undergo a wintertime dormant period, wherein they descend to great depths (~400-1000m) for anywhere from 4-8 months of the year (Dahms, 1995). These copepods then emerge in the springtime to reproduce. Thus copepods have a marked seasonality in their availability to higher trophic levels, often leading to match-mismatch problems.

Unicellular microzooplankton include a diverse array of organisms, such as heterotrophic dinoflagellates, ciliates, and choanoflagellates. These organisms primarily eat other microzooplankton, phytoplankton, cyanobacteria, and bacteria. The CCE biomass of unicellular microzooplankton is not often high, however, their grazing rates are on par with the growth rates of phytoplankton (Li, Franks, and Landry, 2011). Thus, contrary to common belief, it is these unicellular microzooplankton, not crustaceans or fish, which consume the majority of phytoplankton standing stock and production within many areas of the CCE (Calbet and Landry, 2004). Important to note, is that a large portion of the energy that flows into microzooplankton does not reach higher trophic levels, but is returned to detrital pools, or recycled within the microozooplankton trophic level. This retention of energy within the unicellular microzooplanton trophic level is known as the “microbial loop” and, when prevalent, decreases the overall productivity of higher trophic levels. Unicellular microzooplankton are a key prey source for copepods, gelatinous zooplankton, and other small crustacean zooplankton due to their enriched nitrogen relative to carbon, in comparison to similarly sized phytoplankton.

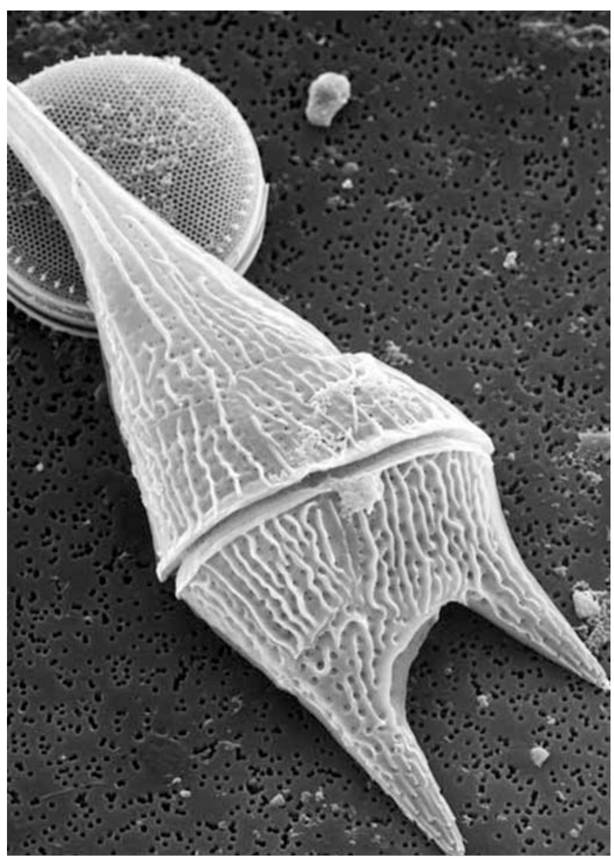
Julie Stewart, Hopkins Marine Station, sorting low trophic level species caught with micronekton net during juvenile rockfish survey. Photo credit: John Field, NOAA.

3.2.1.4 Lowest Trophic Level

Lowest Trophic Level species are those that carry out photosynthesis, i.e. phytoplankton (also known as primary producers). Large multicellular plants and vegetation are described in more detail in section 3.3.2. The most predominant phytoplankton groups within the California current include the single-celled phytoplankton classes:

- Diatoms – eukaryotic cells with hard silica based shells, dominant in upwelling areas, occasionally harmful algal bloom (HAB) forming
- Dinoflagellates – eukaryotic cells, many of which are slightly motile, often dominate in stratified regions, and more commonly form HABs than diatoms
- Cyanobacteria – prokaryotic cells, predominant in offshore regions, but still abundant in nearshore regions (~20% of phytoplankton productivity)

Diatoms are probably the most critical phytoplankton group in terms of overall productivity and importance as a food resource for higher trophic levels. Diatoms grow rapidly in nearshore regions where upwelling provides cool, nutrient-rich water. In turn, diatoms are grazed by most of the low trophic level species (described above). Occasionally, certain species of diatoms may constitute HABs. Specifically, the diatom *Pseudonitchia multiseries* produces a powerful neurotoxin known as Domoic Acid that can be bio-accumulated in the tissues of fish (described in more detail below in section 3.3.2). While diatoms are an important prey for copepods, their protective silica casing (known as a frustules) prevents them from being readily preyed upon by smaller microzooplankton. Dinoflagellates are an important resource in the CCE. Dinoflagellates may outcompete diatoms when silica is limiting, since dinoflagellates do not require silica for growth. Dinoflagellates are also typically preferred by other microzooplankton and small crustacean zooplankton as a food source as compared to diatoms, due to their relatively enriched nutrient content, and lack of a hard Si encasement (Kleppel, 1993; Leising et al., 2005). Because of this, when dinoflagellates predominate, there is a longer chain of organisms between phytoplankton and higher predators, hence a lower total transfer of energy to higher trophic levels (only about 30-35% of energy is transferred upwards from each trophic level, thus 65-70% of the energy is lost to recycling, Paffenhofer, 1976; Fenchel, 1987), as compared to diatom-dominated systems (nearshore upwelling) where the diatoms may be directly consumed by small fish and some fish larvae. Cyanobacteria are more important in offshore regions, where, although they do not have a high biomass, they may have high growth rates, providing for rapid nutrient turnover (Sherr et al., 2005). Cyanobacteria are primarily consumed by uni-cellular microzooplankton that may be prey for other microzooplankton. Hence food webs dominated by cyanobacteria tend to have a low biomass of higher trophic levels due to the relatively large number of trophic links.



Dinoflagellate under scanning electron microsope Photo credit: Carla Stehr, NOAA

3.2.2 Species Interactions

In addition to their own internal dynamics, fish populations interact with, and are influenced by, other species. Species interactions can take a variety of forms summarized in Table 3.2.1.

Table 3.2.1: Species Interaction Types and Their General Effects

Nature of interaction	Species 1	Species 2
Mutualism	+	+
Commensalism	+	0
Predation / herbivory	+	-
Parasitism	+	-
Competition	-	-

+ positive effect; 0 no effect; - deleterious effect

Predation, parasitism, and herbivory all have the same general effects—a positive effect on one species and a negative effect on another. Competition is defined as a species interaction that has a negative effect on both species. Mutualism (two different species each derive benefits from the other) and commensalism (when two different species interact, one benefits while the other is unaffected) are less commonly discussed in the ecological (and especially fisheries) literature, but potentially play important roles for some species.

The vast majority of information we have on species interactions involving fisheries targets is on predation. As evidenced in the sections above, we have a strong general understanding of the trophic interactions among species in the CCE. In large part, this is because it is technically simple to obtain stomach contents—the founding basis for an understanding of predation. Additionally, diet observations can be complemented with stable isotope analyses that match predator diets to known carbon and nitrogen signatures in prey groups (Bosley et al. 2004). However, it is important to remember that diet composition alone is a poor indicator of the importance of predation on prey populations. That is, just because a predator's diet contains a small amount of a particular prey species, this does not mean that mortality from that predator is not important for prey dynamics. For example, harbor seals prefer herring and salmonids as prey; however, they also consume small numbers of rockfish. In some circumstances, this small level of predation by seals on rockfish could have important implications for rockfish population dynamics (Ruckelshaus et al. 2010).

Foreground, Matt Mitchie with lingcod caught during a kayak derby. Background, other competing high-trophic order CCE predators. Photo credit: Matt Mitchie, CDFW

In addition to understanding predation, diet information helps to inform analyses of potential competitive interactions. Interspecific competition may occur when individuals of two separate species share a limiting resource in the same area. If the resource cannot support both populations, then, by definition, both species will suffer fitness consequences in the form of reduced growth, survival or reproduction. A first step in understanding competitive interactions is to document overlapping resource use. In the case of competition for food, this means documenting the degree to which diets overlap. For example, Miller and Brodeur (2007) documented the diets of 20 nektonic species in the CCE and used cluster analysis to group species into trophic groups with similar prey. The strength of competition will be greater within trophic groups than among the groups, if food is a limiting resource. Dufault et al. (2009) similarly summarized diet overlap between both demersal and pelagic species, and other groups such as marine mammals and seabirds – see Figure 3.2.2.

Diet analyses such as those of Miller and Brodeur (2007) and Dufault et al. (2009) can be used to better understand the links between managed species and their prey and predators. Figure 3.2.2, below, illustrates links between Pacific whiting, referred to in the figure as Pacific hake, and its predators and

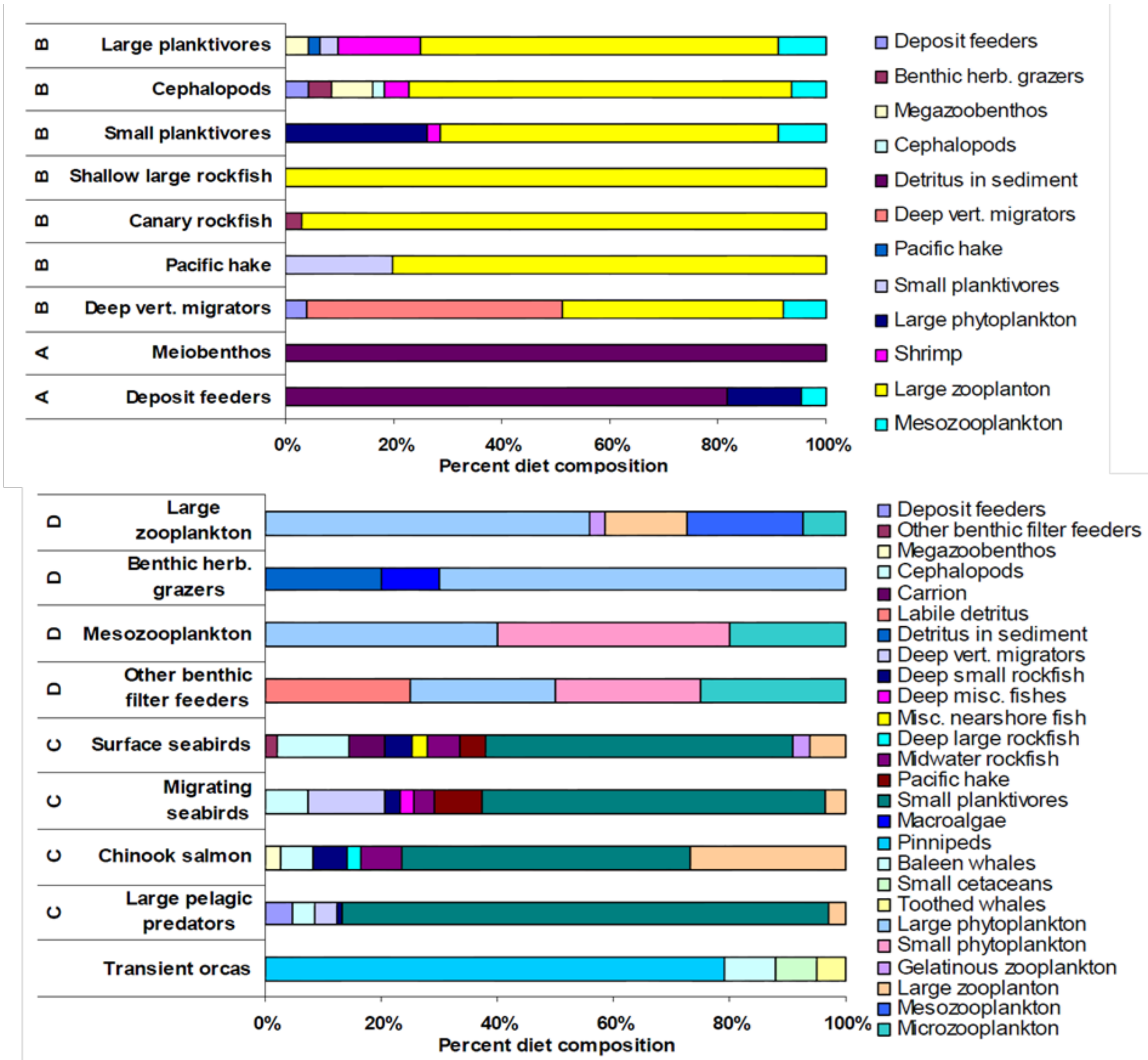


Figure 3.2.2: The prey composition of several feeding guilds of California Current predators, based on a functional group level hierarchical cluster analysis (Dufault et al. 2009; see full reference for other guilds, species, names, and data sources.)

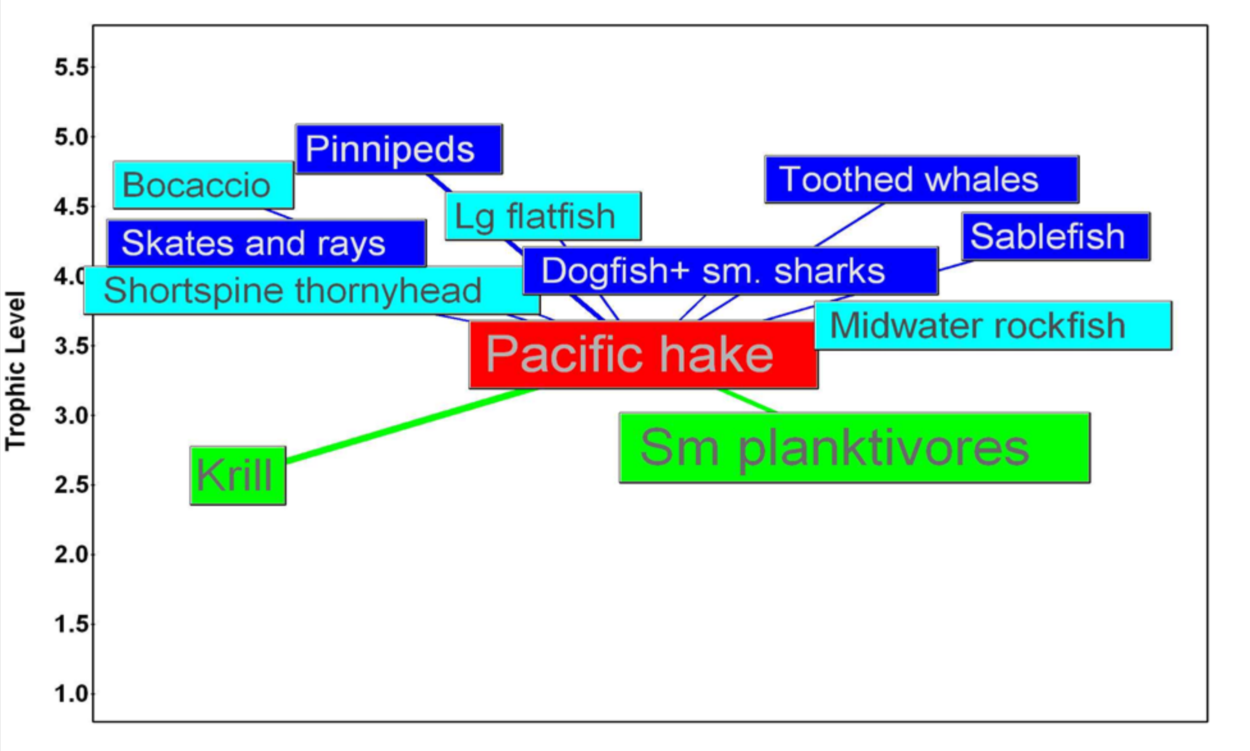


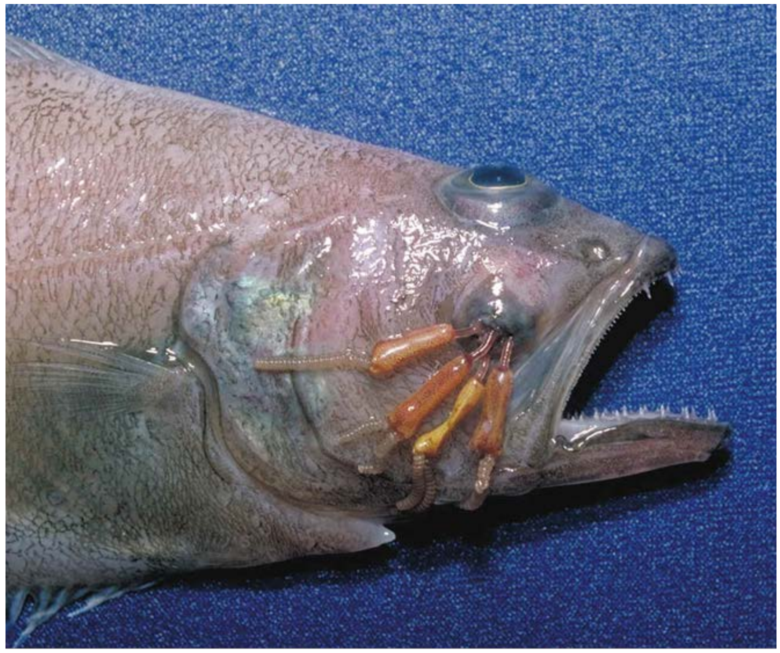
Figure 3.2.3: Primary food web of Pacific hake (also known as whiting). Pacific hake are red, major prey items are green, and major predators are dark blue. Turquoise groups are both prey and predators of hake at different life stages. Vertical position is approximately related to trophic level, with higher positions representing higher trophic levels. Size of the box is related to biomass size of the group. Links between boxes represent links in the food web, and most diet information shown here refers to adult predators. Diagram excludes minor prey items and predators that inflict small proporsions of predation mortality on Pacific hake. (Levin and Wells, 2011, Ecoviz 2.3.6 software provided by Aydin, NOAA AFSC)

prey, both of which classes include other Council-managed species. Diet links between species also connect FMPs, and imply that fishery management policies do not affect species in isolation. For instance, modeling studies suggest that when these linkages are included, simultaneous harvest of all groups at rates estimated to be sustainable based on single species maximum sustainable yield may lead to an erosion of ecosystem structure and declines in top predator biomass and catch (Walters et al. 2005).

Competition for non-food resources may also occur. For instance, competition for space (e.g., refuges from predation) is common in a number of systems (Holbrook and Schmitt 2002, Hixon and Jones 2005). However, such competitive interactions are difficult to demonstrate, and ecologists often rely on manipulative experiments to demonstrate competition. Clearly, because their habitats make sustained observations difficult, such experiments or related observations are difficult for many if not most of the targeted fish species in the CCE. As a consequence, we know little about the role of competition for space or other non-food resources in offshore waters of the CCE.

Parasitism is another type of species interaction that we know little about in the California Current, but that is likely to be important based on the broader ecological literature (Washburn et al. 1991). Parasitism is the most common consumer strategy in food webs (Lafferty et al. 2008); however, parasites may affect hosts differently than predators affect prey. While a predator kills multiple prey individuals during its life, a parasite obtains nourishment from a single host during a life stage. Parasitism is often density dependent, and thus fisheries can directly or indirectly influence the importance of parasites. For example, Lafferty (2004) showed that fisheries for spiny lobsters resulted in an increase in densities of their prey, especially sea urchins. The increase in sea urchin density, however, resulted in an increase in disease (aka micro-parasites), which ultimately resulted in a sea urchin population crash.

In the CCE, one common example of parasitism involves sanddabs (*Citharichthys sordidus*) that are parasitized by *Phrixocephalus cincinnatus*, a blood-feeding parasitic copepod that attaches to the eyes of flatfish hosts, generally blinding one eye but not causing immediate mortality. Prevalence in host populations varies by study year, ranging from 1-3% to 83% (Kabata 1969, Perkins and Gartman 1997). The effects of this dramatic example of parasitism on sanddab growth, reproduction, and population dynamics are currently unknown, as are the factors that determine prevalence of the parasite in host populations.



Arrowtooth flounder with eye parasites. Photo credit: NOAA

In addition to the direct species interactions described above, there are a number of important indirect effects of species interactions (Table 3.2.2). In general, we know that these indirect effects are important in a number of systems, but as with parasitism and competition, evidence of their importance in the dynamics of target species is sparse, at best. Nonetheless, based on the evidence in other systems (including shallow waters of the CCE), we can surmise that these indirect interactions may play some role in the dynamics of the population dynamics of target species.

Table 3.2.2: Indirect Species Interaction Types

Type of interaction	Description
Keystone predation	Predation that has a disproportionate effect on a marine community, relative to the abundance of the predator
Trophic cascades	Changes in abundance at one trophic level (e.g. predator) result in a reciprocal change in abundance of prey, which then leads to reciprocal response in prey at a lower trophic level (e.g. increased predator abundance leads to decreased herbivore abundance and increased plant abundance.)
Apparent competition	Reduction of species A that results from increases in species B, which shares prey or other resource with species A.
Habitat facilitation	One species indirectly improves the habitat of a second by altering the abundance of a third interactor
Apparent predation	An indirect decrease in a nonprey produced by a predator or herbivore, e.g. when urchins reduce kelp cover they eliminate shelter for some rockfish species.

3.3 CCE Abiotic Environment and Habitat

The CCE encompasses over 2 million square kilometers of ocean surface. This large area includes many diverse habitat types that can be described in a variety of ways and at a variety of scales—from individual features like kelp beds, submarine canyons, and seamounts, to broader scale regions, like the continental shelf break, that share certain features coastwide. The Council's efforts with habitat to date have been largely shaped by the MSA's EFH provisions. As discussed in section 3.3.4 below, the Council has described EFH in detail for the species managed in all four of the FMPs, and those details are not repeated here.

In general, ocean habitat can be thought of as extending from the transition between land and sea to the abyssal plain 4,000 meters below the surface and deeper. Key habitat for harvested species exists throughout the bulk of this range. The Council's EFH for groundfish, for example, includes all waters from the high tide line and parts of estuaries to 3,500 meters below the surface. When considering anadromous species like salmonids, the range of significant habitat then extends far into terrestrial watersheds. A wide range of marine and coastal habitat types can be found within relatively small areas of the coast (e.g. the Monterey Bay area) and within 100 or so nautical miles of shore in some places where the continental shelf is relatively narrow.

As described in this section 3.3, habitat can be defined by geologic sediments (e.g., rocky reefs, boulder fields, and sandy seafloors,) or by organisms, including microbes, algae, plants, and even fallen whales (Lundsten et al. 2010) that form biogenic habitats by creating structure or providing resources for other organisms. Geochemical features—such as methane seeps —also create important habitat in deep sea environments, as can artificial structures like jetties, piers, and offshore oil platforms in more coastal waters.

Another important characteristic of marine habitats is that they can vary as much by the motion and physical and chemical properties of seawater (e.g., temperature, salinity, nutrient content) as by particular locations and geologic and biogenic structures. They can also be highly dynamic. For example, EFH for coastal pelagic species is described by sea surface temperature and the thermocline/mixed layer. The location and extent of CPS EFH—in terms of both depth and latitude—will therefore differ between seasons and years. As described in section 3.3.2, features like oceanic fronts and eddies, upwelling zones and shadows, river plumes, and meandering jets all form key habitats throughout the CCE. These features may show regularity of pattern, yet are all marked by seasonal and annual variability in location and size, and in turn, in the type and quality of habitat that they provide.

The CCE's spatial environment can be divided along three main dimensions: from north to south (latitude, and generally in the alongshore dimension), from east to west (longitude, and generally in the onshore-offshore dimension), and from the sea surface to the ocean floor. One key division is between coastal waters and the open ocean (the oceanic area,) with the divide occurring roughly at the edge of the continental shelf break. Coastal waters can be further divided into the

Rosethorn rockfish in rocky slope habitat. Photo credit: NOAA

tidal or littoral zone—existing between the high and low tide marks—and the sublittoral, or neritic zone which includes the waters from the low tide mark to the continental shelf break. Benthic- or demersally-associated species are often limited to one or more of these zones.

The third major division in the marine ecosystem is between the benthic habitats of the seafloor and the pelagic habitats of the water column. Each of these can be further subdivided based on depth and other features. The epipelagic (photic, e.g. where light can reach) zone is the shallowest of the pelagic zones and covers those waters where sunlight is strong enough for photosynthesis to drive primary production. The depth of this zone will vary as a function of water column structure and water clarity, varying in depth from a few meters to tens of meters in the neritic zone, to 200 m in the far offshore oceanic zone. The mesopelagic zone is the next deeper layer and the start of the aphotic zone—sunlight penetrates into this layer yet not enough for photosynthesis to occur. The mesopelagic zone is also typically (but not always) the beginning of the main thermocline. Temperature changes drastically between the top and bottom of the layer. The bathypelagic zone begins at 1,000 m, and where the waters reach depths of 4,000 m and deeper, the abyssalpelagic zones follows. The relative divisions between these depth zones within the CCE change slightly in both the onshore-offshore dimension, and as a function on water column mixing and the east-west location of the major north-south currents. Hence these zones are dynamic in space and time. Delineation of these zones is of importance in that certain species and fisheries are limited at times to particular zones, due to temperature, feeding, or reproductive requirements.

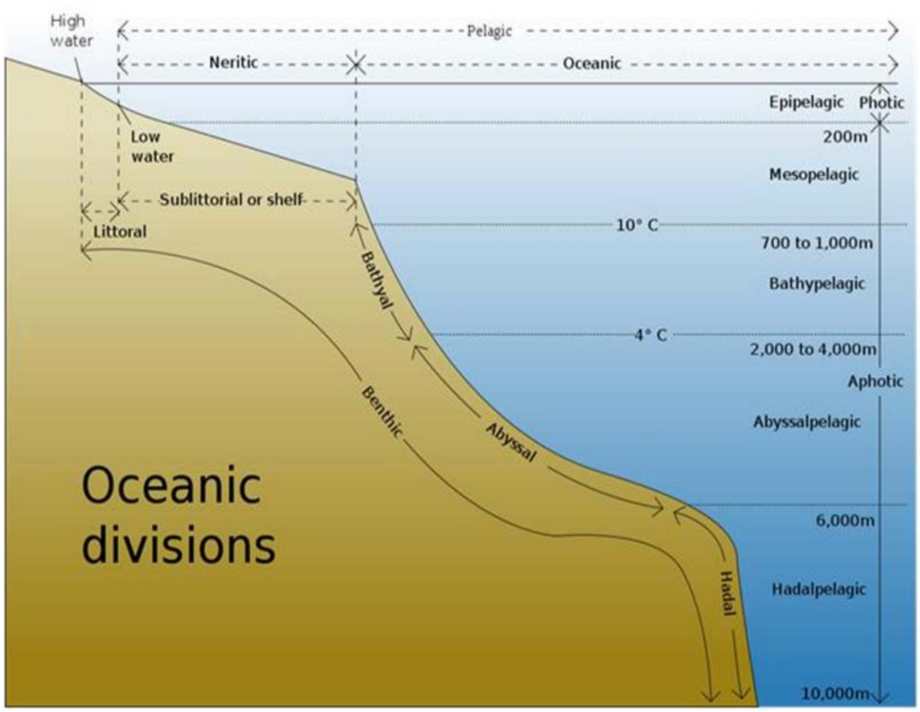


Figure 3.3.1: Divisions of coastal and oceanic zones, Wikimedia Commons

The benthic zone can be similarly divided (see Section 3.3.1). Discussions concerning the Council's Groundfish FMP—the most benthically-oriented of the four FMPs—tend to describe benthic habitats in relation to the continental shelf and slope. Habitats can be referred to as being in the nearshore, on the shelf (sometimes divided between the shallow and deeper shelf), or the slope. The continental shelf break, which describes the transition between the shelf and slope, provides key habitat for several managed species and is the main area covered by the Rockfish Conservation Area (RCA). The habitat of some commercially important species extends down the slope into the bathypelagic zone below 1,000 meters, e.g. sablefish (*Anoplopoma fimbria*) and longspine thornyhead (*Sebastolobus altivelis*). The Council has closed bottom trawling in waters deeper than 700 fathoms (~1,300 meters). Detailed information on benthic habitat types, bathymetry, and other benthic zone features may be found in the Council's EFH Review Committee's September 2012 report to the Council (EFHRC 2012).

3.3.1 Geological Environment

Geologic features greatly influence current and wave patterns and provide habitats that influence species distributions and productivity within the CCE. The geology of benthic habitats is one among a variety of important ecological characteristics for managed fish species. The physical substrate or physiography of benthic habitats of the CCE can be described using a classification scheme developed by Greene et al. (1999) for deep seafloor habitats, which the Council used for describing groundfish EFH. This classification system organizes benthic habitat according to physical features in a hierarchical system of levels: megahabitat, seafloor induration, meso/microhabitats, and modifiers. Specific types of habitats in each level are:

- Level 1 megahabitat includes: continental rise/apron; basin floor; continental slope; ridge, bank or seamount; and continental shelf.
- Level 2 seafloor induration includes: hard or soft substrate.
- Level 3 meso/microhabitat includes: canyon wall; canyon floor; exposure and bedrock; gully; gully floor; ice-formed feature; and landslide.
- Level 4 modifier includes: bimodal pavement; outwash; and unconsolidated sediment.

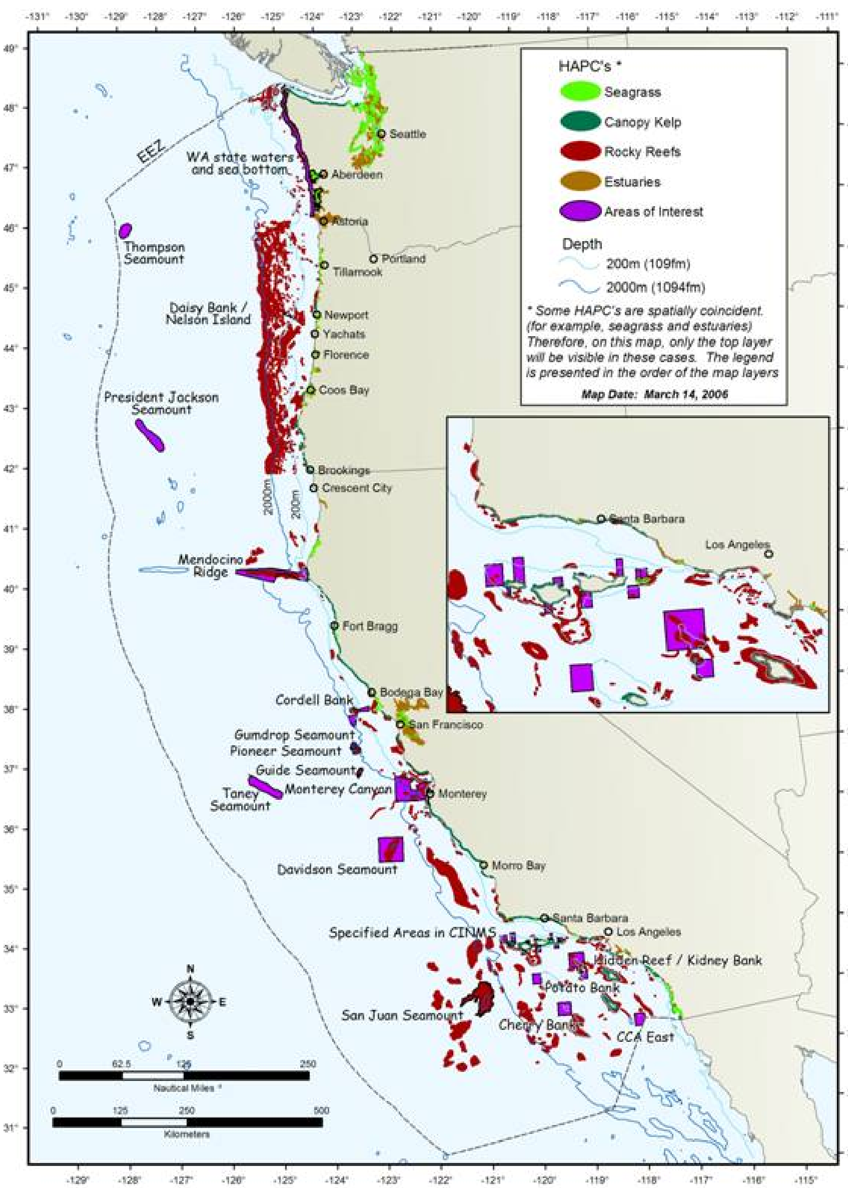


Figure 3.3.2: Groundfish HAPCs and Major Geological Structures [Figure 7-2 from Groundfish FMP]

The West Coast EEZ is geologically diverse and active. It includes all three types of global tectonic plate boundaries: 1) transform or strike-slip, 2) convergence or subduction, and 3) divergence or spreading. The Mendocino

Triple Junction, where three plates meet, lies just south of the state boundary between California and Oregon, making the region geologically complex. Plate movements result in slipping, uplifting, landslides and other changes in the physiographic features off the West Coast.

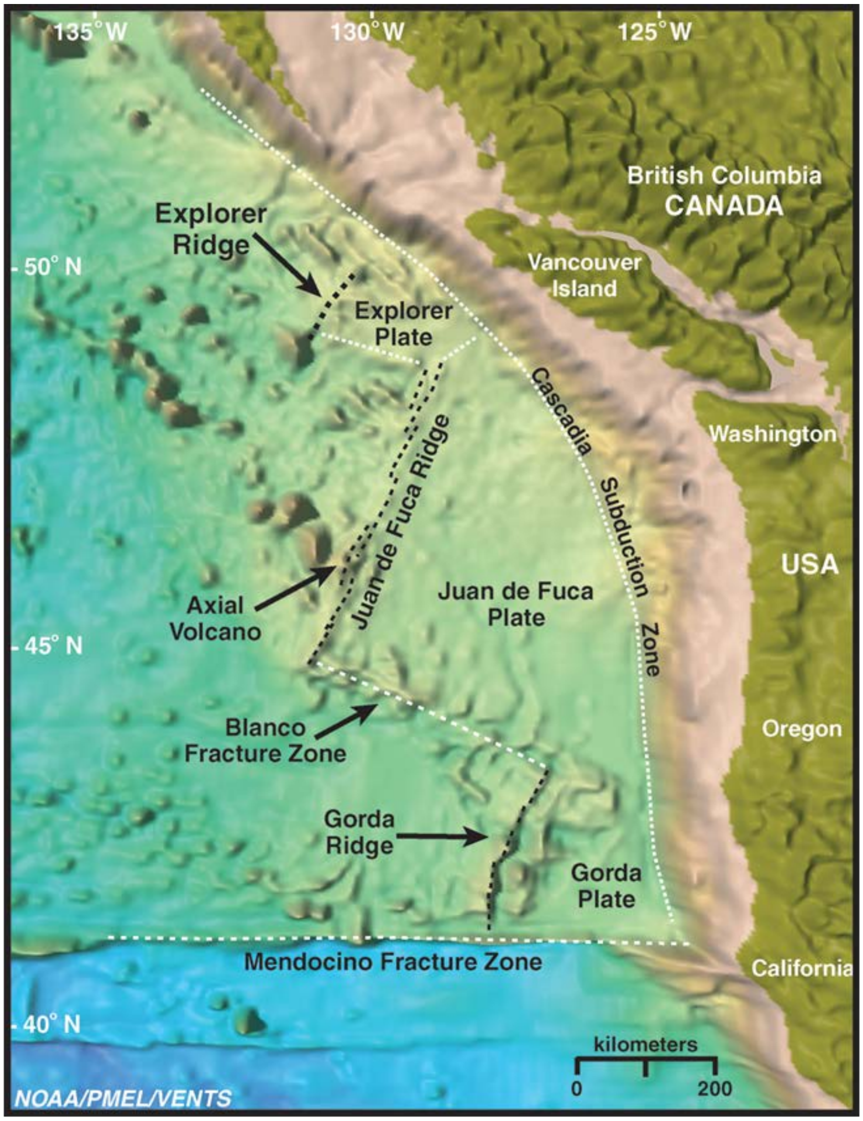


Figure 3.3.3: Satellite imagery of northeast Pacific Ocean tectonic plates. Image courtesy of Submarine Ring of Fire 2002, NOAA/OER.

In general, the West Coast EEZ has a relatively narrow shelf, steep slope and wide abyssal plain. Some important geologic features are shown in Figure 3.3.2. The shelf, ranging from shore to depths of about 2000 m, is generally less than 50 nm wide along most of the West Coast, but widens to about 100 nm wide off northern Washington and in the southern California Bight. Most of the EEZ north of the California Bight also has a narrow slope with deep (abyssal depth) basins fringed on the west by volcanically active ridges. Cape Blanco, Cape Mendocino and Point Conception are prominent features of the coastline and significantly influence oceanographic conditions offshore. They are often identified as boundaries separating biogeographic regions of the coast. Smaller capes are also dotted along the coastline and have more localized influences.

Major offshore physiographic features of Washington and Oregon include the continental shelf, slope and Cascadia Basin. Low benches and hills characterize the upper slope. The lower slope intersects the deep sea floor of the Cascadia Basin at 2200 m depth off the north coast, and at about 3,000 m off the central and southern Oregon coast. Off northern California, the Eel River Basin, located on the continental shelf and stretching from the waters offshore of Oregon, has a high sedimentation rate, fed by the Eel, Mad, and Klamath Rivers. The offshore region of the southern California Bight encompasses some of the most diverse topography along West Coast. It is unique in that a complex series of northwest-southeast-oriented basins and ridges characterizes the continental border south of Point Conception with islands topping most of the ridges. Below, the FEP addresses major Level 1 megahabitat types off the U.S. West Coast.

3.3.1.1 Submarine Canyons

Submarine canyons are submerged steep-sided valleys that cut through the continental slope and occasionally extend close to shore. They have high bathymetric complexity, provide a variety of ecological functions, and affect local and regional circulation patterns. Submarine canyon habitats receive sediment and detritus from adjacent shallow areas and act as conduits of nutrients and sediment to deeper offshore habitats. Canyons are complex habitats that may provide a variety of ecological functions.

Many submarine canyons cut through the continental shelf along the West Coast. The Rogue, Astoria, Quinault, Willapa, Guide, and Grays submarine canyons intersect the continental shelf of Oregon and Washington. Off northern California, five submarine canyons occur between Cape Mendocino and Point Delgada, including Mendocino Canyon, Mattole Canyon, Spanish Canyon, Delgada Canyon and Eel Canyon. Off central California, Monterey Canyon is designated as a groundfish Habitat Areas of Particular Concern (HAPC). Arguello and Conception Canyons occur south of Point Conception. Submarine canyons in the Southern California Bight generally connect to river mouths on land and include the Hueneme-Magu Canyon system, Dume Canyon, Santa Monica Canyon, Redondo Canyon, San Pedro Sea Valley, San Gabriel Canyon, Newport Canyon system, Oceanside Canyon, Carlsbad Canyon, La Jolla Canyon, and Loma Sea Valley.

3.3.1.2 Submarine Fans

Submarine fans often occur in association with submarine canyons when sediment is fed to the canyon head by seasonal flowing currents. For example, the Astoria Fan lies at the base of Astoria Canyon and is fed by sediments carried to the canyon head by seasonal flowing currents. Along with a portion of the Astoria Fan, the Willapa Fan occurs off Washington. Although rivers such as the Klamath possess gently sloping deltas, most of the rivers in Oregon and Washington have drowned mouths and estuaries.

In California, the Delgado Canyon, near Point Delgado, is particularly important because it transports considerable sediment to the Delgado Deep Sea Fan. The large Tufts Submarine Fan occurs in the deep basin off northern California, west of the Gorda Ridge. The Monterey Submarine Fan receives sediment from the Ascension Canyon, Lucia-Partington-Sur Canyons, and the Monterey –Carmel Submarine Canyons (Hamlin 1974). South of Point Conception, submarine fans in the Santa Monica Basin include the large Hueneme Fan and the small Magu and Dume Fans. In Hueneme Canyon, the Santa Clara River has produced a substantial delta that feeds the canyons of the Hueneme-Magu Canyon system. Turbidity currents traveling down Redondo Canyon and the San Pedro SeaValley have created moderate-sized fans in the San Pedro Basin. Turbidity currents in San Gabriel Canyon have constructed a submarine fan in the Catalina Basin.

3.3.1.3 Seamounts and Pinnacles

Seamounts rise steeply to heights of over 1,000 m from their base and are typically formed of hard volcanic substrate. They are unique in that they tend to create complex current patterns. Several unnamed seamounts exist along the mid- to lower-slope and on the abyssal plain in the Cascadia Basin. Within and adjacent to the Cascadia Margin, several major seamounts exist, including (from south to north) President Jackson, Vance, Cobb, Eickelberg and Union seamounts. Off California, significant seamounts include Gumdrop, Pioneer, Guide, Taney and Davidson off the central coast and Rodriguez, San Juan and San Marcos in the southern California Bight. Several of these seamounts have been identified in the Groundfish FMP as HAPCs, including Thompson Seamount and President Jackson Seamount off Oregon and Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Taney Seamount, Davidson Seamount, and San Juan Seamount off California.

3.3.1.4 Ridges, Banks and Islands

A series of large ridges occur at the base of the continental slope offshore of Oregon and Washington with ridge crests elevated 400 m to 1000 m above the abyssal plain of the Cascadia Basin. The Gorda and Juan de Fuca ridges are major tectonic features that are volcanically active. The Gorda Ridge is a narrow shelf in the deep water offshore of northern California and southern Oregon. Near the coastline of Cape Mendocino, three active tectonic plate boundaries meet. These tectonic boundaries are the Cascadia Subduction Zone, the Mendocino Fracture Zone and the San Andreas Fault. The Mendocino Ridge associated with this boundary zone is designated as a groundfish HAPC off California. In southern California, the Patton Ridge, which supports Sverdrup Bank, is a major bathymetric feature that separates the shelf from the abyssal plain.

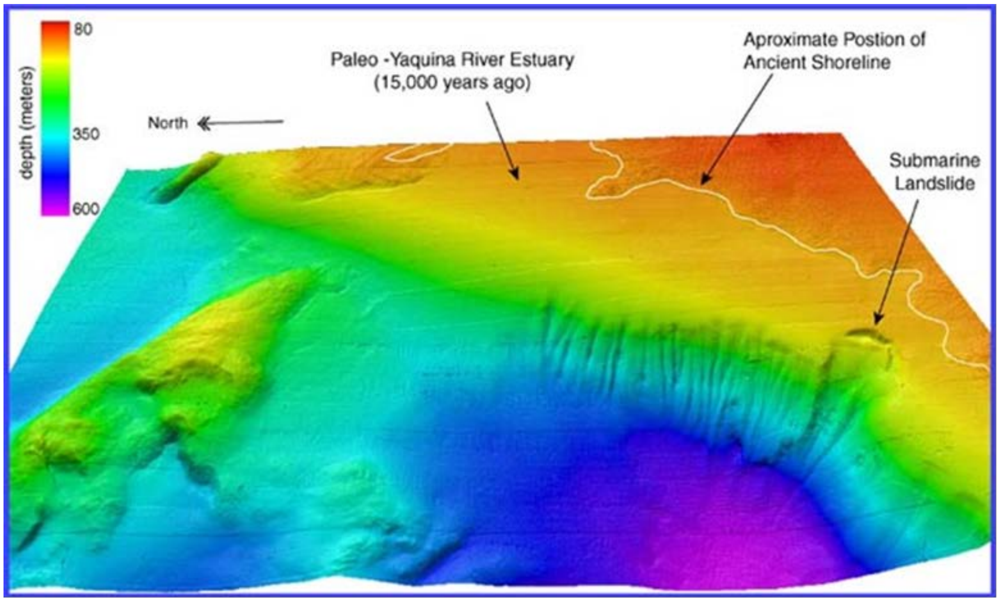


Figure 3.3.4: View of northeast Heceta Bank and the continual shelf break. Image courtesy of Lewis & Clark Legacy Expedition, NOAA/OER.

The continental shelf offshore of Oregon has several rocky submarine banks, creating shallow-water habitats within the deeper shelf waters. Four major banks include Nehalem Bank, Stonewall Bank, Heceta Bank, and Coquille Bank. In addition, Daisy Bank off Oregon and Cordell Bank off California have been designated as HAPCs for groundfish.

Islands and banks are more numerous in the southern California Bight than other areas along the West Coast. The major islands and banks include Richardson Rock, Wilson Rock, and San Miguel, Santa Rosa, Santa Cruz, and Anacapa Islands on the Santa Cruz Ridge that separates the offshore continental slope from the Santa Barbara Basin. The Catalina Ridge supports the Pilgrim Banks and Catalina Island; the San Clemente Ridge supports Santa Barbara Island, Osborn Bank, and San Clemente Island; the Santa Rosa-Cortes Ridge supports Begg Rock, San Nicholas Island, Nidever Bank, Dall Bank, Tanner Bank, and Cortes Bank.

3.3.1.5 Rocky Reefs and Pinnacles

Rocky habitat may be composed of bedrock, boulders, or smaller rocks, such as cobble and gravel. Hard substrates are one of the least abundant benthic habitats, yet they are among the most important habitats for groundfish. Pinnacles are vertical rocky features that are tens of meters in diameter and height, with a cone-shaped geometry. Pinnacles are generally a product of in-place erosional processes acting on rocky outcrops. Pinnacles can be important bathymetric features that attract fish and invertebrates.

3.3.1.6 Fjords (Washington's Inland Waters)

Puget Sound is a fjord formed during the last ice age when the region was repeatedly covered by a continental ice sheet advancing from the north. The main basin of Puget Sound is a partially-mixed estuary connecting through Admiralty Inlet to the Strait of Juan de Fuca and extending southward 100 km to Commencement Bay. The seafloor of Puget Sound is relatively deep (about 200m) and flat. The Sound has estuarine sills at both its seaward (Admiralty Inlet, 65 m depth) and landward (Narrows, 45 m depth) edges (Matsura and Cannon 1997). Four major basins (Main Basin, Whidbey Basin, Southern Basin, and Hood Canal) occur within Puget Sound. The bottom sediments of Puget Sound are composed primarily of compact, glacially formed clay layers and glacial tills. Major sources for sediments to Puget Sound are derived from shoreline erosion and river discharge. Sand and mud prevails in the eastern regions while the shores of Vancouver Island and the complex formation of the Gulf Islands have prominent slopes composed of bedrock and boulders.

The Strait of Juan de Fuca is a 160 km long channel ranging from 22 to 60 km in width with an average depth of less than 200 m. The mouth of the Straits extends to 250 m and except for a sill south of Victoria, British Columbia that extends across the majority of the Strait, there are no distinctive bathymetric features.

3.3.2 Water Column Temperature and Chemical Regimes

Within the CCE there are roughly four common modes of water column structure:

- Well mixed nearshore waters
- Surface stratified nearshore waters
- Transition zones and fronts
- Deeply stratified offshore waters

Well-mixed (meaning that the water has only a very small change in density over depth) nearshore waters are typically the result of wind-driven mixing of upwelled water (Hickey, 1998). Such waters are often cold and nutrient rich, and are the basis for the high productivity of the coastal portions of the CCE, and making them one of the most critical environments within the CCE. Such waters are typically mixed to depths up to 50-75 m (or the bottom, whichever is shallower) depending on water column structure. Well-mixed waters may extend up to 10-20 km

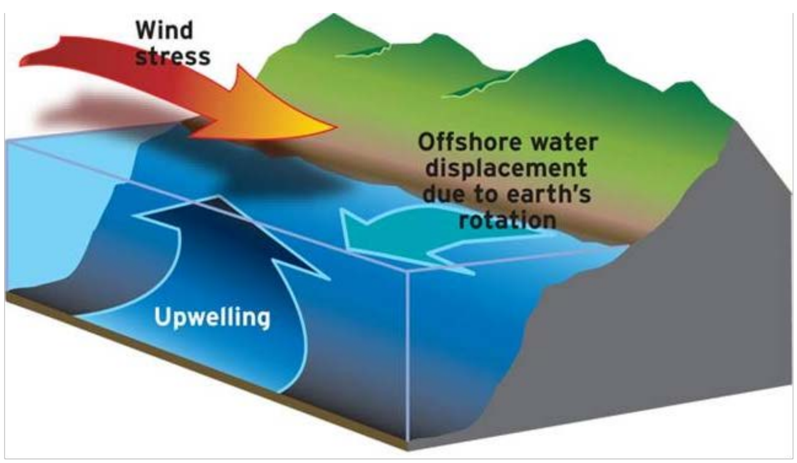


Figure 3.3.5: Forces affecting coastal upwelling in the CCE during the spring and summer. NOAA NWFSC.

offshore in places, but are typically found within approximately 5 km of the coast. Seasonally, well-mixed waters tend to coincide with the spring-summer upwelling season, although wind-based mixing (and occasionally upwelling) can occur at any time of year (Hickey, 1998). Being well-mixed, and near the surface, these waters are typically well-saturated with oxygen.

When not well-mixed (e.g. when winds are low, or upwelling is not occurring), nearshore waters may often be strongly stratified (meaning there are large or abrupt changes of water density vs depth). In the nearshore region, e.g. east of the main core of the California current, such stratified waters are often characterized by a shallow weakly-stratified layer near the surface (often on the order of 10-20 m), with a stronger pycnocline below the weakly-stratified layer, below which lies waters that are also weakly-to-moderately stratified down to the bottom. Such stratified waters may also be an important habitat, since they often occur after upwelling has decreased; significant residual production may occur in these waters, often focused and intensified near the depth of the pycnocline. Where total water column productivity may be lower, it is often more concentrated within a particular depth stratum, forming a type of vertical "hot spot" for biological interactions. Weakly-stratified nearshore waters that form upon the cessation of upwelling are also typically the areas where HABs may form. Nitrate levels versus depth are usually the inverse of temperature, such that with increasing depth and decreasing temperature, nitrate levels increase. When strongly stratified, such waters may be lower in oxygen content, depending on the orginal source of the water, and the balance between oxygen production by plants, and oxygen use for organism respiration and bacterial decomposition. Oxygen levels typically decrease with depth, to the "oxygen minimum zone," which is typically just below to several hundred meters below the beginning of the main thermocline.

Between the nearshore upwelling region and the far offshore region lies the transition zone of the main core of the California Current, typically defined by relatively strong horizontal fronts. The front itself is partly what leads to the strong southward flow of the core of the CCE (Hickey, 1998). Beyond the transition zone lies a region of fairly well stratified waters, with a deep pycnocline, often at a depth of 100-200 meters. Surface waters are warm, and this region is characterized by low, yet steady primary production.

These four major vertical water column types form four distinct habitats, differentiated primarily in terms of their temperature and primary productivity within the surface layers where fisheries occur. Complicating the geographic location of these different vertical water column structures is the dynamic nature of the California Current. Upwelling strength and location varies considerably due to multiple factors. Additionally, the location and strength of the core southward flow of the California is variable, both in strength and location, particularly through the formation of coastal "jets" and large "eddies" which may spin off from the main current.

Eelgrass in Dumas Bay, WA. Photo credit: WDNR

3.3.3 CCE Vegetation and Structure-Forming Invertebrates

Vegetation forms two major classes of large-scale habitats: large macro-algal attached benthic beds, and microalgal blooms. Seagrass beds are also an important macro-algal habitat within the CCE, and are considered EFH for groundfish. Much of the scientific information on structure-forming invertebrates has been collected in recent years, both as a result of improvements in scientific observation technology and as a result of funding and direction expressly provided within the 2007 MSA reauthorization (see §408.)

3.3.3.1 Seagrasses

Seagrass species found on the West Coast of the U.S. include eelgrass species (*Zostera* spp.), widgeongrass (*Ruppia maritima*), and surfgrass (*Phyllospadix* spp.). These grasses are vascular plants, not seaweeds, forming dense beds of leafy shoots year-round in the lower intertidal and subtidal areas. Eelgrass is found on soft-bottom substrates in intertidal and shallow subtidal areas of estuaries and occasionally in other nearshore areas, such as the Channel Islands and Santa Barbara littoral. Surfgrass is found on hard-bottom substrates along higher energy coasts. Studies have shown seagrass beds to be among the areas of highest primary productivity in the world (Herke and Rogers 1993; Hoss and Thayer 1993). Despite their known ecological importance for many commercial species, seagrass beds have not been as comprehensively mapped as kelp beds. Wyllie-Echeverria and Ackerman (2003) published a coastwide assessment of seagrass that identifies sites known to support seagrass and estimates of seagrass bed areas; however, their report does not compile existing GIS data. GIS data for seagrass beds were located and compiled as part of the groundfish EFH assessment process.

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

3.3.3.2 Macro-algal (kelp) beds

Along the Pacific coast, there are two major canopy-forming species of kelp, the giant kelp, *Macrocystis pyrifera*, and the bull kelp, *Nereocystis leutkeana*. These species can form kelp forests which provide habitat for a diverse mix of species including fishes, invertebrates, marine mammals and sea birds. Kelp forests provide cover or nursery grounds for many adult, young of the year, or juvenile nearshore and shelf rocky reef fishes, such as bocaccio, lingcod, flatfish, other groundfish, and state-managed species including kelp basses, white sea bass and Pacific bonito. Kelp is considered EFH for groundfish. Common invertebrates inhabiting kelp forests include abalone, sea urchins, spiny lobsters, and crabs. Sea otters are also found associated with kelp forests.

Giant kelp. Photo credit: NOAA

Kelp plays an important role in the diet of some reef fishes and many invertebrates (e.g., urchins and abalone). In addition, when plants are ripped up after storms, the resulting kelp detritus functions as beach enrichment or contributes nutrients to the benthic environment when drifting plants sink.

Kelp forests are comprised of three main components—the holdfast that anchors the kelp to substrate, the stipes that grow upward from the holdfast toward the surface, and the canopy comprised of stipes and fronds that lay on the water surface, buoyed up by floats. Giant kelp forests are generally more dense, and three dimensional, supporting more diverse communities than bull kelp forests. While the surface canopy of giant kelp is often removed in winter, it is considered a perennial because often the holdfasts remain over winter and new stipes and fronds grow up in the spring. Bull kelp is an annual and the tangling of long stipes in winter storms rips up holdfasts removing entire plants.

Along the coasts of Washington and Oregon, and southward to northern California, kelp forests are predominantly comprised of bull kelp in nearshore rocky reef areas, although these occur as far south as Point Conception. Giant kelp is distributed from Sitka, Alaska to central Baja California, forming dense beds from central California southward through the Southern California Bight and off the Baja Peninsula. Kelp forests are normally found in association with nearshore, rocky substrate – bull kelp occurs in water as deep as 75 feet while giant kelp forests can occupy reefs at 120 feet in areas with excellent water clarity. In the Southern California Bight, kelp beds also occur on sandy surfaces, where they attach to worm tube reefs. Several other canopy-forming species are found in lesser abundance off southern California and the Channel Islands including *Macrocystis integrefolia*, the elk kelp—*Pelagophycus*, *Cystoseira* and *Sargassum*.

Kelp distribution, productivity, growth and persistence is dependent on a variety of factors including nutrient availability, severity of wave action, exposure, water quality, turbidity, sedimentation, water temperature, geology, pollution, and grazer abundance (e.g. sea urchins). Nitrogen and light are two of the most important parameters affecting kelp productivity. Under ideal environmental conditions, giant kelp grows up to two feet a day. It prefers nutrient-rich, cool water (50° to 60° F); in wave-exposed areas, fronds may reach a length of 150 feet. Hence, warmer conditions, or conditions that decrease coastal upwelling, decrease kelp growth (Dayton et al., 1999). Warm water events such as El Niño, in combination with severe storms, can wreak havoc on kelp beds—ripping out plants, reducing growth, and leaving only a minimal or no canopy. Seasonal effects are often more localized, and more large-scale, low-frequency episodic changes in nutrient availability seem to result in the most significant changes due to cascading community effects. For example, the status and success of understory kelps such as *Pterogophora, Eisenia* and *Laminaria* can be affected through competition for light, affects on growth, reproduction, establishment, and survivorship.

Numerous studies explored the role of sea urchins in kelp forests and the dynamics of overgrazing by urchins on kelp resulting in loss of whole kelp forests or the creation of "urchin barrens" (North 1983, Tegner and Dayton 2000). Urchin grazing can destroy kelp forests at a rate of 30 feet per year. In California, there is an active commercial fishery for urchins. Kelp has been commercially harvested since the early 1900s in California, and there was sporadic commercial harvesting in Oregon although it is currently prohibited. Pharmaceutical, food, industrial and forage uses of kelp include—herring-roe-on-kelp, algin, stabilizers, aquaculture food for abalone, and human food products (bull kelp pickles).

Extensive studies since the 1960s addressed concerns regarding the impact of giant kelp harvesting on the nearshore ecosystem. Overall, there was no evidence of long term affects of harvesting (North and Hubbs 1968, Dayton et al 1998). Potential impacts include temporary displacement of adult or young-of-the-year fishes to nearby unharvested reefs, predation on those young-of-the-year by larger displaced fishes (Houk and McCleneghan 1968), increased growth of sub-canopy species, increased harvesting of fishes and invertebrates by anglers or divers when harvesters create pathways through the beds, delayed regrowth of kelp.

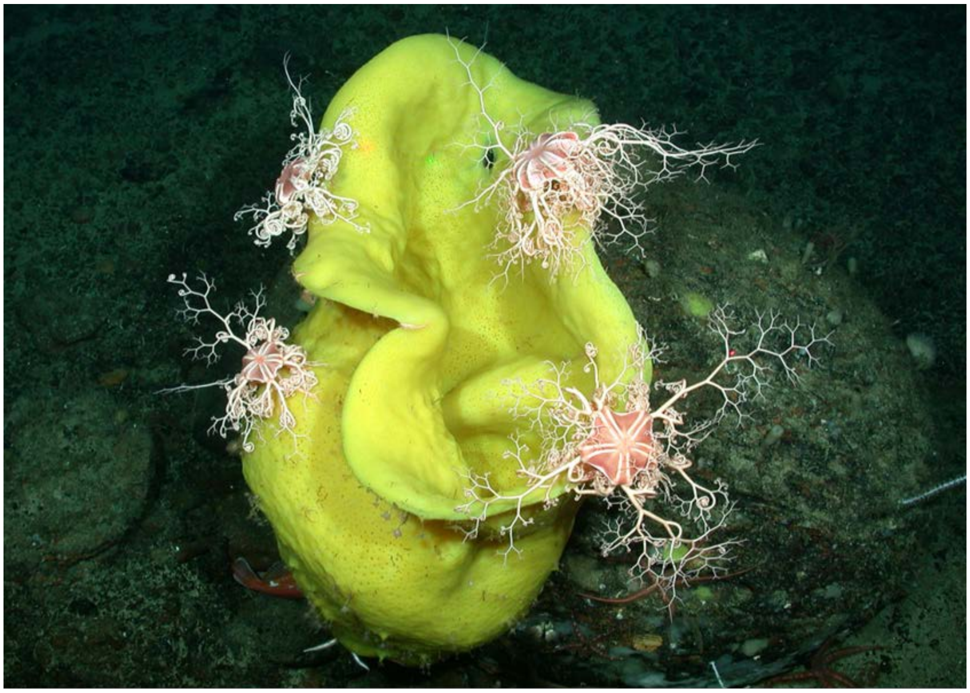
3.3.3.3 Microalgal blooms

The major phytoplankton classes within the CCE include diatoms, dinoflagellates, small (often termed "pico"-) eukaryotes, and cyanobacteria. Diatoms are mainly responsible for large productive blooms in the nearshore upwelling regions. Thus they often form the basis of the productive food webs in those areas. Dinoflagellates also bloom in upwelling and other regions, and may provide an important food source for microzooplankton. Dinoflagellates have a dual role, since certain dinoflagellates may form HABs (although a few species of diatoms may also form HABs as well). Pico-eukaryotes and cyanobacteria are the smallest "phytoplankton" and form only a minor portion of phytoplankton biomass, although their productivity rates may be high in offshore regions. Thus, these pico-phytoplankton form an important link in offshore food webs, and may also fuel the growth of the smallest microzooplankton within nearshore regions as well (Sherr et al., 2005).

Seasonally, diatoms tend to bloom nearshore in the later winter or early spring, in a progression from south to north. The timing of this bloom tends to follow a change in upwelling strength, from the predominant downwelling condition during the fall and spring, to a net cumulative upwelling in the late winter early spring (Lynn et al., 2003). This change from downwelling to upwelling and the resulting phytoplankton blooms are termed the spring transition (Holt and Mantua, 2009). Year to year variability may occur in this timing, due to large scale changes in wind patterns across the Pacific basin. Occasionally, there are brief periods of mixing or upwelling that occur prior to the main spring transition, which may also result in localized phytoplankton blooms of short duration, which may disappear before the main spring transition time. Blooms of dinoflagellates and other phytoplankton types tend to occur significantly after the main spring transition. In particular, dinoflagellates often bloom in the fall period, upon the cessation of upwelling, as the waters stratify.

3.3.3.4 CCE Structure-Forming Invertebrates

A host of invertebrate species of varying sizes and trophic levels inhabit the CCE. The trophic roles of invertebrates and vertebrates are discussed in Section 3.2. In this section, the FEP considers the scientific literature on invertebrates that serve as habitat for other CCE species. The delineation of benthic structure forming invertebrates, in particular corals and sponges, is under more thorough discussion within the Groundfish EFH Review Committee for updates to Groundfish EFH designation (EFHRC 2012). The major challenge with observing bottom-dwelling invertebrates to assess and analyze their population structure, qualities as habitat (or not), and roles within the marine ecosystem is that



Basket stars on a deep sea glass sponge. Photo credit: NOAA SWFSC

they can only be observed alive in the places where they occur, e.g. from a human-occupied submersible, remotely operated vehicle, or autonomous underwater vehicle, or via shallow water diving operations, any of which require deploying equipment that is challenging to use even on small geographic scales (Krieger and Wing 2002, Etnoyer and Morgan 2005, Whitmire and Clarke 2007, Yoklavich and O'Connell 2008). However, laboratory studies can be also used to examine habitat preferences in fishes under controlled conditions and provide the opportunity to introduce predation as a factor influencing habitat preference (e.g., Ryer et al. 2004). Most of NOAA's scientific work on deep sea corals and other structure-forming invertebrates has been conducted in the last four years, coming out of a deep sea coral research program established in the 2007 reauthorization of the MSA [16 U.S.C. §1884.]

Tissot and co-authors (2006) narrowed the question of which invertebrate taxa and associated morphologies should be viewed as having the potential to serve as habitat for other species by characterizing structure-forming invertebrates as those that, like some coral species, add functional structure to benthic habitats by nature of their large size (e.g. black corals, sponges, anenomes, and sea pens) and through having complex morphologies (e.g., black corals, sea pens, and basket stars). Megafaunal invertebrates that aggregate in high numbers, such as sea urchins and sea pens, could also be considered structure-forming in areas where the physical environment is otherwise low-relief (Tissot et al. 2006).

Whitmire and Clarke (2007) listed 101 species of corals identified in the U.S. West Coast EEZ, within which four species were classified as having adequate individual or colony size and morphological complexity to be considered of high structural importance: *Lophelia pertusa*, *Antipathes dedrochristos*, *Paragorgia arborea*, and *Primnoa pacifica*. Several additional classes and individual species of coral were identified as being of medium structural importance: *Dendrophyllia oldroydae*, *Bathypathes* sp., *Isidella* sp., *Keratoisis* sp. Corals of the West Coast EEZ are distributed over a variety of bottom habitats, with higher concentrations on hard-bottom (not sand) and medium-to-high relief rocky habitat. With their morphologically complex forms, corals can enhance the relief and complexity of physical habitat (Whitmire and Clarke 2007), although the literature remains divided on whether West Coast deep sea corals serve to aggregate fish (Etnoyer and Morgan 2005, Auster 2005, Tissot et al. 2006).

Marliave and co-authors (2009) found quillback rockfish (*Sebastes maliger*) using colonies of cloud sponges (*Aphrocallistes vastus*) as nursery habitat in southern British Columbia's coastal waters, which are within the northern extent of the CCE. Hixon and Tissot (2007) found variations between the fish and invertebrate species assemblages and associations in trawled and untrawled areas on Coquille Bank off central Oregon. Pirtle (2005) found fish co-occurring with a range of structure-forming invertebrate species on both the high-relief and mud habitats of Cordell Bank, off central California.

Mary Yoklavich, NMFS SWFSC entering Delta submersible for dive off San Nicholas Island, California. Photo credit: NOAA

3.3.4 Human Effects on Council-Managed Species' Habitat

The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Each of the Council's four FMPs has defined EFH for FMP species. Taken together, EFH of Council-managed species ranges from the salmon streams of Idaho to the outer boundary of the U.S. EEZ. Figure 3.3.3 shows salmon and groundfish EFH, which together encompass a wide variety of terrestrial, coastal, and marine habitats. EFH for Council-managed species also ranges from the near-surface waters used by coastal pelagic and highly migratory species, through the mid-water domain of salmon and some groundfish species, down to the diverse bottom habitats used by many groundfish species. As discussed earlier, this FEP's designated geographic range is the West Coast EEZ. Therefore, this section will address the effects of human activities on CCE habitat within the EEZ. Extensive discussions of the effects of human activities on the freshwater habitat of Pacific salmon may be found in the habitat conservation plans for threatened and endangered salmon and steelhead managed under the Endangered Species Act (http://www.nwr.noaa.gov/Salmon-Habitat/Habitat-Conservation-Plans/Index.cfm).

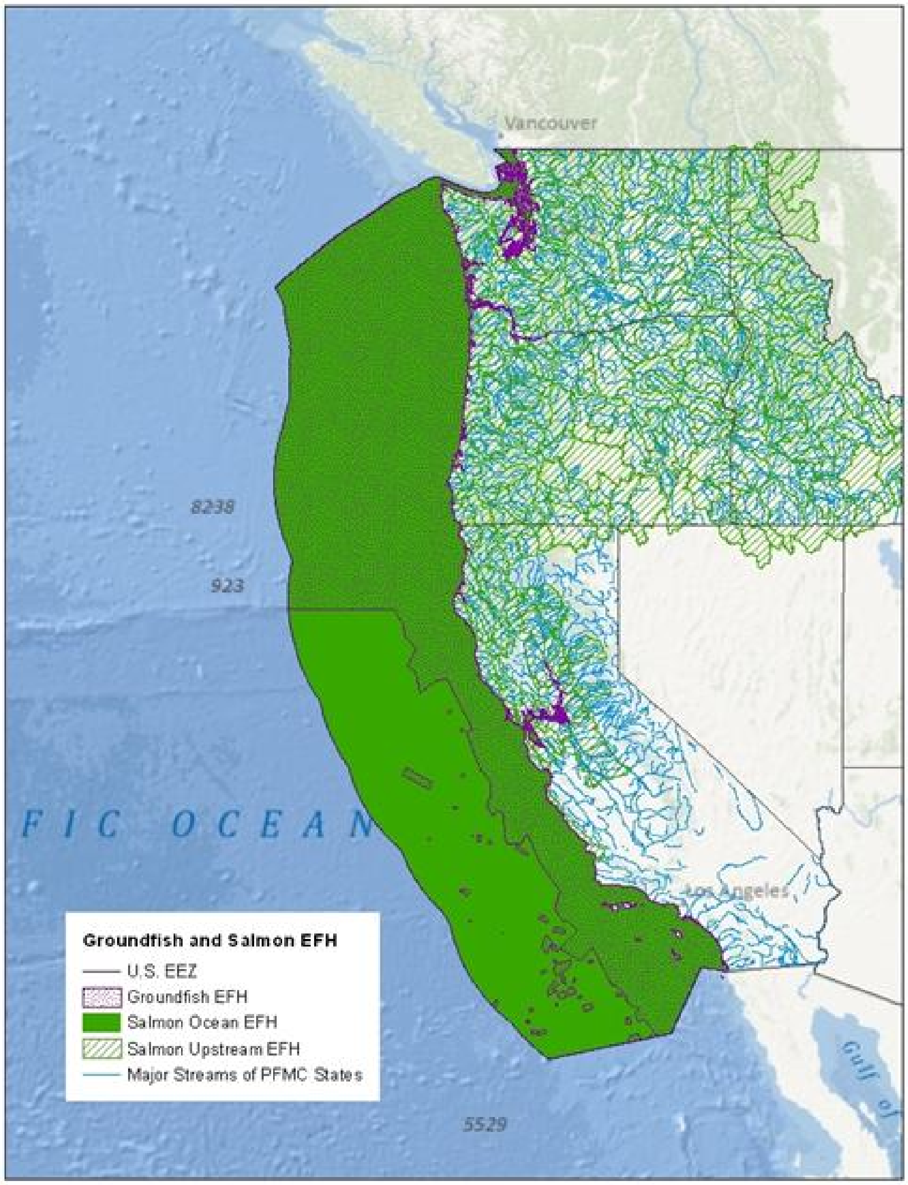


Figure 3.3.6: Groundfish and Salmon EFH of the West Coast

Humans have a variety of uses for the marine waters and substrate of the CCE, from direct uses like fishing, shipping, submarine cables, mining, recreation, or military maneuvers, to indirect uses like pollution and waste assimilation, oxygen-production, or nutrient cycling. The Council has direct responsibility for the effects of Council-managed fisheries on the EFH of FMP species. The Council is also required to comment upon and make recommendations on activities it views as likely to "substantially affect the habitat, including essential fish habitat" of anadromous species (salmon) under its authority. For all other species' EFH, the Council *may* make comments and recommendations. [16 U.S.C. §1855.] Federal regulations to implement the MSA's requirements for EFH at 50 CFR 600.815(a)(7) also regard human activities that may affect species that are the prey of FMP species as having potential effects on EFH fucntionality. While prey species are not considered habitat, the availability of prey species is considered a component of EFH, similar to temperature, water quality, or sediment type. The loss of prey species within EFH may affect the ability of a managed species to use that EFH as feeding habitat – just as, for example, significant shifts in water quality may affect the ability of a managed species to use an EFH area as feeding habitat.

Carcasses of coho salmon blocked by a barrier culvert.
Photo credit: WDFW

3.3.4.1 Fishing Activities that May Affect Habitat

In addition to describing and identifying EFH, FMPs must "minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage conservation and enhancement of such habitat" [16 U.S.C. §1853]. The review of fishing effects on bottom habitat generally focuses on occurrences of fishing gear coming into contact with the sea floor, or with rocks or living structures attached to the sea floor. The review of fishing effects on pelagic habitat generally focuses on occurrences when fishing gear is lost at sea, or when fishing activities, including the discarding of bycatch and offal at sea, affect where prey is available in the water column. For bottom habitat, the Groundfish FMP, which includes gear and fisheries that may come into contact with the sea bottom, has the most detailed and restrictive EFH protections of the Council's four FMPs. In large portions of the EEZ, the use of bottom trawl gear or other bottom tending gear (for any species or fishery) is prohibited – see Figure 3.1.5.

3.3.4.2 Non-Fishing Activities that May Affect Habitat

The Council has reviewed the non-fishing activities that may affect the EFH of its FMP species under each of its FMPs. These reviews are not limited to ocean habitat and often consider effects of non-fishing activities within state and freshwater habitats, particularly for species in the salmon FMP. Using information from the four FMPs, Table 3.3.1 aggregates non-fishing activities that may negatively affect CCE species' EFH.

Table 3.3.1 Non-Fishing Human Activities that May Negatively Affect EFH for One or More Council-Managed Species	
Coastal or Marine Habitat Activities	**Freshwater or Land-Based Habitat Activities**
Alternative Offshore Energy Development Artificial Propagation of Fish and Shellfish Climate Change and Ocean Acidification Desalination Dredging and Dredged Spoil Disposal Estuarine Alteration Habitat Restoration Projects Introduction/Spread of Nonnative Species Military Exercises Offshore Mineral Mining Offshore Oil and Gas Drilling and Liquefied Natural Gas Projects Over-Water Structures Pile Driving Power Plant Intakes Sand and Gravel Mining Shipping Traffic and Ocean-based Pollution Vessel Operation Wastewater/Pollutant Discharge	Agriculture Artificial Propagation of Fish and Shellfish Bank Stabilization Beaver removal and Habitat Alteration Climate Change and Ocean Acidification Construction/Urbanization Culvert Construction Desalination Dam Construction/Operation Dredging and Dredged Spoil Disposal Estuarine Alteration Flood Control Maintenance Forestry Grazing Habitat Restoration Projects Irrigation/Water Management Military Exercises Mineral Mining Introduction/Spread of Nonnative Species Pesticide Use Road Building and Maintenance Sand and Gravel Mining Vessel Operation Wastewater/Pollutant Discharge Wetland and Floodplain Alteration Woody Debris/ Structure Removal

Federal agencies are required to consult with NOAA when undertaking or permitting activities that may have adverse effects on EFH. While the Council does not have the staff or committee capacity to comment on every action that may affect EFH, it often uses its Habitat Committee to provide initial reviews of large-scale non-fishing projects of particular interest or concern to the Council. Taken together, the projects that particularly attract the Council's notice tend to be large-scale energy projects that have the potential to result in the installation of man-made structures within areas designated as EFH, or any other land-based activities or planning processes that the Council believes may result in a significant loss of freshwater habitat or of the flow of freshwater itself within West Coast salmon streams. Some recent examples of non-fishing projects that have sparked Council review and comment have been:

- An Army Corps of Engineers policy on removing vegetation adjacent to its levees (2012)
- The U.S. Department of the Interior's management of water flow within the Klamath River and the adequacy of flow available for migrating Chinook salmon (2012)
- An Army Corps of Engineers policy on removing vegetation adjacent to its levees (2011)
- The Olympic Coast National Marine Sanctuary's management plan review process (2011)
- The U.S. Bureau of Reclamation's draft Environmental Impact Statement on the potential removal of four dams on the Klamath River (2011)
- The U.S. Bureau of Reclamation's implementation of the Central Valley Project Improvement Act and the effects of that project on water flow within affected streams (2010)

- NOAA's engagement in Pacific salmon restoration within the Columba River Basin and the Biological Opinion for the Federal Columbia River Power System (2010)
- The potential effects of a Federal Energy Regulatory Commission permitting process for the Reedsport Ocean Power Technologies Wave Park on Council-managed species (2010)
- The U.S. Bureau of Reclamation's implementation of the Central Valley Project Improvement Act and the effects of that project on California's Central Valley salmon stocks (2010)
- The U.S. Bureau of Reclamation's consideration of the Council's EFH recommendations in its implementation of the Central Valley Project and State Water Project and the effects of those projects on Council-managed salmon stocks (2009)
- A U.S. Minerals Management Service proposal to lease areas off the outer continental shelf for alternative energy testing sites and the effects of that proposal on Council-managed species, fisheries, and EFH (2008)

In addition to and as partial mitigation for the various human activities that have the potential to negatively affect habitat, government agencies from small municipalities to the federal government have implemented a variety of MPAs coastwide. NOAA and the Council's large-scale MPAs – the EFH conservation areas and the National Marine Sanctuaries – appeared earlier in the FEP at Figure 3.1.5. Below, Figures 3.3.7 through 3.3.11 illustrate some of the many nearshore West Coast MPAs under state, county, or local jurisdiction. More detailed maps and MPA information are available in the Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat Report to the Pacific Fishery Management Council (EFHRC 2012).

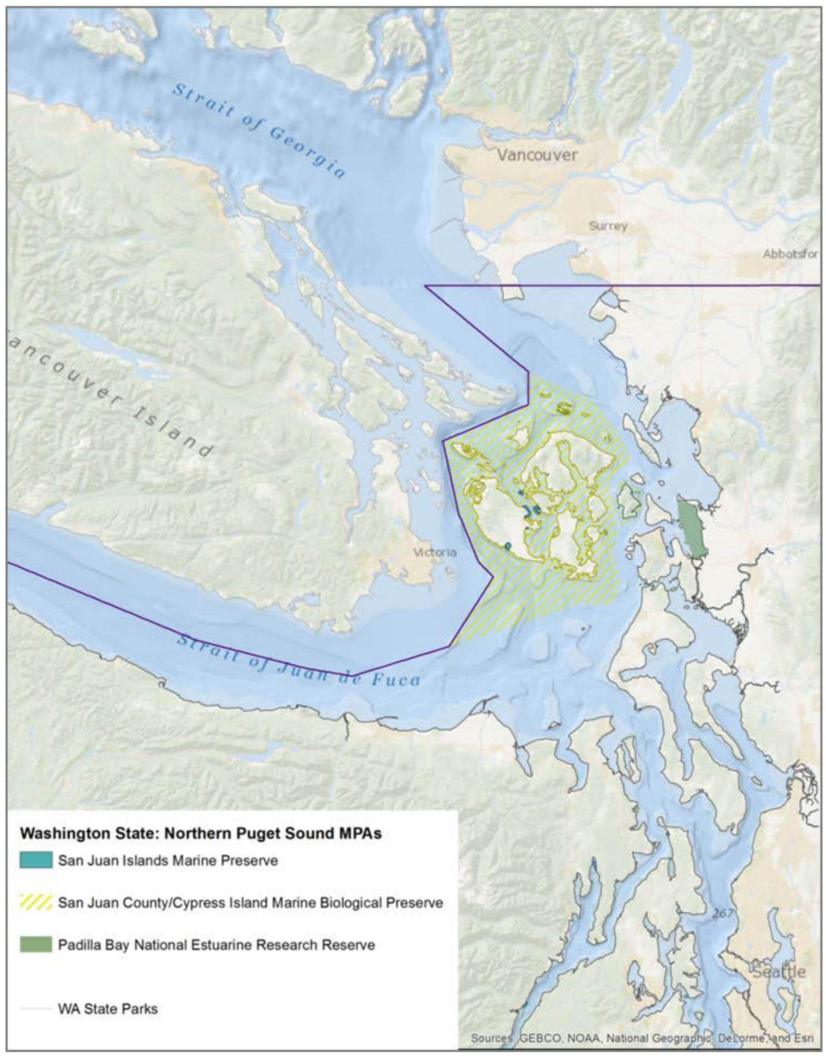


Figure 3.3.7: MPAs of Northern Puget Sound, WA

Washington State has a variety of MPAs managed under the authorities of its different natural resource agencies: Department of Fish and Wildlife, Department of Natural Resources, and Department of Ecology. Counties in Washington have county-specific MPAs and the University of Washington works with the state and counties in several research reserves. Many of Washington's MPAs are concentrated in Puget Sound and on the southern portion of the outer Washington Coast, near Willapa Bay. Figure 3.3.7 shows some of Washington's nearshore MPAs, highlighting those in northern Puget Sound.

The largest MPAs in Oregon's state waters are two adjacent sites south of Port Orford, known together as the Redfish Rocks Marine Reserve and MPA – see Figure 3.3.8. No extractive activities are permitted within the marine reserve; within the MPA, the only permitted extractive activities are troll salmon fishing and crab fishing. These sites were proposed by the Port Orford Ocean Resource Team, a non-profit organization directed by fishermen and with a mission to support long-term sustainable fisheries in the Port Orford area. Developed locally, the Redfish Rocks sites were implemented through state legislation, first effective in 2009.

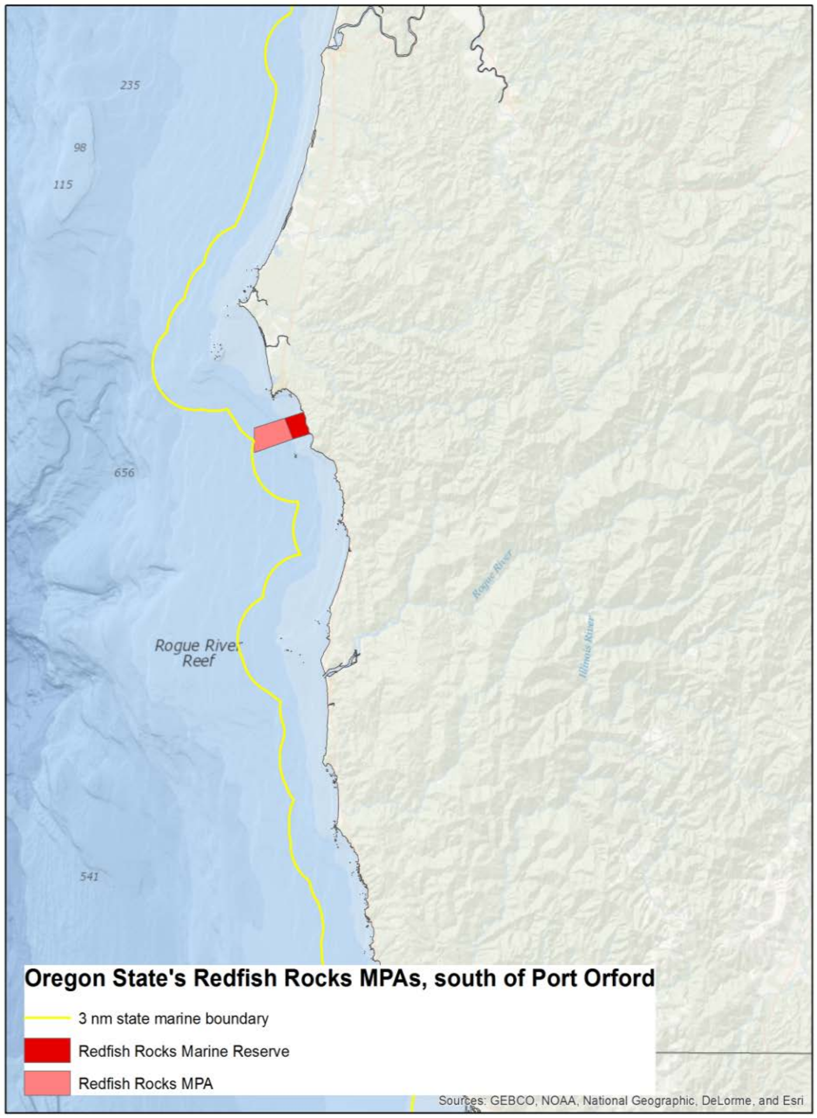


Figure 3.3.8: Redfish Rocks MPAs of southern Oregon

California has 124 MPAs along the entire length of the state's coast, from the Pyramid Point State Marine Conservation Area (SMCA) at the state border with Oregon to the Tijuana River Mouth SMCA at the U.S. border with Mexico. MPA designations in California include State Marine Reserves, SMCAs and State Marine Parks; the level of protection from extractive use varies by designation from full protection to allowance of limited commercial and/or recreational use. California's approach to fisheries management within state waters and integrated with its participation in the Council process is described, including the legislation behind its MPA designation process, in Section 3.5.2.5 of the FEP. As discussed in that section, 2013 marks the 15th anniversary of the state's Marine Life Protection Act (MLPA), which, among other things, directed the state to develop a coherent system of MPAs. Figures 3.3.9 through 3.3.11 show California's MPAs, from north to south. Figure 3.3.11 focuses on the Channel Islands in the Southern California Bight area, illustrating a complex combination of state and federal MPAs designed to meet the federal mandates under the NMSA and MSA, and state mandates under the MLPA.

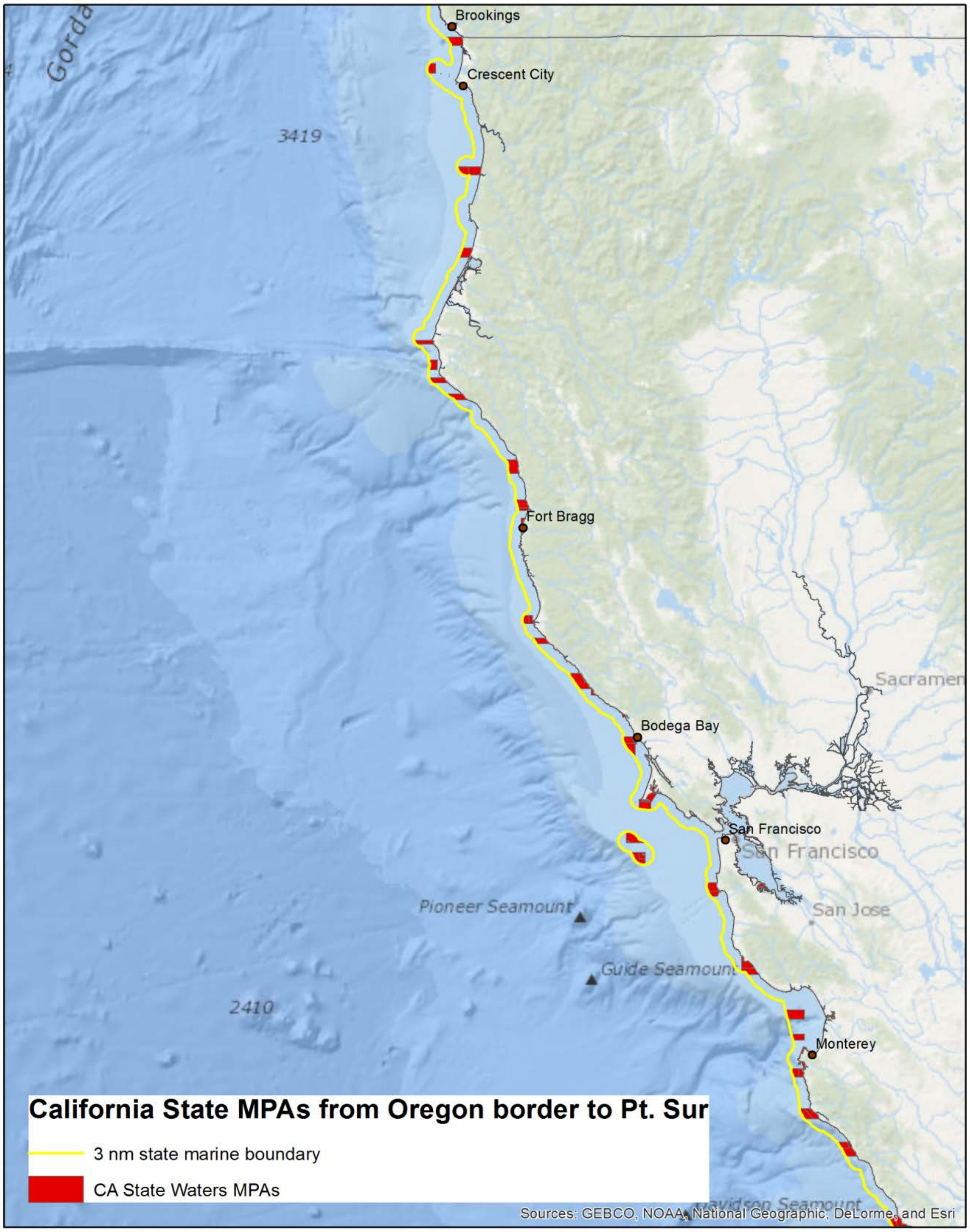


Figure 3.3.9: State MPAs of Northern California

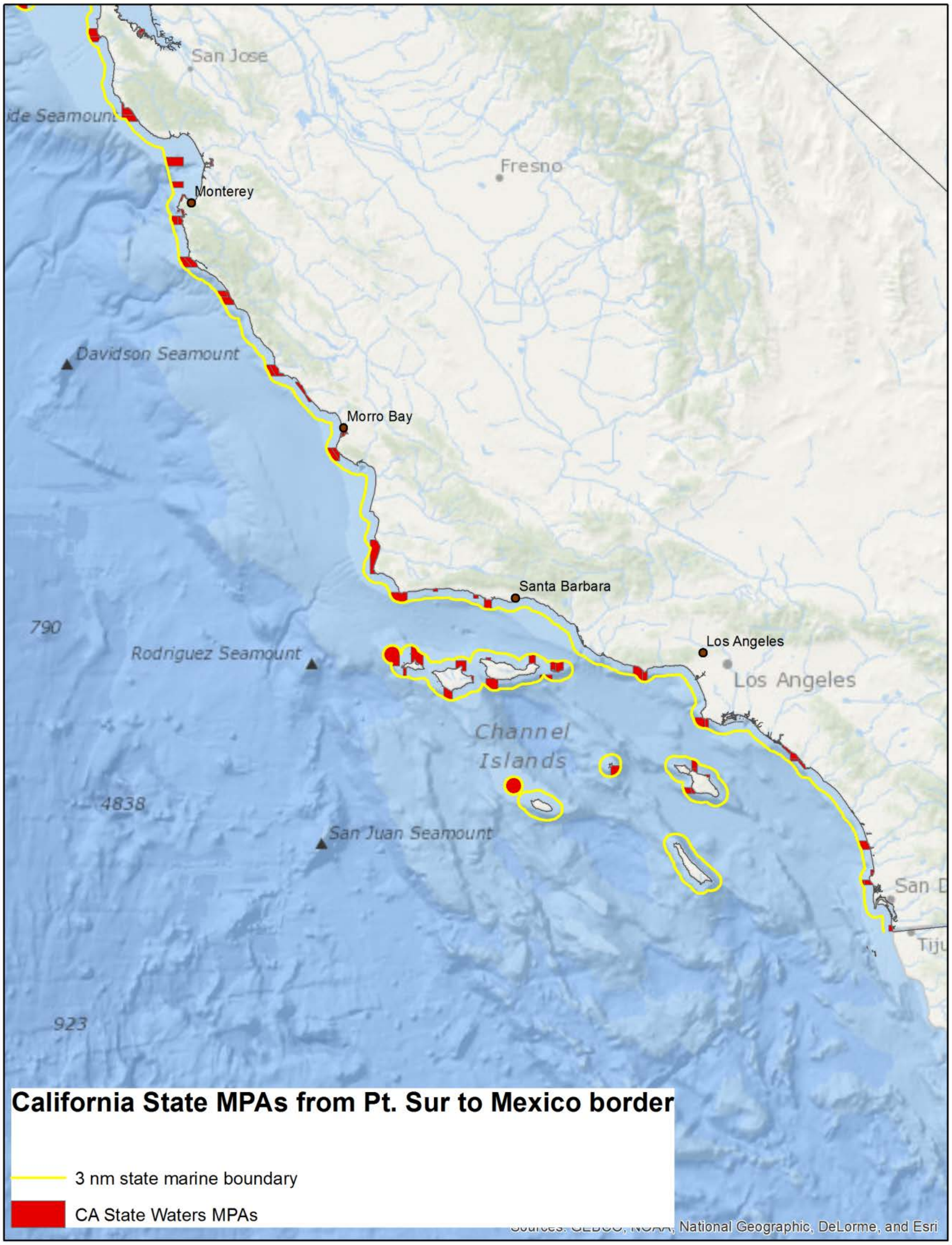


Figure 3.3.10: State MPAs of Southern California

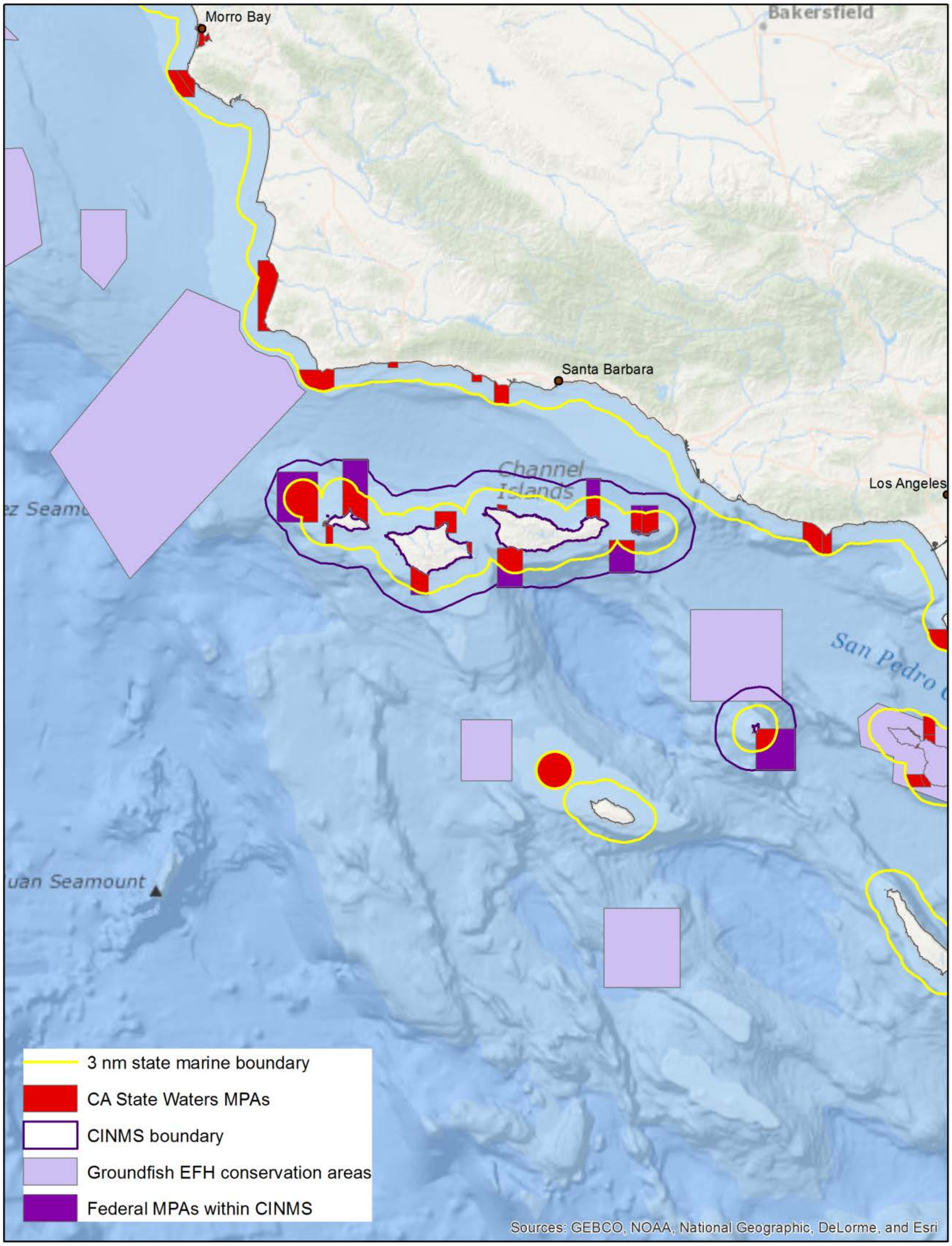


Figure 3.3.11: State and Federal marine management areas of the Southern California Bight

3.4 Fisheries of the CCE

Fisheries for a broad range of species occur within the CCE, and have since humans first inhabited North America's western coastal lands. The Council's four FMPs and analysis document for actions taken under those FMPs provide details on the fisheries for managed stocks, including: gear used, landings locations, season timing and duration, prohibitions, technical challenges, and communities that dominate landings. This section of the FEP is intended to look at all of the FMP fisheries together, minimizing duplication of descriptions in the Council's FMPs. This section provides a background on historic fishing in the EEZ and discusses cumulative CCE fisheries harvest, West Coast fisheries capacity levels, and the cumulative socio-economic effects of Council-generated fishery management measures on fishing communities.

3.4.1 Historical CCE Fisheries

The perception of the effects of fisheries exploitation on the environment has varied over time. Freon et al. (2005; see also MacCall et al. 2009) have defined a set of time periods that help frame the history of exploitation and the accompanying evolution of associated science. The period prior to the 20th century is best described as the "inexhaustible" period, when conventional wisdom held that fisheries could not have an appreciable impact on the resources that they exploited. Prior to the 1900s, global landings were minimal relative to contemporary catches. During the industrial exploitation period of 1900-1950, global landings for some species increased, and then often decreased dramatically. The rise and fall of the California sardine fishery is a classic example of such industrial fisheries, and the collapses that followed led to what might be considered the conventional management period of 1950-1975. That period saw the development of most of the basic foundations of contemporary fisheries science: fisheries oceanography, spawner/recruit relationships, surplus production models and virtual population analysis. The conventional management period also saw some of the greatest development of industrial fisheries, coupled with the application of the newly developed science of fisheries management. However, the conventional management period also saw the world's largest fisheries failure, the crash of the Peruvian anchoveta fishery, which had been responsible for up to one quarter of global

**Makah Tribe members at Neah Bay, WA, 1890.
Photo credit: U.S. National Archives**

fisheries landings at the time. The anchoveta fishery collapse had tremendous ecosystem consequences (Jahncke et al. 1998) and led to what Freon described next as the “doubt” period from the mid-1970s through the mid-1990s. This period recognized the limitations and constraints of the sciences, and saw renewed emphasis on the role of climate as a driver of population and fishery dynamics. Based on the Freon et al. suggestion of major eras of fisheries management, the ecosystem-based management period has emerged from the mid-1990s to the present. This period is characterized by a gradual and wide recognition that ecosystem factors are important to marine resource science and management, but most management actions tend to be based in an assemblage-based context that integrates single-species assessment model results. The marine and nearshore ecosystems of the CCE have been exploited at industrial levels for well over two centuries, and supported some of the most populous and culturally sophisticated Native American communities for millennia (McEvoy 1986, Trosper 2003). Figure 3.4.1 (from Field and Francis 2006) presents an accounting of the history of the most substantial marine resource removals over the past two centuries, illustrating both the magnitude of removals as well as the sequential nature of the development of the major fisheries in the region. European-era exploitation in this ecosystem began with the rapid conversion of the energy at the top of the food chain into commodities. The great whales, fur seals, elephant seals, sea lions, otters and many seabird colonies were transformed into oil, pelts and food. Exploitation continued with the depletion of many salmon populations due to fishing, the massive alteration of their freshwater habitat, and hatchery production. Next arose the classic tale of the rise and fall of the California sardine fishery, and subsequent fisheries for anchovy, mackerel, herring and squid. Throughout the past two centuries, some fisheries grew unsustainably fast, rapidly depleting resources (typically low turnover resources) in short pulses, including fisheries for: abalone, black and white seabass, and various elasmobranchs such as basking, soupfin and dogfish sharks. Fisheries for many groundfish, including Pacific (and California) halibut, sablefish, lingcod, Pacific ocean perch and other rockfish seemed to be sustainable at low levels prior to the development of modern industrial fisheries during the 1950s, after which high fishing effort depleted many stocks below sustainable levels.

The large scale removals of marine mammal populations began in the late 18th and early 19th century, at the scale of the entire North Pacific (Scammon 1874, Ogden 1933). Although New England whalers had been operating in the North Pacific since the late 1700s, they initially avoided coastal waters of the CCE due to the “savage disposition” of California gray whales (Gordon 1987). However, whalers had been targeting CCE whale populations, and by the 1850s as many as a dozen shore-based whaling stations were spread out between Crescent City and San Diego, targeting a mix of gray, humpback and other whales encountered in coastal waters. Gray whales were subsequently harvested to near extinction in the lagoons of Baja California by the 1870s, and the first pulse of coastal whaling ended shortly thereafter. Similarly, exploitation of sea otters, fur seals and elephant seals began during the late 19th century, with all of these animals taken for a mix of pelts, food and oil. Many of these populations were commercially extinct by the late 1800s, during which time sea lions, harbor seals and seabirds were also exploited. For example, the harvest of seabird eggs on the Farallon Islands and elsewhere was as great as 14 million eggs between the mid-

Puget Sound halibut schooner crew and catch, 1888.
Photo credit: NOAA Historic Fisheries Collection

1800s and 1900, with the result that the common murre population on the Farallons may have declined from nearly half a million birds to less than 5000 by the 1920s (Ainley and Lewis 1974).

Both shoreside and at-sea whaling operations were widespread throughout the North Pacific during the second wave of whaling in the 1910s and 1920s, with catches of all species diminishing rapidly in the early 1920s (Tonnessen and Johnsen 1982, Estes et al. 2006). It is interesting to consider that these removals occurred in concert with the major expansion of the California sardine fishery, since stomach contents data from whales caught off California show humpback, as well as fin and sei whales, fed primarily on sardines, as well as euphausiids, anchovies, herring and other prey (Clapham et al. 1997). If whales historically represented a substantial fraction of sardine (and other coastal pelagic) mortality, the decline of whale and other predator populations (e.g., fur seals, sea lions, tunas) might have led to a greater than average production or availability of sardines, contributing to that fishery's expansion throughout the early 1920s and the early 1930s. The observation that current abundance of sardines and other coastal pelagic species is far lower than the historical abundance could be, in part, a function of the differences in predation mortality between these periods. Populations of most marine mammals in the CCE have recovered to, with some perhaps even exceeding, historical levels of abundance in recent decades. Appreciation for the historical impacts of whaling and sealing, and the potential cascading impacts to marine ecosystems, has grown as marine mammal populations have recovered (NRC 1996, Springer et al. 2003, Estes et al. 2006), and a basic understanding of the relative significance of both contemporary and historical trends and abundance of predators should be an integral component of an ecosystem approach to managing CCE fisheries.

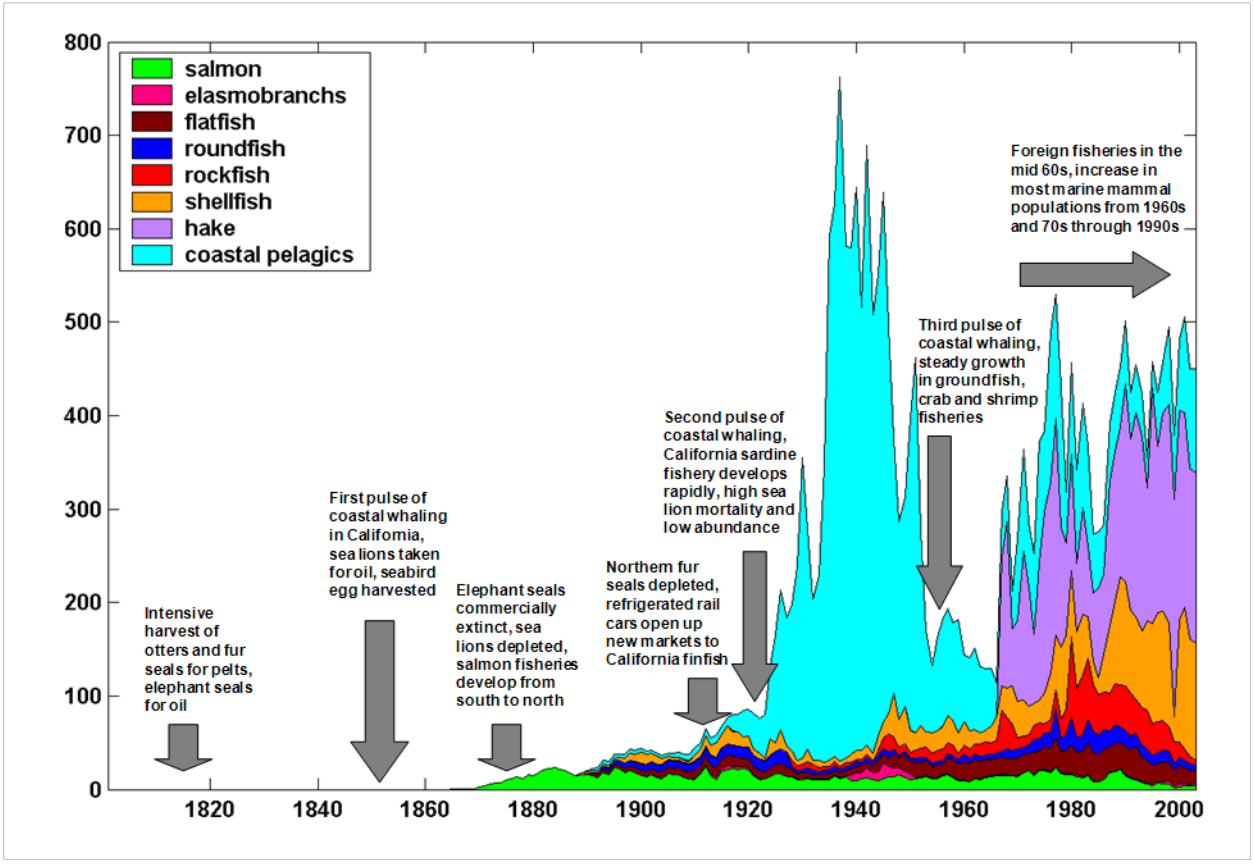


Figure 3.4.1: Major fisheries removals and developments within the U.S. portion of the CCE over the past two centuries

Salmon fishing preceded sardine fishing as the first major finfish to be exploited throughout CCE (both inland and offshore) waters, and salmon represented the foundation of the livelihoods of native communities for thousands of years prior to settlement by Europeans (McEvoy 1986, Lyman 1988). Unsustainable salmon removals likely began with the rapid late 19th century development of the Sacramento river salmon fisheries, spreading rapidly northwards as Sacramento fisheries were overexploited (McEvoy 1986, 1996). Fishing and canning operations quickly developed on the Columbia River, where the salmon fishery grew from just tens of thousands of pounds in 1866 to over 20 million pounds by 1876 and over 40 million by 1885 (Cobb 1930). Salmon have continued to be among the most valued and vulnerable fisheries in the CCE with the associated fisheries management challenges and habitat issues remaining the subject of continual controversy. As the bridge between freshwater, estuarine and marine environments, salmon have evolved complex population structures and life histories to cope with the variability in each of these environments. Prior to western contact, Pacific salmon had evolved complex meta-population structures, and the physical template provided by high quality freshwater habitat is thought to have provided the insurance needed for such population structures to persist under highly variable ocean conditions (Nickelson and Lawson 1998). Ongoing degradation of freshwater and estuarine habitats and the current hatchery production have contributed to a decline in the diversity of populations and life history types, increasing the vulnerability of both the remaining populations and the associated fisheries to climate variability (Lindley et al. 2009).

Of the major historical fisheries in the CCE, probably the most noteworthy is the Pacific sardine fishery, immortalized by John Steinbeck in *Cannery Row*. Although sardines had been fished in California waters since the mid-1800s, markets for canned sardines (and later highly lucrative markets for fishmeal and fertilizer) did not develop until World War I, largely in response to declining salmon canning opportunities in California. Sardine fishing rapidly expanded throughout the coast, from British Columbia to Southern California, and coastwide landings grew from roughly 70,000 metric tons per year in 1920 to a peak of over 700,000 metric tons in 1936. Both the sardine population and the fishery began to decline sharply shortly after World War II, with the sardines disappearing sequentially from north to south, leading to debates that continue to this day regarding the relative contributions of fishing and environment with respect to the interactions between fisheries and climate more generally.

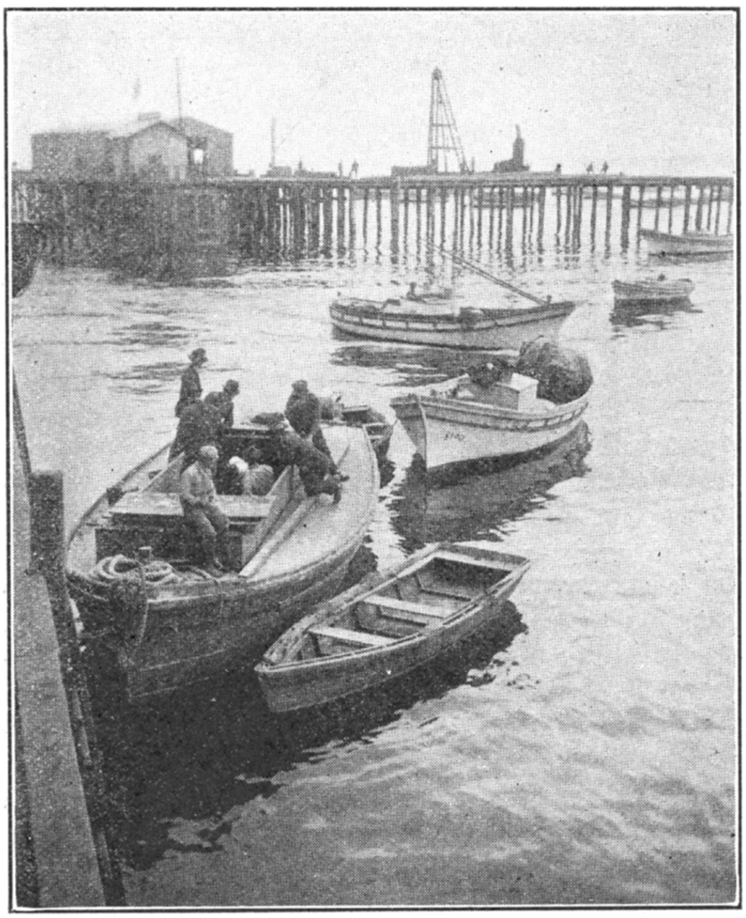


FIG. 7. Flat-bottomed lighter, skiff and launch with lampara piled in the stern. The second launch (center background) is a salmon troller with short mast and outrigger "poles." Photograph by W. L. Scofield, Monterey, July, 1919.

Image credit: Online archive of California, Division of Fish and Game California, Bulletin of Fish #19

By the time the fishery was closed in 1968, the sardine population had declined by several orders of magnitude, and fluctuations were noted in other CPS fisheries as well. For example, the Pacific mackerel fishery being closed in 1972 as a result in declines in that population (which reversed in the late 1970s,) while the anchovy fishery grew in the 1960s and 1970s, apparently in response to increases in abundance. Decades of studies devoted to understanding the proximate causes of the sardine decline, and comparable declines and dynamics in other ecosystems, have lead researchers to appreciate the role of climate in driving variability in the abundance and productivity of coastal pelagic species, and it is now generally accepted that the sardine fishery exacerbated what would have likely been a natural decline in the abundance of sardine in the 1950s and 1960s (Baumgartner 1992, MacCall 1996, Chavez et al. 2003, Checkley et al. 2009). The recovery of Pacific sardines in the 1980s and 1990s was generally associated with changes in environmental conditions, resulting in a resurgent fishery as well as a more conservative management regime. However, uncertainties remain with respect to understanding the principle drivers of sardine productivity and the optimal management measures for balancing conservation needs with fisheries.

Pacific halibut and other groundfish were harvested by coastal native cultures throughout the CCE region, and soon became a staple of early explorers and traders throughout the Northeast Pacific. By 1892, coastwide catches of halibut and other flatfish, cod, rockfish and sablefish combined were over 10 million pounds per year, with the majority taken from coastal inland waters of San Francisco Bay, the Columbia River estuary, and Puget Sound. Through the early 20th century, longline fisheries for Pacific halibut and sablefish expanded, as did paranzella (two-boat trawl) fisheries that had begun as early as 1876 in San Francisco. The introduction of otter trawls to West Coast fisheries following World War I was associated with a gradual expansion of the trawl fleet northwards, and by the late 1930s the center of West Coast trawling had shifted from San Francisco to Eureka (Scofield 1948). A sharp increase in effort and landings occurred during World War II, spurred on by both a need for inexpensive protein from flatfish and rockfish (much of which was ordered by the U.S. Army), and engine lubricant from the livers of dogfish, soupfin and basking sharks. Demand for groundfish dipped slightly after the war, but trawlers kept busy as a market for mink food supplemented markets for fresh and frozen fish. The fishery grew steadily in the 1950s and 1960s following the postwar dip, and diversified as fisheries for Dungeness crab, pink shrimp and albacore tuna developed and expanded alongside existing fisheries for salmon and groundfish.

Southern California angler with 360 lb black sea bass
Photo credit: Phil Crawford family

In the late 1960s through the 1980s massive fleets of Japanese, Russian and Polish trawlers, many of them recent expatriates of declining whale fisheries, began intensively fishing the CCE's continental shelf and slope waters. The size and capacity of these trawlers stood in sharp contrast to the coastal fleets of trollers, draggers and crab boats, and helped fuel the desire to nationalize marine resources and develop greater domestic fishing capacity. Senator Warren Magnuson captured the mood of the day, when he advised fishermen and scientists that "You have no time to form study committees. You have no time for biologically researching the animal. Your time must be spent going out there and catching fish… Let us not study our resources to death, let's harvest them" (Magnuson 1968). As the growing conservation movement of that era drove passage of a plethora of environmental legislation in the early 1970s, environmental concerns soon matched the desire to nationalize marine resources. The Fishery Conservation and Management Act of 1976 (later reauthorized as the Magnuson-Stevens Fishery Conservation and Management Act, or MSA) ultimately included objectives that included both developing domestic fisheries as well as attaining sustainability as defined by the concept of MSY, although the latter was treated as a "target" in the 1976 Act, and has since evolved to represent a "limit" reference point.

3.4.2 Current Fisheries

3.4.2.1 Commercial Fisheries

West Coast commercial fisheries landings data is collected within the PSMFC's Pacific Fisheries Information Network (PacFIN) database. Commercial data represent landings recorded on state fish tickets (landings receipts,) but does not include any fisheries' biomass removals that may occur as bycatch to commercial fisheries, nor does it include recreational fisheries' removals. Thus, while commercial landings data cannot tell us about the cumulative effects of West Coast fisheries on the CCE, they can tell us about how the fisheries function within the CCE: species groups targeted by fisheries, how the volume of landings compares with exvessel revenues from those landings, and levels of fishery participation by vessels operating off the U.S. West Coast. This section of the FEP considers recent, 2000-2011 landings and ex-vessel revenues for U.S. West Coast commercial fisheries.

Commercial landings of all species for 2000-2011 peaked at about 400,000 mt in 2000, 2006 and 2011, and reached lows near 310,000 mt in 2003, 2004 and 2008 (Fig. 3.4.2). Real exvessel revenues were generally increasing throughout the period (Fig. 3.4.2). Annual landings were dominated by CPS, mainly squid and sardine; by volume, CPS averaged 48% of total landings for the

F/V Noah's Ark. Photo credit: NOAA NWR

period. Groundfish followed CPS as a share of total landings, averaging 29% by volume for the period (Fig. 3.4.3). Dungeness crab accounted for the greatest share of exvessel revenues, an average of 31% for the period; groundfish had the next highest share at 17% (Fig. 3.4.4).

Figure 3.4.2: Total U.S. west coast landings (mt) and real exvessel revenues (2011 $), 2000-2011.

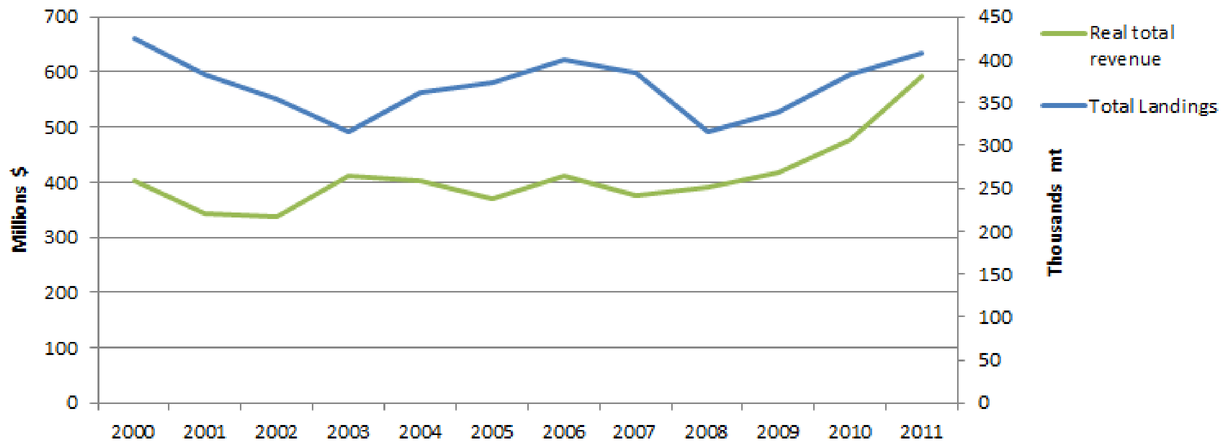


Figure 3.4.3: Percentage of total U.S. west coast commercial landings by PacFIN management group, 2000-2011.

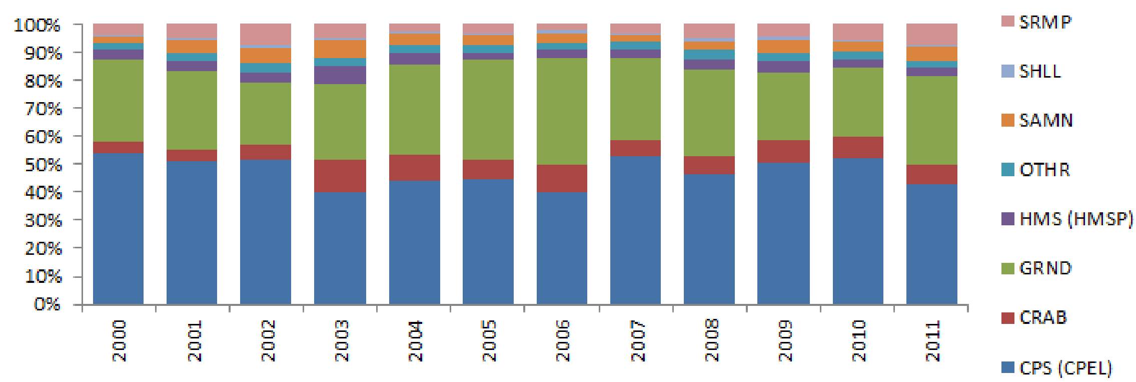
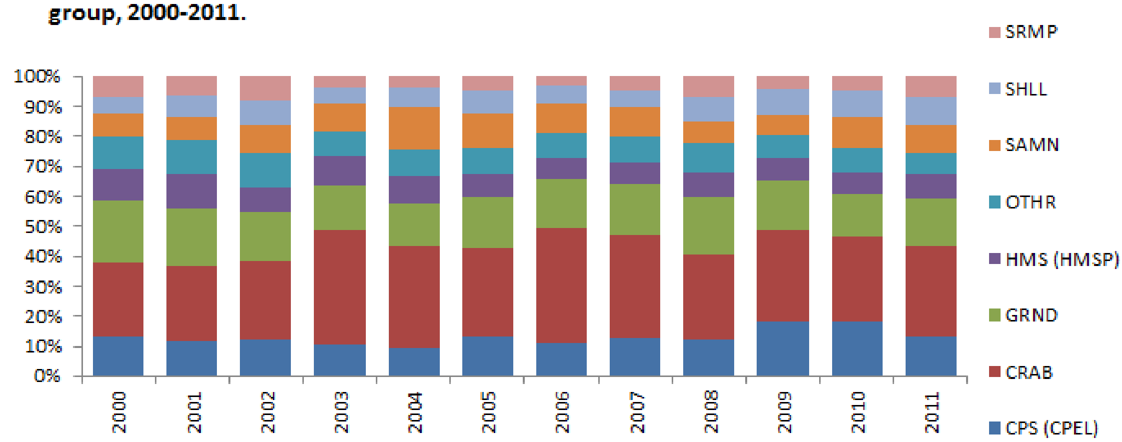
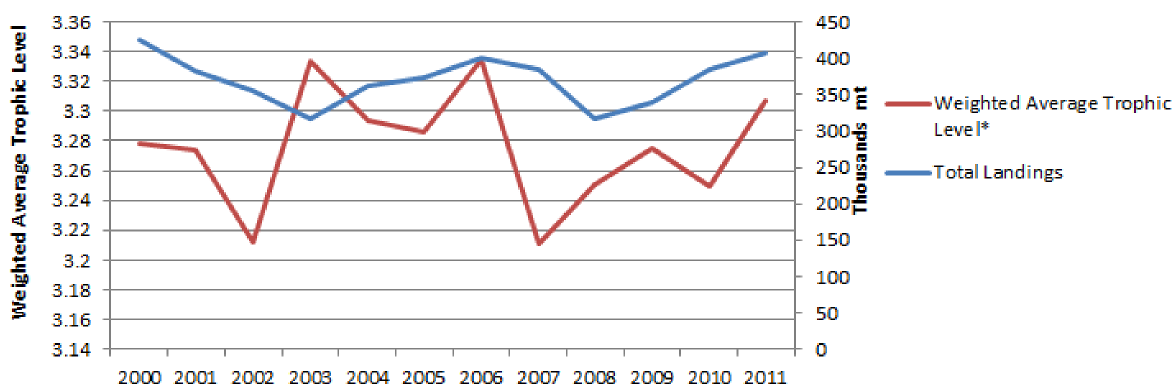


Figure 3.4.4: Percentage of total U.S. west coast exvessel revenues by PacFIN management group, 2000-2011.



U.S. West Coast commercial landings for 2000-2011 cover a wide range of species' trophic levels, ranging from 2.0 to 4.5 with an arithmetic mean and median of 3.6. Ranking the PacFIN management groups by their mean trophic levels from lowest to highest, shellfish are at the bottom, moving upward to shrimp, crab, CPS, other, groundfish, salmon, with HMS at the top of the trophic scale. Based upon the species composition of the commercial landings, and trophic level measures for the individual species, the volume weighted mean trophic level (MTL) of the annual landings is shown in Figure 3.4.5. In both 2002 and 2007, the MTL was at its lowest level for the period, 3.2, and in both 2003 and 2006 it was at its highest level. In the low MTL years, species from the lower half of the trophic scale, predominately CPS, are above average in quantities landed, while species in the upper half of the scale, mainly groundfish, salmon and HMS are below average. For the high MTL years, the converse holds.

Figure 3.4.5: Total quantity (mt) and weighted average trophic level of U.S. west coast landings, 2000-2011.



Ports in the Southern California port area, mainly San Pedro, Terminal Island, Port Hueneme and Ventura, accounted for the greatest share of landings volume by PacFIN port area over the 2000-2011 period. Ports along the northern Oregon coast, mainly Newport and Astoria, had the next highest share, followed by ports, primarily Chinook and Westport, in the Washington external marine port area (Fig. 3.4.6). CPS made up the significant bulk of the landings in Southern California while landings in the northern Oregon coast ports and in Washington external marine area consisted mainly of CPS, groundfish and shrimp. Exvessel revenues were more evenly divided among port areas for the period, with Southern California (CPS and HMS), the northern Oregon coast (crab, groundfish and shrimp) and Washington internal and external marine areas (crab, groundfish, salmon and shellfish) being the major receivers of commercial fisheries revenue (Fig. 3.4.7).

Figure 3.4.6: Percent total of U.S. west coast landings by port area, 2000-2011

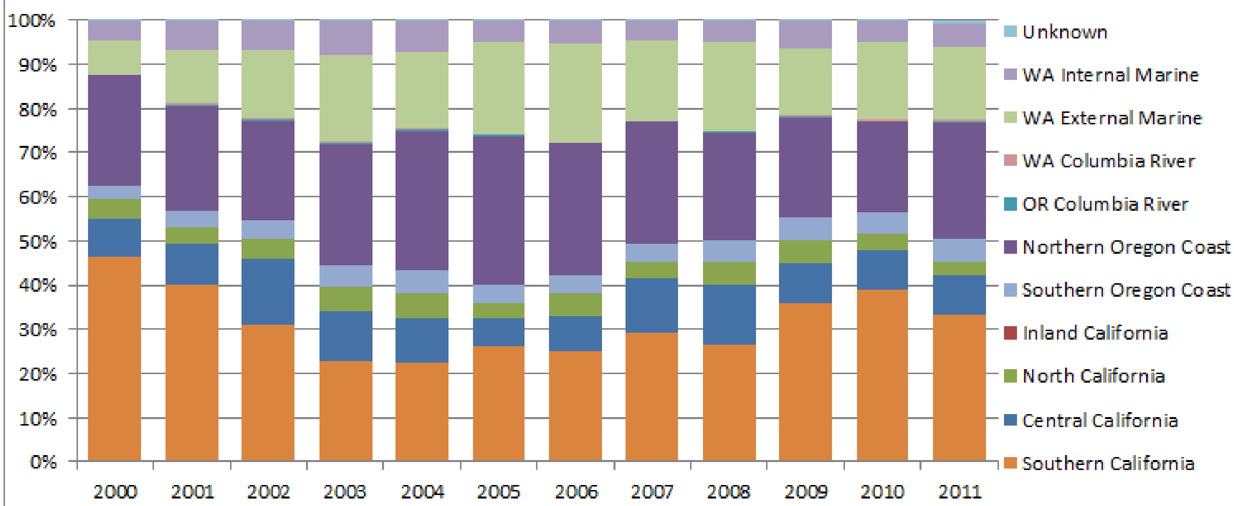
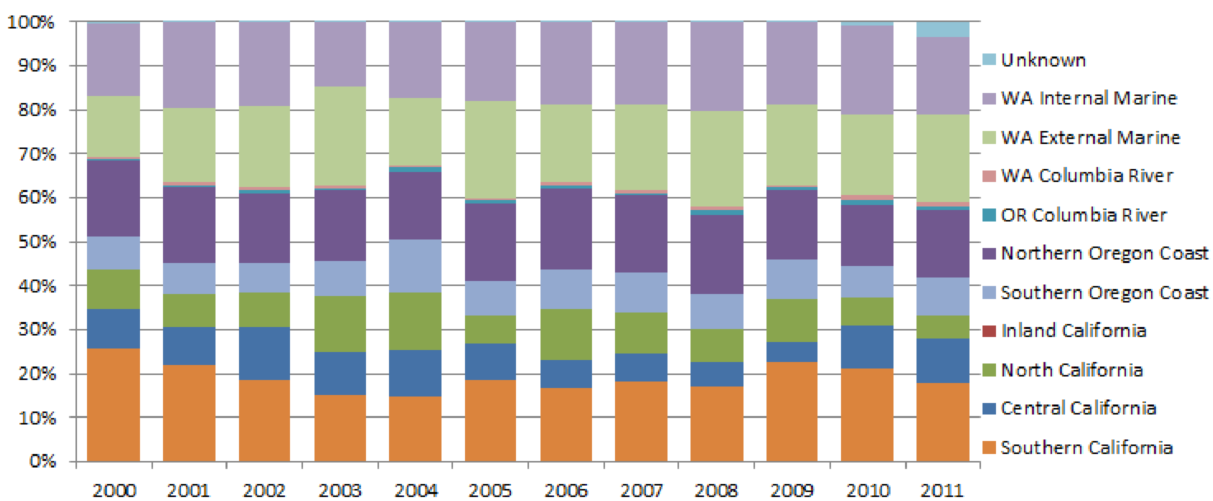


Figure 3.4.7: Percent total of U.S. west coast total exvessel revenue by port area



The greatest shares of landings volume by PacFIN gear category were in the seine and midwater trawl categories (Fig. 3.4.8). Purse seine is the primary gear used in the high volume CPS fisheries, while midwater trawl accounts for shoreside landings in the high volume Pacific whiting fishery. The pot and trap gear category accounted for the greatest share of exvessel revenues over the period (Fig 3.4.9). Pots and traps are used to harvest relatively high valued Dungeness crab, shrimp, prawns, lobster and sablefish. Seine gear, based on the volume of CPS landings, also consistently accounted for a relatively high revenue share. The relatively high revenue share for the other known gear category can be mainly attributed to landings of high valued geoduck clams harvested using dredge gear, which falls in the "other known gear" category.

Figure 3.4.8. Percent total U.S. west coast landings by gear category, 2000-2011.

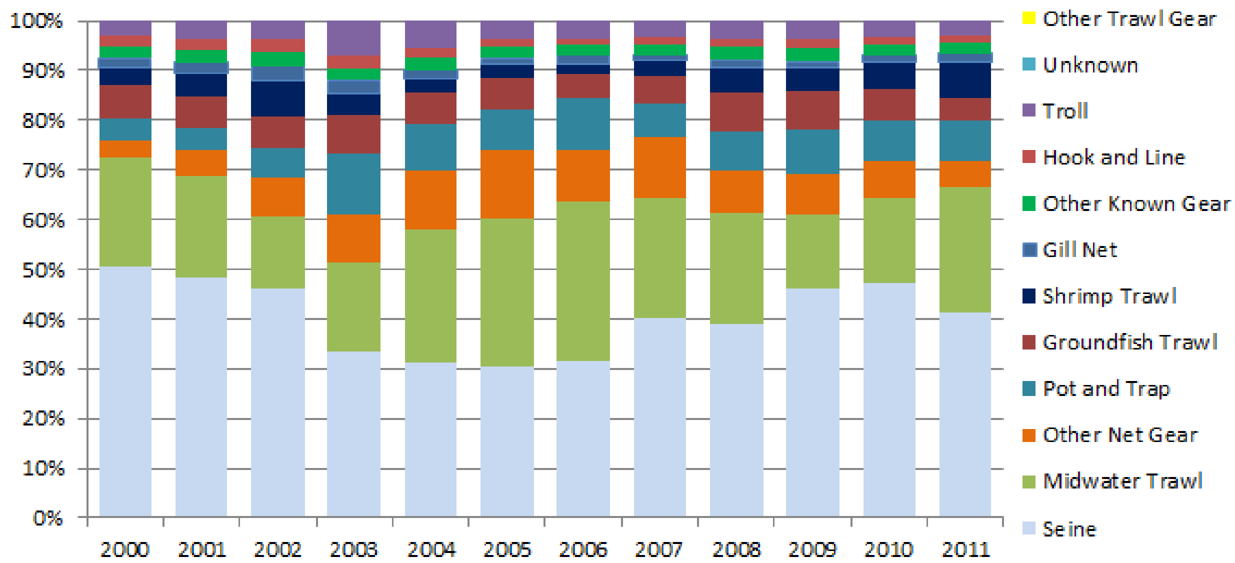


Figure 3.4.9: Percent total U.S. west coast exvessel revenues by gear category, 2000-2011.

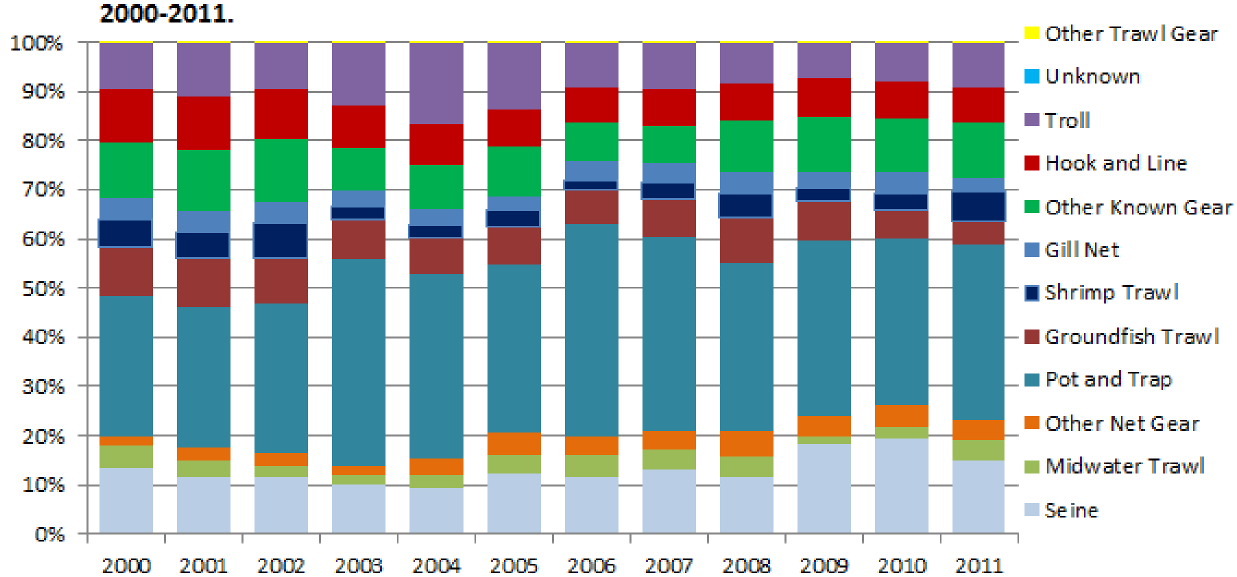
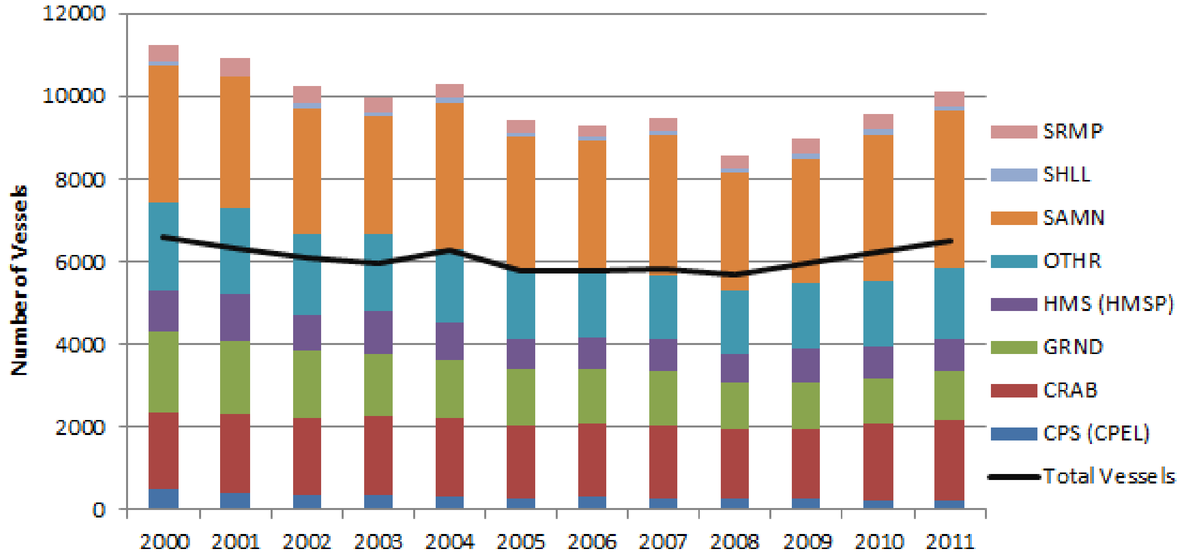


Figure 3.4.10: Total vessels with west coast landings and number with landings by management group, 2000-2011.

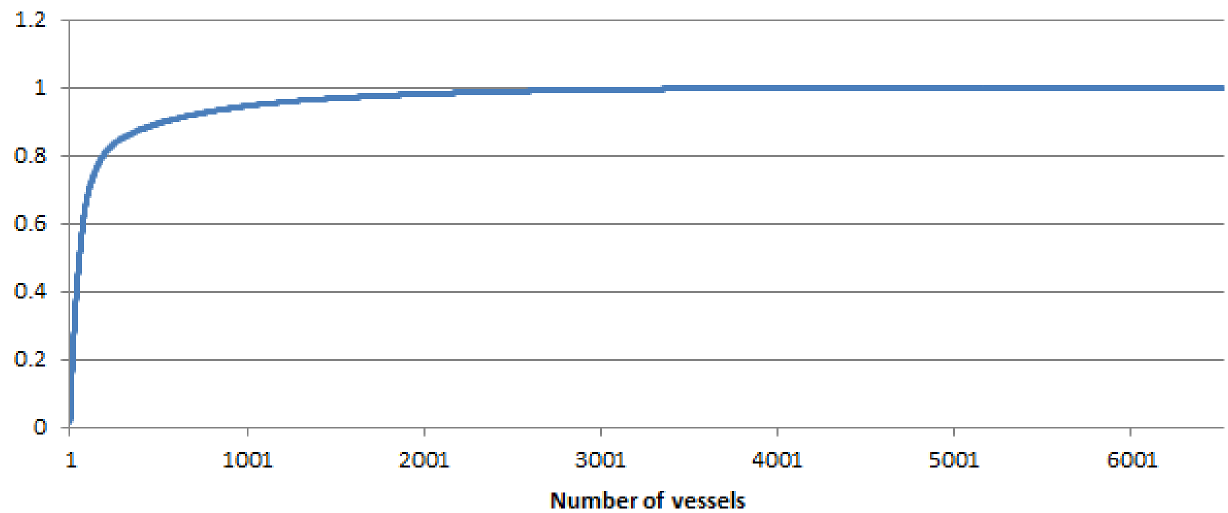


During the 2000-2011 period, the number of vessels that made landings in U.S. West Coast commercial fisheries remained fairly constant at around 6,000 annually (Fig. 3.4.10). Many of these vessels are capable of harvesting species in more than one management category, either using a single gear type (e.g. trawlers landing groundfish and shrimp) or multipurpose vessels that use different gear types (e.g. vessels landing: crab [pots] and groundfish [trawl]; crab [pots] and salmon [troll]). This multiplicity of fishing operations by vessels is indicated by the vessel totals in each management category shown in Figure 3.4.10. In all years, more vessels participated in salmon fisheries, which are comparatively unrestricted in terms of participation, than in any other management group. On the other hand, limited entry CPS fisheries with the highest annual landings over the period had relatively few participants.

F/V April. Photo credit: OCZMA

In 2011, 6,523 vessels made at least one West Coast shoreside commercial landing of one pound or more. It is questionable how many of these vessels would be considered to be engaged in a significant business enterprise in the conventional sense. Assigning a reasonable criterion for distinguishing a significant fishing business enterprise is not within the scope of this FEP. Using a gross revenue criterion for example, of the 6,523 vessels only 5,128 had exvessel revenues in excess of $1,000. Nonetheless, Figure 3.4.11 presents the distribution of the 6,523 vessels according to their share of the total shoreside landings in 2011 and shows that 1,064 vessels, 16% of the total number of vessels with landings, accounted for more than 95% of the total harvest. This example, using the $1,000 exvessel revenue threshold, suggests that in 2011 there may have been far more vessels than necessary to harvest the total landings. This finding for 2011 must be tempered by the spatial-temporal scale and scope of West Coast commercial fisheries, which are subject to the vagaries of ecosystems and economic systems alike.

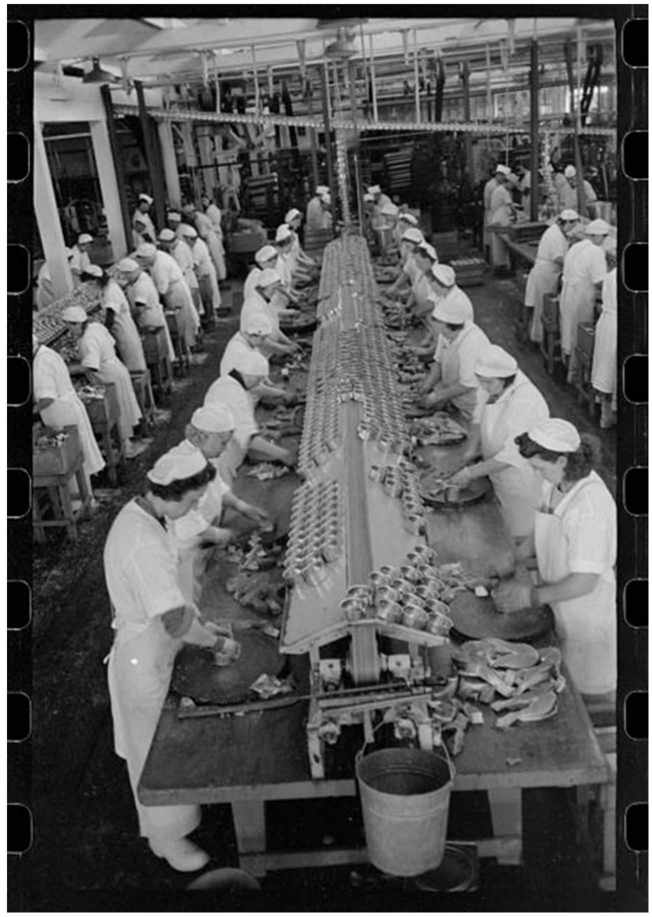
Figure 3.4.11: Cumulative vessel share of total shoreside landings, 2011.



Hauling squid in Monterey Bay.
Photo credit: D.B. Pleschner & R. Price, California Wetfish Producers Association

3.4.2.2 Fish Receivers and Processors

West Coast fish processors and receivers process fish and shellfish in a wide variety of forms for sale in domestic and international markets. Most Council-managed species are processed on shore, although some species, such as Pacific whiting, may be processed at sea. Depending on the species and market preferences, fish may be sold live or processed into fresh, frozen, blast-frozen forms, canned or smoked or converted to fish meal, oil, or surimi. Dungeness crab product, as an example, is sold live, or as fresh or frozen whole cooked crabs, as well as picked meat, legs and sections. Fish landed or otherwise caught in West Coast tribal fisheries for economic purposes are routed through similar processing chains to those used by the non-tribal fisheries. Tribal fisheries also land fish for personal and cultural uses, which are usually processed locally into fresh, frozen, smoked or canned products and are typically banned by tribal regulation from entering commercial markets.


Packing salmon into cans at the Columbia River Packing Association, Astoria, Oregon, 1941.
Photo credit: Library of Congress

Regulating the Buying, Processing, and Selling of Seafood

Delivery, purchase, and sale of fish are activities regulated primarily under state law, or when conducted on tribal lands, under tribal law. Federal rules can apply to certain activities as well. For example, those wishing to purchase fish harvested in the groundfish individual fishing quota program must be issued a first receiver site license from NMFS.

The first landing of fish from a vessel into a port or other place of delivery is the core activity regulated and monitored by the states and tribes. Each state and tribal government requires deliveries to be recorded on a marine fish receiving ticket, or “fish ticket,” that records species landed, the amount landed in weight or numbers of fish, and the price paid for each species or market category. The fish tickets provide an official record of landings on the coast and can be used for other purposes such as the assessment of general and special taxes and fees on fish landings. Rules on the specific items needing to be reported and the timing of that reporting can differ by state and by fishery but also show similarities. Contrasting Oregon and California, Oregon requires fish tickets to be forwarded to ODFW in paper form within five days or submitted electronically through the PSMFC West Coast E-Ticket system. In California, fish tickets are due at the local California Department of Fish and Wildlife (CDFW) office on the 16th and last day of the month, whichever is earlier, and electronic submission is not currently allowed.

Oregon and Washington regulate this system by licensing wholesale fish dealers to businesses that purchase fish directly from a vessel. A separate permit or license may be issued to fish buyers that represent a wholesale dealer or that purchase fish in a different location than the dealer’s main operation. In Washington, buyers on tribal lands are licensed by the tribal governments and may be dually licensed by the state. California has a similar system where the main license is referred to as a fish receiver's license. In all three states, it is possible for fishermen to be licensed as a wholesale dealer or fish receiver and, in essence, to deliver fish to themselves. Such deliveries must be recorded on a fish ticket in the same manner as if the transaction occurred between separate entities.

Processing and sales activities can fall under a variety of categories, which the states may regulate with one or more permit or license requirements. These categories range from the import and export of fish to direct sale to the public off the docks. The transport of fish is another activity that is regulated as a means of enforcing fish landings and importing rules. Regulations on sales, processing, and transport of fish differ by state, but also show many similarities. For example, Oregon requires a special permit for wholesale bait dealers. California has six major classes of commercial fish business licenses in addition to the fish receiver license and then a special permit for those businesses wanting to reduce anchovy for fish meal or other reduction purposes. All three states require special permits or licenses for fishing operations that sell directly from their vessel to a consumer or restaurant. The states and tribes can also differ in rules specifying how fish may be landed. For example, Washington does not allow fish to be landed and sold live whereas California, Oregon, and certain tribes do.

Seafood safety regulation, marketing and sustainability certification

Processors of fish and fishery products are required by the U.S. Food and Drug Administration to develop Hazard Analysis Critical Control Point plans to help identify potential hazards and develop control strategies and practices. Also for food safety purposes, state agencies like the Oregon Department of Agriculture require additional permits for shellfish distributors, shippers, and wholesalers; shuckers and packers; shellfish growers; and commercial harvesters from shellfish growing areas.

Seafood products are marketed in many ways, ranging from traditional methods such as local fishermen selling off their boat directly to consumers, to web-based marketing and sophisticated product coding that links an individual fish product to its harvester. For example, Pacific Fish Trax is an online information sharing system focused on West Coast fisheries. Its website provides viewers with tools to track seafood products, link customers and fishermen, and improve science, marketing and management (Figure 3.4.12).[1]

In Oregon, four seafood commodity commissions under the auspices of the Oregon Department of Agriculture, allow the fishing industry members to tax themselves and use the pooled funds to increase their commodity's recognition, value and use. The Oregon Albacore Commission, Oregon Dungeness Crab Commission, Oregon Salmon Commission and Oregon Trawl Commission cooperate under the Seafood OREGON banner in marketing, promotion and education. In 2009, California's Legislature passed the Sustainable Seafood Act – to develop and implement a voluntary sustainable seafood program to promote California fisheries. Actions to date include developing voluntary certification protocols for sustainable fisheries and recommendations for a marketing assistance program, as well as appointing an advisory committee.

Figure 3.4.12 Example of FishTrax bar code card

[1] Pacific Fish Trax website: http://www.pacificfishtrax.org/.

Ecolabeling and fishery sustainability certification by recognized organizations can improve marketability and profitability. For example, the Monterey Bay Aquarium Seafood Watch program makes recommendations to consumers and businesses on which seafood to buy or avoid. NOAA's FishWatch program provides similar advice to consumers.[2] Several West Coast fishery organizations and commodity commissions obtained Marine Stewardship Council (MSC) certification for their fisheries, including North Pacific albacore, Oregon pink shrimp, Oregon Dungeness crab, and Pacific whiting.

Salmon processing at Pacific Seafoods, Clackamas, OR, 2008. Photo credit: Rod Moore, WCSPA

Coastwide and state level statistics

The National Marine Fisheries Service publishes descriptive statistics on the seafood processing industry in the *Fisheries Economics of the U.S.* series. This section describes statistics for the Pacific region and three West Coast states from the 2009 edition of that report (NMFS 2010) and an enhanced version of the economic model used to estimate the economic impact created by the seafood industry (NMFS 2012).

The fisheries under Council management are an important source of economic activity in the West Coast seafood processing industry. However, the West Coast seafood industry as a whole also depends on harvest from shellfish operations and other fisheries not managed by the Council. As discussed in Section 3.4.2.1, coastwide shellfish operations accounted for 62 percent of total landings revenue during the period 2006-2009. In addition, Dungeness crab fisheries, which are managed by the three states and several tribes individually, provides the most valuable source of landings in most years. As Table 3.4.1 indicates, seafood dealers and processors purchase shellfish and crab at the highest per pound prices with sablefish being the only species under Council management of similar per pound value. Foreign imports are another major source of economic activity in the West Coast seafood industry, as shown below.

Table 3.4.1. Total coastwide landings revenue ($ thous.) for the years 2006-2009 showing the relative contributions of finfish and shellfish harvesting

	2006	2007	2008	2009
Total revenue	471,788	459,772	500,447	488,155
Finfish & other	176,425	176,104	215,784	168,213
Shellfish	295,363	283,668	284,663	319,942

[2] http://www.fishwatch.gov/

Table 3.4.2. Coastwide average annual price ($ per pound) of key species and species groups.				
	2006	2007	2008	2009
Albacore Tuna	0.85	0.85	1.18	1.02
Crab	1.69	2.33	2.38	2.09
Flatfish	0.47	0.43	0.42	0.35
Pacific whiting	0.06	0.07	0.11	0.06
Shellfish	3.79	4.08	4.55	4.56
Rockfish	1.03	1.01	0.98	0.86
Sablefish	1.68	1.80	2.10	2.18
Salmon	1.18	1.38	1.42	0.74
Shrimp	0.61	0.65	0.70	0.50
Squid	0.25	0.27	0.31	0.28

The Fisheries Economics of the U.S. series also reports the number of seafood businesses active in the seafood product preparation and packaging, seafood retail sales, and seafood wholesale sales sectors in each of the states. These statistics are also categorized by whether the businesses hire employees or not. Figure 3.4.12 provides a view of the number of processing business from the PacFIN database plotted against landings of the major species management groups.

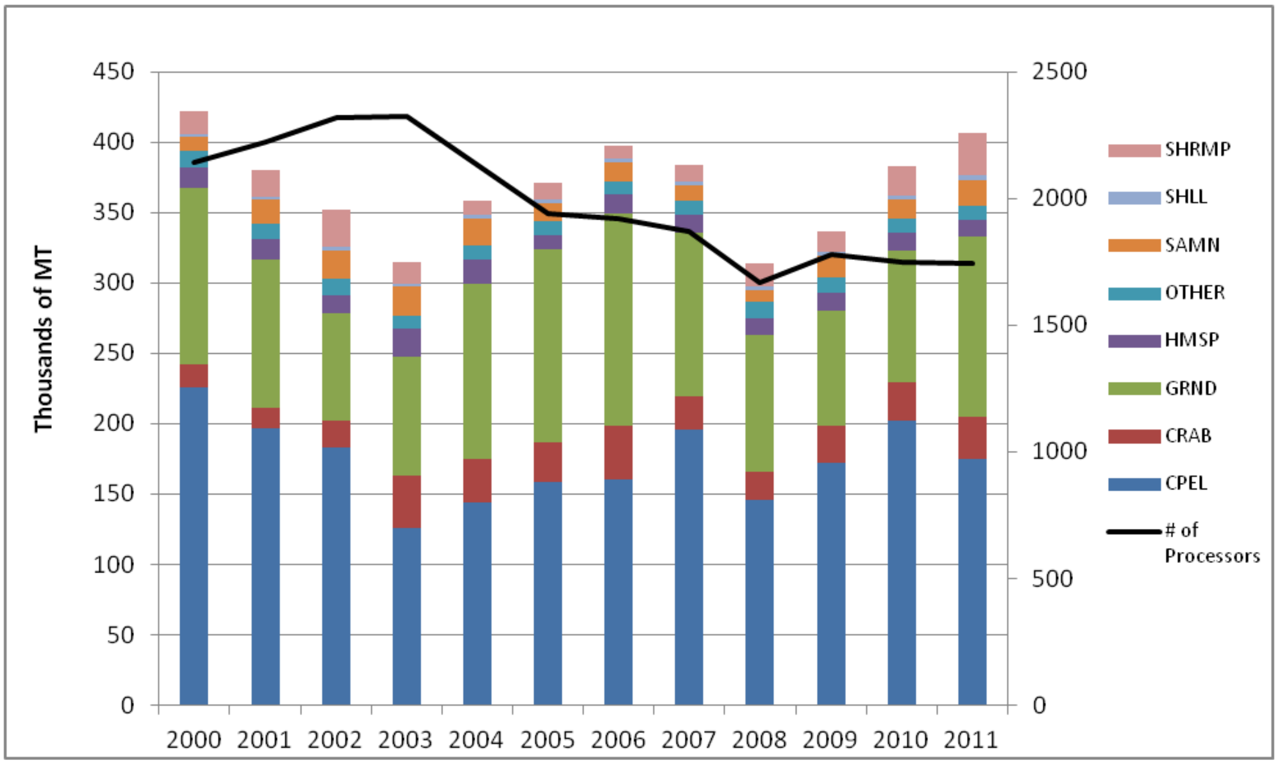


Figure 3.4.12 Coastwide processor count and major management species groups landings in mt. Unique primary processors only (secondary plants not counted), any processor that landed >100 lb in 2000-2011. Note: double-counting exists, since most processors land more than one type of species. Data source: PacFIN.

Table 3.4.3. Number of seafood businesses by state for 2006-2008 (NMFS 2010).			
Seafood product prep. & packaging			
	2006	2007	2008
Washington			
Non-employer firms	53	63	44
Employer firms	96	98	96
Oregon			
Non-employer firms	7	0	19
Employer firms	21	22	23
California			
Non-employer firms	91	121	139
Employer firms	47	49	45
Seafood sales, retail			
	2006	2007	2008
Washington			
Non-employer firms	29	32	33
Employer firms	49	50	44
Oregon			
Non-employer firms	11	11	16
Employer firms	22	23	21
California			
Non-employer firms	163	222	210
Employer firms	184	182	161
Seafood sales, wholesale			
	2006	2007	2008
Washington			
Employer firms	115	127	108
Oregon			
Employer firms	16	18	18
California			
Employer firms	252	300	278

Broiled sablefish.
Photo credit: NOAA

NMFS also estimates the seafood industry's economic impact—nationally, regionally, and statewide for each of the 23 coastal states—using the National and Coastal State Input/Output Model (NMFS 2012). The estimates for the three West Coast states are reproduced in Tables 3.4.4 through 3.4.6.

These tables show direct economic impacts only. Direct impacts are those that "express the economic effects (for sales, income or employment) in the sector directly affected by the activity under consideration." (NMFS 2012). The National and Coastal State Input/Output Model also estimates indirect and induced impacts. Indirect impacts are those that describe the economic effects created by seafood businesses purchasing from other industries (e.g. sales generated by the business providing goods and services to seafood business); and, induced impacts are those arising from employees and owners spending the income they have earned from seafood businesses. These activities describe the bigger picture of how fish harvest can affect state, regional, and national economies. Indirect, induced, and total economic impacts can be queried with the NMFS Interactive Fisheries Economics Tool.

The National and Coastal State Input/Output Model is based on the same methods as used in the Fisheries Economics of the U.S. series, but certain enhancements have been made to the model and the values reported may differ between the two. For both, the primary inputs to the model are the fish and shellfish harvested and landed into each state and the foreign imports of seafood into each state. Various studies and surveys of the seafood industry are then used to translate those landings into the estimates of direct, indirect, and induced economic impacts.

Of note, the model does not take into account interstate movements of fish products. NMFS identifies this as a shortcoming of the model, but one that washes out for the model's main purpose of describing national economic activity. The likely result of not accounting for interstate transfers of fish products is an underestimate of regional and state economic impacts where interstate movements of fish occur. On the West Coast, fish landed in one state are often trucked and processed or sold in another. For example, landings into Washington might be processed and sold in Oregon. The model also misses fish products that originate as landings into Alaska. Washington in particular has been a traditional processing and business hub for fish caught in Alaska. Some of the economic activities attributed to Alaska may actually occur in the West Coast states. At the same time, some of the activities attributed to the West Coast states might occur elsewhere, including Alaska.

Pike Place Market, Seattle, WA.
Photo credit: Smithsonian Institution

The model outputs reported in Tables 3.4.4 through 3.4.6. include:

- The **employment impacts** estimate total full-time and part-time jobs produced in each sector.
- The **income impacts** that consist of wages and salaries and includes self-employment income to business owners.
- The **sales impacts** that estimate the total sales revenues made by businesses within each sector category.
- The **value added impact** is an estimate of sales revenues minus the cost of the goods and services needed for production. It is the estimate of the industry or industry sector's overall contribution to the U.S. Gross Domestic Product (GDP).

NMFS advises that it is incorrect to add impacts across the income, sales, and employment impact categories (NMFS 2012). Fish imports contribute a substantial portion of the direct economic impacts in the region, especially in California and Washington. The *Fisheries Economics of the U.S.* identifies California as first in terms of overall seafood sales and value added impact in the nation, and Washington third, based largely on the size of the foreign imports of fish products into those states (NMFS 2010).

In Figure 3.4.13, regional landings are shown by weight and value, with 12 year trends and average proportions for major West Coast management species groups, 2000-2011. Differences between landings values and landings volumes are clearly visible for species that are either low-value/high-volume, or high-value/low-volume.

Table 3.4.4. Direct Seafood Industry Impacts for Washington, 2007-2009 (source: NMFS 2012)

	2007	2008	2009
Primary dealers/processors			
Employment Impacts (#)	12,118	10,901	10,714
Income Impacts ($ thous.)	346,260	312,211	307,311
Sales Impacts ($ thous.)	763,424	688,353	677,550
Total value added impacts ($ thous.)	369,096	332,801	327,578
Secondary wholesalers/distributors			
Employment Impacts (#)	1,557	1,412	1,373
Income Impacts ($ thous.)	63,979	59,281	58,342
Sales Impacts ($ thous.)	178,434	165,330	162,713
Total value added impacts ($ thous.)	68,199	63,190	62,190
Importers and brokers			
Employment Impacts (#)	545	479	473
Income Impacts ($ thous.)	21,815	19,194	18,919
Sales Impacts ($ thous.)	1,508,480	1,327,220	1,308,219
Total value added impacts ($ thous.)	62,321	54,833	54,048
Restaurants			
Employment Impacts (#)	15,016	14,433	13,941
Income Impacts ($ thous.)	196,398	192,817	188,453
Sales Impacts ($ thous.)	382,814	375,835	367,328
Total value added impacts ($ thous.)	209,350	205,533	200,882
Grocers			
Employment Impacts (#)	2,000	1,930	1,886
Income Impacts ($ thous.)	47,910	46,719	45,938
Sales Impacts ($ thous.)	81,883	79,848	78,511
Total value added impacts ($ thous.)	51,070	49,800	48,967
Total			
Employment impact (#)	31,236	29,155	28,387
Income impact ($ thous.)	654,547	611,028	600,044
Sales Impacts ($ thous.)	1,406,555	1,309,366	1,286,102
Total value added impacts ($ thous.)	697,715	651,324	639,617

Table 3.4.5. Direct Seafood Industry Impacts for Oregon, 2007-2009 (source: NMFS 2012)

	2007	2008	2009
Primary dealers/processors			
Employment Impacts (#)	827	854	805
Income Impacts ($ thous.)	21,257	22,355	21,283
Sales Impacts ($ thous.)	46,866	49,289	46,924
Total value added impacts ($ thous.)	22,659	23,830	22,686
Secondary wholesalers/distributors			
Employment Impacts (#)	366	342	332
Income Impacts ($ thous.)	14,825	14,136	13,909
Sales Impacts ($ thous.)	41,896	39,949	39,306
Total value added impacts ($ thous.)	15,803	15,068	14,826
Importers and brokers			
Employment Impacts (#)	65	58	55
Income Impacts ($ thous.)	2,620	2,314	2,191
Sales Impacts ($ thous.)	181,198	160,010	151,475
Total value added impacts ($ thous.)	7,486	6,611	6,258
Restaurants			
Employment Impacts (#)	5,258	5,336	5,002
Income Impacts ($ thous.)	63,371	65,688	62,299
Sales Impacts ($ thous.)	123,521	128,038	121,433
Total value added impacts ($ thous.)	67,550	70,020	66,408
Grocers			
Employment Impacts (#)	746	742	719
Income Impacts ($ thous.)	14,817	14,943	14,612
Sales Impacts ($ thous.)	25,324	25,540	24,973
Total value added impacts ($ thous.)	15,794	15,929	15,576
Total			
Employment impact (#)	7,262	7,332	6,913
Income impact ($ thous.)	114,270	117,122	112,103
Sales Impacts ($ thous.)	237,607	242,816	232,636
Total value added impacts ($ thous.)	121,806	124,847	119,496

Table 3.4.6. Direct Seafood Industry Impacts for California, 2007-2009 (source: NMFS 2012)

	2007	2008	2009
Primary dealers/processors			
Employment Impacts (#)	2,908	2,987	2,773
Income Impacts ($ thous.)	87,438	90,330	84,156
Sales Impacts ($ thous.)	192,781	199,156	185,546
Total value added impacts ($ thous.)	93,205	96,287	89,707
Secondary wholesalers/distributors			
Employment Impacts (#)	6,410	6,624	5,565
Income Impacts ($ thous.)	267,534	282,381	240,038
Sales Impacts ($ thous.)	789,282	833,084	708,165
Total value added impacts ($ thous.)	285,178	301,004	255,869
Importers and brokers			
Employment Impacts (#)	1,953	2,069	1,735
Income Impacts ($ thous.)	78,189	82,821	69,444
Sales Impacts ($ thous.)	5,406,612	5,726,911	4,801,942
Total value added impacts ($ thous.)	223,368	236,601	198,387
Restaurants			
Employment Impacts (#)	35,766	36,515	31,646
Income Impacts ($ thous.)	515,559	537,638	471,468
Sales Impacts ($ thous.)	1,004,879	1,047,914	918,942
Total value added impacts ($ thous.)	549,560	573,095	502,562
Grocers			
Employment Impacts (#)	7,534	7,929	6,854
Income Impacts ($ thous.)	193,435	203,858	176,421
Sales Impacts ($ thous.)	330,599	348,413	301,519
Total value added impacts ($ thous.)	206,192	217,303	188,056
Total			
Employment impact (#)	54,571	56,124	48,573
Income impact ($ thous.)	1,063,966	1,114,207	972,083
Sales Impacts ($ thous.)	2,317,541	2,428,567	2,114,172
Total value added impacts ($ thous.)	1,134,135	1,187,689	1,036,194

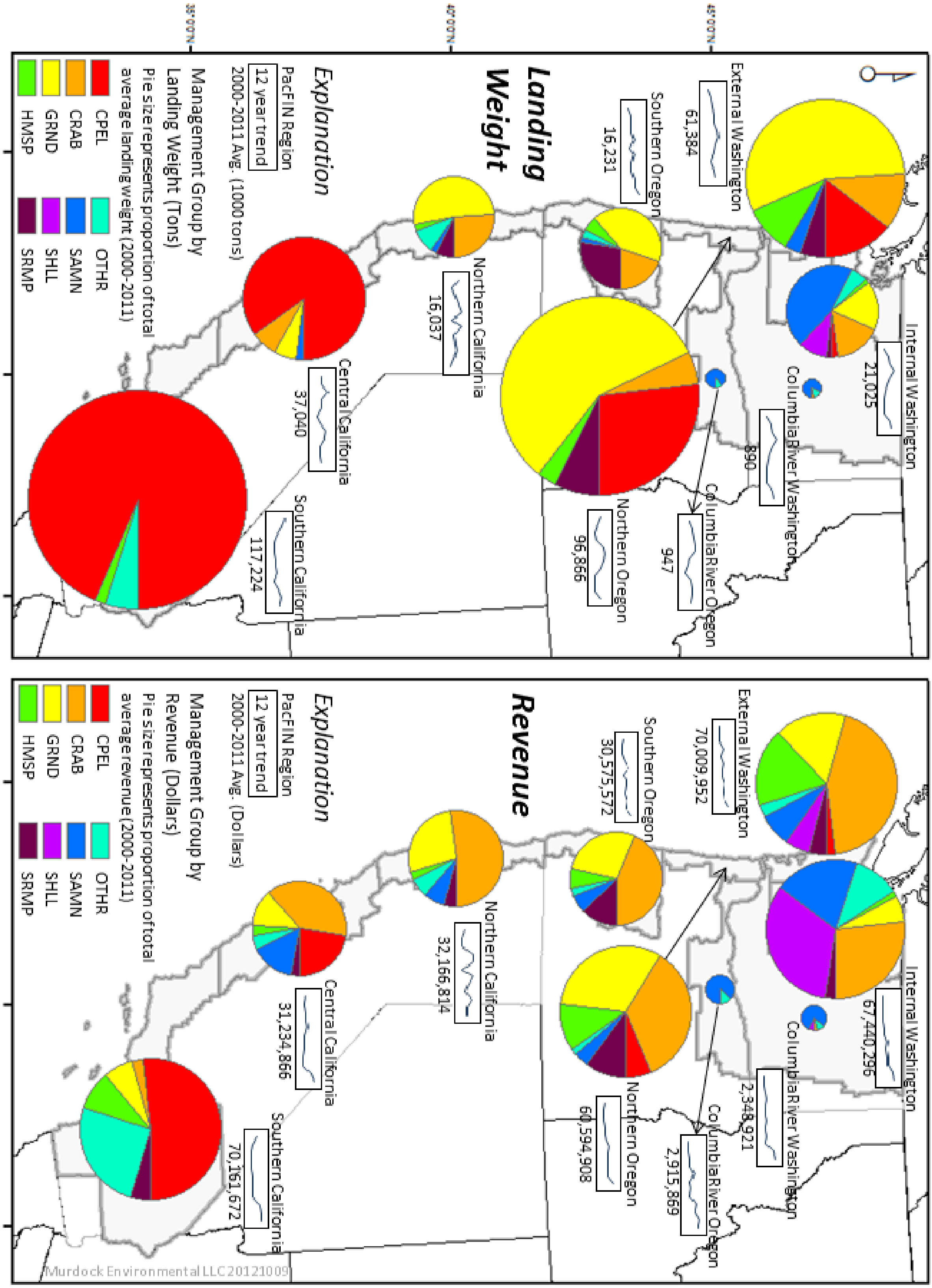


Figure 3.4.13. Regional landings by weight and value, with 12-year trends and average proportions for each major West Coast management group, 2000-2011. (Maps courtesy of Murdock Environmental, data source: PacFIN.

3.4.2.3 Recreational Fisheries

West Coast recreational marine fisheries catch data are compiled within the PSMFC's Recreational Fisheries Information Network (RecFIN) database. Each of the three states manages separate but compatible recreational fisheries data gathering programs. For marine waters, each state conducts a combined survey and sampling program to provide a statewide, comprehensive approach to recreational fishery data collection intended to estimate total marine recreational catch and effort. The RecFIN network coordinates state sampling programs to provide a regional survey designed to gather information for all finfish species, from anglers in all modes of recreational fishing (i.e., shore, party/charter and private/rental, or skiff). Given the high cost of sampling, the states focus resources on the highest conservation needs and some modes and times of year are not sampled. Oregon has annually conducted the Ocean Recreational Boat Survey since 1979, with some modifications as fishing patterns changed (Schindler, 2012). California conducts the California Recreational Fisheries Survey (CRFS). Washington conducts two survey programs, one to sample recreational catch from boats leaving coastal ports and the other for Puget Sound.

Client Randy Brown(r) and deckhand Seagra Carconnen (l) with Pacific halibut. Photo credit: Westport Charterboat Association

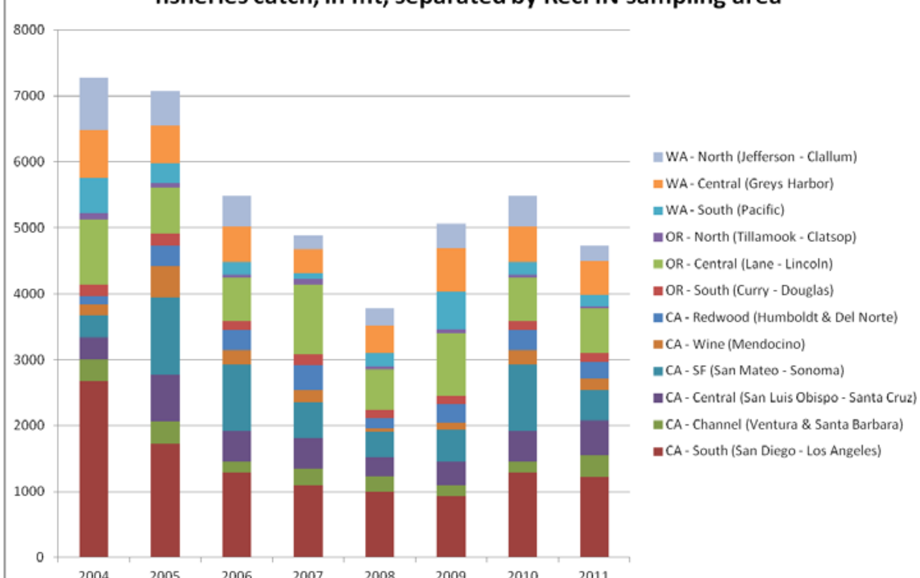
Components common to the three state data collection programs include: number, length and weight (if possible) of fish observed in the catch, fishing effort, along with the angler's demographic and fishing activity information. Most of this information is collected by dockside samplers. Onboard observers are used in some cases to collect information on fish that are released. Phone surveys and catch record cards are used as well. Other information on anglers is collected through the sale of fishing licenses, which are required by the states with limited exemptions (e.g. juvenile anglers). The Council relies on both state data gathering programs and on RecFIN to evaluate the effects of recreational fisheries on Council-managed species. All three states were granted a regional survey exemption from the Federal saltwater angler registry based on their coordination and participation in RecFIN.

Recreational catch estimates are incorporated into stock assessments, particularly for salmon, Pacific halibut, and some groundfish and HMS species. In addition, some estimates are used as the season progresses, to track groundfish catches against low bycatch allowances for some rebuilding species or to track healthy species of interest, or to closely monitor daily or weekly catches of Pacific halibut and salmon. Inseason management is necessary because of variation in the number of participating anglers and the rate at which they encounter fish. Managers use catch and effort estimates to forecast and structure seasons that provide a target level of fishing opportunity. Yet the variation in catch and effort can result in actual opportunities varying from those forecasted.

Client Luis Mercado (r) and boat owner Robert Ingles (l) with lingcod. Photo credit: Half Moon Bay Sportsfishing

Recreational and commercial fisheries data are not strictly comparable, since the sampling programs for the different types of fisheries vary according to the operational practices of the various fisheries, the importance of the fishery, and the ability of the states to monitor them. For this FEP, however, recreational fisheries data offers a broad-scale perspective on fluctuations in catch volume from year to year and in different sections of the coast. This section of the FEP considers recent, 2004-2011, fisheries catches for U.S. West Coast recreational fisheries. Figures 3.4.14 and 3.4.15 show catch trends from 2004 through 2011, separated by RecFIN sampling area, and illustrates the often wide fluctuations in recreational catch totals. On average, about half of the catch comes from California.

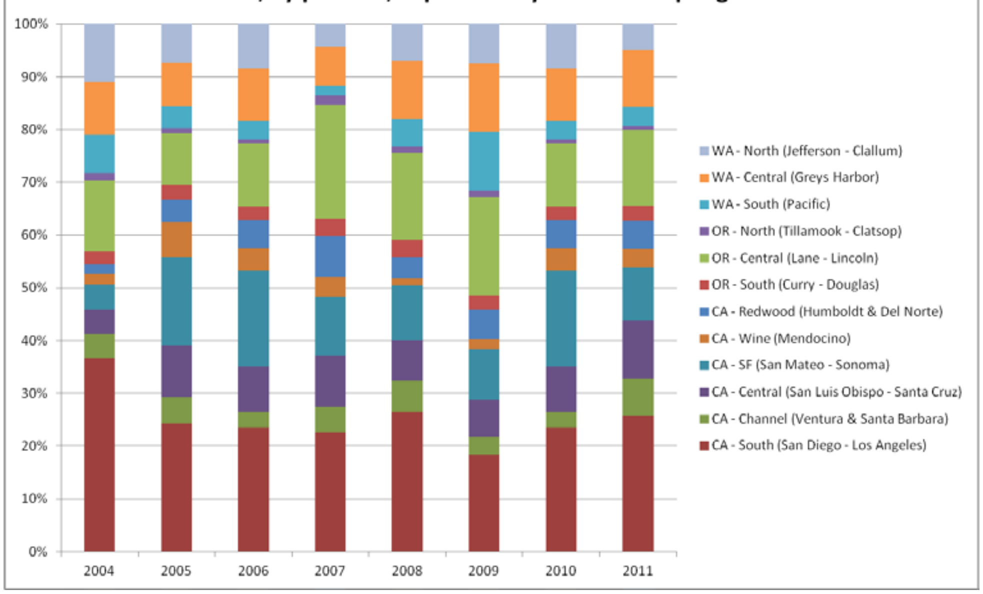
Figure 3.4.14. Annual cumulative West Coast recreational fisheries catch, in mt, separated by RecFIN sampling area



The fluctuations seen each year can arise from variability in angler participation, differences in catch rates, or changes in the quotas made available to the recreational sectors. Cumulative recreational fisheries landings during the 2004-2011 period hit a low of about 3,800 mt in 2008, with a recent high in 2010 of about 5,500 mt. The ocean salmon fisheries in 2006 and 2008 were declared fishery disasters by the U.S. Department of Commerce. The absence of a salmon fishery in California and salmon fisheries at their lowest level in a decade in Oregon during 2008 contributed to the lower catch that year. Variations in catch can also result from how the catch is counted. Recreational catch numbers come from statistical estimates that will vary in precision and accuracy based on factors like the sampling design and the number of anglers that the state sampling program encounters. The states and PSMFC significantly revised West Coast recreational fisheries sampling and estimation methodologies after 2003, making comparisons between the periods before and after 2003 difficult.

Recreational fisheries catches are strongly focused on a few particularly popular species. Table 3.4.7 shows the top twenty species taken in the marine recreational fisheries, by weight, for each year from 2004 through 2011. Of the Council-managed species, Chinook and coho salmon are consistently popular recreational targets, although recreational fishing for coho is prohibited in California. Other popular recreational targets are albacore tuna, several of the nearshore rockfish species, Pacific halibut, and Pacific mackerel. Many of the more popular recreational targets are state-managed species, particularly those taken in Southern California fisheries. All finfish species are overwhelmingly taken using hook and line gear, although some fish are caught by spear divers, and other gears

Figure 3.4.15. Annual cumulative West Coast recreational fisheries catch, by percent, separated by RecFIN sampling area



CDFW samplers Shannon Walkenhauer and Dan Troxel interviewing kayak angler at the Trinidad boat hoist during a rockfish tournament. Photo credit: Edgar Roberts, CDFW

Off the coasts of Washington, Oregon and northern California the primary targets include salmon, lingcod, albacore, Pacific halibut and nearshore rockfishes (primarily black or blue). Chinook salmon can be taken in all three states and coho salmon can be taken in Oregon and Washington. The portion of the Northern Biogeographic Sub-Region [see 3.1.2] from Washington to north of Cape Mendocino is fairly similar from a recreational fisheries perspective, and the species diversity for rockfishes is much lower than areas further south. Primary targets along the central California coast include Chinook salmon, lingcod, albacore, nearshore and shelf rockfishes, Pacific sanddabs, and California halibut. The diversity of rockfishes in catches of the Central Sub-Region includes 25 to 30 species, although, historically, it approached 40 species when anglers had more access to shelf waters. South of Point Conception, the diversity of primary recreational targets significantly increases for southern California anglers due to the added influence of warmer waters and year-round opportunities. Targets include albacore, yellowfin tuna, California scorpionfish, rockfishes (primarily vermilion, bocaccio, and gopher), chub mackerel, Pacific bonito, California halibut, the basses, yellowtail, and barracuda. Albacore are an ephemeral target north of Point Conception due to their strong association with warmer waters and their tendency to school on the seaward side of upwelling fronts; they are encountered closer to shore during years when the warmer water moves shoreward—such as El Niño years.

In Washington, recreational fishing for Council managed species is primarily boat-based, occurring aboard private and charter vessels that operate in ocean waters. Salmon angling is the main exception with fishing also occurring in the Strait of Juan de Fuca, Puget Sound, and in the state's rivers and estuaries. Although the discussion here is focused on Council-managed finfish, shellfish populations like Dungeness crab and razor clams also provide popular and valuable recreational harvest opportunities in the state.

Access to ocean waters is limited by the state's geography. Neah Bay, La Push, Westport, and

Table 3.XX. Top 20 species, by weight, in each year's West Coast marine recreational catch, 2004-2011.

	2004	2005	2006	2007	2008	2009	2010	2011
	COHO SALMON	CHINOOK SALMON	BLACK ROCKFISH	ALBACORE	BLACK ROCKFISH	COHO SALMON	BLACK ROCKFISH	BLACK ROCKFISH
	BLACK ROCKFISH	BLACK ROCKFISH	CHINOOK SALMON	BLACK ROCKFISH	ALBACORE	BLACK ROCKFISH	ALBACORE	CHINOOK SALMON
	CHINOOK SALMON	LINGCOD	LINGCOD	CHINOOK SALMON	CHINOOK SALMON	ALBACORE	CHINOOK SALMON	LINGCOD
	BARRED SANDBASS	COHO SALMON	PACIFIC HALIBUT	LINGCOD	LINGCOD	LINGCOD	COHO SALMON	ALBACORE
	PACIFIC BARRACUDA	BARRED SANDBASS	ALBACORE	PACIFIC BARRACUDA	CALIFORNIA HALIBUT	PACIFIC HALIBUT	LINGCOD	SQUID CLASS*
	ALBACORE	BLUE ROCKFISH	BLUE ROCKFISH	PACIFIC HALIBUT	PACIFIC HALIBUT	CALIFORNIA HALIBUT	SQUID CLASS*	PACIFIC HALIBUT
	YELLOWTAIL	PACIFIC HALIBUT	COHO SALMON	VERMILION ROCKFISH	COHO SALMON	CHINOOK SALMON	PACIFIC HALIBUT	VERMILION ROCKFISH
	PACIFIC HALIBUT	VERMILION ROCKFISH	YELLOWTAIL	BLUE ROCKFISH	PACIFIC BONITO	VERMILION ROCKFISH	VERMILION ROCKFISH	BARRED SANDBASS
	KELP BASS	ALBACORE	VERMILION ROCKFISH	COHO SALMON	VERMILION ROCKFISH	PACIFIC BARRACUDA	CALIFORNIA HALIBUT	COHO SALMON
	LINGCOD	PACIFIC BARRACUDA	PACIFIC BONITO	CALIFORNIA HALIBUT	PACIFIC BARRACUDA	BARRED SANDBASS	BARRED SANDBASS	CALIFORNIA HALIBUT
	VERMILION ROCKFISH	CALIFORNIA HALIBUT	CALIFORNIA HALIBUT	KELP BASS	BARRED SANDBASS	KELP BASS	PACIFIC BARRACUDA	YELLOWTAIL ROCKFISH
	CALIFORNIA HALIBUT	KELP BASS	BARRED SANDBASS	BARRED SANDBASS	BLUE ROCKFISH	YELLOWTAIL ROCKFISH	WHITE SEABASS	BOCACCIO
	BLUE ROCKFISH	YELLOWTAIL	KELP BASS	YELLOWTAIL ROCKFISH	KELP BASS	CALIFORNIA SCORPIONFISH	GOPHER ROCKFISH	PACIFIC BARRACUDA
	PACIFIC BONITO	PACIFIC BONITO	PACIFIC BARRACUDA	COPPER ROCKFISH	YELLOWFIN TUNA	COPPER ROCKFISH	BLUE ROCKFISH	CALIFORNIA SCORPIONFISH
	CHUB (PACIFIC) MACKEREL	CALIFORNIA SCORPIONFISH	DOLPHINFISH	CALIFORNIA SCORPIONFISH	CALIFORNIA SCORPIONFISH	BLUE ROCKFISH	YELLOWTAIL ROCKFISH	BROWN ROCKFISH
	BOCACCIO	OLIVE ROCKFISH	BROWN ROCKFISH	YELLOWTAIL	COPPER ROCKFISH	BROWN ROCKFISH	BROWN ROCKFISH	BLUE ROCKFISH
	OLIVE ROCKFISH	CHUB (PACIFIC) MACKEREL	CHUB (PACIFIC) MACKEREL	BROWN ROCKFISH	DOLPHINFISH	GOPHER ROCKFISH	CALIFORNIA SCORPIONFISH	WHITE SEABASS
	CABEZON	BROWN ROCKFISH	OLIVE ROCKFISH	CHUB (PACIFIC) MACKEREL	BROWN ROCKFISH	YELLOWTAIL	BOCACCIO	ROCKFISH GENUS
	YELLOWTAIL ROCKFISH	BOCACCIO	COPPER ROCKFISH	BOCACCIO	ROCKFISH GENUS	CHUB (PACIFIC) MACKEREL	KELP BASS	PACIFIC SANDDAB
	STRIPED BASS	ROCKFISH GENUS	CABEZON	OLIVE ROCKFISH	CHUB (PACIFIC) MACKEREL	PACIFIC BONITO	COPPER ROCKFISH	KELP BASS
Percentage of Year's total recreational catch, by weight, represented by top 20 species	90.01%	87.87%	83.06%	86.00%	82.29%	84.48%	87.00%	82.99%

*RecFIN places all squid species in the "squid class." Although Market squid (*Loligo opalescens*) are within the CPS FMP, the squid referred to here may be Jumbo squid (*Dosidicus gigas*), which have had a population explosion off the U.S. West Coast in recent years

Chinook/Ilwaco on the Columbia River are the state's major access points for recreational anglers. Access is also limited by weather and ocean conditions, with fishing occurring mostly during spring, summer, and early fall. May through September are the peak fishing months.

Brett Wolfe with Chinook salmon. Photo credit: Westport Charterboat Association

Of marine finfish, Pacific salmon are the most popular target for anglers in Washington. In the years 2008 to 2010, salmon trips accounted for 50 to 74 percent of all angler trips in the ocean with variations in that range attributable mainly to changes in salmon fishing opportunity. As discussed above, fishing opportunity for salmon can vary substantially from year to year based on fish abundance and quotas set by the Council, the state, or other management bodies. In 2008, there were fewer than 47,336 angler trips taken for salmon. In 2009, that number jumped to more than 120,409 because of the increased quota. That jump in salmon activity raised the total angler trips in the ocean by nearly 70,000, while activity targeting other species remained stable or slightly decreased, demonstrating the popularity of salmon angling within the state.

Bottomfish typically provided the most consistent recreational fishing opportunity off Washington's coast and fishing seasons have been typically open all year round, although tight quotas for some species have the potential to limit the length of the season. In 2012, WDFW had to close bottomfish opportunities off the state's north coast after Labor Day weekend off because of higher than expected catch of the rebuilding yelloweye rockfish stock. The state saw an average of 19,160 angler trips targeting bottomfish during 2008-2010.

Recreational fishing's contribution to Washington's economy was evaluated in a 2008 report commissioned by WDFW (TCW Economics 2008). That report estimated recreational angling to have contributed $393 million in total income and nearly 13,000 jobs to the state's economy in 2006. These figures included all recreational fishing activities, of which freshwater fishing typically makes up around 90 percent. Figures were also based on a USFWS (2008) survey that found anglers spent $900 million on fishing related activities during in 2006. This USFWS survey was conducted again for 2011 and found recreational fishing expenditures rose to above $1 billion (U.S. Fish and Wildlife 2012). The 2008 study of Washington's fishing economy also estimated that fishing for salmon and other marine finfish created $58 million in net economic value to anglers. Net economic value is intended as a measure of the value that people place on fishing opportunity and as a metric of the overall benefit that fishing provides anglers. The metric does not capture the economic value of or economic activity from fishing-related business like charter fishing operations.

To provide a sense of who participates in the boat-based ocean fisheries off Washington, Figure 3.4.16 displays a county level look at anglers who caught Pacific halibut or salmon off the Washington coast in

2011. Over 90 percent of that catch was taken by state residents and residents of the most highly populated counties accounted for more than half of the catch. As shown in the bottom panel of Figure 3.4.16, counties near coastal ports contributed to the catch in much higher proportions than would be suggested by their share of the state's population.

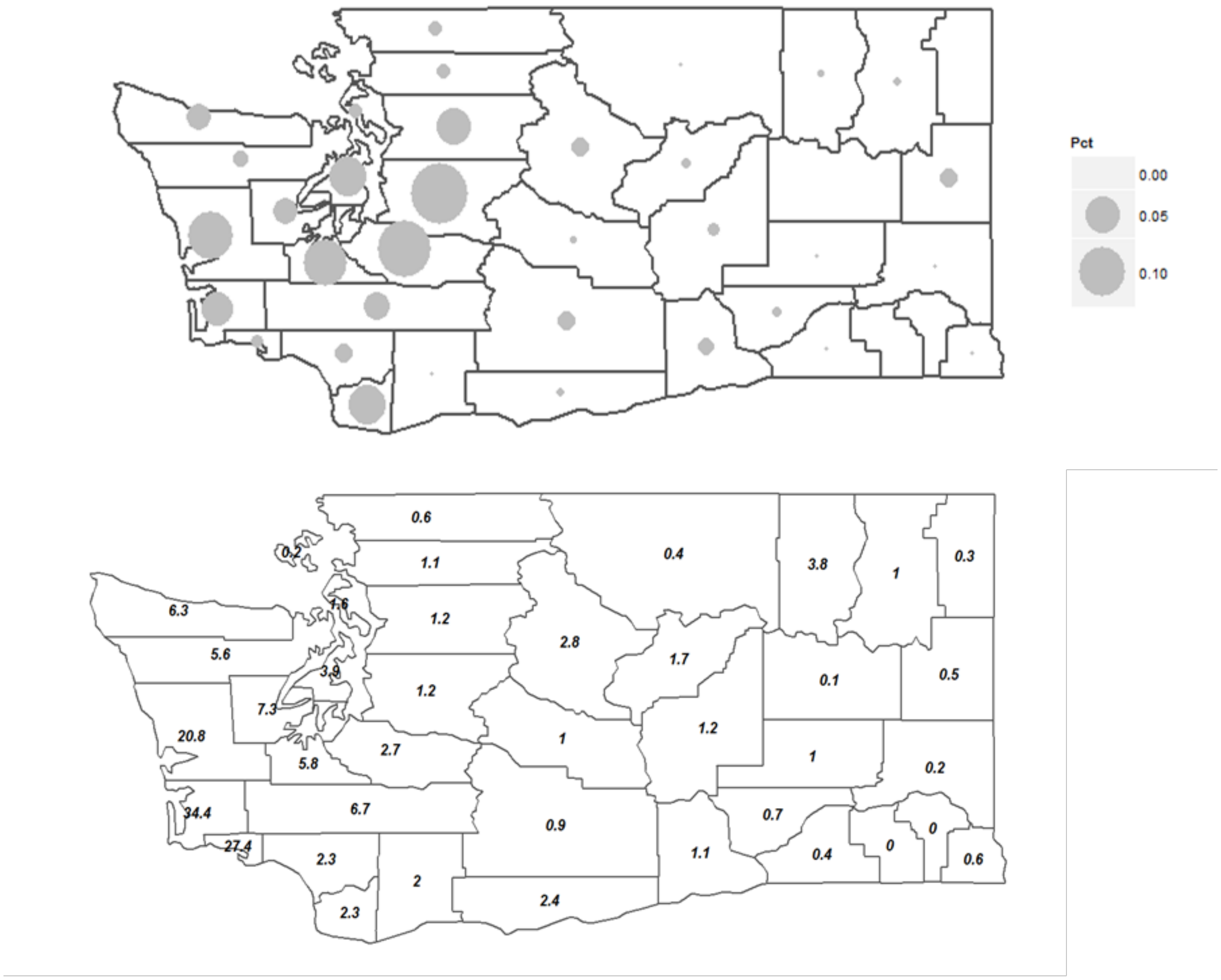


Figure 3.4.16 The distribution of the 2011 recreational catch of Pacific salmon and Pacific halibut off the WA coast (WDFW Marine Areas 1-4) by county residence of anglers. Circles in the top map, found at the center of each county, are scaled to the percentage ("Pct") of total catch reported by anglers from that county. Anglers from other states accounted for 8.4% of total reported catch. Bottom map compares the catch to the county's population size; numbering represents the ratio of the county's total catch percentage to its percentage of the statewide population. For example, catch for Grays Harbor County's share of the catch is 20.8 times its share of the state's population. (Source: WDFW catch record card data and U.S. Census Bureau, Population Division).

In Oregon, recreational effort for marine fish and salmon species in the ocean, coastal estuaries and lower Columbia River totaled 802,000 angler trips during 2007 and 738,000 trips in 2008. Although the recreational salmon fishery was at a ten-year low, trips targeting salmon accounted for slightly more than half the total (55%) in 2008. The statewide estimated economic contribution (in personal income) from these trips totaled $33.5 million in 2007 and $29.8 million in 2008 (The Research Group, 2009). Recreational fishing is important to coastal residents, but also draws anglers from around the state and from other states. For example, many anglers tow boats long distances, generally from more populated towns and cities in central Oregon, to fish for marine species. Figure 3.4.16 shows the hometowns of boat owners who participated in the central Oregon coast halibut fishery and where they launched in 2011.

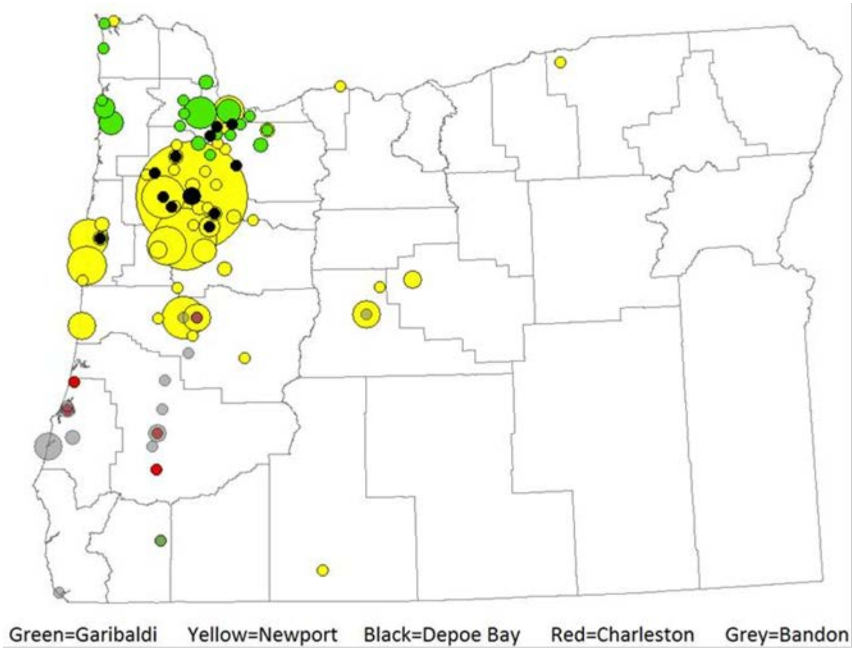
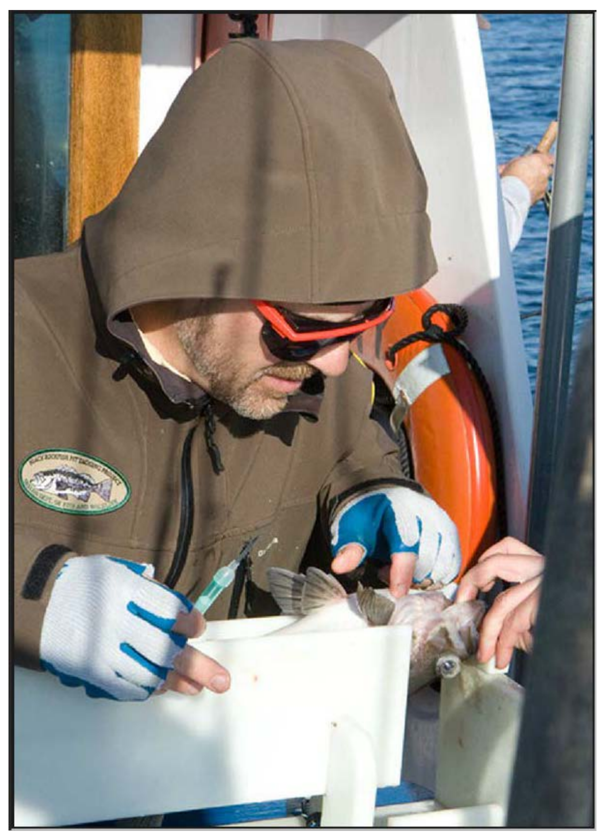


Figure 3.4.17 Hometowns of vessel owners and anglers who participated in the central Oregon coast halibut fishery. The colors and legend indicate the ports from which they launched. (Map courtesy Patrick Myrick, ODFW).

In addition, significant recreational fisheries for shellfish occur along the Oregon coast, contributing an estimated $36 million in travel expenditures alone during 2008 (Runyon, 2009). Fisheries for razor clams on the north coast and for Dungeness crab are especially popular. Recreational catch and effort in the razor clam fishery on the Clatsop beaches is monitored annually. Clam diggers made an estimated 128,000 trips for razor clams, harvesting 1.8 million clams on the Clatsop beaches in 2006. Both catch and effort were higher than the previous 10-year average of 65,000 trips and 840,000 clams (Hunter, 2008). In 2011, recreational crabbers targeted Dungeness crab during an estimated 120,000 trips, including aboard private and charter boats, and from shore and piers along the Oregon coast. In total, they harvested 1,066,000 pounds of Dungeness crab in 2011 (Ainsworth et al. 2012).



David Wagman, ODFW, inserting black rockfish PIT tag. Photo credit: ODFW

Recreational fishing in ocean waters off the state of California includes boat-based modes (occurring aboard private and charter vessels) in addition to a significant shore-based component. Although the discussion here is focused on Council-managed finfish, Californians also participate in valuable recreational fisheries of state managed species, such as California halibut and several basses, surfperches, Dungeness crab, California spiny lobster, and abalone. However, information on catch and effort of many state-managed species is limited due to the emphasis on collecting information on the FMP species—this is particularly the case for invertebrates and species that are harvested from shore.

Recreational ocean fishing occurs year-round in California, especially in southern California where ocean and weather conditions are less extreme than in the northern portions of the state, permitting anglers greater access to the resource in winter months. Fishery regulations are often the constraining factor that determines when most recreational fishing occurs and regulations have become increasingly restrictive over the last ten years. As in other West Coast states, peak fishing months are May through September.

NMFS estimated in its Fisheries Economics of the U.S. (FEUS 2011) report that recreational ocean fishing contributed $710 million and more than 13,000 jobs to California's economy in 2009. The NMFS report also estimated more than 1.4 million anglers made 4.6 million fishing trips for all modes of ocean fishing in 2009, which represents an 11 percent increase in number of fishing trips compared to 2008. The increase in number of fishing trips seen in 2009 is likely due to the low number of trips that occurred in 2008, a year when no salmon fishing was allowed in California's ocean waters. Under an average season, ocean salmon anglers contribute an estimated $121 million in direct revenues to the State's business sector, based on a USFWS national survey of fishing, hunting, and wildlife associated recreation in 2006 and adjusted for inflation. Adding the indirect and induced effects of this initial revenue contribution, the total benefit of the recreational salmon fishery to California's economy is normally almost $184 million. The USFWS 2008 survey estimated $2.4 billion was spent in the state of California on all recreational fishing (ocean and freshwater fishing combined) in 2006. The USFWS survey was conducted again in 2011, and recreational fishing expenditures were estimated to have decreased to $2.3 billion in 2009 (USFWS 2012). In the most recent FEUS report (2012), added-value angler expenditures for ocean related fishing activities were $1.4 billion in 2010.

Bill Ernst with record-holding white seabass, Malibu. Photo credit: CDFW

Information is limited for the state's recreational invertebrate fisheries, although angler report cards provide some information on abalone and spiny lobster. An estimated 216,000 abalone were harvested by recreational divers in 2011, lower than the 2002-2011 annual average of

259,000. A study completed in 2010 indicated that the contribution of the abalone fishery to the North Coast's (Marin, Sonoma, Mendocino, Humboldt, and Del Norte Counties) total economic output, wages, employment, and to local sales taxes as: $22 million (2009$), $9 million (2009$), 211 jobs, and $720,000, respectively, based on direct expenditures for abalone trips. Spiny lobster are the focus of a popular southern California recreational fishery. Based on available information, in 2010 an estimated 347,000 pounds of lobster were taken on 127,183 angler trips by divers or recreational anglers using hoop nets (D. Neilson pers. com.)

To provide a sense of who participates in the state's boat-based ocean fisheries, Figure 3.4.18 displays the county of residence of anglers who caught salmon off the California coast in 2012 and their major port of fishing activity. Data are from CRFS interviews. At least eighty one percent of California anglers participating in the recreational salmon fishery resided in coastal counties – 2.5% declined to respond or were from out-of-state. Anglers from coastal counties in the central and northern portions of the state participated in the fishery at higher levels than anglers further south because the salmon resource is primarily located north of Point Conception (34°27' N. lat). Overall in 2010, the most recent year available, 77% of angler trips in California were made by anglers living in coastal counties (NMFS 2011).

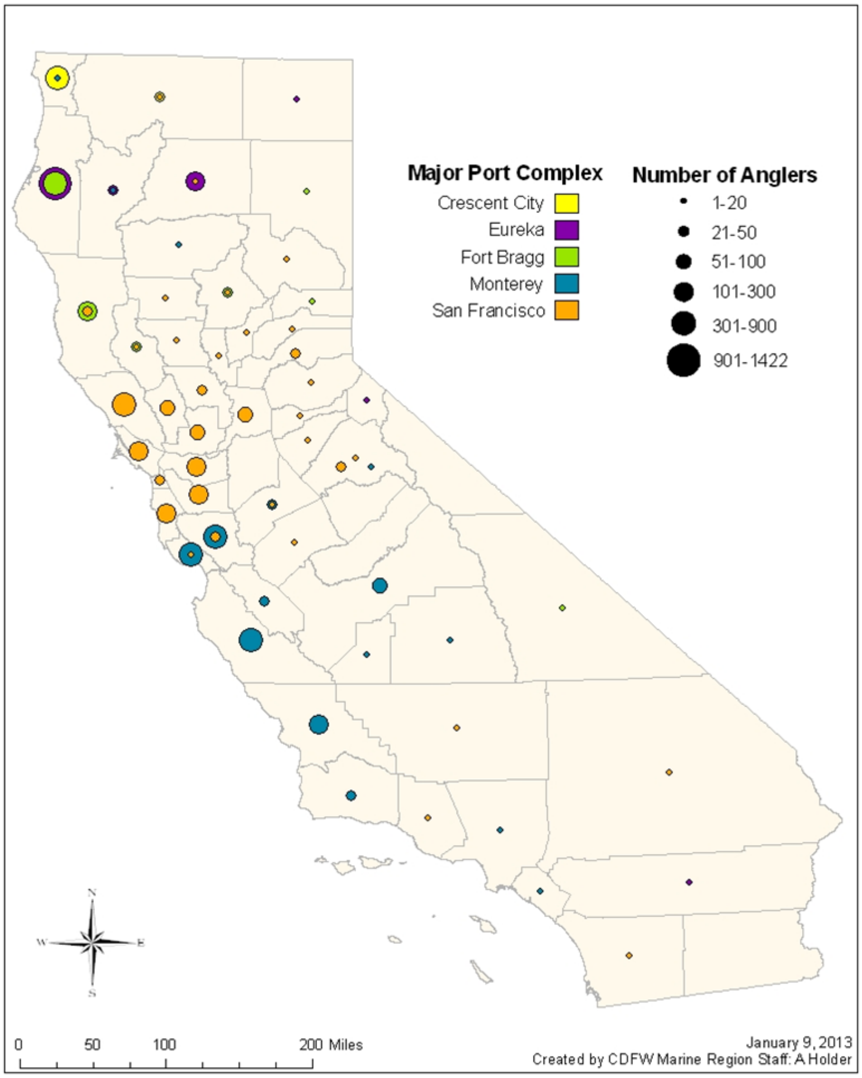


Figure 3.4.18: Distribution of 2012 California recreational salmon anglers based on fishing port of origin and angler county of residence from CRFS interviews. The colors and legend indicate the port area from which anglers launched. Some points overlap when multiple anglers residing in the same county fished out of different port complexes

3.4.3 Fishing Communities

The MSA places highest priority on conservation of fish stocks for the achievement of optimum yield. However, the MSA's National Standard 8 requires conservation objectives to be achieved in a manner that provides for the sustained participation of fishing communities in fisheries and minimizes adverse impacts on fishing communities to the extent practicable (16 U.S.C. 1851). National Standard 8 also requires the Council to use the best available scientific information when weighing impacts to fishing communities and fishing participation.

Morro Bay Fish Company. Photo credit: Steve Copps, NOAA NWR

Under its Groundfish FMP, the Council has particularly addressed the Act's direction to place highest emphasis on rebuilding overfished stocks, while still taking into account the needs of fishing communities, by also looking at the vulnerabilities of fishing communities to changes in availability of groundfish harvest (PFMC 2010). The Groundfish FMP at 4.6.3.2 characterizes fishing communities as needing "a sustainable fishery that: is safe, well-managed, and profitable; provides jobs and incomes; contributes to the local social fabric, culture, and image of the community; and helps market the community and its services and products." Although that language is found within the Groundfish FMP, it reflects priorities expressed in other FMPs to manage fisheries so that both harvest and community participation in fisheries is sustainable over the long-term.

Under the MSA, a "fishing community" is a community that is "substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (16 U.S.C. §1802). Social scientists have used that definition to develop profiles of West Coast fishing communities (Norman et al. 2007), and to define and quantify community involvement in commercial fisheries and their vulnerability to changes in fishery conservation and management measures (Sepez et al. 2007, Clay and Olson 2008, Alsharif and Miller 2012). NOAA's Technical Memorandum NMFS-NWFSC-85, Community Profiles for West Coast and North Pacific Fisheries: Washington, Oregon, California and other U.S. States (Norman et al. 2007) provides detailed social and demographic analyses of over 100 West Coast communities, which the FEP will not repeat here. However, that document provides a framework for thinking about


Teaching children about ocean creatures at the Port Orford, OR, Water Festival. Photo credit: POORT

coastal communities' vulnerability to changes in available commercial fishery harvest levels and available recreational fishing opportunities.

The FEP Initiatives Appendix at A.2.6 suggests an initiative for the Council to look at human recruitment to the fisheries as a way to assess the long-term sustainability of the fishing communities themselves. In several West Coast fleets, the age distribution of fishery participants differs notably from the age distribution of West Coast residents. U.S. Census data of total populations includes children too young to be employed in fisheries, but even a simple comparison of work-force aged persons shows that the age distribution of participants in several West Coast fleets is skewed to greater ages than the age distribution of the general population – see Figures 3.4.17 through 3.4.19.

Within the Council process, economic analyses often separate fishing communities by geography or by sector (e.g., commercial or recreational, treaty or non-treaty, fishing or processing, trawl or fixed gear, purse seine or longline, etc.) Regional economic models are employed to assess the amount of economic activity, in terms of sales, income and employment, that is generated by the business

Figure 3.4.17. Age Distribution of Oregon's Human Population -- 2010 U.S. Census

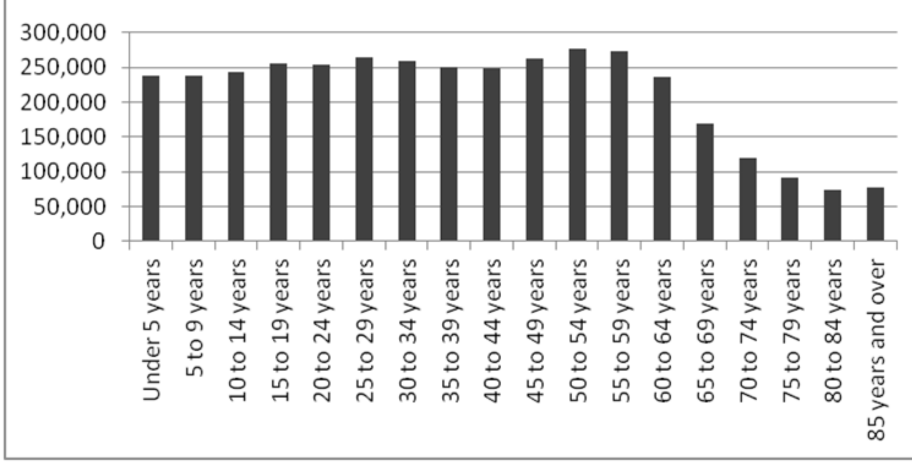


Figure 3.4.18. Age Distribution of Oregon's Salmon Troll Permit Owners

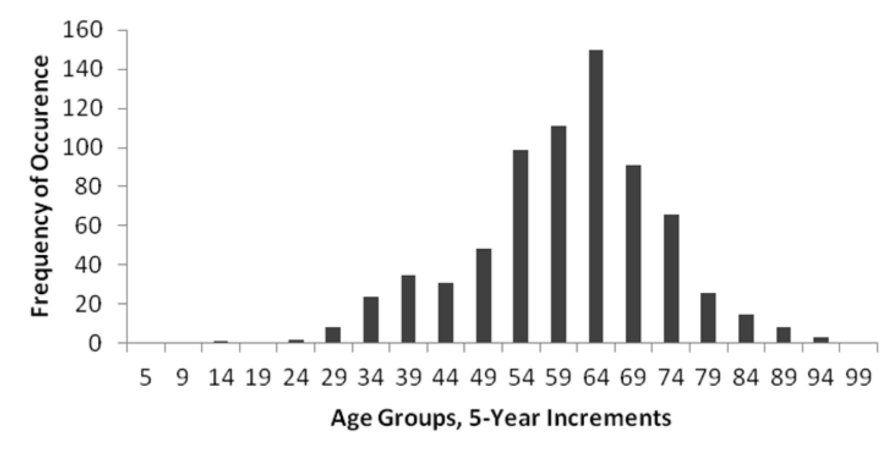
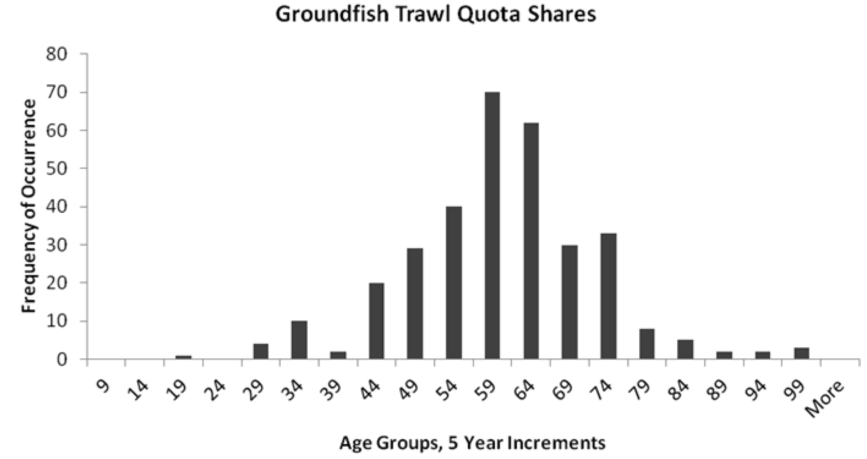


Figure 3.4.19. Age Distribution of Owners of Vessels Assigned to Groundfish Trawl Quota Shares

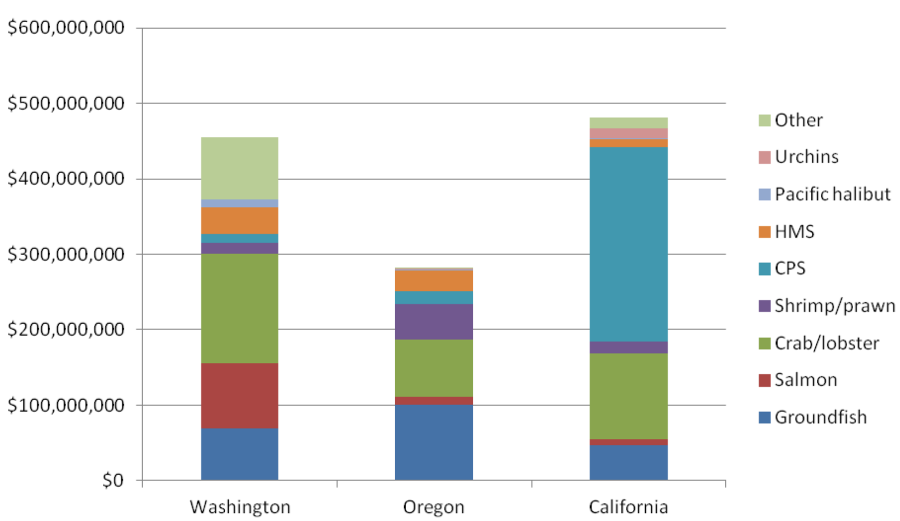


operations of economic entities within a particular geographic region. The input-output model is one type of economic impact model that tracks the flow of dollars within a regional economy. With respect to ecosystem-based management, an input-output model can help to evaluate, predict and assess goals and policies in an inter-connected system of sectors or industries comprising a regional economy. In this sense, it is akin to an ecological food web that characterizes predator-prey interactions within an ecosystem.

NOAA scientists sharing ocean creatures with the public at the Seattle, WA, Fall Fishing Festival. Photo credit: NOAA AFSC

To understand the socioeconomic effects of fishery management actions, the Council uses the Fishery Economic Assessment Model (FEAM,) a production oriented input-output model to estimate the contribution of West Coast commercial fishery sectors to the total income of the coastal communities of Washington, Oregon and California (Seung and Waters 2005). The FEAM allows for geographic resolution from the state level down to port area within each state. It distinguishes fishery sectors within each geographic area by their corresponding FMP, and where appropriate, disaggregates harvests within a sector according to vessel or gear type and the condition in which they were landed (e.g. alive or dead). The FEAM[3] provides estimates of the income impacts stemming from the dollar value added to

Figure 3. 4.20. 2011 fisheries income impacts for West Coast states, by species type



[3] The Fishery Economic Assessment Model (FEAM) was developed by Dr. Hans Radtke and Dr. William Jensen to estimate local, state and regional marginal and average income impacts for West Coast fishery landings. The FEAM model is based on the U.S. Forest Service IMPLAN model enhanced with fishing sector coefficients specific to West Coast fisheries. In its current configuration the FEAM was calibrated using coefficients from the IMPLAN's 1998 input-output database, and PacFIN landings extractions for Year 2000.

landings of West Coast commercial species as they make their way from the ocean, to the exvessel level, and through to the exprocessor level of the fishery. It does this by deriving input-output multipliers, which are used to convert the revenues at each stage of the production process into either: (1) direct income - exvessel income generated in the region of interest by the harvesting sector of the fishing industry from landings by species, by port and by gear; (2) indirect income - income generated in the region of interest by all industries, due to the iteration of industries purchasing from industries in response to landings of a particular species at the exvessel level; (3) induced income - the expenditures from new household income within the region of interest, generated by the direct and indirect income effects of landings of a particular species.

Darrin Seiji (l) and Erin Loury (r), with vermilion rockfish on research cruise for California Collaborative Fisheries Research Program. Photo credit: SLOSEA

Here, the FEAM was used to estimate the total income impact from each state's 2011 landings of species targeted by the major commercial fisheries occurring within the CCE (Figures 3.4.20 through 3.4.23). From the quantities landed and the corresponding exvessel revenues for a specific fishery sector shown Figures 3.4.20 through 3.4.23, and the related value added from processing that volume of raw fish, the direct, indirect and induced incomes are calculated. These are then combined to estimate the total income impact generated by the fishery sector at the state and entire West Coast levels. For example, at the average exvessel price for each pound of Dungeness crab landed in Washington during 2011, the average total income impact was estimated to be $1.69 per dollar of exvessel revenue at the state level and $1.84 per dollar of exvessel revenue coastwide; for Oregon and California these total income impacts were $1.68 and $1.91 respectively at the state level and $1.78 for Oregon and $2.13 for California coastwide.

Market squid boats in Monterey Bay, CA. Photo credit: Deb Wilson-Vandenberg CDFW

Figure 3.4.21. 2011 fisheries income impacts in Washington , shown in US$, and as a percent of the total.

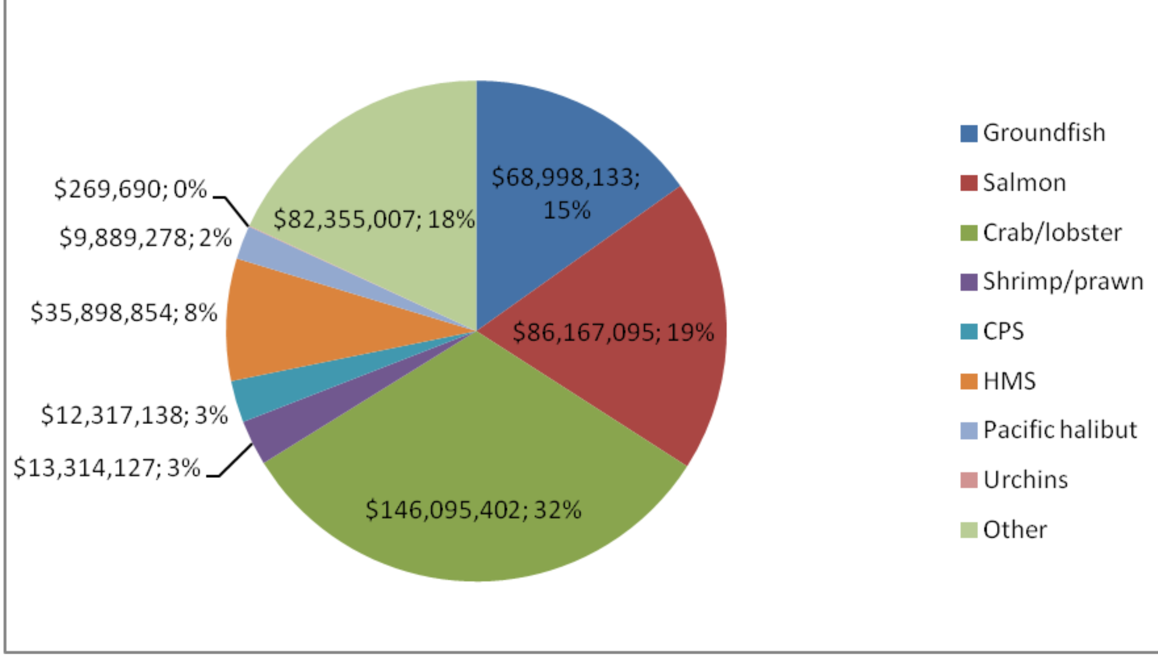


Figure 3.4.22. 2011 fisheries income impacts in Oregon , shown in US$, and as a percent of th e total.

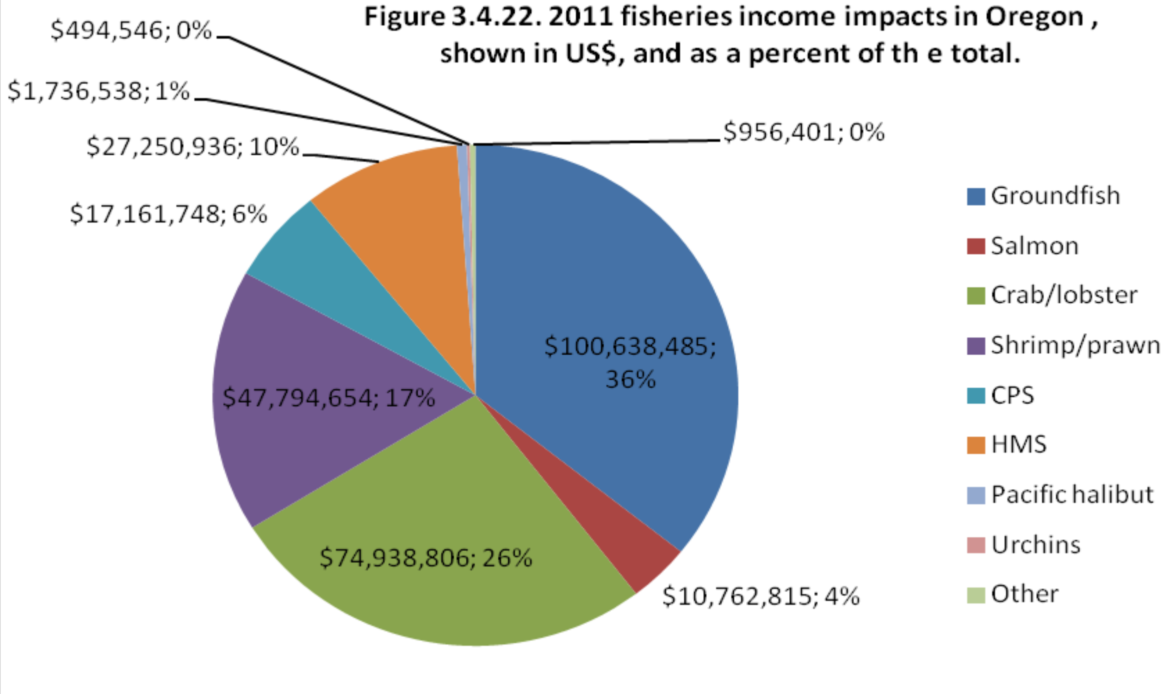
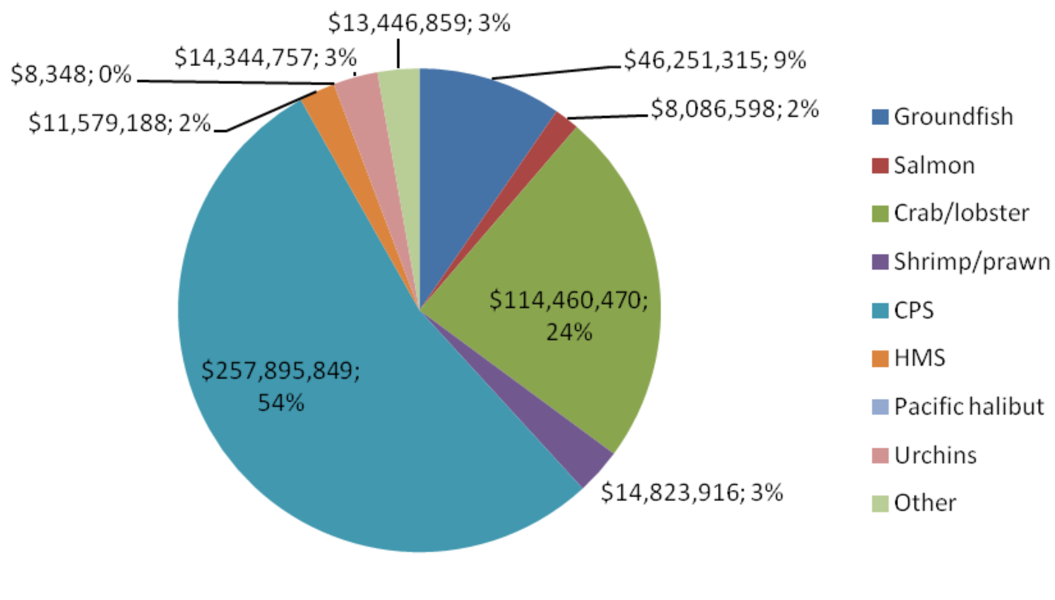


Figure 3.4.23. 2011 fisheries income impacts in California, shown in US$, and as a percent of the total.

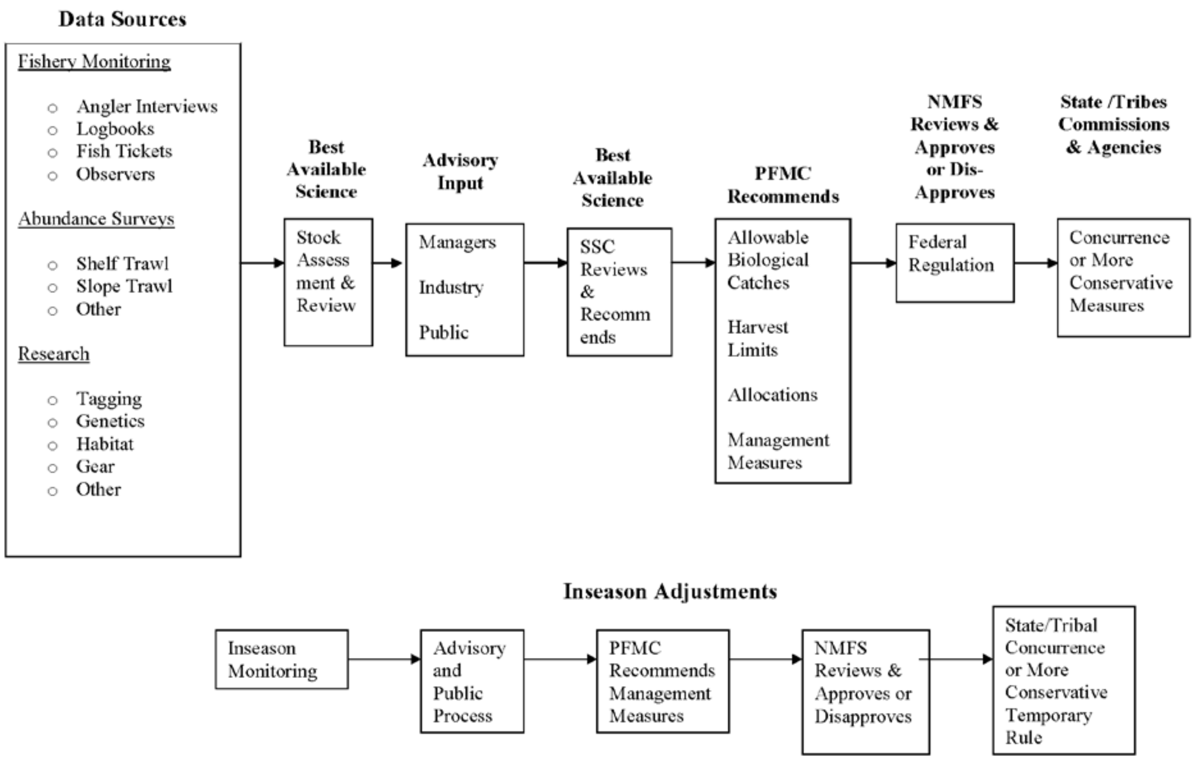


Half Moon Bay, CA, Pillar Point direct-to-public Dungeness crab market. Photo credit: Pietro Parravano

3.5 Fisheries and Natural Resource Management in the CCE

Many CCE fisheries are under the Council's jurisdiction, but the Council also shares jurisdiction over or management responsibility for the species it manages with other entities or institutions. While the states and tribes participate in the Council process, they also have separate management processes linked to and informing the Council's work. Beyond the EEZ, management processes for several Council species include multi-national processes with their own priorities and institutions. Figure 3.5.1 provides a general overview of the state/federal management process: the states, tribes, and federal government together organize and implement fisheries monitoring, data gathering, and research programs; scientific information is reviewed through the Council's SSC; management measures and programs are developed through the Council's advisory bodies and associated public processes; scientific analyses are again reviewed through the SSC for their utility within the management process; the Council uses the SSC recommendations and advice from its advisory bodies and the public to recommend harvest levels and other management measures; Council recommendations are then reviewed and partially or wholly implemented through federal, and then state, regulatory processes.

Figure 3.5.1: State/Tribal/Federal Management Process Overview



For species and fisheries under a federal FMP, states and tribes may adopt regulations or management measures that concur with federal regulations or which are more conservative than federal regulations. Table 3.5.1 lists the major species within the CCE and the entity or entities responsible for managing fisheries for those species.

Table 3.5.1. Management authorities for CCE fisheries, by major species or species groups

SPECIES or SPECIES GROUP	STATE MANAGEMENT[1]	TRIBAL MANAGEMENT[2]	STATE-TRIBAL-FEDERAL MAMAGEMENT	INTERNATIONAL MANAGEMENT
All Salmon, except:	Concur/Conservative	Concur/Conservative	FMP	US/Canada Salmon Treaty
Nearshore & In-river	Regulation, SFMP	Regulation		US/Canada Salmon Treaty
All Groundfish, except:	Concur/Conservative	Concur/Conservative Intertribal Sharing Agreements	FMP	US/Canada Whiting Treaty
Cabezon	Regulation, SFMP			
California scorpionfish	Regulation, SFMP			
Some Greenlings	Regulation, SFMP			
Some Nearshore Rockfish	Regulation, SFMP	Regulation		
California Halibut	Regulation			
Miscellaneous spp.	Regulation	Regulation		
Pacific Halibut	Concur/Conservative	Concur Intertribal Sharing Agreement	Catch Sharing Plan	US/Canada Pacific Halibut Convention, IPHC
All Coastal Pelagic Species, except:	Concur/Conservative	Concur/Conservative	FMP	
Herring	Regulation or SFMP	Regulation		
Smelts	Regulation or SFMP	Regulation		
Squid, market	Regulation or SFMP			
Miscellaneous spp.	Regulation or SFMP	Regulation		
All Highly Migratory Species, except:	Concur/Conservative		FMP	WCPFC, IATTC, and US/Canada Albacore Treaty
Many sharks	Regulation			
Miscellaneous spp.	Regulation			
Other fish				
White seabass	Regulation, SFMP			
All Shellfish	Regulation or SFMP	Regulation		
Dungeness Crab	Regulation and Tri-State MOU	Regulation		
Other Crabs	Regulation			
Clams & Mussels	Regulation	Regulation		
Oysters	Regulation			
Scallops	Regulation			
Shrimp	Regulation			
Urchins	Regulation	Regulation		
Miscellaneous spp.	Regulation, SFMP (CA abalone)	Regulation		
All Other Marine Life	Regulation	Regulation		

[1] State Fishery Management Plan (SFMP)
[2] Several treaty tribes and Washington State have co-management responsibilities for many species

3.5.1 Council Fisheries Management

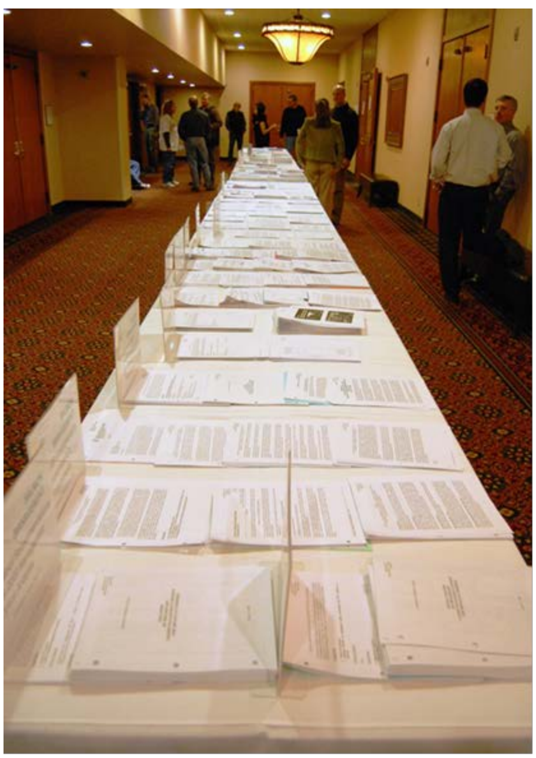
Fishery management councils were first authorized by the Fishery Conservation and Management Act of 1976 [Pub. L. 94-265]. That act also established an ocean fishery conservation zone [later, the EEZ] beyond state marine waters out to 200 nautical miles offshore of U.S. coastlines, and gave councils areas of authority within the zone. The Pacific Council first met October 12-15, 1976, to begin discussions of shared state-federal management priorities for the fisheries within U.S. waters offshore of the U.S. West Coast. Over the last 30+ years, the Council has developed four FMPs and a Catch Sharing Plan for Pacific Halibut, and has addressed a wide range of fisheries and environmental issues through amendments to those plans discussed in over 200 formal meetings and in countless public hearings. Major fishery management planning events in the Council's history are shown in Table 3.5.2, many of which were developed in response to the 1996 and 2007 reauthorizations of the MSA, the current-day iteration of the 1976 Fishery Conservation and Management Act.

PFMC meeting in the late-1970s. Photo credit: PFMC

Table 3.5.2: Major fishery management planning events in PFMC history

Federal Fisheries Legislation-Related Events	Year	Major Council Events
Fishery Conservation and Management Act first enacted, including assertion of 200 nm fishery conservation zone (later EEZ)	1976	
	1976	Council's first meeting
	1978	Northern Anchovy FMP final
	1978	Salmon FMP final
	1982	Groundfish FMP final
	1984	Amendment 6 to Salmon FMP – preseason and inseason management framework
First West Coast salmon ESA listing: Sacramento Winter-run Chinook, threatened	1989	
	1990	Amendment 4 to Groundfish FMP – specifications and management measures process
	1992	Amendment 6 to Groundfish FMP – limited entry program
	1995	Pacific Halibut Catch Sharing Plan adopted
Sustainable Fisheries Act (SFA)	1996	
	1997	Combined Amendment 12 to Salmon FMP & Amendment 10 to Groundfish FMP – setting parameters for salmon bycatch in whiting trawl fisheries
National Standard Guidelines revised	1998	

Table 3.5.2: Major fishery management planning events in PFMC history		
Federal Fisheries Legislation-Related Events	Year	Major Council Events
	1999	Amendment 11 to Groundfish FMP – SFA provisions
	1999	Amendment 8 to Northern Anchovy FMP – expanded FMP scope to establish CPS FMP, SFA provisions
	2000	Amendment 14 to Salmon FMP – SFA provisions
	2001	Amendment 14 to Groundfish FMP –permit stacking program for limited entry fixed gear sablefish fishery
	2003	Amendments 16-1 & 16-2 to Groundfish FMP – established groundfish rebuilding plan framework, plus first four groundfish rebuilding plans (darkblotched rockfish, Pacific ocean perch, canary rockfish, lingcod)
	2004	HMS FMP final
	2005	Amendments 19 to Groundfish FMP – EFH identification and coastwide protection measures
MSA reauthorized	2007	
	2007	Amendment 1 to HMS FMP – bigeye tuna rebuilding plan and FMP reorganization
National Standard 1 guidelines revised	2009	
	2009	Amendment 12 to CPS FMP – prohibition on krill harvest
	2010	Amendment 20 to Groundfish FMP – trawl rationalization (catch share program)
	2011	Amendment 13 to CPS FMP, Amendment 23 to Groundfish FMP, Amendment 2 to HMS FMP, and Amendment 16 to Salmon FMP – annual catch limits (ACLs) and accountability measures (AMs)



Contemporary PFMC meeting's reading material available to the public. Photo credit: PFMC

3.5.1.1 Cross-FMP Goals and Management Measures

While the Council develops and considers management programs for West Coast fisheries in four separate FMPs, the ideas about and priorities for management come from the MSA and from a regional ethos that collaboration and cooperation in management discussions can better sustain fisheries now and into the future. The goals and objectives of the four FMPs share five common themes consistent with an ecosystem approach to fishery management: avoid overfishing, minimize bycatch, maintain stability in landings, minimize impacts to habitat, and accommodate existing fisheries sectors. Those four larger themes emerge in a variety of ideas that are common across the FMPs, divided roughly in Table 3.5.3:

Table 3.5.3 FMP Shared Goals and Objectives, by FMP Objective/Goal Number

Ecological	CPS	Groundfish	Salmon	HMS
Prevent overfishing and rebuild depleted stocks.	X	X	X	X
Provide adequate forage for dependent species.	X			
Describe, identify and minimize adverse impacts on essential fish habitat		X		X
Minimize bycatch (incl. protected species) and encourage full utilization of resources	X	X	X	X
Economic				
Achieve greatest possible net benefit (economic or OY) from resource	X	X	X	X
Promote efficiency and profitability in the fishery, including stability of catch	X	X	X	X
Accommodate existing fishery sectors	X	X	X	X
Minimize gear conflicts.	X	X		X
Minimize adverse impacts on fishing communities and other entities		X	X	X
Use gear restrictions to minimize need for other management measures wherever practicable		X		
Management				
Acquire biological information and develop long term research	X			X
Foster effective monitoring and enforcement.	X	X		X
Establish management measures to control fisheries impacts, use management resources effectively	X	X		X
Encourage cooperative international & interstate mgmt.	X		X	X
Promote the safety of human life at sea		X	X	
Support enhancement of stock abundance			X	
Promote outreach and education efforts				X

Table 3.5.4 details the array of fishery conservation and management measures that the Council uses to implement its priorities for West Coast fish and fisheries.

Table 3.5.4 Conservation and Management Measures Across FMPs

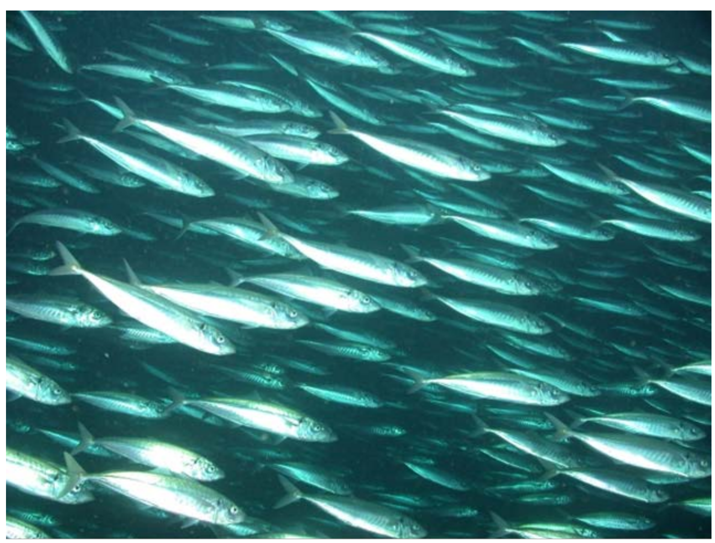
	CPS	Groundfish	Salmon	HMS
Annual harvest limits	✓	✓	✓	
Harvest restrictions to provide prey base for other spp.	✓	✓		
Season limits for all or some species	✓	✓	✓	
Fishing area restrictions to minimize bycatch		✓	✓	✓
Fishing area restrictions to minimize effects on EFH		✓		
Gear restrictions to minimize bycatch	✓	✓	✓	✓
Participation/access limitation program(s)	✓	✓		
Bycatch monitoring for all or some species/fisheries	✓	✓	✓	✓

3.5.1.2 Ecosystem-Based Management Measures within FMPs

This section identifies existing ecosystem-based principles and management measures within current FMPs, particularly management measures that were either taken to mitigate the impact of fishing on the environment or ecosystem, or measures that take into account the effects of the biophysical environment on managed species. Additional protective management measures have also been promulgated under the ESA and Marine Mammal Protection Act (MMPA). The fisheries are managed to include these protection measures. For each measure listed under the species group FMPs, we indicate in brackets the FMP species groups or protected species that may benefit from the measure listed. The following lists, separated by FMP, are current through February 2013.

Coastal Pelagic Species FMP

1. Krill harvest prohibition: The CPS FMP prohibits harvest of all species of euphausiids (krill) that occur within the U.S. West Coast EEZ to help maintain important predator-prey relationships and the long-term health and productivity of the West Coast ecosystem. These ecosystem conservation principle enhance fishery management by protecting, to the extent practicable, krill resources, which are an integral part of the ecosystem [HMS, groundfish, salmon, CPS, marine mammals, birds]
2. Conservative Management Strategy: The Council has demonstrated a consistently conservative approach to CPS harvest management in response to their ecological role as forage and importance to West Coast fisheries. The Council frequently reviews new science in support of stock assessments and management strategies and conducts annual stock assessments for the actively managed species because of the annual variability that can occur in the biomass of CPS. In the late-1990's, the Council chose the most conservative harvest control rule for Pacific sardine when presented a wide range of FMP harvest policies. The rationale for this harvest policy, like the other harvest controls rules in the FMP, is oriented toward maximizing biomass versus maximizing catch. Because of this, the annual harvest levels that result from the rule never exceed 12 percent of the estimated biomass for that year. [HMS, groundfish, salmon, CPS, marine mammals, birds]
3. Environmental Indicators: The intent of the existing environmental parameter in the Pacific sardine harvest control rule is to explicitly adapt harvest levels in response to environmental variability. The existing environmental parameter is one of the Council's priority research needs and new science suggests a need to explore a broader range of ecological indicators of Pacific sardine productivity. Additionally the annual Stock Assessment and Fishery Evaluation (SAFE) document for CPS includes an 'Ecosystem Considerations' chapter that provides a summary of oceanographic trends and ecological indicators being tracked by NMFS in the CCE and potentially having an effect on CPS stocks. [CPS]
4. Cutoff Parameters: CPS harvest control rules have long utilized "Cutoff" parameters to protect a core spawning population and prevent stocks from becoming



Anchovy school. Photo credit: NOAA SWFSC

overfished. The Cutoff is a biomass level below which directed harvest is not allowed. Cutoff values are set at or above the overfished threshold and have the effect of automatically reducing harvest rates as biomass levels decline. This mechanism serves to preserve a spawning stock size. For Pacific sardine, the Cutoff value is 150,000 mt or three times the overfished threshold and is part of the Council's conservative management approach. [HMS, groundfish, salmon, CPS, marine mammals, birds]

5. Monitored stock harvest strategy: The ABC control rule for monitored stocks consists of a 75% reduction from the species overfishing level. This precautionary approach is in response to greater scientific uncertainty about stock status or management. [HMS, groundfish, salmon, CPS, marine mammals, birds]
6. EFH: EFH for CPS finfish species is temperature-based: The east-west geographic boundary of EFH for CPS is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10°C to 26°C. The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10°C isotherm, which varies seasonally and annually. [CPS]
7. Ecosystem Component (EC) Species: The CPS FMP contains two EC species, jacksmelt and Pacific herring. In recognition of their role as forage, bycatch and incidental catch of these species is specifically monitored, along with all other bycatch/incidental catch, annual in the CPS Stock Assessment and Fishery Evaluation document.
8. Bycatch provisions: Incidental catch provisions are often included in annual management recommendations for CPS. These provisions are included to allow for small allowances of incidental catch of a specific CPS species, for which the directed fishery may be closed, in other CPS fisheries to prevent and reduce discard. [CPS]
9. ESA incidental take protections: CPS fishing boat operators and crew are prohibited from deploying their nets if a southern sea otter is observed within the area that would be encircled by the purse seine. [otters]

Groundfish FMP

1. EFH Conservation Areas: extensive, coastwide, long-term closed areas to protect groundfish EFH from bottom contact gear, particularly in rocky reef areas; extensive, coastwide, long-term closed area to freeze the footprint of West Coast trawl gear use to inshore of 700 fm depth contour. [Groundfish, salmon (particularly Chinook), marine mammals, seabirds]
2. Rockfish Conservation Areas: coastwide, seasonally-variable closed areas to minimize bycatch in all groundfish fisheries of rebuilding groundfish species. For cowcod and yelloweye rockfish, species-specific closed areas off the southern (cowcod) and northern (yelloweye) U.S. West Coast. [Groundfish, salmon (particularly Chinook), marine mammals, seabirds]

Tom Ghio at the helm of F/V Miss Alison.
Photo credit: John Field, NOAA SWFSC

3. Salmon Conservation Zones: mid-coast, estuary-plume-focused closed areas to minimize bycatch in whiting fisheries of endangered and threatened salmon stocks. [Salmon, CPS, green sturgeon, marine mammals, seabirds]
4. Commercial fishery vessel monitoring system (VMS) requirements to better enforce closed areas and other regulations. [Groundfish, salmon, marine mammals, seabirds]
5. Coastwide, mandatory observer program to gather total catch data from commercial fisheries. [All FMP species, all protected species taken as bycatch]
6. Weak stock management to curtail allowable harvest of more abundant species in order to reduce opportunities for incidental catch of less abundant, co-occurring species. Harvest levels for species managed via an overfished species rebuilding plan are usually set at a fraction of FMSY harvest rate. [Groundfish, salmon]
7. For less abundant stocks and stocks with little scientific information, harvest policies become increasingly precautionary. [Groundfish]
8. Allowable harvest of shortbelly rockfish, an abundant species with high prey value to the CCE, is set extremely low to accommodate incidental catch while discouraging any fishery development, to ensure that it retains its role as prey for other (non-human) predator species. [Groundfish, HMS, salmon, marine mammals, seabirds]
9. Stock assessments include literature review and discussion of relevant ecological biological, social and economic factors and the interactions between them, to allow SSC and Council to weigh impacts of those factors under different potential harvest scenarios. [Groundfish]
10. Trawl gear regulations to constrain habitat damage through a small footrope requirement shoreward of the RCAs, and minimize catch of juveniles through a minimum mesh size requirement. Fixed gear regulations to prevent lost gear from ghost fishing through a gear attendance requirement and, for pots, a biodegradable escape panel requirement. [Groundfish, salmon (particularly Chinook), marine mammals, seabirds]
11. Regulations requiring fishery participants to sort their catch by species, ensuring better long-term data on the hugely varied groundfish species catch and landings. [Groundfish]
12. For whiting, participation in a U.S.-Canada bilateral treaty organization to jointly manage and conserve Pacific whiting to ensure that harvest of the cross-boundary resource remains within sustainable parameters. [Groundfish, marine mammals, seabirds]
13. Implementation of the Individual Fishing Quota trawl rationalization program, which has demonstrated reduced bycatch of non-target species such as halibut and overfished species of concern since its inception in January 2011. [Groundfish, Halibut]

Dan Kamikawa, NWFSC scientist, on groundfish trawl survey.
Photo credit: NOAA NWFSC

Highly Migratory Species (HMS) FMP

1. FMP designates EFH for each species within the FMP, with sub-designations for the different life stages of those species. EFH designations for some HMS' life stages are temperature-based, recognizing those species' habits of associating with certain temperature ranges, regardless of where those temperatures may occur in any given season or year.
2. Sea turtle and marine mammal bycatch minimization and mitigation measures: NMFS-trained observers on vessels. Sea turtle protections: swordfish longline fishery prohibited west of 150° W. long.; prohibition on light stick possession for longline vessels operating west of 150° W. long.; shallow set longline fishing prohibited east of 150° W. long; seasonal area closures for drift gillnet in times and areas where there have been prior fishery interactions with leatherback sea turtles (the Pacific Leatherback Conservation Area), regulations for drift gillnet closures during El Niño events; equipment and handling requirements for bringing incidentally caught turtles onboard, and resuscitating and releasing when possible; mandatory sea turtle amd marine mammal training for skipper and crew participating in the drift gillnet fishery. Marine mammal protections: Pacific Cetacean Take Reduction Plan requires gear modifications on drift gillnet gear (pinger and gear depth requirements). State regulations to reduce marine mammal bycatch using time/area closures. sea turtles, marine mammals]
3. Seabird bycatch minimization and mitigation measures: gear configuration and setting requirements, offal discharge requirements, equipment and handling requirements for bringing incidentally caught short-tailed albatross onboard, and resuscitating and releasing when possible. [Seabirds]
4. Bycatch limitations for HMS taken with non-HMS gear. [HMS]
5. HMS permitting and record-keeping requirements for U.S. vessels operating in the EEZ and on the high seas and landing HMS in U.S. ports. [HMS]
6. Selected commercial fishery vessel monitoring system (VMS) requirements to better enforce closed areas and other regulations. [HMS]
7. Mandatory observer program to gather total catch data from commercial fisheries. [HMS, salmon, CPS, groundfish]

F/V Diane Susan and 400 lb swordfish. Photo credit: Tom Roff, Central CA Joint Cable/Fisheries Liaison Committee

8. Nation-wide shark-finning prohibition. [Sharks]
9. Nation-wide dolphin-safe tuna import requirements. [Marine mammals]
10. Participation in international regional fishery management organizations to develop and implement multinational conservation measures, such as restricting fishing around fish aggregating devices (FADs) for tropical tunas, and area closures to minimize bycatch of mammals and turtles. [HMS, marine mammals, sea turtles]

Salmon FMP

1. FMP designates EFH from the ocean extent of the EEZ to the shore, and inland up to all freshwater bodies occupied or historically accessible to salmon in Washington, Oregon, Idaho, and California, with exceptions for dammed streams, recognizing the long-term potential for managed stocks to recover in historically-used areas. [Salmon, and in marine waters, groundfish and CPS where EFH for those species intersects with salmon EFH]
2. Yelloweye Rockfish Conservation Area off Washington state to minimize bycatch of an overfished rockfish species in the salmon troll fisheries. Regulations restricting groundfish and halibut retention, coupled with inseason management to adjust those as needed. [Groundfish, halibut]
3. Geographic control zones that may be opened or closed to fishing on an annual basis, depending on a particular year's management objectives and run forecasts, used to constrain the catch of salmon from less abundant runs caught in common with salmon from more abundant runs. [Salmon]
4. Adaptive management process that allows swift inseason regulations changes to respond as catch information becomes available. That same process also includes an annual retrospective analysis of the effectiveness of modeling and management, ensuring an ongoing refinement of predictive and monitoring methodologies. [Salmon]
5. Oregon coastal natural (OCN) and Columbia River coho harvest matrices that use juvenile salmon ocean survival as a predictor of ocean conditions, ultimately providing allowable total fishery impacts rates based on the return of jacks (sub-adults) to spawning streams. Also for OCN coho, the Council's SSC has recommended a new predictor methodology that blends multiple parameters, including sea surface temperature and copepod assemblage abundance. [Salmon]
6. Participation in international regional fishery management organizations to ensure cooperation on both North American and high-seas multinational conservation measures to prevent overharvest. [Salmon]
7. Prohibition on the use of nets to fish for salmon within the EEZ to allow for live release of undersized salmon and to prevent bycatch of non-target species. [Salmon, HMS, groundfish]

Swinomish tribal members Mike Cladoosby (l), and Kevin Day (r) fish the Skagit River during a one-day spring Chinook fishery. Photo credit: Kari Neumeyer, NWIFC

3.5.1.3 CCE Species Managed Under the ESA or MMPA

Southern sea otter. Photo credit: NOAA

Recovering ESA-listed endangered and threatened anadromous and marine species within the U.S. portion of the CCE is a joint effort between U.S. citizens, and federal, state, and tribal management agencies. NMFS has jurisdiction over recovery and protection of most marine and anadromous fish and mammal species of the U.S. CCE, including most marine mammals, sea turtles, marine fishes, invertebrates, and plants. Sea otter recovery is under the jurisdiction of the USFWS. The USFWS also has jurisdiction over recovery of CCE seabird species. The Council's FMPs include a variety of fishery management measures intended to minimize fisheries interactions with ESA-listed species. These measures are often the result of consultations on the FMPs required by the ESA. As the agency implementing FMPs, NMFS must ensure that all federal fisheries comply with the ESA and that actions authorized by the FMPs do not jeopardize listed species or adversely modify or destroy designated critical habitat. To meet this requirement, all FMPs have gone through ESA section 7 consultation with NMFS and with USFWS. Biological opinions, the outcomes of the consultations, have been completed for all federal fisheries.

In Section 3.2, the FEP briefly describes the contributions of different species to the trophic levels of the CCE's marine food web from a biological perspective. From a management perspective, the laws that are used to manage the different species of the EEZ do not necessarily reflect their trophic interactions, but instead often reflect their abundance levels as individual stocks, or as particular distinct population segments (DPSs) or evolutionarily significant units (ESUs) of fish or other animals. Under the ESA, species considered for ESA protection include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." For marine species with vast migratory ranges, a distinct population of a particular species may occur off the U.S. West Coast, while other distinct populations of that same species may occur elsewhere within the North Pacific or beyond. For example, Steller sea lions range across the entire North Pacific Ocean from coastal Japan and Korea to the U.S. West Coast. The portion of the Steller sea lion population off the U.S. West Coast is considered a DPS, known as the eastern DPS. The Steller sea lion's U.S. western DPS, generally found off Alaska and farther north, remains listed as endangered under the ESA. NOAA has proposed removing the eastern DPS from ESA listing, based on its recovery under the ESA (77 FR 23209, April 18, 2012).

Leatherback turtle. Photo credit: NOAA

Since 1991, NOAA has assessed ESA-listed salmonids for whether a particular population could be considered a DPS based on whether it could be considered an evolutionarily significant unit of the particular population (56 FR 58612, November 20, 1991). Using the ESU designation allows NOAA to acknowledge under the ESA what salmon fishing people have known for centuries – that a single stream can host multiple runs of the same species of salmon arriving in their freshwater habitats at different times of year. A spring-run Chinook for a particular river may be genetically similar to a fall-run Chinook for that same river, but those fish cannot breed with each other because they are not in the same breeding place at the same time, thus they are distinct ESU's. The complex salmon-linked ecologies of North American rivers that drain to the Pacific Ocean require government agencies and the public to see salmon runs for their very particular roles in small geographic areas like individual streams, and for their ecosystem-wide roles linking the North American land mass to the Pacific Ocean. Salmon also serve as an important prey item for endangered southern resident killer whales, which are listed as endangered under the ESA.

As shown in Table 3.5.5, ESA-listed marine or anadromous species that, in some or at all times of the year, may occur within the U.S. West Coast EEZ include marine mammals, sea turtles, fish, and invertebrates.

Table 3.5.5: ESA-listed species that may occur in U.S. West Coast EEZ

Species	**Status**
Marine Mammals	
Blue whale *(Baleaenoptera musculus)*	Endangered
Fin whale *(Baleranoptera physalus)*	Endangered
Humpback whale (*Megaptera novaeangliae*)	Endangered
Sei whale (*Balaenoptera borealis*)	Endangered
Sperm whale (*Physeter macrocephalus*)	Endangered
Killer whales, southern resident DPS (*Orcinus orca*)	Endangered
North Pacific Right whale (*Eubalaena japonica*)	Endangered
Steller sea lion, eastern DPS (*Eumetopias jubatus*)	Threatened
Southern sea otter (*Enhydra lutris nereis*)	Threatened
Guadalupe fur seal (Arctocephalus townsendi)	Threatened
Birds	
Short-tailed albatross (*Phoebastria albatrus*)	Endangered
Marbled murrelet *(Brachyramphus marmoratus marmoratus)*	Threatened
California least-tern *(Sternum antillarum browni)*	Endangered
Xantus's murrelet *(Synthliboramphus hypoleucus)*	Candidate
Sea turtles	
Leatherback turtle (*Dermochelys coriacea*)	Endangered
Loggerhead turtle, North Pacific Ocean DPS (*Caretta caretta*)	Endangered
Olive Ridley (*Lepidochelys olivacea*)	Endangered/Threatened
Green Sea Turtle (*Chelonia mydas*)	Endangered/Threatened
Marine invertebrates	
White abalone (*Haliotis sorenseni*)	Endangered
Black abalone (*Haliotis crachereodii*)	Endangered
Fish	
Green Sturgeon, southern DPS (*Acipenser medirostris*)	Threatened
Pacific eulachon, southern DPS (Thaleichthys pacificus)	Threatened
Yelloweye Rockfish, Puget Sound/Georgia Basin DPS (Sebastes ruberrimus)	Threatened
Bocaccio, Puget Sound/Georgia Basin DPS (Sebastes paucispinis)	Endangered
Canary Rockfish, Puget Sound/Georgia Basin DPS (Sebastes pinniger)	

Table 3.5.5: ESA-listed species that may occur in U.S. West Coast EEZ		
Species		**Status**
Yelloweye Rockfish, Puget Sound/Georgia Basin DPS (Sebastes ruberrimus)		
Salmonids		
Chinook (*Oncorhynchus tshawytscha*)	Sacramento River winter ESU	Endangered
	Central Valley Spring ESU	Threatened
	California Coastal ESU	Threatened
	Snake River Fall ESU	Threatened
	Snake River Spring/Summer ESU	Threatened
	Lower Columbia River ESU	Threatened
	Upper Willamette River ESU	Threatened
	Upper Columbia River Spring ESU	Endangered
	Puget Sound ESU	Threatened
Chum (*Oncorhynchus keta*)	Hood Canal Summer Run ESU	Threatened
	Columbia River ESU	Threatened
Coho (*Oncorhynchus kistuch*)	Central California Coastal ESU	Endangered
	S. Oregon/N. CA Coastal ESU	Threatened
	Oregon Coast ESU	Threatened
	Lower Columbia River ESU	Threatened
Sockeye (*Oncorhynchus nerka*)	Snake River ESU	Endangered
	Ozette Lake ESU	Threatened
Steelhead (*Oncorhynchus mykiss*)	Southern California DPS	Endangered
	South-Central California DPS	Threatened
	Central California Coast DPS	Threatened
	California Central Valley DPS	Threatened
	Northern California DPS	Threatened
	Upper Columbia River DPS	Endangered
	Snake River Basin DPS	Threatened
	Lower Columbia River DPS	Threatened
	Upper Willamette River DPS	Threatened
	Middle Columbia River DPS	Threatened
	Puget Sound	Threatened

Orca whales, Monterey Bay. Photo credit: NOAA

Marine mammals are protected under the MMPA, regardless of whether their populations are depleted enough to warrant listing as threatened or endangered under the ESA. Marine mammals that may, during some or at all times of the year, occur within the CCE are shown in Table 3.5.6:

Table 3.5.6: MMPA-protected species that may occur in U.S. West Coast EEZ	
Species	**Stocks**
Cetaceans	
Harbor porpoise (*Phocoena phocoena*)	Various
Dall's porpoise (*Phocoenoides dalli*)	CA/OR/WA stock
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	North Pacific stock; CA/OR/WA stock
Risso's dolphin (*Grampus griseus*)	CA/OR/WA stock
Bottlenose dolphin (*Tursiops truncatus*)	California coastal stock
Bottlenose dolphin (*Tursiops truncatus*)	CA/OR/WA offshore stock
Short-beaked common dolphin(*Delphinus delphis)*	CA/OR/WA stock
Long-beaked common dolphin(*Delphinus capensis)*	California stock
Northern right whale dolphin (*Lissodelphis borealis*)	CA/OR/WA stock
Striped dolphin (*Stenella coeruleoalba*)	CA/OR/WA stock
Short-finned pilot whale (*Globicephala macrorhynchus*)	CA/OR/WA stock
Sperm whale (*Physeter macrocephalus*)	CA/OR/WA stock
Dwarf sperm whale (*Kogia sima*)	CA/OR/WA stock
Pygmy sperm whale (*Kogia breviceps*)	CA/OR/WA stock
Killer whale (*Orcinus orca*)	Eastern North Pacific southern resident stock
Killer whale (*Orcinus orca*)	Eastern North Pacific offshore stock
Killer whale (*Orcinus orca*)	west coast transient stock
Mesoplodont beaked whales (*Mesoplodon* spp.) - (Hubbs' beaked whales, Gingko -toothed whale, Stejneger's beaked whale, Blainville's beaked whale, Pygmy beaked whale or Lesser beaked whale, Perrin's beaked whale)	CA/OR/WA stocks
Cuvier's beaked whale (*Ziphius cavirostris*)	CA/OR/WA stock
Baird's beaked whale (*Berardius bairdii*)	CA/OR/WA stock
Blue whale (*Balaenoptera musculus)*	Eastern North Pacific stock
Fin whale (*Balaenoptera physalus)*	CA/OR/WA stock
Humpback whale (*Megaptera novaeangliae*)	CA/OR/WA stock
North Pacific right whale (*Eubalaena japonica*)	Eastern North Pacific stock
Sei whale (*Balaenoptera borealis)*	Eastern North Pacific stock
Minke whale (*Balaenoptera acutorostrata*)	CA/OR/WA stock
Gray whale (*Eschrichtius robustus*)	Eastern North Pacific stock
Pinnipeds	
California sea lion (*Zalophus californianus californianus*)	U.S. stock
Harbor seal (*Phoca vitulina richardsi*)	CA stock and OR & WA coastal stock
Northern elephant seal (*Mirounga angustirostris*)	CA Breeding Stock
Guadalupe fur seal (*Arctocephalus townsendi*)	
Northern fur seal (*Callorhinus ursinus*)	San Miguel Island stock
Steller sea lion (*Eumetopias jubatus*)	eastern Pacific stock (U.S.)

3.5.2 Tribe and State Fisheries

3.5.2.1 Northwest Tribes' Fisheries Management

The Treaty Tribes of Oregon and Washington (Tribes) have both exclusive and shared authority to manage a wide variety of fisheries and natural resources affected by both current and future actions of the Council and by biophysical conditions within the CCE. The Tribes manage and harvest marine species covered by the Council's FMP's as well as other species governed by the Tribes' own exclusive authorities or by co-management agreements with the states of Oregon and Washington. The Tribes also retain property interests in species they do not currently manage or harvest but may choose to do so at a future time.

Quinault Indian Nation Fisheries: Bruce Wagner (l) and Scott Mazzone (r), collecting otoliths and inspecting catch. Photo credit: Debbie Ross-Preston, NWIFC

Tribal fisheries have ancient roots and their harvests are used for commercial, personal-use and cultural purposes. Authorities to plan, conduct and regulate fisheries, manage natural resources and enter into cooperative relationships with state and Federal entities are held independently by each of the Tribes based on their own codes of law, policies and regulations. The independent sovereign authorities of each Tribe were federally recognized initially in a series of treaties negotiated and signed during 1854-1855 (Treaty with the Tribes of Middle Oregon (1855), Treaty with the Walla Walla, Cayuse, and Umatilla Tribes (1855), Treaty with the Yakama (1855), Treaty with the Nez Perce (1855), Treaty of Medicine Creek (1854), Treaty of Neah Bay (1855), Treaty of Olympia (1855), Treaty of Point Elliot (1855) and Treaty of Point No Point (1855) and have been reaffirmed by judicial review (e.g., U.S. v. Oregon (SoHappy v. Smith) 302 Supp.899 (D. Oregon, 1969) and U.S. v. Washington 384 F. Supp. 312 (W. Dist. Wash., 1974) and administrative policies (e.g., Executive Order 13175 and Secretarial Order 3206).

Each Treaty Tribe exercises its management authorities within specific areas usually referred to as Usual and Accustomed (U&A) fishing locations. These areas have been adjudicated within the federal court system or confirmed by federal administrative procedures. The restriction of treaty-right fisheries to specific geographic boundaries creates place-based reliance on local resource abundance and limits the Tribes' latitude for response to variations in ecosystem processes, species distributions or fisheries management effects.

Each Tribe has established sets of laws and policies to achieve sustainable fisheries production through traditional and science-based management. Regulations to control the conduct of each fishery (time, place, gear, etc.) are set through governmental procedures, and performance is monitored to ensure objectives are met. The Tribes participate as full partners with federal and state entities to ensure their criteria for resource conservation and sustainable fisheries are compatible. For example, the Tribes participate in the annual Pacific Salmon Commission process to preserve fishing opportunities on healthy salmon stocks and ensure conservation of depressed stocks of Chinook, chum and coho salmon. They also participate in the North of Falcon process with the State of Washington to achieve an annual set of co-management plans for salmon fisheries within both the EEZ and terminal areas for Council action.

The Tribes' combined regions of management interest and authority include areas outside the EEZ and the physical boundaries of the California Current. However, many of the species managed and harvested in these areas are affected by Council management and by conditions within the CCE. For example, Treaty salmon fisheries in the Columbia River watershed and interior (Strait of Juan de Fuca, Puget Sound and their watersheds) and coastal waters of Washington are significantly affected by salmon harvest quotas and schedules in the EEZ and by general marine conditions for growth and survival. All of the Tribes hold a vested interest in, and participate in, the Council's processes because salmon, other anadromous fishes (e.g., sturgeon spp., lamprey spp., smelt spp., trout and char spp.) and many migratory species of interest (e.g., marine mammals, herring, halibut) traverse and/or are affected by actions and activities within the EEZ and the California Current.

The four coastal Treaty Tribes (Coastal Tribes) of Washington (Makah Nation, Quileute Indian Tribe, Hoh Indian Tribe and Quinault Indian Nation) have broad interests in the CCE and more complex relationships with Council processes and decisions. The U&A's of the Coastal Tribes overlap with the EEZ and they have active ocean fisheries operating under the Council's current FMP's (Table 3.5.5). Harvests in the Coastal Tribes commercial fisheries (Figures 3.5.2 – 3.5.4) provide important employment and entrepreneurial opportunities for their remote communities and make significant contributions to the coastal economy of Washington.

Table 3.5.5: Coastal Treaty Tribes commercial fisheries

Fishery	Species	FMP	Tribes
Longline	Blackcod, Pacific halibut	Groundfish	Makah, Quileute, Hoh, Quinault
Bottom Trawl	Groundfish	Groundfish	Makah
Mid-Water Trawl	Whiting, Yellowtail Rockfish	Groundfish	Makah, Quileute
Troll	Salmon	Salmon	Makah, Quileute, Hoh, Quinault
Purse Seine	Sardine	CPS	Quinault
Pot	Dungeness Crab		Makah, Quileute, Hoh, Quinault
Manual Intertidal	Razor Clam		Quinault

Figure 3.5.2: Coastal Tribes' Commercial Groundfish and Shellfish Harvest, in lb, 2000-2010

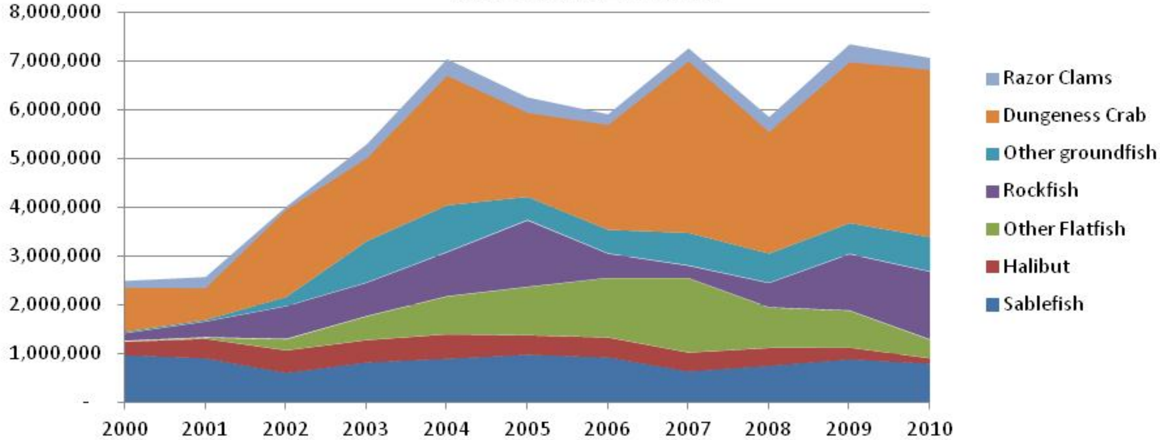


Figure 3.5.3: Coastal Tribes' Commercial Salmon Fisheries Landings, in number of fish, 2000-2010

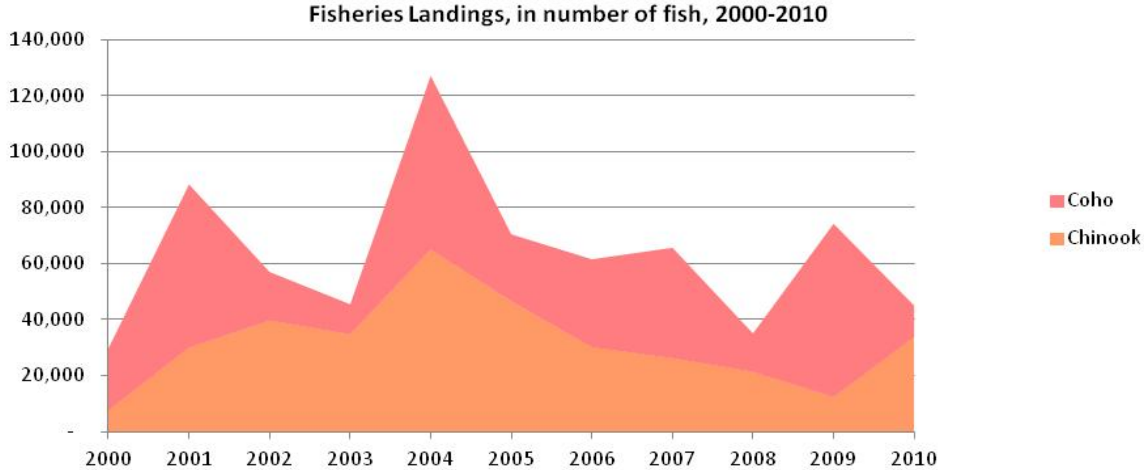
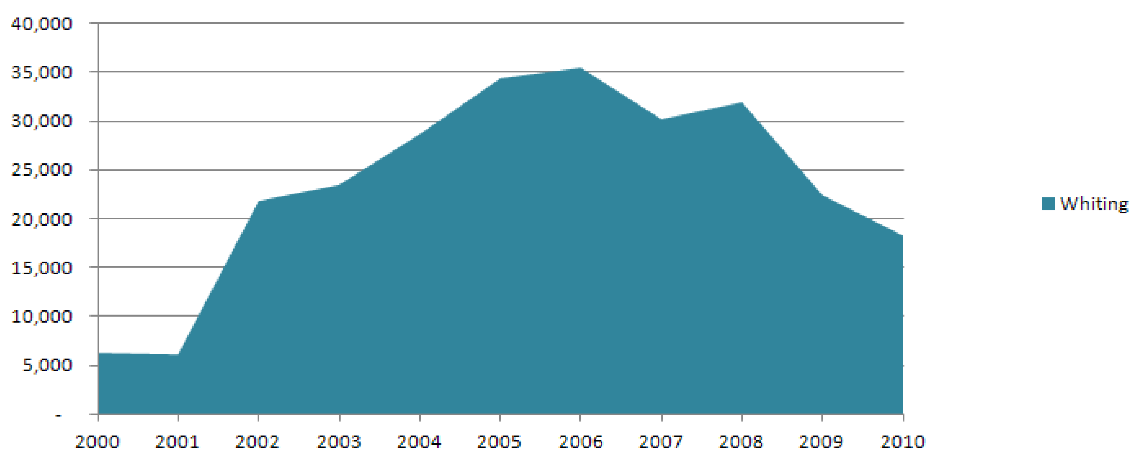


Figure 3.5.4: Coastal Tribes' Commercial Whiting Harvest, in mt, 2000-2010



3.5.2.2 California Tribes in the Council Process

Fisheries have been important to California tribes since time immemorial for cultural purposes, subsistence, and commerce-related activities. The primary stock co-managed by the Council, California, and the Hoopa Valley and Yurok Tribes is fall Chinook of the Klamath and Trinity River basins, which is an indicator stock for the Southern Oregon and Northern California (SONC) complex of the Salmon FMP. Klamath Basin spring Chinook are considered a component of the SONC complex; however, co-managers have not yet identified conservation objectives or coordinated regional management for this stock.

Yurok Tribe members, Pete Thompson and Bob Ray, throwing drift net near the mouth of the Klamath River. Photo credit: Yurok Tribe

The Yurok Tribal fishery occurs within the lower 44 miles of the Klamath River and within a portion of the Trinity River below the boundary of the Hoopa Valley Reservation. The Hoopa Tribal fishery occurs in the Trinity River from approximately one mile above the confluence with the Klamath River to the upstream boundary of the Hoopa Valley Indian Reservation, approximately 12 river miles. The primary gear type used is gill nets; however, a small portion of the Chinook harvest is taken by dip nets and hook and line. Fall Chinook are typically harvested from early August through mid-December, with peak harvest in the Klamath River estuary occurring during late August through mid September and in the Trinity River during late-September to early-October.

In 1993, the Interior Department Solicitor issued a legal opinion that concluded that the Yurok and Hoopa Valley Tribes of the Klamath Basin have a federally-protected reserved right to 50 percent of the available harvest of Klamath Basin salmon. Under the Council’s annual salmon management process, half of the annual allowable catch of Klamath River fall Chinook has been reserved for these tribal fisheries since 1994. Federal courts affirmed this decision in Parravano v. Masten, 70 F. 3d 539 (9th Cir. 1995), cert. denied, 116 S. Ct. 2546 (1996). Tribal fisheries with recognized Federal fishing rights occur on the Yurok and Hoopa Valley Indian reservations located on the Lower Klamath and Trinity Rivers, respectively. These fisheries are regulated by their respective governments..

The Yurok Tribal Council regulates the fall and spring Chinook fishery via annual Harvest Management Plans, which are based upon the tribal allocation and subsequent regulations regarding sub-area quotas, conservation measures, and potential commercial fisheries. When the Tribal Council allows a portion of the allocation to go to commercial fishing, then most harvest is taken in the estuary where commercial fisheries are held. Subsistence fisheries are spread throughout the reservation.

The Hoopa Tribal Fishery is conducted in accordance with the Hoopa Valley Tribe's Fishing Ordinance. Fishing by tribal members occurs within the exterior boundaries of the Hoopa Valley Indian Reservation. The Hoopa Valley Tribal Council is the sole authority responsible for the conduct of the tribe's fishery, enforces the fishing ordinance, and ensures collection of harvest statistics through its Fisheries Department.

The tribal fisheries normally set aside a small (unquantified) number of fish for ceremonial purposes. Subsistence needs are the next highest priority use of Klamath River fall Chinook by the Tribes. The subsistence catch has been as high as 32,000 fish since 1987, when separate tribal use accounting was implemented. Generally, commercial fishing has been allowed when the total allowable tribal catch was over 11,000 –16,000 adult KRFC (PFMC, 2008).

Commercial sales from the Yurok and/or Hoopa Valley Reservation Indian fall gillnet fisheries occurred in 1987-1989, 1996, 1999-2004, and 2007-2011. Average commercial catch of fall Chinook was about 17,200 in those years, most of which occurred in the estuary of the Yurok Reservation. Commercial sales also occurred in spring gillnet fisheries in 1989, 1996, 2000-2004, and 2007-2011, with an annual average of about 1,200 fish sold; however, these were typically spring Chinook (as identified from Trinity River Hatchery coded wire tags) harvested in the estuary during the fall season (early August). Detailed Klamath Basin tribal fishery data can be found in the Council's annual Stock Assessment and Fishery Evaluation Document: Review of Ocean Salmon Fisheries.

3.5.2.3 Washington Fisheries Management

Legislative Mandate and Management Areas

The Washington Department of Fish and Wildlife (WDFW) was created to "preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish in state waters and offshore waters" (Revised Code of Washington (RCW) 77.04.012). This legislative mandate also instructs WDFW to conserve fish and wildlife "in a manner that does not impair" the resources while also:

- seeking to "maintain the economic well-being and stability of the fishing industry in the state";
- promoting "orderly fisheries"; and
- enhancing and improving the recreational and commercial fishing in the state.

WDFW recognizes this conservation mission also requires the protection, preservation, management, and restoration of natural environments and ecological communities as well as management of human uses for public benefit and sustainable social and economic needs (WDFW 2012[4]).

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[4] Washington Department of Fish and Wildlife. 2012.
—Mission and Goals: http://wdfw.wa.gov/about/mission_goals.html.
—Rules Information Center: http://wdfw.wa.gov/about/regulations.
—WFWC Policy Documents: http://wdfw.wa.gov/commission/policies.html.

WDFW divides management of coastal fisheries from those in inner waters. Inner waters begin at Cape Flattery and include the U.S. portions of the Strait of Juan de Fuca and Strait of Georgia, the San Juan Islands, Hood Canal, and Puget Sound. Marine areas on the coast and in inner waters include estuaries, with the transition to freshwater management areas occurring at the mouth of rivers and streams.

Westport, WA, commercial crab fleet. Photo credit: WDFW

WDFW's Council-related activities focus mainly on the coastal region, although WDFW's management activities for salmonids extend well into the inner marine and freshwater areas of the state. The Department's legislative mandate covers "offshore waters" in addition to state waters, which the State Legislature defined as the "marine waters of the Pacific Ocean outside the territorial boundaries of the state, including the marine waters of other states and countries (RCW 77.08.010(33)). The state has direct authority to manage the offshore activities of state residents and vessels that are registered or licensed with the state. WDFW also pursues its mission in offshore waters through collaboration and coordination with federal, state, and tribal partners; formal engagement in intergovernmental forums, and interjurisdictional enforcement of state, federal, and international laws. WDFW's collaborative efforts also include the co-management relationship the state has with tribal governments that hold rights to fish and to manage the fishing activities of their members.

WDFW's management is, on the whole, highly integrated with Council managed fisheries. As in Oregon and California, the state is responsible for tracking commercial landings and recreational catch from vessels landing into state ports.

State Policy Process and Fisheries

WDFW consists of the Director, responsible for general operation and management of the agency, and the Washington Fish and Wildlife Commission (WFWC), which establishes policy and provides direction and oversight over the agency's conservation and management activities. The WFWC consists of nine citizen members that are appointed by the Governor and subject to confirmation by the Washington State Senate.

The WFWC's policy role includes rulemaking over the time, place, and manner of fishing activities, although the authority to issue some rules has been delegated to the Director (RCW 77.12.047). Regulations are issued through the process established by the states' Administrative Procedure Act, Regulatory Fairness Act, and State Environmental Policy Act. The WFWC takes input and deliberates on proposed policies and regulations in formal meetings and informal hearings that are open to the public and held throughout the state. More information on the WFWC and the state's rulemaking process can be found on the WFWC's website (WDFW 2012).

The WFWC Policy C-3603 guides WDFW's involvement in the Council process. Preservation, protection, and perpetuation of the living marine resources through coordinated management of fisheries is WDFW's guiding principle. Among other things, this policy instructs WDFW's representatives to:

- Support harvest strategies that promote optimum long-term sustainable harvest levels.
- Seek the views of the public, including those who represent consumptive and non-consumptive interest groups;
- Support initiatives and existing programs that more closely align the harvest capacity with the long-term sustained harvest quantities of marine resources, including individual quota programs and license and effort limitations programs;
- Support tribal fisheries that are consistent with the applicable federal court orders while recognizing the need for management flexibility to optimize fishing opportunity;
- Consider the social implications, impacts on fishing dependent communities, net economic benefits to the state , and other factors when taking positions on resource allocation issues;
- Take a precautionary approach in the management of species where the supporting biological information is incomplete and/or the total fishery-related mortalities are unknown; and,
- Support consideration of the use of risk-averse management tools to protect the resources in the face of management uncertainty.

WDFW patrol boat at work. Photo credit: WDFW

To facilitate integration between state rules and Council management, the WFWC has delegated rulemaking authority to the Director over rules pertaining to the harvest of fish and wildlife in the EEZ. WDFW incorporates many federal regulations issued through the Council process into state rules. Among other things, this allows for the enforcement of Council-recommended regulations in state courts.

Other WFWC policies that are of relevance to WDFW's engagement on the Council include:

- Policy C3012 – Forage Fish Management Policy, Goals and Plan
- Policy C3601 – Management Policy for Pacific Halibut
- Policy C3611 – Marine Fish Culture
- Policy C3613 – Marine Protected Areas
- Policy C3619 – Hatchery and Fishery Reform

The full set of policies can be viewed and tracked on the WFWC website (WDFW 2012).

The state has a few major commercial fisheries targeting species that are not included in Council's FMPs or for which Council management is limited. Dungeness crab is the highest value fishery, followed by pink shrimp and spot prawn. The state also allows limited harvest of anchovy for license holders of the baitfish fishery. The state has only one emerging commercial fishery program in place, now targeted at hagfish. The state has closed state waters off the coast to commercial fishing for groundfish and Pacific sardines. The state does not have a commercial nearshore fishery and has also chosen to not allow the live fish fishery that has developed in Oregon and California. The major recreational fisheries on the coast are boat based and target primarily salmon, halibut, groundfish (a.k.a. bottomfish), sturgeon, and albacore tuna.

3.5.2.4 Oregon Fisheries Management[5]

The major policies affecting Council FMP species include: the Oregon Food Fish Management Policy, the Oregon Conservation Strategy, the Nearshore Strategy, and the Oregon Native Fish Conservation Policy. Oregon's statutory Food Fish Management Policy (ORS §506.109) is intended to provide for the optimum economic, commercial, recreational and aesthetic benefits for present and future generations of the citizens of the state. This policy includes the following broad goals:

- Maintain all species of food fish at optimum levels and prevent the extinction of any indigenous species.
- Develop and manage the lands and waters of this state to optimize the production, utilization and public enjoyment of food fish.
- Permit an optimum and equitable utilization of available food fish.
- Develop and maintain access to the lands and waters and the food fish resources thereon.
- Regulate food fish populations and the utilization and public enjoyment of food fish in a compatible manner with other uses of the lands and waters and provides optimum commercial and public recreational benefits.
- Preserve the economic contribution of the sports and commercial fishing industries, consistent with sound food fish management practices.
- Develop and implement a program for optimizing the return of Oregon food fish for Oregon's recreational and commercial fisheries.

Seven Oregon Fish and Wildlife Commission (OFWC) members are appointed by the Governor and formulate general state programs and policies concerning management and conservation of fish and wildlife resources. The Legislature has also granted the OFWC the authority to adopt regulations for seasons, methods and limits for recreational and commercial take and sale as well as other restrictions and procedures for taking, possessing or selling food fish, with the exception of oysters. Oyster production and commercial harvest is regulated by the Oregon Department of Agriculture.

[5] ODFW Fishery and Fish Resource Information: http://www.dfw.state.or.us/fish/
ODFW Nearshore Strategy: http://www.dfw.state.or.us/MRP/nearshore/strategy.asp
ODFW Conservation Strategy: http://www.dfw.state.or.us/conservationstrategy/
Oregon Fish and Wildlife Commission: http://www.dfw.state.or.us/agency/commission/
Oregon Revised Statutes (Chapters 496-501 & 506-513): http://www.leg.state.or.us/ors/
Oregon Fisheries Rules: http://www.dfw.state.or.us/OARs/index.asp#Fish
Oregon State Ocean Planning Information: http://www.oregonocean.info/

In addition to federal license limitation programs for some FMP species, Oregon limits participation in ten state waters fisheries: sardine, salmon troll, Dungeness crab, pink shrimp (trawl,) black rockfish/blue rockfish/ nearshore fish, scallop, sea urchin, bay clams (diving,) roe-herring, and brine shrimp. Oregon fisheries are generally open, unless closed or otherwise restricted by regulation. Although fisheries currently fully utilize many food fish species in Oregon waters, some are underutilized. Under Oregon's Developmental Fisheries Program underutilized species are identified and categorized according to whether they are actively managed and whether they have the potential to support an economically viable fishery. Currently, there are no species that have been identified as not currently actively managed off Oregon under another state or federal management plan and that have the potential to be economically viable. Some underutilized species have been identified as underutilized yet have not shown the potential to be a viable fishery. Fishing for these species is open and is regulated indirectly through fishery regulations for other species, gears, seasons and areas.

ODFW biologist Steve Jones looks at the bycatch during testing of an excluder grate in a pink shrimp trawl off the Oregon coast. Photo credit: ODFW

The Oregon Conservation Strategy is a blueprint, based on best available science, for conservation of the state's native fish and wildlife and their habitats. The Nearshore Strategy is a component of the Oregon Conservation Strategy for marine resources from shore to 55 meters. Its purpose is to promote actions that will conserve ecological functions and nearshore marine resources to provide long-term ecological, economic and social benefits. The Nearshore Strategy is also intended to contribute to the larger domain of marine resource management processes, such as the Council, by guiding management, research and monitoring, and education and outreach actions toward priority nearshore issues and areas that have not received adequate attention, rather than duplicate efforts by other management processes. The purpose of the Oregon Native Fish Conservation Policy is to ensure the conservation and recovery of native fish in Oregon. This policy identifies three goals: prevent the serious depletion of native fish, maintain and restore naturally produced fish, and foster and sustain opportunities for fisheries consistent with the conservation of naturally produced fish and responsible use of hatcheries.

ODFW has authority to manage and set harvest restrictions for marine protected areas, including marine gardens, habitat refuges and research reserves. Marine gardens are areas targeted for educational programs that allow visitors to enjoy and learn about intertidal resources. Habitat refuges are specially protected areas needed to maintain the health of the rocky shore ecosystem and are closed to the take of marine fish, shellfish and marine invertebrates. Research reserves are used for scientific study or research including baseline studies, monitoring, or applied research. In addition, ODFW has authority to manage shellfish preserves, which are closed to clam harvesting.

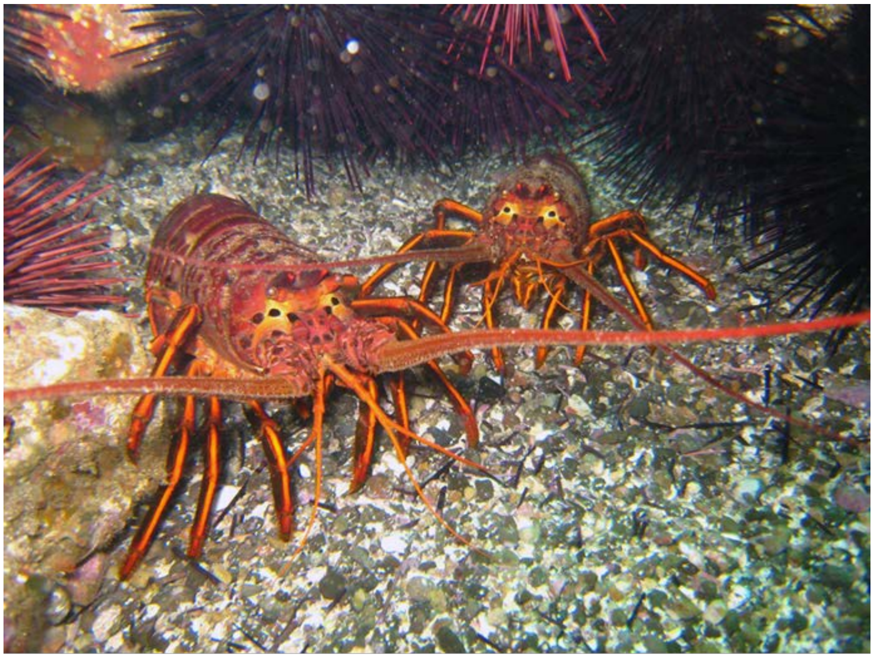
For marine reserves, the state Legislature has authorized the establishment of five reserves to date – see also Section 3.3.4. To implement these marine reserves, rule-making authorities of the Oregon Department of Fish and Wildlife, Oregon Department of State Lands (ODSL), and the Oregon Parks and Recreation Department (OPRD) must be coordinated. ODFW has authority to regulate fishing activities in the reserves. ODSL has authority for managing submerged lands and OPRD has authority for managing Oregon's ocean shore, which includes public beaches, state parks, and intertidal areas along the entire coast.

The federal Coastal Zone Management Act (CZMA) provides the Oregon Department of Land Conservation and Development (DLCD) with regulatory authority to review various federal actions in or affecting the state's coastal zone for consistency with the Coastal Management Program. DLCD reviews various NMFS regulations, including those recommended by the Council, for consistency. Also under the Oregon Department of Land Conservation and Development's Coastal Management Program, the Oregon Territorial Sea Plan is designed to carry out Oregon's statewide planning goal for ocean resources: To conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and social value and benefits to future generations. The Territorial Sea Plan provides an ocean management framework, identifies the process for making resource use decisions, provides a rocky shores management strategy, and identifies uses, including ocean energy, of the seafloor and the territorial sea.

Boats on Yaquina Bay, Newport, OR. Photo credit: ODFW

3.5.2.5 California Fisheries Management[6]

Within California's Natural Resources Agency there is the Fish and Game Commission (CFGC) and the CDFW administered by the Director. While the Director can exercise some regulatory authority, the majority is accomplished by the CFGC. The CFGC is comprised of five commisisoners appointed by the governor and confirmed by the Senate, who have been granted increasing management authority for the state's marine resources by the Legislature. They regularly meet 11 times per year to address resource issues and adopt management measures, and they may schedule additional special meetings to gain information on specific issues or take emergency actions.



Spiny lobsters. Photo credit: CDFW

The Marine Life Management Act (MLMA) was passed in 1998 and effective in 1999, and introduced a new paradigm in the management and conservation of California's marine living resources. The MLMA was developed in part based on many of the tenets of the MSA. The MLMA's overriding goal is to ensure the conservation, sustainable use, and restoration of California's living marine resources, including the conservation of healthy and diverse marine ecosystems. Through the MLMA, the Legislature delegated greater management authority to the CFGC and the CDFW. Key features of the MLMA include:

- Application to entire ecosystems rather than only to exploited marine resources, with an over-arching priority of resource sustainability.
- Recognizing the state's resources for their use benefits, aesthetic and recreational enjoyment, and value for scientific research and education.
- Shifting the burden of proof towards initially demonstrating that fisheries and other activities are sustainable, rather than requiring demonstration of harm to initiate action.
- Requiring an ecosystem-based approach to management rather than focusing on single fisheries, and the development of FMPs as the framework for management—initially specifying development of FMPs for the nearshore fishery and white seabass.

[6] CDFW Nearshore Fishery Management Plan: http://www.dfg.ca.gov/marine/nfmp/
California Coastal Commission: http://www.coastal.ca.gov/whoweare.html
California Code of Regulations Title 14: http://ccr.oal.ca.gov/
California Fish and Game Code (Sections 2850-2863, 7050-7090, 8585-8589.7)
California Fish and Game Commission: http://www.fgc.ca.gov/public/information/
California Ocean Protection Council, http://www.opc.ca.gov/
Marine Life Protection Act: http://www.dfg.ca.gov/mlpa/
Public Resources Code (Sections:30000-30900, 35500-35515): http://www.leginfo.ca.gov/calaw.html

- Requiring development of a master plan that prioritizes fisheries according to the need for comprehensive management through FMPs.
- Recognizing the importance of habitat by mandating its protection, maintenance, and restoration.
- Minimizing bycatch and rebuilding depleted stocks.
- Emphasizing science-based management developed in collaboration with all interested parties so that stakeholders are more involved in decision making and all aspects of management.
- Recognizing the long-term interests of people dependent on fishing; adverse impacts of management measures on fishing communities are to be minimized.
- Annual reporting on the status of the state's resources and their management.

With respect to regulating new or developing fisheries, the MLMA did not prohibit development of new fisheries. The MLMA recognized the need to be more precautionary in allowing existing fisheries to expand, or to encourage the initiation and growth of new fisheries that would be sustainable from the onset.

Developing FMPs was mandated by the MLMA—to date, fishery management and/or recovery plans are completed for the State's nearshore, white seabass, market squid and abalone fisheries. The state's FMPs are prepared by CDFW and adopted by the CFGC. A spiny lobster FMP is in progress and completion of an FMP for California halibut is a priority.

Concurrent with implementation of the MLMA, the Legislature enacted the Nearshore Fisheries Management Act (NFMA) to address the need to protect nearshore finfish species due to limited biological data, lack of stock status information and an expanding commercial live fishery. The NFMA recognized the importance of recreational and commercial fisheries for nearshore finfish species and provided management authority to the CFGC for those fisheries operating within state waters. The NFMA defined specific nearshore finfish species to be managed within one mile of the shoreline and established minimum size limits for nine species. All designated species, except for California sheephead, are also included in the federal Groundfish FMP. A state commercial limited entry nearshore fishery permit was established and annual fees associated with the permit are deposited into a dedicated fund established under the NFMA. Funds may be used for research or management purposes, such as developing fishery management plans or stock assessments, or for enforcement involving education and outreach. Imperative to nearshore management under the NFMA, and mandated under the MLMA, is the state's nearshore FMP, which provides a framework for managing 19 nearshore species (16 of which are also federally managed,) including fishery control rules more conservative than those in the federal Groundfish FMP and incorporating marine protected areas into fishery management.

Herring eggs on eelgrass. Photo credit: CDFW

The Marine Life Protection Act (MLPA) was passed and made effective in 1999 and directs the state to reevaluate and redesign California's system of MPAs to: increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and research opportunities provided by marine ecosystems subject to minimal human disturbance. The MLPA also requires the best readily available science be used in the redesign process, as well as the advice and assistance of scientists, resource managers, experts, stakeholders and members of the public.

California has taken a regional approach to developing a network of integrated MPAs along its 1,100 mile coastline in accordance with the MLPA – see also Section 3.3.4. The statewide coastal network includes 124 MPAs and 16 special closures covering approximately 848 sq mi of state waters and representing approximately 16% of all coastal state waters including those already adopted or proposed for the north coast (Point Arena north to the CA/OR border). Currently, almost 461 sq mi of state waters have been set aside as no-take marine reserves to observe their transition to an unfished state and evaluate ecosystem impacts on marine resources. These MPAs are expected to benefit California's marine resources including species under federal FMPs.

The California Coastal Act (or the Coastal Act) commenced California's coastal zone management rules as the means to regulate projects with possible impacts on use of land and water in the coastal zone. The Coastal Act permanently established the California Coastal Commission as the reviewing or governing body over the coastal zone. Along with the [San Francisco] Bay Conservation and Development Commission, the Coastal Commission is one of California's two designated coastal management agencies for the purpose of administering the federal CZMA in California. The Coastal Commission mission is to: "…protect, conserve, restore, and enhance environmental and human-based resources of the California coast and ocean for environmentally sustainable and prudent use by current and future generations."

Spencer Gilbert, CDFW game warden. Photo credit: CDFW

The California Ocean Protection Act (COPA) was implemented in 2003 to better integrate and coordinate regulations and agencies, both state and federal, responsible for protecting and conserving the state's ocean resources. One objective of the COPA is to "...encourage cooperative management with federal agencies, to protect and conserve representative coastal and ocean habitats and the ecological processes that support those habitats." The COPA established the Ocean Protection Council (OPC), a cabinet level oversight body, which actively works to facilitate coordination among various agencies on activities promoting ocean health and helps prioritize ocean resource needs. In addition, a Trust Fund overseen by the OPC was developed to insure best use of the state's limited resources for ocean resource management.

Although the MLMA lays out policies for achieving sustainability, it does not provide a specific method for measuring sustainability of California's vast marine resources. In 2009, California's Legislature passed the Sustainable Seafood Act requiring the state's OPC to develop and implement a voluntary sustainable seafood promotion program for California. The directives of the state program include development of protocols for guidance on certification of sustainable fisheries to internationally-recognized standards, a marketing and assistance program for fisheries ultimately certified, a competitive grant and loan program for assisting in certification, an eco labeling component and an advisory committee. While the CDFW is not directly involved in the efforts to establish this program, it will provide biological data and expert consultation on the state's fisheries for sustainability determinations.

California limits participation in the following commercial fisheries (some of which may also be restricted through federal FMPs): nearshore live fishery, urchin (diving), lobster, herring, rock crab, Dungeness crab, sea cucumber (diving and trawl), market squid, salmon, spot prawn (trap), California halibut (trawl), and northern pink shrimp (trawl). An additional limitation exists for the drift gill net and set gill net fisheries, which limits the number of participants specifically using each gear type (drift and set gill net) rather than the species taken by the gear. Further species or fisheries in California that are monitored through the use of non-restrictive permits are: anchovy, golden prawn (trawl), ridgeback prawn (trawl), swordfish (hook-and-line or harpoon only), bay shrimp, northern rock crab, southern pink shrimp (trawl), ghost shrimp, Tanner crab, marine aquaria collection, tidal invertebrates, and coonstripe shrimp (trawl). These non-restrictive permits do not limit the number of fishery participants, but are useful for indicating whether or not there is increased interest or potential development of market demand that would otherwise be unknown. Additional regulations may or may not be applicable to these non-restricted permits such as (but not limited to): size limits, trip limits, season closures, area closures and gear restrictions. In recent years, California recognized developing fisheries, for Kellet's whelk and hagfish, which are not currently covered under existing FMPs or limited permits.

The major recreational fisheries in California are boat-based and target groundfish, salmon, tunas and other highly migratory species, California halibut, surf perches and sea basses. Retention of several sensitive species including white shark, Garibaldi, giant (black) sea bass, gulf and broomtail groupers, and all species of abalone other than red abalone are prohibited in regulations.

3.5.2.6 Idaho Fisheries Management

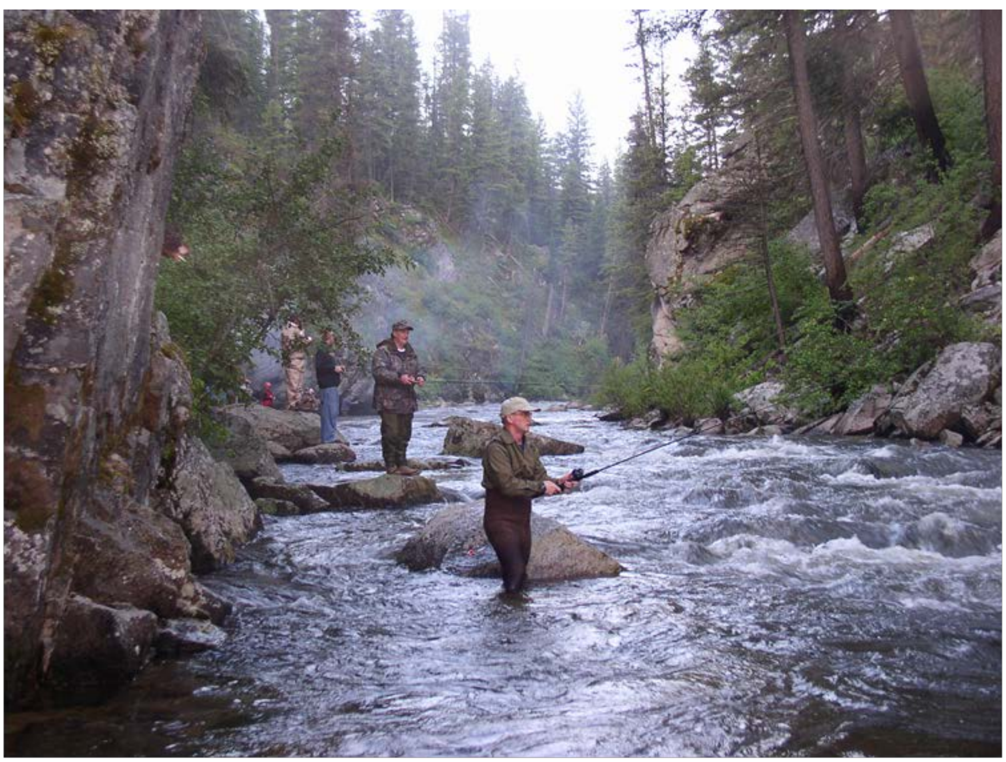
Although Idaho is landlocked, it contains much of the Columbia River basin's salmon and steelhead spawning and rearing habitat in the middle and upper Snake River system (Waples et al 1991). The Snake River provides EFH for ESA-listed sockeye, spring, summer and fall Chinook salmon and summer steelhead (Ford et al 2010). Of these, only fall Chinook salmon are substantially affected by ocean fisheries. All are caught in fisheries in the lower Columbia and Snake Rivers.

The Idaho Department of Fish and Game manages sport fisheries for Chinook salmon and steelhead to minimize incidental take of ESA-listed wild fish and ensure adequate return of hatchery fish for brood stock needs (Hassemer, personal communication). The Nez Perce and Shoshone-Bannock tribes also pursue these anadromous fishes within Idaho. Historically, Idaho had an abundance of anadromous coho salmon, Pacific lamprey and sturgeon. Snake River Coho were declared extinct in 1986. In the mid 1990s, the Nez Perce Tribe initiated a program to restore coho to the Clearwater River. Lamprey have dwindled to near extirpation in Idaho with only 48 crossing Lower Granite Dam in 2011 (Columbia River DART). White sturgeon rarely use fish ladders but have maintained a landlocked population mostly in Hells Canyon of the Snake River.

Historically, the Snake River spring/summer Chinook run exceeded 1 million fish, but was reduced to near 100,000 fish by the mid 1950s (Mathews and Waples 1991). The Columbia's largest tributary, the Snake River and its tributaries lie mostly in Idaho and to a lesser extent in eastern Washington and Oregon. The Snake River fall Chinook run was about 72,000 in the 1940s and about 29,000 in the 1950s, but remained the most important natural production area for Columbia basin fall Chinook. Prior to the 1960s, the Snake River was considered the most important drainage in the Columbia River system for the production of anadromous fishes (Waples et al 1991). Dam construction on the upper Snake River substantially reduced the distribution and abundance of Snake River fall Chinook salmon (Irving and

Bjornn 1981). Although considerable high quality spawning and rearing habitat remain in Idaho for spring and summer Chinook in the Salmon and Clearwater tributaries, their numbers have also declined in large part due to mortality during the outmigration through eight mainstem reservoirs and dams on the lower Snake River and Columbia.

Only limited Snake River fall Chinook spawning occurred downriver from Snake River km 439, the site of Oxbow Dam. The construction of Brownlee Dam in 1959 at Snake River km 459, Oxbow Dam (1961; RKm 439), and Hells Canyon Dam (1967; RKm 397) eliminated the primary production areas of Snake River fall Chinook salmon. Chinook were prevented from accessing 58% of prime spawning habitat as early as 1901 with the construction of Swan Falls Dam at RKm 734 (Parkhurst 1950). River habitat was further reduced with the construction of four fish-passable dams on the lower Snake River: Ice Harbor Dam (1961; RKm 16), Lower Monumental Dam (1969; RKm 67), Little Goose Dam (1970; RKm 113), and Lower Granite Dam (1975; RKm 173). Apart from the possibility of deep-water spawning in lower areas of the river, the main-stem Snake River from the upper limit of the Lower Granite Dam reservoir to Hells Canyon Dam (approximately 165 km) and the lower reaches of the Imnaha, Grande Ronde, Clearwater, and Tucannon Rivers are the only remaining areas available for fall Chinook salmon spawning in the Snake River Basin (Waples et al 1991). In 2009, state, federal and tribal fisheries projects released 5.4 million fall Chinook smolts in the free flowing reach of the Snake River and tributaries between Lower Granite Reservoir and Hells Canyon Dam[7]. In 2011, 25,541 adult fall Chinook salmon returned to this river reach (Columbia River DART), a smolt-to-adult return rate of 0.5%. Although most of these adults came from the smolt releases, Idaho Power's river flow management from Hells Canyon Dam since the early 1990s has benefited fall Chinook natural spawning and incubation in the Snake River. Additionally, cold-water releases from Dworshak Reservoir on the North Fork Clearwater River have improved migration conditions for juvenile fall Chinook. The main fisheries for Idaho-reared fall Chinook are in the ocean and lower Columbia River, with total exploitation rates of 40% to 50% (Ford et al. 2010). Of the 25,541 adult fall Chinook crossing Lower Granite Dam in 2011, only 952 (4%) were caught and only 210 (<1%) were harvested in Idaho sport fisheries (IDFG unpublished data 2012). Only 28% of the adults caught were adipose fin-clipped and legal to harvest. The 2011 Joint Staff Report prepared by the Oregon and Washington



Anglers in the South Fork Salmon River, Idaho. Photo credit: Richard Scully

[7] Fish Passage Center: http://www.fpc.org/

Departments of Fish and Wildlife estimate that 8,097 wild adult fall Chinook crossed Lower Granite Dam in 2011.This was the second largest run of naturally produced fall Chinook since their near collapse in 1975.

Habitat restoration, improved hatchery fish health, and improved juvenile fish passage technology at the lower Snake River dams have increased the return of spring and summer Chinook to an average of 56,000 from 1996 through 2004 (Columbia River DART), 40% (22,400) of which were wild fish (IDFG unpublished data). Although spring and summer Chinook are rarely harvested in the CCE, they are listed as threatened and managed under the ESA. When there is a harvestable surplus of hatchery spring and summer Chinook, and when there are sufficient natural spawners to allow for some incidental mortality, Idaho Department of Fish and Game opens state fisheries. After accounting for the number of spawners needed to fully seed hatcheries in the Snake River basin, the surplus production is allocated equally between sport and tribal fisheries. Sport allocation for spring/summer Chinook in Idaho was 17,300 in 2011 and is 29,490 in 2012 (IDFG unpublished data 2012). The lower value is closer to the average annual allocation for the recent decade.

Summer steelhead support the largest anadromous fishery in Idaho. Idaho’s adult steelhead generally leave the ocean between June and October and are caught in state and tribal fisheries in the lower Columbia River. They are caught in fisheries in Idaho from mid-July through April. Spawning occurs in April and May. About 200,000 steelhead cross lower Granite Dam annually and about 76% are adipose fin clipped and available for harvest. In recent years, about 50% of the adipose-clipped steelhead are harvested (IDFG unpublished data).

Shoshone-Bannock tribal spear fishing in the South Fork Salmon River, Idaho.
Photo credit: Enrique Patiño, NOAA NWR

3.5.3 Multi-State, Multi-Tribe and State-Tribal Entities

In addition to the Council process, there are West Coast multi-state or state-tribal natural resource management processes that affect fisheries management within the CCE.

3.5.3.1 Pacific States Marine Fisheries Commission

Established in 1947, the PSMFC is an interstate compact agency that helps resource agencies and the fishing industry sustainably manage Pacific Ocean resources in a five-state region. PSMFC's member states are California, Oregon, Washington, Idaho, and Alaska. Each state is represented by three Commissioners. PSMFC participates in both the PFMC and North Pacific Fishery Management Council processes as a non-voting member of each Council.

PSMFC has no regulatory or management authority. It serves as a neutral party, providing for collective participation by member states on topics of mutual concern and offering a forum for discussion and consensus-building. Its primary purpose is to promote and support policies and actions to conserve, develop, and manage these fishery resources. It coordinates research activities, monitors fishing activities, and facilitates a wide variety of projects. PSMFC staff collect data and maintain databases on salmon, steelhead, and other marine fish for fishery managers and the fishing industry. For example, PSMFC maintains the PacFIN and the Pacific RecFIN databases, which the Council and others rely on for timely and accurate data for management. Other major projects or programs relevant to Council management include the habitat program, the West Coast groundfish observer program, the passive integrated transponder (PIT) tag and coded wire tag programs, the aquatic habitat data project (StreamNet), the West Coast economics data program, an aquatic invasive species prevention program, and the Pacific ballast water group.

The PSMFC is also charged with convening the Tri-State Dungeness Crab Committee to discuss issues and with making reports to Congress on Dungeness Crab management. Under the MSA at Section 306, authority to manage the non-tribal ocean Dungeness crab fishery is delegated to the states of Washington, Oregon, and California. Each state may adopt and enforce State laws and regulations governing fishing and processing in the EEZ adjacent to that state in any Dungeness crab fishery for which there is no federal FMP in effect. By memorandum of agreement, the state fishery directors have agreed to take mutually supportive actions to further the management and maximize the sound economic and biological utilization of the crab resource when appropriately requested by the Director of one of the other three cooperating state agencies. Decisions about West Coast openings of the commercial season based on crab soft shell condition are made under this agreement.

Dungeness crab. Photo credit: Scott Groth, ODFW

3.5.3.2 North of Falcon Process

The "North of Falcon" process is an annual salmon management planning process involving representatives from salmon treaty tribes, the states of Washington and Oregon, and the federal government. Its name refers to the geographic area it addresses, salmon and fisheries management north of Cape Falcon, Oregon. The North of Falcon process is intended to support the Council's annual salmon management process by providing a series of advance public discussions of alternatives for the coming year's salmon seasons. Each November, the Council hears from its SSC and Salmon Technical Team on methodologies used to develop, support, and later assess the effects of, that year's salmon season management parameters. In the winter months, salmon scientists update the models intended for use in the subsequent year's fisheries. Beginning in February, managers working within the North of Falcon process start their review of new science and management information for salmon fisheries. The North of Falcon process allows managers to both prepare for Council action in March and April to set the year's salmon season parameters, and to prepare for shifts in state- or tribe-specific regulations intended to keep the applicable fisheries within their allocations.

3.5.3.3 Intertribal Fisheries Commissions

The Northwest treaty tribes of Washington and Oregon formed two commissions in the mid-1970s to pursue common objectives and provide coordinated services to their memberships. The Columbia River Inter-Tribal Fish Commission (CRITFC) was formed by agreement among the Warm Springs, Yakama, Umatilla, and Nez Perce tribes in 1977. The Northwest Indian Fisheries Commission (NWIFC) was formed in 1976 by its 21 member tribes (Lummi, Nooksack, Swinomish, Upper Skagit, Sauk-Suiattle, Stillaguamish, Tulalip, Muckleshoot, Puyallup, Nisqually, Squaxin Island, Skokomish, Suquamish, Port Gamble S'Klallam, Jamestown S'Klallam, Lower Elwha Klallam, Makah, Quileute, Hoh and Quinault). The commissions are governed by their member tribes, which appoint commissioners to develop policy and guidance for their operations. All actions and policies created are by unanimous consent of the membership.

The commissions do not possess inherent, sovereign authority but, upon consent, can represent member tribes in local and regional fisheries management venues. The commissions provide mostly coordinating, advisory and technical services to support tribal natural resources management efforts and provide mechanisms for unified actions to address joint issues and needs.

3.5.3.4 West Coast Governors' Alliance on Ocean Health

The West Coast Governors' Agreement (later "Alliance" on Ocean Health (WCGA) was created in 2006 as a unique regional partnership among Washington, Oregon and California to protect and manage coastal and ocean resources and the economies they support along the entire West Coast. The WCGA's is intended to forward coastwide priorities on:

- Ensuring clean coastal waters and beaches;
- Protecting and restoring healthy ocean and coastal habitats;
- Promoting the effective implementation of ecosystem-based management of our ocean and coastal resources;
- Reducing adverse impacts of offshore development;
- Increasing ocean awareness and literacy among our citizens;
- Expanding ocean and coastal scientific information, research, and monitoring; and
- Fostering sustainable economic development throughout our diverse coastal communities.

Upon completing an action plan in 2008, ten Action Coordination teams, comprised of volunteers with expertise in priority areas, were created to develop and implement work plans to achieve high priority regional goals of addressing: climate change, integrated ecosystem assessments, marine debris, ocean awareness and literacy, polluted runoff, renewable ocean energy, seafloor mapping, sediment management, *Spartina* eradication, and sustainable coastal communities. The recently adopted federal National Ocean Policy identifies the WCGA as the regional ocean governance partnership for the West Coast and one of nine such entities recognized throughout the United States. For advancing functional, resilient estuarine and nearshore marine ecosystems along the West Coast, the WCGA has endorsed a working relationshin with the newly-formed Pacific Marine Estuarine Fish Habitat Partnership, a group convened by the PSMFC.

3.5.4 International Science and Management Entities

For FMP species, the United States is a party with Canada in three treaties addressing fisheries for transboundary stocks: Pacific salmon, Pacific whiting, and North Pacific albacore. The United States is also a party with Canada on the Pacific Halibut Convention. Pacific Halibut is not an FMP species, but is taken as bycatch in some FMP fisheries and the Council has a Catch Sharing Plan for Pacific halibut taken off the U.S. West Coast. In addition, the U. S. is a party to several multi-lateral treaties addressing fisheries for HMS FMP species, and is a party to several agreements to conserve marine resources worldwide.

3.5.4.1 Pacific Halibut

The U.S./Canada Pacific Halibut convention established the *International Pacific Halibut Commission* (IPHC, originally called the International Fisheries Commission) in 1923 for the preservation of Pacific halibut in waters off Canada and the United States of America. Its mandate is research on and management of the stocks, including monitoring the fishery, conducting research, assessing stock condition and setting the allowable harvest for management areas. Halibut fisheries off Washington, Oregon and California are within IPHC’s management area 2A. The states, halibut treaty tribes, and NMFS together develop an annual Catch Sharing Plan for Pacific halibut fisheries off the US West Coast, which the Council and IPHC review and adopt annually.

3.5.4.2 Salmon

The U.S./Canada Pacific Salmon Treaty was signed in 1985 and sets long-term goals for the benefit of the salmon and the two countries. The *Pacific Salmon Commission* is the body formed by the governments of Canada and the United States to implement the Pacific Salmon Treaty. The Commission itself does not regulate the salmon fisheries, but provides regulatory advice and recommendations to the two countries. It is responsible for all salmon originating in the waters of one country that are subject to interception by the other, that affect management of the other country's salmon or that biologically affect the stocks of the other country. The Pacific Salmon Commission must also take into account the conservation of steelhead trout while fulfilling its other functions. The role of the Pacific Salmon Commission is to: conserve Pacific Salmon in order to

Sockeye salmon in Olympic National Park. Photo credit: National Park Service

achieve optimum production, to divide harvests so that each country reaps the benefits of its investment in salmon management.

High seas salmon management in the North Pacific Ocean, for waters beyond the EEZs of any countries, is conducted under the multi-lateral Convention for the Conservation of Anadromous Stocks in the North Pacific Ocean. That Convention authorized the *North Pacific Anadromous Fish Commission* (NPAFC,) the parties to which are the U.S., Canada, Japan, South Korea, and Russia. The NPAFC replaced the 1952-1992 International North Pacific Fisheries Commission (INPFC,) the international high-seas salmon management commission that, among other things, first separated coastal waters around the North Pacific into scientific study areas. Off the U.S. West Coast, we still sometimes use and refer to INPFC science and management areas: Vancouver (north of 47°30' N. lat.), Columbia (between 47°30' and 43°00' N. lat.), Eureka (between 43°00' and 40°30' N. lat.), Monterey (between 40°30' and 36°00' N. lat.), and Conception (south of 36°00' N. lat.). The NPAFC's Convention recognizes that its participant nations invest in conservation and salmon freshwater habitat protection in accordance with their national priorities, so takes the stance that fisheries for anadromous stocks should be conducted within EEZs to ensure that the benefits of those investments accrue to the nations making the investments. To that end, the Convention prohibits directed fishing for anadromous fish within North Pacific high seas waters, and the NPAFC provides a forum for an international exchange of science, management, and enforcement information in support of its Convention.

3.5.4.3 Whiting

The U.S./Canada Pacific Whiting Treaty was signed in 2003 and establishes agreed percentage shares of the transboundary stock of Pacific whiting (also known as Pacific hake). It also creates a process through which U.S. and Canadian scientists and fisheries managers recommend the total catch of Pacific whiting each year. The agreement anticipates that stakeholders from both countries will have significant input into this process. The Agreement, implemented for the first time in 2012, created four bodies to assist in the assessment and sustainable management of the shared whiting resource:

- The Joint Management Committee (JMC) is charged with determining the total annual allowable whiting catch;
- An industry Advisory Panel (AP) is charged with reviewing the management of the fishery and making recommendations to the JMC regarding the overall total allowable catch;

Top photo: Pacific whiting being washed prior to processing. Bottom photo: Mothership Arctic Storm employees inspecting fillets. Photo credit: Arctic Storm, Inc.

- The Joint Technical Committee (JTC) is charged with annually providing the JMC with a stock assessment that includes scientific advice on the annual potential yield of the offshore whiting resource;
- The Scientific Review Group (SRG) is charged with providing an independent peer review of the work of the JTC.

Amendment 23 to the Groundfish FMP exempted the Pacific whiting stock from the FMP's annual catch limit requirements based on the harvest policies of the Agreement. However, the Agreement's harvest policy is based on the Groundfish FMP's original 40-10 harvest control rule, which involves a precautionary adjustment to the harvest rate when the stock drops below the 40 percent of its unfished stock size (i.e. B40%, the recommend abundance level for producing maximum sustainable yield from the stock). The main difference between this approach and the current harvest policies of the Groundfish FMP is that the Agreement does not require a scientific uncertainty buffer between the overfishing limit and the acceptable biological catch. Under the Agreement, the JMC may recommend a different harvest policy "if the scientific evidence demonstrates that a different rate is necessary to sustain the offshore hake/whiting resource."

3.5.4.3 HMS Species

Because of the wide-ranging movements of highly migratory stocks, all management unit species in the HMS FMP are covered under international agreements. Vessels from the U. S. and many other nations harvest HMS FMP species throughout the Pacific Ocean and effective management of the stocks throughout their ranges requires international cooperation. The MSA requires adoption of annual catch limits (ACLs) and accountability measures (AMs) and other provisions to prevent and end overfishing and rebuild fisheries. However, a stock or stock complex may not require an ACL and AMs if it qualifies for a so-called "international exception" for stocks managed under an international agreement to which the United States is a party. However, if the Secretary of Commerce determines that an HMS FMP Management Unit Stock is overfished or approaching overfished due to excessive international fishing pressure, and for which there are no management measures to end overfishing under an international agreement, the Secretary and/or the Council must take action under MSA Section 304(i). This section requires the Secretary, with the Secretary of State, to take action at the international level to end overfishing. Further, within one year, the Secretary and/or Council shall recommend domestic regulations to address the relative impact of U.S. vessels on the stock and recommend to Congress, international actions to end overfishing and rebuild, taking into account, the relative impact of vessels of other nations and vessels of the U.S.

Yellowfin tuna. Photo credit: NOAA

The U.S. and Canada manage cross-border albacore fisheries interactions through a bilateral treaty. The U.S. is a member of the multi-lateral Inter-American Tropical Tuna Commission (IATTC), which is responsible for the conservation and management of fisheries for tunas and other species taken by tuna-fishing vessels in the eastern Pacific Ocean. The U.S. is also a member of the Western and Central Pacific Fisheries Commission (WCPFC), which plays a parallel role in the western and central Pacific (generally, west of 150° W. longitude).

The U.S.-Canada Albacore Treaty took effect in 1982 and has been renegotiated several times to address limitations on access to North Pacific albacore tuna by fishing vessels of one country operating in the jurisdiction of the other. The Treaty is a framework that allows fishing in the host country beyond 12 nautical miles during the fishing season. Until 2012, the two countries have agreed to a reciprocal fishing regime that specified conditions for vessels fishing of waters of the other country. Pursuant to the treaty, the United States and Canada annually exchange lists of fishing vessels that may fish for albacore tuna in each other's waters. The vessels agree to abide by the provisions of the Treaty, which include vessel marking, recordkeeping, and reporting. It also allows the fishing vessels of each country to enter designated fishing ports of the other country to conduct several types of business transactions including the landing of albacore without payment of duties; transshipment of catches to any port of the flag state; selling catches for export or locally; and obtaining fuel, supplies, repairs, and equipment on the same basis as albacore tuna vessels of the other country. The Treaty allows Canadian albacore vessels to land their catch in the U.S. ports of Bellingham and Westport, Washington; Astoria, Coos Bay, and Newport, Oregon; and Eureka, California.

The Inter-American Tropical Tuna Commission (IATTC) was established in 1949 for the conservation and management of fisheries for tunas, tuna-like species, and other species of fish taken incidentally by tuna fishing vessels in the eastern Pacific Ocean. Currently, there are 21 members of the IATTC: Belize, Canada, China, Colombia, Costa Rica, Ecuador, El Salvador, the European Union, France, Guatemala, Japan, Kiribati, Korea, Mexico, Nicaragua, Panama, Peru, Chinese Taipei, United States, Vanuatu, and Venezuela. The Cook Islands is a Cooperating Non-Member.


School of bluefin tuna. Photo credit: NOAA

The IATTC is responsible for the conservation and management of fisheries for tunas and other species taken by tuna-fishing vessels in the eastern Pacific Ocean. The Tuna Conventions Act of 1950 provides the United States with the federal authority to implement the measures adopted by the IATTC. In 2003, the IATTC adopted a resolution that approved the Antigua Convention, a major revision of the original convention establishing the IATTC. It brings the convention current with respect to internationally accepted laws on the conservation and management of oceanic resources, including a mandate to take a more ecosystem-based approach to management. The Antigua Convention entered into force in 2010.

The Western and Central Pacific Fisheries Commission was created in 2004 under the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the western and central Pacific Ocean. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks. The United States signed the Convention in 2000 and ratified it in 2007, thereby becoming a member of the WCPFC. The U.S. domestic procedures for ratification of the Convention were completed in June 2007. There are 25 Members of the Commission: Australia, China, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Japan, Kiribati, Korea, Republic of Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States, and Vanuatu. American Samoa, Guam, French Polynesia, New Caledonia, Tokelau, Wallis, Futuna, and the Commonwealth of the Northern Mariana Islands are Participating Territories, and Belize, Indonesia, Panama, Senegal, Mexico, El Salvador, Ecuador, Thailand, and Vietnam are Cooperating Non-members.

The International Scientific Committee (ISC), under the auspices of the WCPFC, enhances scientific research and cooperation for conservation and rational utilization of the species of tuna and tuna-like fishes which inhabit the North Pacific Ocean during a part or all of their life cycle. The ISC conducts HMS stock assessments that, within the U.S., are used to develop harvest management measures within the Pacific and Western Pacific Fishery Management Councils. The ISC also develops proposals for conduct of and coordinates international and national programs of research addressing such species.

Other International Fisheries Agreements and Action Plans: The HMS FMP provides a framework for the United States to meet its obligations under other international agreements to which the U.S. is a party. United Nations Implementing Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks interprets the duties of nations to cooperate in conserving and managing fisheries resources, and dictates that coastal states (i.e., nations) may not adopt measures that undermine the effectiveness of regional measures to achieve conservation of the stocks. The U.S. is also a member of the Food and Agriculture Organization of the United Nations (FAO,) which has implications for HMS management. In 1995, the FAO's Committee on Fisheries developed a Code of Conduct for Responsible Fisheries, which more than 170 member countries, including the U.S., have adopted. Pursuant to this Code of Conduct, the U.S. has adopted the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas and four International Plans of Action: 1) for Reducing Incidental Catch of Seabirds in Longline Fisheries, for the Conservation and Management of Sharks , for the Management of Fishing Capacity, and to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing.

3.5.4.4 Other International Forums

The *Tri-National Sardine Forum* began in 2000 and provides an annual opportunity for international coordination and collaboration among industry, scientists, and managers from Mexico, the U.S. and Canada for the sardine stock. The forum promotes coordinated coastwide data collection for sardine stock assessments, and promotes science and fishery management information-sharing. This forum is science-focused and there is no treaty governing the multi-national management of CCE sardines.

In 1902, northern Atlantic Ocean nations established the International Council for the Exploration of the Sea (ICES,) an international partnership for the cooperative exploration of ocean and fisheries science. In 1992, northern Pacific Ocean nations, including those that had long been ICES members, established the *North Pacific Marine Science Organization,* known as PICES for "Pacific ICES." PICES meets annually to promote and coordinate multi-national marine science within the North Pacific Ocean north of 30°00' N. lat. Its member nations are the U.S., Canada, Japan, China, South Korea, and Russia.

The *North American Migratory Bird Treaty Act* of 1918 decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected. The Migratory Bird Treaty Act is the domestic law that affirms, or implements, the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions protect selected species of birds that are common to both countries (i.e., they occur in both countries at some point during their annual life cycle).

The *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES, 27 U.S.T. 108) establishes a system of import/export regulations to prevent the over-exploitation of plants and animals listed in three appendices to the Convention. Different levels of trade regulations are provided depending on the status of the listed species and the contribution trade makes to decline of the species. Procedures are provided for periodic amendments to the appendices. CITES went into force worldwide in 1975. Within the U.S., the ESA is the implementing legislation for CITES. Executive Order 11911, signed April 13, 1976, designated Management and Scientific Authorities to grant or deny requests for import or export permits.

Western Hemisphere Convention (Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere; 56 Stat. 1354; TS 981.) Under this 1940 treaty, the governments of the U.S. and 17 other American republics expressed their wish to "protect and preserve in their natural habitat representatives of all species and genera of their native flora and fauna, including migratory birds" and to protect regions and natural objects of scientific value. The nations agreed to take actions to achieve these objectives, including the adoption of "appropriate measures for the protection of migratory birds of economic or esthetic value or to prevent the threatened extinction of any given species." Within the U.S., the ESA is the implementing legislation for the Western Hemisphere Convention (16 U.S.C. 1531-1543; 87 Stat. 884).

Convention on the Conservation and Management of High Seas Fisheries Resources in the North Pacific Ocean. Discussions to implement an agreement on limiting bottom fishing effort within the high seas waters of the North Pacific Ocean (FAO Statistical Area 61) have not yet resulted in a final international convention to regulate high seas bottom fisheries in accordance with United Nations General Assembly Resolution 61/105. The last multilateral meeting to discuss this convention occurred in 2011, with the following countries participating: Canada, China, Japan, Korea, Russia, the U.S., and Chinese Taipei.

Laysan albatross mother and chick. Photo credit: Kevin Rolle, Smithsonian Institution

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4 Addressing the Effects and Uncertainties of Human Activities and Environmental Shifts on the Marine Environment

The purpose of this chapter is to consider the potential effects of human activities and environmental processes on the CCE. In Chapter 3, the FEP describes the CCE from a wide variety of disciplines and perspectives. Chapter 4 is intended to broadly look at how human and environmental forces may, singly or combined, have effects on Council-managed resources. For those effects that can be addressed by fishery management measures, the Council can improve and integrate the information that supports decision-making across its FMPs. Ultimately, the Council could use this FEP to inform fishery management measures to help buffer against uncertainties resulting from those effects, and to support greater long-term stability within the CCE and for its fishing communities.

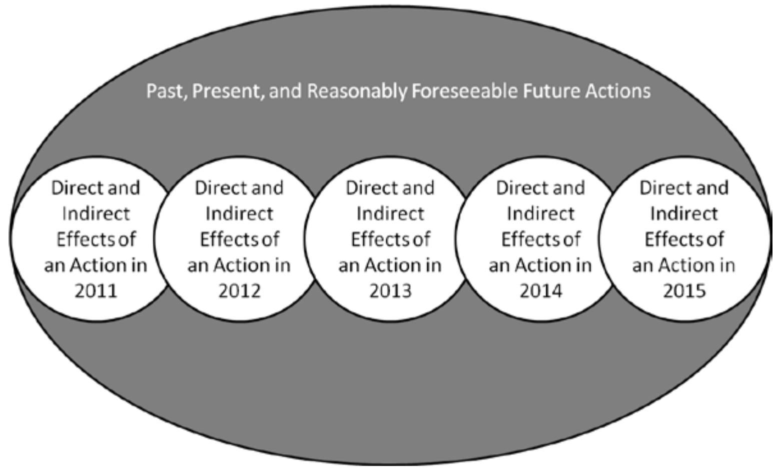


Figure 4.1: Cumulative Effects under NEPA

Chapter 4 discusses five broad categories of effects, whether from human actions or environmental shifts, of changes within the marine environment. Because the Council's work is focused on fisheries management requirements and challenges, this chapter focuses on the types of effects that are most relevant to the Council work and which can be linked back to MSA guidance and direction. This chapter discusses potential changes in the following areas of Council interest or responsibility: fish abundance within the CCE (Section 4.1), the abundance of nonfish organisms within the CCE (Section 4.2), changes in biophysical habitat within the CCE (Section 4.3), changes in fishing community involvement in fisheries and dependence upon fishery resources (Section 4.4), and aspects of climate change expected to affect living marine resource populations within the CCE (Section 4.5).

A suite of laws guide the issues NOAA and the Council must consider in making fisheries management decisions: MSA, NEPA, ESA, MMPA, the Regulatory Flexibility Act, Executive Order 12866, and others. NEPA particularly requires that we assess the cumulative effects of the proposed action, taken together with other "past, present, and reasonably foreseeable future actions" (40 CFR 1508.7 – see Figure 4.1.) This FEP's objectives, detailed in Chapter 2, call for the Council to use information generated from the ecosystem fishery management planning process to support its work within existing FMPs by broadening scientific information available on the cumulative ecological effects of management actions taken for FMP species and their fisheries. The scientific questions, processes, and tools discussed in Chapter 6 are all intended to work towards this goal by ultimately improving the quality of ecological information available to inform Council decision-making. In Chapter 5, the FEP provides guidance on the Council's priorities for how other management and private entities considering action within the CCE might best account for the nation's long-term needs for productive CCE fisheries. The FEP's Ecosystem Initiatives Appendix proposes several potential fisheries management initiatives that the Council could undertake to address some of the effects of human activities and environmental shifts on the marine environment.

4.1 Changes in Fish Abundance within the Ecosystem

Three major factors drive changes in the abundance and distribution of fished species in ecosystems: removals by fishing (and consequent changes in community structure and energy flow/predation within ecosystems), removals or habitat loss unrelated to fishing (typically such impacts are greater in freshwater, estuarine and nearshore systems), and shifts in climate that lead to both direct and indirect changes in productivity (including indirect effects such as changes in the abundance of prey or predators). Any and all of these effects can have cascading and cumulative impacts on ecosystem structure and energy flow in marine ecosystems that could lead to unexpected changes or surprises with respect to marine resource and fisheries management activities.

4.1.1 Direct and Indirect Effects of Fishing on Fish Abundance

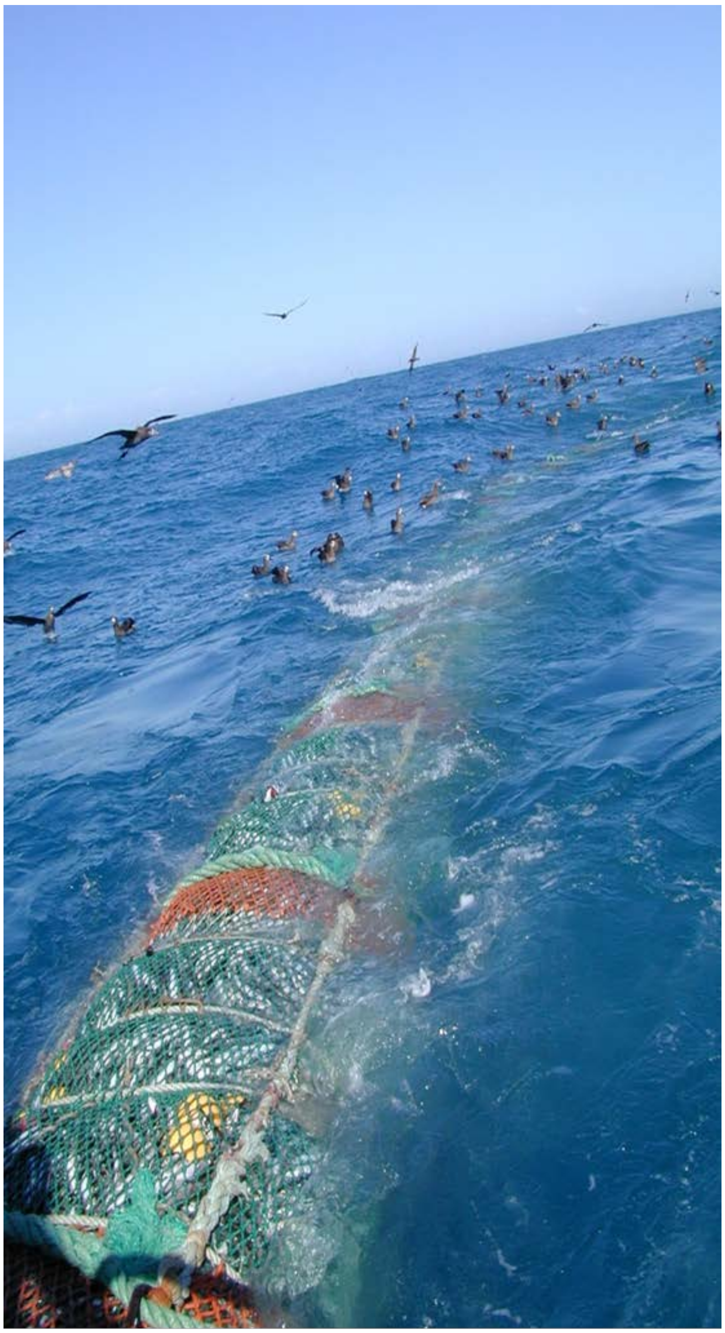
The consequence of fishing removals is typically predictable at the single species level, but less so at the community or ecosystem level. By both definition and design, fishing can result in substantial reductions in standing biomass of targeted populations and in moderate to severe shifts in the size and age structures of those populations. When adequate data exist, the consequences of fishing are relatively easy to monitor and estimate; however, the subsequent real or potential effects on predators, prey, or competitors within the ecosystem (and their predators, prey, competitors, etc) are much less tractable. Marine fisheries management in the U.S. and elsewhere is based on the idea that the reproductive strategies of harvested fish and shellfish populations will compensate for regular and sustained harvest of those populations. Compensatory processes are varied, complex and often poorly understood (see Rose et al. 2001 for a thorough review). Both theory and observations indicate that populations that are below their theoretical carrying capacities are capable of growing at faster rates and producing more young than would be needed in an unharvested population. However, such processes may only be relevant over one to a few decades, and over longer time scales, management concerns will ultimately include consideration of how population dynamics and evolutionary processes may shift in response to longer-term ecosystem processes, including sustained fishing pressure and global climate change.

In U.S. fisheries management, the implicit assumption is that if single species management approaches are able to successfully maintain the aggregate of fish stocks and populations close to target levels (usually by fishing at rates slightly lower than MSY or MSY proxies), then the ecosystems in which such stocks exist are likely to be "healthy." Limited evidence from food web models is consistent with the notion that the health of the whole of the ecosystem is equal to the status of sum of its managed parts (Worm et al. 2009). However, the concept of a "healthy ecosystem" is subjective and not defined in objectively quantifiable terms. A "healthy" and fished or otherwise human-disturbed ecosystem is dramatically different from the ecosystem in its unfished state. We have yet to develop a clear or comprehensive


NOAA Research vessel Miller Freeman leaving Newport, OR. Photo credit: NOAA NWR

understanding of the possible long term consequences to ecosystems from maintaining entire assemblages and communities of fish and invertebrates at abundance levels and with associated size or age structures that are notably different from where they would be in an undisturbed state (Jennings and Kaiser 1998, Hall 1999, Stokes and Law 2000, Longhurst 2006). From an ecosystem perspective, fisheries remove fish and other organisms from the sea that would have otherwise entered energy or nutrient pathways within their food web.

The 1996 Sustainable Fisheries Act commissioned a panel to develop "recommendations to expand the application of ecosystem principles in fishery conservation and management activities" (MSA at §406). Among other things, the panel suggested the rationale for surplus production is unclear if fishing is examined from an ecosystem context, since most production within an ecosystem prior to the advent of modern fisheries was simply recycled within that ecosystem (EPAP 1999). The consequences of various levels of fishing (or other impacts) include changes in the ecological relationships among competitors, prey and predators, and those consequences are rarely accounted for in single-species models. While any fishing activity will have some impact on an ecosystem, the levels of fishing that may trigger ecosystem-wide effects are unknown, and probably vary dramatically among ecosystems. Evidence for large scale shifts in community and ecosystem structure as a consequence of intensive fishing has been documented in ecosystems ranging from polar to tropical waters, and temperate shelf communities have been observed to have undergone large scale shifts as a result of intensive removals of target and non-target species (Hall 1999, Jennings and Kaiser 1999, Worm et al. 2009). There is general scientific consensus that overfishing is associated with large scale ecosystem impacts. However, there is less consensus over how to develop a more holistic perspective on the trade-offs between harvest levels that can be modeled as sustainable for single-species and the cumulative effects of harvesting multiple species on ecosystem "health and integrity" (Francis 2001, Longhurst 2006, Gaichas 2008).



West Coast Pacific hake trawl net and interested seabirds. Photo credit: NOAA NWR

There are few examples of comprehensive efforts to evaluate the integrated and cumulative effects of fishing activities on marine ecosystems, since the scientific work needed to develop a comprehensive understanding of these effects is still under development. There has been one example of this type of evaluation, in which the cumulative consequences to the ecosystem of a range of fishing rates and harvest levels (from highly precautionary management to aggressive yield-maximizing harvest strategies) were evaluated for all groundfish fisheries in the EEZ off of Alaskan waters (NMFS 2004). The ultimate preferred alternative was associated with harvest strategies that adopted conservative harvest levels without explicitly embracing the transition to an ecosystem approach. There is also some empirical and model-based evidence of consequences to overall ecosystem productivity and yield when those are evaluated in multi-species models, rather than a suite of single-species models (May 1979, Walters et al. 2005, Steele et al. 2011), which indicates that exploiting lower trophic level species at maximum rates will lead to reduced productivity of higher trophic level species. More recently, both empirical and model-based research has demonstrated that dependent predators are likely to be notably affected when their prey populations are depleted to levels lower than the typical thresholds adopted by fisheries managers (Cury et al. 2011, Smith et al. 2011); examples from the California Current were included in both of these analyses.


Anglers and their halibut catch, Bandon, OR. Photo credit: Prowler Charters

For the CCE, both empirical evidence and simulation studies have suggested that there are likely to be impacts and interactions at broad-scale levels between the harvests of some assemblages on the productivity and abundance of others. Most of these have focused on interactions between lower trophic level species and their predators, or on very large-scale fisheries such as that for Pacific whiting. For example, Kaplan et al. (2012) evaluated the extent to which different fishing fleets (targeting different assemblages of species) acted in either an additive or combined (cumulative) manner using an Atlantis model of the Calfornia Current. They found a range of indirect effects of different fisheries on species other than those targeted. Their simulations indicated that increased fishing for Pacific whiting led to increases in the relative abundance of small planktivores, large flatfish, shortbelly rockfish and pandalid shrimp. By contrast, changes in the effort of the purse seine fleet (targeting small planktivores) led to a range of responses; increases led to increased productivity of krill, salmon and myctophids. With respect to cumulative effects, they found that the biomass of small planktivores (forage fishes) was lowest when all fishing was ceased, due to the increased abundance of higher trophic level piscivorous fishes.

While these simulations represent a major step forward in efforts to integrate the consequences of various fisheries on the food web, many of the models used in such approaches are not always capable of predicting or replicating trophic cascades or other “ecological surprises” (Shaeffer et al. 2001, Folke et al.

2004, Baum and Worm 2009). A tremendous amount of research and effort has been invested in evaluating the extent to which sound single-species management may or may not be considered comparable to successful ecosystem-based management. Although the science needed to address such questions objectively and comprehensively is still in its relatively early stages (and is often limited by inadequate data), the Council's FEP development process resulted in the Council recommending a host of ecosystem-based revisions to its Research and Data Needs document and in adding potential ecosystem initiatives to the FEP's Ecosystem Initiatives Appendix that could improve the scientific basis for addressing such issues in a management context.

Chad Leiferman (l), F/V Miss Yvonne crewman, Robert Hannah (c), ODFW biologist, and Jeff Boardman (r), F/V Miss Yvonne skipper, with experimental fish-excluding bycatch reduction device developed for Oregon's pink shrimp fishery through cooperative ODFW-industry experimentation. Photo credit: ODFW

Beyond the combined potential effects of managing suites of species to their estimated MSY levels, fishing often shifts or truncates the age- and size (length)- structure of fish populations, as older and larger individuals are typically subjected to higher cumulative mortality rates once they are fully selected by fisheries (Murawski et al. 2001). When well understood or quantified, some of the consequences of changes to the age and size structure of a population can be explicitly addressed in population stock assessments. For example, more than half of the current stock assessments for West Coast rockfish (Sebastes spp.) explicitly considered size-dependent fecundity (in which larger, older fish produce proportionately greater numbers of eggs or larvae), in the estimation of the reproductive potential of the population (as opposed to the often made assumption that spawning biomass is proportional to spawning output). Interestingly, while Spencer et al. (2007) and Spencer and Dorn (2013) found that accounting for such factors resulted in significant changes in management reference points, in some examples the consequences also included more optimistic perceptions of productivity, as estimated by the steepness of the spawner/recruit relationship. However, other indirect effects may be more subtle, or more difficult to formally quantify. For example, studies have shown larger, older mothers invest comparably more energetic resources into egg or larval quality (Marteinsdottir and Steinarsson 1998, Berkeley et al. 2004b, Sogard et al 2008), and concerns have also been raised regarding the potential consequences to migratory behavior on populations for which younger fish "learn" migratory patterns from older, larger groups or individuals (Petigas et al. 2010, MacCall 2012).

In addition to the consequences of age or size truncation on the reproductive potential, there are likely consequences to population stability as well, such that truncation of size and age structure (and perhaps simply population reduction more generally) can lead to greater population variability and instability (Hsieh et al. 2006, Anderson et al. 2008, Shelton and Mangel 2011). The mechanisms may be varied, but have long been thought to relate to the significance of a broad age and/or size structure in buffering environmental variability (Leaman and Beamish 1984, Warner and Chesson 1985, Secor 2007). Shifts in age structure can increase the overall variance in recruitment (Lambert 1990; Marteinsdottir and Thorarinsson 1998; Worden, et al. 2010, Shelton and Mangel 2011), which has led to concerns over the effect of fishing on the response of populations to specific time scales of variability in the environment, as the dominant time scales of environmental variability are likely to change with climate change (Planque et al. 2010, Hollowed et al. 2011). The FEP's Ecosystem Initiatives Appendix proposes, in Section A.2.1, a potential initiative to investigate the long-term effects of both current and potential future Council harvest policies on age-and size- distribution in managed stocks. Current harvest control rules set a target level of female spawning biomass as an MSY proxy, while future harvest control rules may also explicitly consider the population age or length structure.

4.1.2 Direct and Indirect Effects of Non-Fishing Human Activities on Fish Abundance

Grand Coulee Dam. Photo credit: U.S. Department of the Interior

The consequence of removals or habitat loss not directly related to fishing, and exclusive of climate change, vary significantly depending on the species and habitat type in question. In freshwater systems (e.g. for salmonids and other anadromous species), the impacts are tremendous and severe, with indirect effects of habitat loss and alteration, and direct losses of smolts that suffer mortality as a result of being run through turbines (see section 3.3.4). Direct mortalities or indirect impacts on carrying capacity can also result from dredging and dredge spoil disposal, offshore energy installations, saltwater intakes or other human activities and habitat alterations. Such effects are typically greatest on anadromous, estuarine, nearshore species, or offshore species with a nearshore juvenile stage, although future effects are likely to extend further offshore as a consequence of wave or wind energy structures, aquaculture operations, or other offshore development activities. Some indirect effects could be a consequence of past, present and future human activities that influence the abundance and distribution of other predators of managed species as well. At the scale of most of the PFMC managed resources of the CCE, few such activities have notable or major impacts on FMP stocks or complexes other than salmonids, although both catastrophic events (e.g., oil spills) and future human activities that could have larger footprints (e.g,. wave energy, offshore aquaculture) could be associated with broader scale impacts on managed species.

As a key energy pathway and bridge between freshwater, estuarine and marine environments, salmon have evolved complex population structures and life histories to cope with the variability in each of these environments (Nickelson and Lawson 1998, Mantua and Francis 2004, Lindley et al. 2009). However, this evolutionary strategy has been threatened by the combined impacts of habitat loss, hydropower, excessive harvest and hatcheries (NRC 1996a); problems that were exacerbated during generally poor environmental conditions throughout the 1980s and 1990s (Hare et al. 1999). Consequently, current salmon populations may lack the life history diversity and high quality freshwater habitat that acts as a buffer against the intrinsic variability in their ocean habitat. For example, the marine waters off of central California are generally the southernmost habitat occupied by Chinook salmon, most of which are associated with the Sacramento River system and San Francisco Bay estuary. These freshwater and estuarine ecosystems have been massively altered by dams, water diversion, flow alteration, pollution, nutrient loading and the introduction of non-native species. Simultaneously, these salmon are at the edge of the habitat range for this species, and consequently are likely to experience the strongest environmental impacts from regional and basin scale variability in ocean conditions. The combination of more extreme climate fluctuations and a reduction of life history and habitat diversity have led to additional strain on these populations, and represents a long-term threat to their sustainability and persistence (Lindley et al. 2009, Carlson and Satterthwaite 2011).

Indirect consequences of altered freshwater and estuarine environments also include the facilitation of predation pressure on managed species by other (native) components of the ecosystem, most frequently pinnipeds and seabirds, and often as a result of altered or expanded distribution and changes in behavior. There have been three eras of human relationships with pinnipeds and seabirds. The first involved subsistence and commercial hunting, harassment and pesticide contamination (described in greater detail in section 3.4.1). Subsequent declines in many marine mammals and seabirds ended in the early 1970s with the enactment of the Marine Mammal Protection Act and other environmental protection laws. This began the second era, in which killing or harassment of pinnipeds and sea birds was prohibited, which in turn facilitated the rapid population recovery of these species (e.g., Caretta et al 2011). As a result of localized interactions between populations and individuals of mammals and birds that threaten conservation efforts to protect or rebuild salmonid and other populations, we may now be entering into a third era. In this era, biologists will observe and quantify the risk associated with predator interactions with managed fish species, and respond with management actions when warranted.

For example, sea lions have posed substantial conservation problems to steelhead, Chinook and other salmon populations throughout the California Current, with very high profile management issues associated with reducing these impacts at both the Ballard Locks in Seattle and the base of Bonneville dam on the Columbia River (NMFS 1997, IMST 1998). Similarly, Caspian terns and double crested cormorants have been estimated to consume millions of salmonid smolts per year in the lower Columbia River. In both instances, increased vulnerability of salmonids to predation was facilitated by human activities; the increased vulnerability of salmon to predation as they hold near dams and other structures, and the creation of nesting habitat for terns and cormorants as a result of man-

California sea lions. Photo credit: NOAA.

made islands (the consequence of dredge spoils) on the lower Columbia (Roby and Collis 2011). In the latter case, there are no historical records of terns nesting in the Columbia River estuary before 1984, when about 1,000 pairs apparently moved from Willapa Bay to nest on East Sand Island (NWP&CC 2004). However, by 2011, the East Sand Island tern colony was the largest in the world with 7,000 breeding pairs that consumed an estimated 4.8 million salmon smolts, and an additional 13,000 breeding pairs of double-crested cormorant colony (the largest colony in western North America) consuming an estimated 20.5 million salmon smolts. Piscivorous bird colonies have also increased on man made islands further up the Columbia, including John Day and McNary pools (Evans et al 2012). Past and future management efforts include both non-lethal and lethal removals of problem sea lions to protect salmon, and relocation of colonies and reduction of available nesting habitat in order to better manage avian predation on salmon smolts (Roby 2011). It is highly likely that such activities will continue as threats to recovering or at-risk species arise.

4.1.3 Environmental and Climate Drivers of Fish Abundance

Although current management strategies and reference points for many stocks and species are often based on a reference "unfished" biomass level, the abundance of an unfished resource is rarely constant over time. Rather, species, communities and ecosystems are in a constant state of flux and variation, responding to changes in the physical and biological environment and multiple temporal and spatial scales. The ocean-atmospheric climate system in the Pacific, and throughout the world, is characterized by large scale interannual (e.g., ENSO) and interdecadal (e.g., PDO) variability in physical properties that in turn lead to dramatic changes in both lower and higher trophic level productivity and dynamics. In the CCE, at least part of the mechanism for the impacts on productivity are the physical circulation patterns that often favor some source waters over others, which in turn contributes to large-scale variability in primary and secondary production in this ecosystem (Chelton et al. 1982, Peterson and Schwing 2003, Checkley and Barth 2009).

Numerous detailed studies of physical and biological time series indicate that there is coherence between various indicators of this physical forcing and biological indices of biomass, productivity and recruitment of a wide range of stocks throughout the region (Mantua et al. 1997, McGowan et al. 1998, Hollowed et al. 2001, Mantua and Hare 2001, King et al. 2011). For high turnover species (such as market squid), abundance and productivity can change within months, and subsequent impacts on fisheries catches can be dramatic. From 1997 to 1999, market squid catches fluctuated from ~70,000 mt, to ~3,000 mt and back to 90,000 mt, thought to be almost exclusively a function of high frequency variability in abundance in response to high frequency

Anglers and Humboldt squid catch, HuliCat Sportfishing, Half Moon Bay, CA. Photo credit: John Field, NOAA SWFSC

environmental variability. Nearly all migratory stocks, including Pacific sardine, Pacific salmon, Pacific whiting, and virtually all highly migratory species, vary their movement patterns and distributions in relation to this variability. Typically, there are responses in recruitment, growth and productivity as well, although these may only be observed over longer time scales.

Low frequency variation in productivity is also an important factor; in general, there appear to have been shifts to lower values of zooplankton biomass, salmon smolt marine survival rates, and other indices of productivity for West Coast species following an apparent 1977~1999 regime shift, with higher values for similar time series in the North Pacific (Gulf of Alaska and Bering Sea). During this period, the West Coast observed higher productivity and abundance of Pacific sardine, particularly during warm years that were otherwise associated with lower productivity of many species (Jacobson and MacCall 1996, Rykaczewski and Checkley 2008, Song et al. 2012), demonstrating that there will be species and assemblages or species that do better or worse under different conditions. This information has been influential in fisheries management decisions, including the environmentally driven control rule for California sardine harvest policy, and the differential treatment of pre- and post-1976 ecosystem properties and abundance levels for the purposes of estimating groundfish reference points by the North Pacific Fishery Management Council. There is only one unfished groundfish stock that has been carefully evaluated, shortbelly rockfish, which indeed does demonstrate considerable variability (coupled with an apparent long-term decline) in abundance (Field et al. 2007). However, relative abundance time series of other unfished or lightly exploited species indicate comparable patterns (Moser et al. 2000) and both simulations of groundfish model results and evaluation of the significance of climate factors indicate that there should be non-trivial changes in the abundance and productivity of many stocks (beyond the more noticeable higher-frequency variation observed in recruitment) for many species in the absence of fishing (Schirripa and Colbert 2006, Field et al. 2010, Zabel et al. 2011).

Although historical records of both climate conditions and the abundance of different stocks are difficult to come by, these patterns of long-term variability held in the early 1900s, and it seems increasingly clear that these patterns are typical of this ecosystem, as suggested by the high production of California salmon observed in the 1880s (McEvoy 1986), historical recognition of the massive changes in distribution and abundance of fishes and their prey associated with El Niño events (Hubbs 1948, Wooster and Fluharty 1985, MacCall 1996), a century's worth of massive changes in the abundance and distribution of coastal pelagics and tunas in the southern California Current (MacCall 1996), and a growing volume of paleological evidence that demonstrates that variability in the production of sardines, salmon and other species on such time scales has likely been occurring for thousands of years (Baumgartner et al. 1992, Finney et al. 2002, Field et al. 2006). However, it is becoming increasingly evident that recent patterns of variability are not necessarily consistent with historical patterns index (Di Lorenzo et al., 2008). With global climate change, variability patterns will likely deviate further from those of the past. This issue will be addressed more comprehensively in section 4.5. Despite uncertainties with respect to precise mechanisms of change, fisheries management decision-making should seek scientific tools that recognize that shifts in productivity exist and can matter to fish populations and the ecosystem. Further research should improve both our understanding of the processes that drive such variability, and the means by which such knowledge can and should be used in management decisions.

Canary rockfish school. Photo credit: NOAA.

4.2 Changes in the Abundance of NonFish Organisms within the Ecosystem

U.S. laws and regulations differentiate incidental mortality of protected, nonfish species (e.g., marine mammals, sea turtles) from directed fishing mortality. In terms of the overall effects, however, the same question applies – What are the ultimate effects of successive, human-caused mortality over time? Many of the higher trophic order non-targeted species, particularly marine mammals, were historically targeted by human hunting and their populations may still be recovering from periods of intense targeting.

Elephant seals, Farallon Islands, CA. Photo credit: NOAA.

4.2.1 Direct and Indirect Effects of Fishing on Non-Fish Abundance

Although fisheries may affect non-target species in a variety of ways, impacts may be divided into two broad categories, direct and indirect effects. Direct effects are those directly related to the action, particularly those that occur at the same time and place as the action, such as non-target species being caught or taken during the prosecution of the fishery (incidental catch or bycatch) or habitat can be altered through direct contact with fishing gear. For indirect effects, there is some intermediate cause-and-effect between the action and the actual effect being evaluated; indirect effects may occur at a distance in time or place from the action, such as reductions in prey base that serve as forage. Although bycatch is often considered the most serious direct effect of fisheries on non-target species(Dayton et al. 1995), other potentially important fishing effects include: direct or indirect damage to habitat-forming organisms or benthic communities (Auster 1998), behavioral aggregation of scavengers from bycatch discards, and the indirect effects of target species reduction (Botsford et al. 1997).

Nonfish organisms in the CCE include everything from phytoplankton, zooplankton, and larger invertebrates within a size range typically smaller than fish, up to birds and marine mammals at sizes typically much larger than fish. Thus, nonfish organisms include both the major prey and the major predators of our managed fisheries species; these two groups are incredibly diverse. U.S. laws that require the monitoring and reduction of incidental catch and bycatch include: the Magnuson-Stevens Fishery Conservation and Management Act (MSA), 16 U.S.C. 1801 et seq.; the Marine Mammal Protection Act (MMPA), 16 U.S.C. 1361 et seq.; and the Endangered Species Act (ESA), 16 U.S.C. 1531 et seq. The MSA requires that FMPs establish standardized reporting methodologies to assess the amount and type of bycatch occurring within fisheries, and that conservation and management measures for fisheries minimize bycatch and bycatch mortality [16 U.S.C. 1853, 1851]. These protections extend to target and non-target species, with additional laws providing protections to species not managed under the MSA.

For example, pursuant to the MMPA, NOAA has promulgated specific regulations that govern the incidental take of marine mammals during fishing operations (50 CFR Part 229). Section 118 of the

MMPA requires NMFS to place all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals occurring in each fishery (16 U.S.C. 1387(c)(1)). The regulations designate three categories of fisheries, based on relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery:

I. **frequent** incidental mortality or serious injury of marine mammals
II. **occasional** incidental mortality or serious injury of marine mammals
III. **remote likelihood of/no known** incidental mortality or serious injury of marine mammals

Annually, NMFS publishes a List of Fisheries, which classifies each U.S. commercial fisheries into one of these categories. The classification of a fishery in the List determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and Take Reduction Plan requirements. In the most recent List of Fisheries, out of the 53 classified fisheries that operate out of California, Oregon and Washington, none were Category I fisheries, nine were Category II fisheries and the remaining 44 were Category III fisheries (76 FR 73912, November 29, 2011). The nine West Coast Category II fisheries, those that include occasional incidental mortality or serious injury of marine mammals:

- California halibut, white seabass and other species set gillnet fishery
- California yellowtail, barracuda and white seabass drift gillnet fishery
- California thresher shark and swordfish drift gillnet fishery
- Washington Puget Sound Region salmon drift gillnet fishery (including all non-tribal fishing in inland waters south of U.S. – Canada border and eastward of the Bonilla-Tatoosh line)
- California spot prawn pot fishery
- California Dungeness crab pot fishery
- Oregon Dungeness crab pot fishery
- Washington coastal Dungeness crab pot fishery
- Washington/Oregon/California sablefish pot fishery


White-sided dolphins off California. Photo credit: NOAA

Of these Category II fisheries, the California thresher shark and swordfish drift gillnet fishery of the HMS FMP (discussed below) and the sablefish pot fishery of the Groundfish FMP are Council-managed fisheries. The sablefish fishery has been classified as a Category II fishery based on a 2006 event when a humpback whale (Megaptera novaeangliae), became entangled with a sablefish pot vessel’s gear. Because humpback whales are listed as endangered under the ESA, even a single encounter with or mortality from fishing gear can be notable as a percent of that species potential biological removal level.

Jannot et al. (2011a) summarized the interactions of the West Coast groundfish fishery with marine mammals, seabirds, and turtles, based on observer data for that fishery. That report found that, over the 2002-2009 period, 22 marine mammal, seabird, and sea turtle species were caught incidentally, killed, or seriously injured through interactions with groundfish fishing vessels, gear, or vessel personnel. Incidental interactions noted by Jannot et al. (2011a) included both lethal and non-lethal interactions. During that 2002-2009 period, a single leatherback turtle (Dermochelys coriacea) was taken, found entangled in sablefish pot fishing gear. Having only a single data point for sea turtle take over an eight year period makes estimating turtle interactions for the fishery challenging, but turtle interactions are assumed to be rare. For marine mammals, direct cetacean interaction is rarely observed, although five cetacean species are known to have either interacted with the fishery through potentially injurious contact with a vessel or through lethal take as bycatch by fishing gear: Risso's dolphin (Grampus griseus), Pacific white-sided dolphin (Lagenorhynchus obliquidens), Bottlenose dolphin (Tursiops truncates), Harbor porpoise (Phocoena phocoena), sperm whale (Physeter macrocephalus). Unsurprisingly, the highly abundant California sea lion is the pinniped species that most commonly interacts with the groundfish fishery, with higher bycatch rates occurring south of Cape Mendocino, CA, where they are most abundant. The Jannot et al. (2011a) analysis of groundfish fishery bycatch found that, of the seabird species incidentally taken in the groundfish fisheries, the most commonly taken species during the 2002-2008 period was black-footed albatross (Phoebastria nigripes), with northern fulmar (Fulmarus glacialis) being the most commonly taken species in 2009.

California sea lions off San Miguel Island, California. Photo credit: NOAA

The Northwest Fisheries Science Center (2011) summarized the potential impact of the CCE groundfish fisheries on species (mammals, birds, turtles, fish) listed as threatened or endangered under the ESA in its Risk Assessment of U.S. West Coast Groundfish Fisheries to Threatened and Endangered Marine Species. While there are limited data for some ESA-listed marine species, interactions between most ESA-listed marine species and the U.S. West Coast groundfish fisheries are infrequent enough to either not affect listed populations, or to not hinder the potential recovery of listed populations. However, there is low observer coverage for most fixed gear fleets, meaning that the potential for indirect or unobserved effects (Bearzi et al. 1999, DeMaster et al. 2001, DeMaster et al.

2006, Robbins et al. 2007) can cause considerable uncertainty in characterizing population level impacts from this gear type.

Of the Council-managed fisheries, only the groundfish fisheries use bottom-contacting gear, raising the potential for the fishery to have direct effects on benthic non-fish organisms. Benthic invertebrate communities are susceptible to damage from fishing gear, which can reduce habitat complexity by smoothing bedforms, damaging emergent epifauna, and removing invertebrate species that produce structures such as burrows (Auster 1998, Turner et al. 1999). Bottom trawling and other benthic fishing gear has been shown to damage corals and sponges that may be very slow to recover from such disturbance (Miller et al. 2012).

Like the sablefish pot fishery, the classification of the California thresher shark and swordfish large mesh draft gillnet fishery as a Category II fishery is based on a participating vessel's recent encounter with a humpback whale. In 2009, a fisherman in this fishery reported an accidental entanglement of a humpback whale with his gear and, although he successfully cut the whale free, that the whale escaped with gear still entangling its fins. Based on the amount of gear still on the animals, this incident was considered a serious injury. As noted above, a single humpback whale serious injury or mortality from fishing gear can be notable as a percent of that species potential biological removal level. Outside of this humpback whale interaction, this sector of the HMS fisheries has a history of increasingly restrictive management measures intended to monitor and reduce bycatch levels for marine mammals and sea turtles. Federal regulations for this fishery include Protected Resource Area closures for leatherback and loggerhead sea turtles. The leatherback closure occurs annually from August 15 through November 15 along central California when leatherbacks are in the area foraging. The loggerhead Protected Resource Area, off southern California, is in place only during El Niño periods, when loggerhead sea turtles are more abundant within the U.S. EEZ.

HMS fisheries are subject to monitoring by NMFS-trained observers. NMFS's Southwest Region manages the observer program for HMS fisheries and tracks observed target and incidental catch in both the drift gillnet and deep-set longline fisheries. Both of these fisheries cause entanglement and sometimes mortality of ESA-listed species. NMFS has evaluated these fisheries and developed incidental take statements of ESA-listed marine mammals and sea turtles for the entanglements and mortality caused by the fisheries. These incidental take statement numbers are including in the Council's HMS SAFE documents. The 2012 SAFE Report for HMS fisheries through 2011 included the incidental take statement for the drift gillnet fishery for these species: fin whale, humpback whale, sperm whale, green turtle, leatherback turtle, loggerhead turtle, and olive ridley turtle. For the more recently developed deep-set longline HMS fishery, the 2012 SAFE Report included the incidental take statement for four turtle species: green turtle, leatherback

Leatherback sea turtle. Photo credit: NOAA

turtle, olive ridley turtle, and loggerhead turtle. (PFMC 2012) The absolute number of animals anticipated and observed to be taken incidentally is low for all species, but historic data from these fisheries indicate that takes are possible. Green olive ridley, and loggerhead turtles are particularly uncommon in these fisheries, except in El Niño years, or under other conditions when temperatures off the U.S. West Coast may increase to levels tolerable to these species.

CPS vessels fish with roundhaul gear (e.g. purse seine or lampara nets), which are encircling type nets deployed around a school of fish or part of a school. Using purse seine gear and management directives like area and time closures, CPS fishery participants can usually target single-species schools and minimize bycatch of non-target species (CPS FMP). The most common incidental catch in the CPS fishery (99% of the time) is another CPS species (e.g., Pacific mackerel incidental to the Pacific sardine fishery). Within the CPS fishery, bycatch and interactions with protected species are and have been monitored through dockside sampling, logbooks, and occasional observer programs when funding has been available. Information from dockside monitoring and logbooks are reported annually in the CPS SAFE.

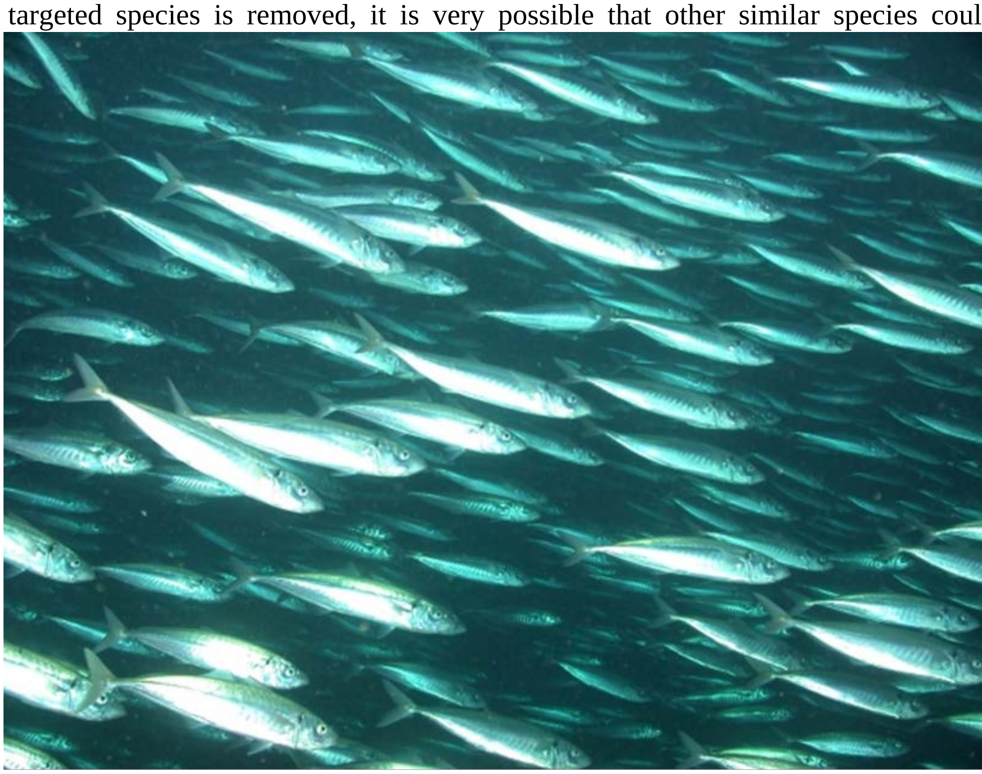
NMFS has conducted consultations related to the CPS fishery on ESA-listed sea birds, marine mammals, and fish stocks and determined that fishing activities are not likely to jeopardize protected species. NMFS's most recent section 7 consultation on the operation and prosecution of the Pacific sardine fishery determined that fishing activities conducted under the CPS FMP and its implementing regulations are not likely to jeopardize the continued existence of any endangered or threatened species under the jurisdiction of NMFS or result in the destruction or adverse modification of critical habitat of any such species, specifically including ESA-listed salmon. As a result of a consultation with the USFWS, and although interactions with sea otters and the CPS fishery are extremely rare, with only two known instances of otters jumping in and out of nets during fishing, reporting requirements and conservation measures are in place to avoid interactions with sea otters: CPS nets may not be deployed in an area where a sea otter is observed and can be encircled by the purse seine; any sea otter entanglements within CPS nets, regardless of whether the animal escapes without harm, must be reported to NMFS within 24 hours of the occurrence; and CPS vessel operators must record and report on all vessel or gear interactions with otters, (defined as otters within encircled nets or coming into contact with nets or vessels, including but not limited to entanglement) with their purse seine net(s) or vessel(s).

Southern sea otters.
Photo credit: California Coastal Commission

The salmon troll fisheries in federal waters off the U.S. West Coast are Category III fisheries under the MMPA List of Fisheries, with no known encounters with marine mammals. Within Washington State's Puget Sound waters, the salmon gillnet fishery is a Category II fishery for its interactions with Dall's porpoise, harbor porpoise, and harbor seal. The Puget Sound salmon gillnet fishery is not a Council-managed fishery, although the salmon populations targeted in that fishery are either of interest to Council process participants or also occur within federal waters for some portion of their lives. Like the CPS fisheries, the federal waters salmon troll gear fisheries use a gear type that can more readily avoid direct interactions with non-fish species. West Coast salmon fishing is concentrated northward of central California, where most species of sea turtles rarely occur, although leatherback sea turtles have been observed throughout the CCE as far north as British Columbia. There are no known interactions between the salmon troll fishery and sea turtles. While the salmon fisheries have not been evaluated for their potential direct effects on seabirds, troll gear has not been the subject of international or national concern for its effects on seabirds (e.g. NMFS 2001).

While direct effects are relatively easy to indentify and quantify, at least to the extent that reliable data exists on the amount or type of bycatch or areas with potential contact with gear, indirect effects although often as apparent, can be extremely difficult to quantify or determine the level of impact. For example, depletion of a prey stock may reduce the food supply of the predator and therefore may have a negative effect on the predator stock. However, given that most species feed on a variety of prey, it is very difficult to know how large the effect will be. Is the forage fish a vital prey item, or will the predator just shift to different prey? Additionally, interactions between species are seldom straightforward, and there can be several effects involved which can further complicate things.

For example, all species of the CPS FMP are critical members of the ecosystem, since they are the major grazers on phytoplankton, zooplankton, and in some cases fish larvae and small fish (in the case of market squid and mackerel). In turn, these species are preyed upon by a large variety of higher predators, such as fish, large marine invertebrates, marine mammals, and birds, and are generally thought of as part of a more general “forage” fish assemblage. Removal of these species, through fishing, therefore imparts a potential impact on the entire ecosystem, with krill in particular being noted as such an important resource that all harvest of them is prohibited. Of the remaining targeted CPS, if enough of them were removed from the system, it is possible that there could be two effects: 1) an increase in the abundance of their prey, as the prey are released from predation pressure, and 2) a decrease in the survival and/or reproductive success of their predators. However, what is unclear is whether enough of any of these particular species could be removed in such numbers as to have these effects, particularly, since once one targeted species is removed, it is very possible that other similar species could fill their role in the ecosystem. Removal of sardines or anchovies from the system, for example, could potentially result in an increase in other small pelagic fishes (such as herring or smelts) that preyed on a similar prey base, such that large swings in plankton were unlikely.


Schooling sardines. Photo credit: NOAA

The extent to which different species and niches are interchangeable as predators is likely to be limited, at least to some extent, due to subtle differences in prey size spectrum and life histories that likely relate to the low frequency variations that characterize these populations (e.g., Arthur 1976, Van der Lingen et al. 2006, Rykaczewski and Checkley 2008). The extent to which these species may be interchangeable as prey is less clear. Although there are some indications that some predators may tend to forage preferably on one species rather than another (e.g., it has been suggested that albacore forage more exclusively on anchovies rather than sardines according to Glaser 2010), most studies have shown most piscivorous predators to have more opportunistic diets, and many documented predators of sardines showed no signs of population duress or decline during periods of low sardine abundance in the CCE from the 1950s through the 1980s when their diets reflected an absence of this prey resource (Hannesson et al. 2009 and references therein). Although the CPS fishery targets, including sardine, anchovy, and mackerel, make up a significant fraction of the forage base, there are a wide range of other forage species, including the juvenile stages of many larger marine fish species, that provide alternative forage opportunities for predators. These type of indirect impacts of fishing have proven more difficult to quantify in anything but broad terms (Cury et al. 2011, Smith et al. 2011), however attempts to quantify the effects typically suggest relatively modest impacts when exploitation rates are below single-species based MSY levels. These results, combined with the observation that there have historically been no obvious declines of predators linked to historical declines or fluctuations in CPS populations, suggests that substantial impacts on predators in the CCE are unlikely under the existing management regime. Similarly, Kaplan et al. (2012) found that indirect trophic effects of groundfish fisheries on marine mammals in the CCE appear to be negligible.

Non-targeted species can also be inadvertently affected by activities associated with vessel operation (e.g., contaminant and noise pollution, introduction of invasive species, marine debris and habitat modifications caused by vessel anchorings). Under normal operation of fishing vessels, discharges of lubricating petroleum products are inevitable (Lin et al. 2007, Rosenberg 2009). Petroleum products consist of thousands of chemical compounds that can be particularly damaging to marine biota because of their extreme toxicity, rapid uptake, and persistence in the environment (Johnson et al. 2008). Normal vessel operation also increases underwater noise. When background noise levels increase, many marine mammals amplify or modify their vocalizations which may increase energetic costs or alter activity budgets when communication is disrupted among individuals (Holt et al. 2009, Dunlop et al. 2010). Fisheries may also contribute to the amount of marine debris encountered by non-target species in the form of lost fishing gear and trash disposed overboard (Keller et al. 2010, Watters et al. 2010). Marine debris, especially plastics, produces fragments that can be ingested by many marine organisms, resulting in mortality (Derraik 2002, Thompson et al. 2004, Browne et al. 2008). Marine debris in the form of lost fishing gear continues to “fish” by trapping fish, invertebrates, seabirds and marine mammals (Kaiser et al. 1996, Good et al. 2010) and may affect populations behaviorally by concentrating individuals both a t the water’s surface (FAD – floating aggregation devices; Aliani and Molcard 2003)) and on the bottom (artificial reefs; Stolk et al. 2007).

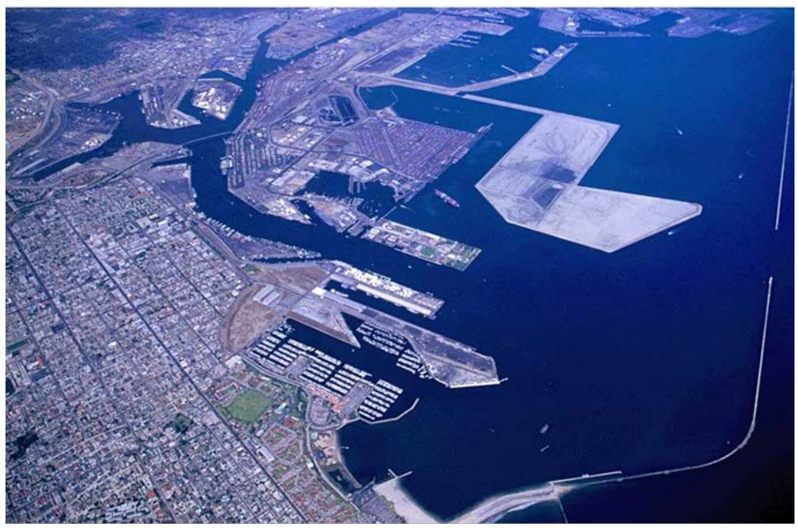
Retrieved derelict Dungenes crab gear. Photo credit: NOAA

4.2.2 Direct and Indirect Effects of Non-Fishing Activities on Non-Fish Abundance

The California Current IEA team has developed indicators for 23 anthropogenic pressures on the CCE. For many of the non-fisheries related pressures, they found that pressures were relatively constant over the short-term and most were within historic long-term averages (Agenda Item K.3.a, Supplemental Attachment 1, November 2012 PFMC.) However, inorganic and organic pollution and invasive species showed decreasing trends over the short-term, but were still within historic levels. Conversely, dredging, shellfish aquaculture, coastal engineering, commercial shipping activity and marine debris in the northern CCE have been increasing over the short-term, but were still within historic levels. Seafood demand, sediment and freshwater input have been constant over the short-term, but are above historic levels, while offshore oil and gas activity and benthic structure construction are at historically low levels. Of particular note is that the indicator for disease was increasing over the short-term and was at historically high levels during the last five years of this dataset.

Importantly, none of these pressures act upon the ecosystem in a vacuum (i.e. many pressures are acting simultaneously on populations), and we have little understanding about whether the effects of multiple pressures will be additive, synergistic or antagonistic on populations of interest. Moreover, these anthropogenic pressures will interact with the underlying effects of climatic and oceanographic pressures.

The extent to which these diverse threats influence non-target species will depend on exposure of species to these threats and their susceptibility to threats once exposed. To date, there are no comprehensive risk analyses of these non-fisheries threats to species of interest to the Council.



Port of Los Angeles, CA. Photo credit: Los Angeles County.

4.2.3 Environmental and Climate Drivers of Non-Target Species

As discussed section 4.1.3, a number of climatic and environmental factors can influence the population size and dynamics of marine species not targeted by fisheries. The same processes that influence targeted fish populations will also affect non-target species. Thus, large-scale interannual variability (e.g., ENSO) and interdecadal (e.g., PDO) variability can lead to dramatic changes in both lower and higher trophic level productivity and dynamics. As discussed previously, in the CCE, the impacts on productivity are related to the physical circulation patterns that often favor some source waters over others, which in turn contribute to large-scale variability in primary and secondary production.

Small nonfish organisms have very rapid growth, and high turnover, and are thus much more directly responsive to changes in environmental variability. Large marine organisms, such as birds and mammals, are relatively slow growing, and live for longer periods, and thus may have less of a direct response to climate variability, although they still somewhat integrate the impacts of climate over their lifetimes, and may also have critical stages (e.g. egg production by birds) that can respond at shorter time scales to environmental drivers. In both cases, however, environmental variability may be expected to have some influences over these ecosystem components which might then have impacts upon managed fisheries species.

Plankton are well known to be correlated in various ways with climate variability. For example, oceanic levels of chlorophyll-a (see Figure 4.2.1,) which roughly tracks phytoplankton biomass, is correlated with trends in the North Pacific Gyre Oscillation (a.k.a. NPGO index (Di Lorenzo et al., 2008)). Thus the increased recent variability in this index may be indicating increased variability in phytoplankton biomass, which could then affect fisheries species through bottom-up impacts. Additional similar impacts through bottom-up processes driven by climate variability are further described in sections 4.5 and 3.2. Beyond correlations of abundance (and/or productivity) with these major climate signals, a potentially more critical aspect of the response to climate variability in plankton would be major community shifts. An example of how a plankton community may change as a function of environmental drivers can be seen in the coastal Oregon copepod community index (Hoof and Peterson 2006, Peterson et al. 2012). Roughly tracking the PDO, there are observed switches between a zooplankton community dominated by northern vs southern copepod species. The key difference being that the northern group has more lipids in their bodies, and is thus a richer food source, likely promoting higher productivity in fish, versus the southern community, which has less lipid, and thus likely favors smaller fish or invertebrates. Currently, the system off of Oregon appears to oscillate between these two communities; however, it is possible that under long-term change, there might be a more permanent switch to one community over the other. It is also not clear if other portions of the community, such as phytoplankton, may undergo similar changes in species composition. Such changes in species and community composition driven by environmental factors might not lead to large changes in measured plankton abundance and/or biomass and productivity, but could still effect large changes in the trophic web if such changes lead to drastic changes in prey quality for higher tophic level organisms.

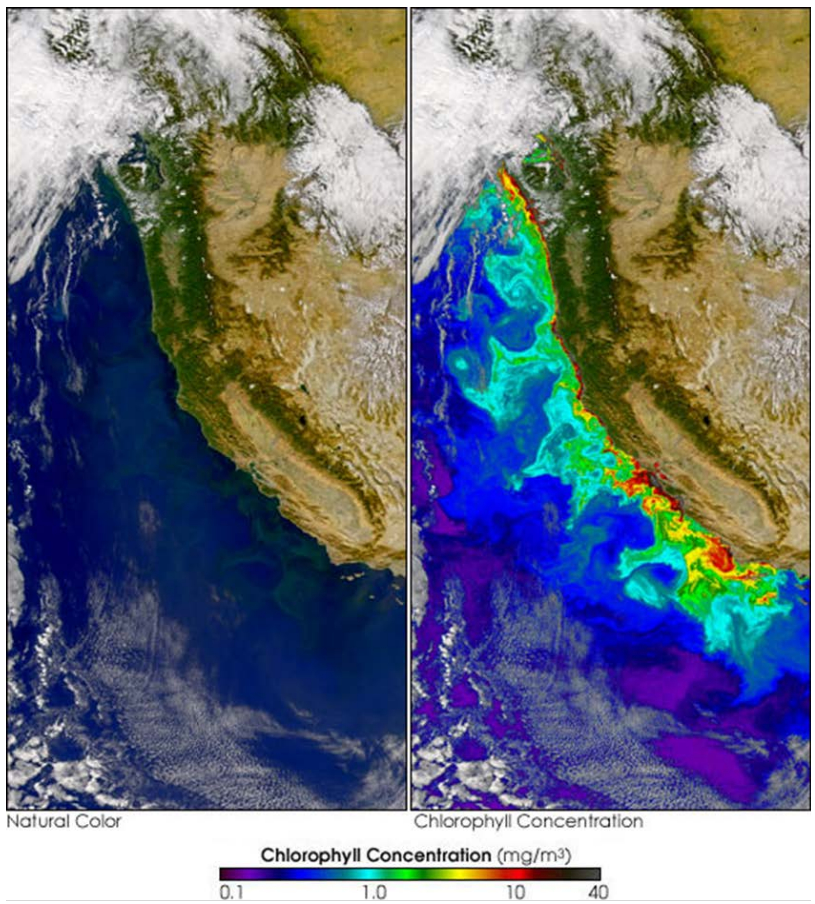
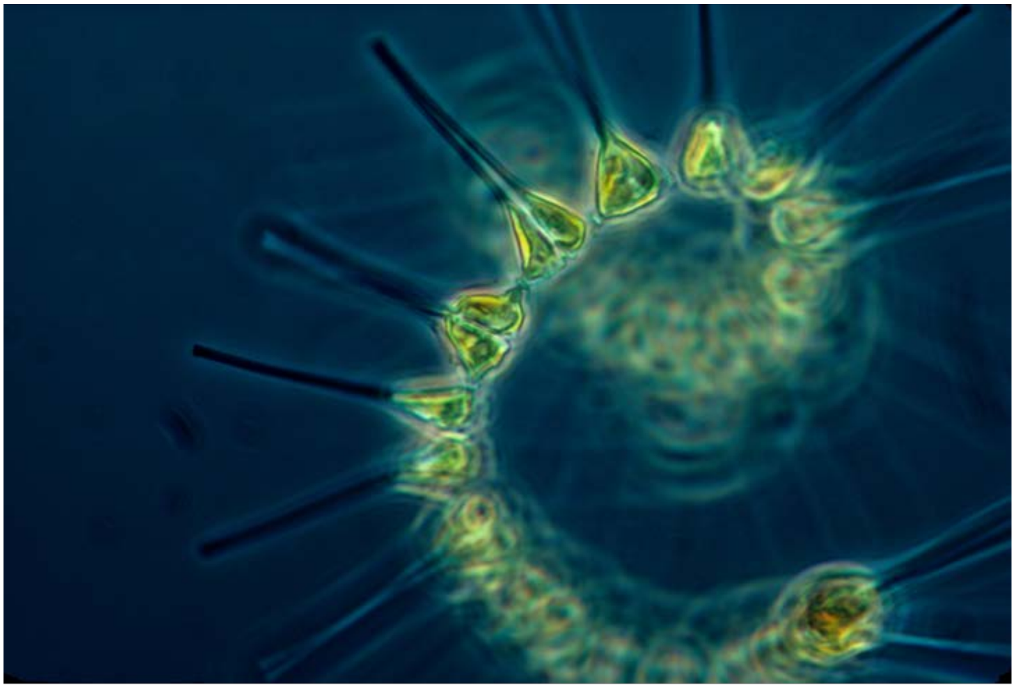


Figure 4.2.1: September 21, 2004 NASA image of the West Coast of North America during period of high phytoplankton bloom. In left-hand image, dark green waters indicate phytoplankton bloom. Right-hand image is colorized to indicate strongest concentrations of chlorophyll (red) to weakest (purple). (http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=14015)

The impacts of climate variability on large non-fish organisms, such as birds and marine mammals within the CCE are harder to estimate, and are thus harder to assess than impacts on managed fisheries species. Long-lived marine mammals and birds effectively integrate the effects of climate variability over their lifespan, however, some species have particularly sensitive periods. For instance, marine birds have been shown to have connections between their reproduction in a particular year or season, and climate conditions or prey supply (Sydeman et al., 2006, Byrd et al., 2008). Similarly, whales and other marine mammals may not be as sensitive in their total growth over their lifetime to interannual variability, but their reproductive output during any particular season may be sensitive to more immediate climatic controls. Since both birds and marine mammals are important predators on both fisheries managed species, and the prey of fisheries managed species (particularly seabirds and whales feeding on krill), changes in the overall long-term abundance of these groups as a result in changes in demographic output through climate-related controls could have significant impacts on managed fisheries species. The extent of such impacts are currently unknown, and complicated to forecast.



Phytoplankton under magnification. Photo credit: NOAA.

4.3 Direct and Indirect Effects of Fishing on Biophysical Habitat

Aside from the direct consequences of mortality to the target populations themselves, the effects of fishing gear on marine habitat, particularly benthic marine habitat, is thought to be among the most significant impacts of fishing on the marine environment. Although virtually all fishing gear can impact the structure and biota of a given bottom habitat, the significance of the impact can be difficult to fully predict and quantify. There are natural background levels of disturbance to all types of benthic communities as a consequence of large scale activities such as storms, wave action, tidal currents, and geological events, as well as smaller scale actions such as bioturbation or predator feeding activities (Hall 1994, Kaiser et al. 2002). Consequently, shallow habitats are typically subject to greater natural disturbance than deeper habitats, such that the biota in such habitats may be more resilient to certain levels of disturbance than those in deeper or less disturbed habitats. It is generally acknowledged that for fishing activities to have ecologically significant impacts, the disturbance must exceed the background levels and frequency of the natural disturbance regime (Kaiser et al. 2002). Where fishing does exceed background levels of disturbance, the impacts of fishing will also vary as a consequence of the magnitude and spatial extent of the disturbance, the complexity of the habitat substrate, the configuration and towing speed of the gear, and other factors (Collie 2001, NRC 2002). For example, depending upon the habitat type, intensive but spatially localized disturbance may have relatively lower ecological impacts than more infrequent, but wide-spread, fishing disturbance (Kaiser et al. 2002). Another important consideration is the recovery rate for the return of the ecosystem to a state that existed before a disturbance. In some instances, altered habitat may not return to its pre-disturbance state.

Under the MSA, each FMP must contain an assessment of the potential adverse effects of fishing on EFH for management unit species. CPS fisheries have has little effect on physical substrates, because the contact between pelagic round haul gears and the bottom is rare and the opportunity for damage to benthos or the substrate is through lost gear (PFMC 1998). Similarly, HMS fisheries use pelagic fishing gears and fishing effects on biophysical habitat are presumed to be negligible or unknown, and not described (PFMC 2007). At the time EFH was adopted in the Salmon FMP (PFMC 1999), there were no studies that indicated direct gear effects on salmon EFH from PFMC-managed fisheries.

As described in the Groundfish FMP, Appendix 2C (2006), limited empirical data from the West Coast coupled with information from literature reviews showed that bottom trawl gear has effects on biophysical habitat. Information on the habitat effects of gears other than trawls was very limited, and empirical data were generally non-existent for West Coast habitats and fisheries. Based on this limited information, indices of sensitivity and recovery for the effects of fishing gears on bottom habitats were developed. The general results of the sensitivity analyses in the Groundfish FMP showed a nearly consistent ranking by substrate/macrohabitat type almost regardless of gear type from the most adversely impacted to least: biogenic > hard bottom > soft sediment. It also suggested the relative rankings of gear from highest to lowest impact: dredges > bottom trawls > pots & traps (no empirical data available for nets and hook & line gears). Although very little research exists, the various types of nets are generally considered to have much less impact on the seabed than dredges and trawls, and hook-and-line methods have the least impact (PFMC 2006). The Council's Groundfish EFH designations are currently under review and the EFH Review Committee is developing new sensitivity analysis methods for this review (EFHRC 2012). General impacts of the gear types with the potentially greatest effects on habitat are described below.

Red gorgonian coral, basket star, shark egg cases. Photo credit: NOAA.

4.3.1 Commercial Fisheries with Mobile Fishing Gears

4.3.1.1 Groundfish Trawl Fishery

The Groundfish FMP is the only Council FMP managing fisheries that use gear that regularly contacts the ocean floor. As a result, the Council, its advisory bodies, and associated agencies have halibut dto devote considerable energy to identifying groundfish EFH even under data poor conditions, and assessing and mitigating for the effects of bottom contacting gear on EFH. Impacts of bottom trawling to physical and biogenic habitats include removal of vegetation, corals, and sponges that may provide structure for prey species; disturbance of sediments; and possible alteration of physical formations such as boulders and rocky reef formations (National Research Council, 2002). Mid-water trawl gear is used to harvest Pacific whiting, shrimp, and other species. Mid-water trawl gear is not intended to as bottom-contacting gear, and effects are generally limited to the effects of (1) removal of prey species, (2) direct removal of adult and juvenile groundfish, (3) occasional, usually unintentional, contact with the bottom, and (4) effects resulting from loss of trawl gear, potentially resulting in impacts to bottom habitats and ghost fishing.

Trawl effort for groundfish, measured in number of tows, dropped 60% between 1991 and 2001. Between the 1991–1993 and 1998–1999 periods the number of annual tows for groundfish declined from 28,489 to 11,487. Based on distance trawled estimated from logbook data, limited-entry groundfish trawl effort continued to decline through 2004. Trawl effort (estimated distance trawled) over most habitat types is low and decreasing, compared to historical levels (Figure 4.3.1).

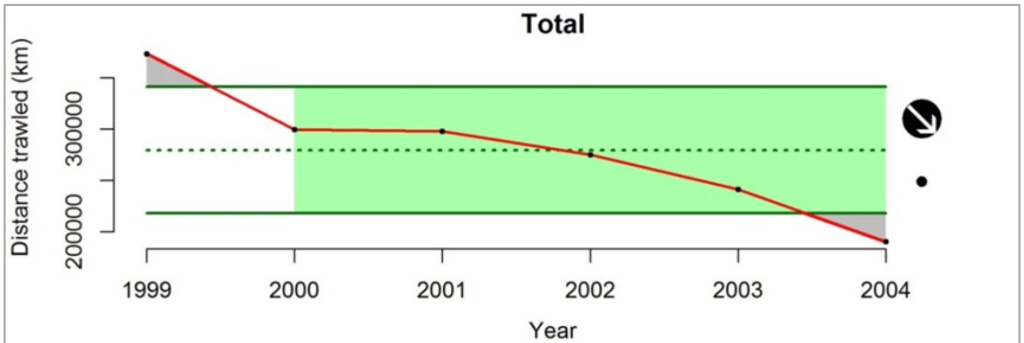


Figure 4.3.1. The time series of total distance trawled (km) along the coast of Washington, Oregon and California made by limited entry groundfish trawl fishery, with two relative statistics on the right hand side: the arrow at the top right indicates whether the trend of the last five-years is positive (arrow up), negative (arrow down) or unchanged (arrow sideways); the sign at the bottom right shows whether the mean of the last five years is greater than (a plus sign), less than (a negative sign) or within 1SD of the mean (a large dot) of the entire time series. Figure: CCIEA 2012. Data: Bellman and Heppell, 2007

4.3.1.2 Pink Shrimp Trawl Fishery

The trawl fishery for pink shrimp off the coasts of Washington, Oregon, and Northern California operates in much the same way and has similar types of impacts to biophysical habitat as the trawl fishery for groundfish. Pink shrimp trawling, however, is concentrated in the muddy soft bottom areas pink shrimp inhabitat. Soft mud habitat tends to recover more swiftly from the effects of trawling than rocky, hard bottom habitat. Shrimp trawl effort mainly occurs at 200m depth or shallower. In Oregon, 53 vessels participated in the fishery during 2010 and totaled 20,600 hours on the bottom, remaining in the low range seen in the fishery since 2003.

4.3.1.3 Geoduck Fishery

The commercial fishery for geoducks in Washington uses water jets to dislodge sediment from around the geoduck, which allows it to be removed from the substrate. A Habitat Conservation Plan (HCP) addresses fishing effects on habitat for commercial geoduck harvesting in Puget Sound, the Strait of Juan de Fuca and San Juan Archipelago (Washington Department of Natural Resources, 2008). Commercial harvest occurs in specific leased areas called tracts, at subtidal water depths between 18 and 70 feet. Commercial geoduck tracts commonly encompass soft sand or sand and silt substrate. The topography of the tracts varies, but most are relatively flat or are gently sloping.

Harvest activities, particularly the use of water jets, and to a lesser degree vessel anchoring, diver movement and the dragging of hoses and collection bags, temporarily disturb bottom sediments and unintentionally remove and damage organisms on and in the substrate in the vicinity of the harvest. Harvesting geoducks temporarily leaves behind a series of holes where the clams are extracted, sediments displaced, and fine particles suspended. On average, harvest holes are about 15 inches wide, 3 inches deep and the depth to which disturbance was measured is 18 inches. The time for them to refill can range from days to months. Disturbance is limited to the area that is harvested each year (1732 – 2380 acres). Soft-bodied animals may be inadvertently damaged and displaced from within the substrate by the water jets and those brought to the surface are exposed to predation by fish, crab, and other predators and scavengers. Tubeworms may be broken apart, while very small animals may be suspended and carried away by currents.

The HCP reports research results that indicate transport and deposition of sediment put into suspension by harvest activities has minimal impacts on the physical environment within the tract and adjacent areas. The amount of sediment re-suspended by harvest activities is negligible. Substrate disturbance, subsequent sediment suspension and eventual deposition, and impacts to fauna on the tracts cause temporary, local effects, confined to the track and immediate vicinity.

4.3.2 Commercial Fisheries with Fixed Fishing Gears

In general, the effects of fishing gear on habitat for non-Council fisheries, especially fisheries for shellfish, is less well described. Saez, et al (in press) characterized eleven fixed gear fisheries on the West Coast, including longline, trap/pot and set gillnet anchored to the bottom. Fishing areas within operational depth ranges are described for each fishery (Table 4.1), and gives a general indication of habitats potentially affected. Saez et al (in press) graphically reported quarterly commercial landings aggregated by PacFIN port complex as a proxy for fishery effort for each fishery. Although many fixed gear fisheries operate in shallow depths close to the coast, fishing with sablefish pots and longlines occurs as deep as 450 fathoms and up to 80 kilometers offshore.

Table 4.1. Fishery operational depths (in fm) summarized by state (Table 2 from Saez, et al, in press).

Fishery	CA depth (fm)	OR depth (fm)	WA depth (fm)
Coonstripe shrimp	20-30[1]	20-30[2]	X
California nearshore live fish	0-20[3]	X	X
California halibut/white seabass set gillnet	15-50[4]	X	X
Dungeness crab	10-40[1]	5-50[2]	5-60[5]
Hagfish	50-125[1]	80-120[2]	50-125[5]
Pacific halibut longline	X	30-150[6]	30-150[6]
Rock crab	10-35[1]	X	X
Sablefish longline	100-450[7]	100-450[7]	100-450[7]
Sablefish traps	100-375[7]	100-375[7]	100-375[7]
Spiny lobster	0-40[1]	X	X
Spot prawn	100-150[1]	60-175[2]	70-120[5]

Sources: 1. CDFW; 2. ODFW; 3. CDFW fishery regulations, Title 14 CCR § 1.90 (d);4. NMFS (2008); 5. WDFW; 6. IPHC; 7. NMFS West Coast Groundfish Observer Program

4.3.2.1 Dungeness Crab Fishery

The commercial Dungeness crab fishery off the West Coast is one of the largest of the fixed gear fisheries, in terms of the amount of fishing gear deployed. With the recent implementation of pot limits in all three states, approximately 400,000 pots are allowed to be fished annually, primarily on sandy substrates within ten miles of shore, from central California north to the Canadian border. Anecdotal information suggests that about 10% of pots may be lost each year as an unavoidable consequence of fishing largely during harsh winter conditions.

Limited information is available on the fishery's effects on habitat. Each pot is fished singly and may be deployed to the bottom, retrieved to unload catch, and re-deployed nearly on a daily basis through the peak months of the season. Effects on habitat may include crushing, burying, or exposing marine flora and fauna under the footprint of the pot or vicinity if its buoy line scrapes along the bottom with currents and tides. In the sandy areas typically fished, some local sediment disturbance can occur. Crab pots and lines may also add temporary habitat structure while fished on the bottom. Over the longer term, perhaps several years, a derelict pot can add structure to a variety of habitats, depending on where currents, tides, vessel traffic or other factors may deposit it on the seafloor. Observations of recovered derelict gear shows a variety of algae and sessile marine invertebrates attach themselves to derelict pots and lines. Underwater observations also show that crabs and other marine life may take refuge in the derelict pots. All three states require that pots have escape mechanisms ("rotten cotton"), so that derelict pots do not continue to ghost fish.

Oregon fisherman collecting derelict crab pots through industry/government gear recovery program. Photo credit:ODFW

4.3.2.1 Sablefish and Halibut Longline Fisheries

As indicated in Table 4.1 above, the sablefish fishery operates in deeper waters than most West Coast fixed gear fisheries and farther from shore. The fishery for Pacific halibut is generally shallower than the sablefish fishery, but the fisheries do overlap in the 100-150m range. Empirical data are scant on the effects of longline gear on biophysical habitat on the West Coast. Movements of lines with currents along the bottom and as gear is being set and hauled may have the greatest impacts, perhaps increasing turbidity, severing or crushing sessile, structure-forming invertebrates, and altering sediments that may be in the path of lines.

4.3.3 Recreational Fisheries

Little is known about the effects of recreational gears on biophysical habitat. The primary recreational fishing gear on the West Coast is hook-and-line. As with other recreational gears, its effects on biophysical habitat are not well-studied on the west coast, but are likely small and quite localized. Individual fishing lines may sever or tangle small amounts of kelp fronds if gear is fished in areas with kelp. Lost gear, such as sinkers, leaders, etc. also contributes to marine debris on the seafloor, shorelines, and structure-forming biota.

The recreational Dungeness crab fishery occurs in bays and nearshore coastal areas from central California northward. Fishing effort information is limited. Recreational pots are smaller and lighter than commercial pots although they may have similar types of impacts on benthic habitats.

Effort in the razor clam fishery in large, sandy stretches of beaches on the Oregon and Washington coasts can be intense during low tides. Digging with shovels or clam guns occurs in the surf zone and vicinity. Sediments and infauna are disturbed in this high energy environment, although holes are often filled in within minutes or by the next tidal cycle.

Sport fishing off Southern California. Photo credit: CDFW.

Harvesting of mussels, abalone, or other shellfish with some hand tools from rocks and rocky areas may have very minor localized, but longer-lasting effects on habitat.

4.4 Changes in Fishing Community Involvement in Fisheries and Dependence Upon Fisheries Resources

Like any community, fishing communities are affected by a variety of internal and external pressures, many of which are beyond the scope or control of Council fishery management programs. Fishing communities are necessarily located in coastal areas, which serve a wide variety of marine and other industries – from regional shipping hubs, to destination tourism locations, to submarine cable landing stations. Council decisions affect how much of which species of fish are taken within larger-scale geographic areas, but do not control whether and how coastal municipalities maintain harbor facilities, coastal community investments in attracting industries other than fishing, transportation infrastructure between fish landing facilities and major fish markets, or myriad other factors that affect income generated and quality of life within fishing communities.

Council decisions directly affect the amount of managed species available in any one year, but are less likely to affect the prices West Coast fishing operations receive for their catch. Ex-vessel revenues for West Coast species are often linked to the species' prices in the worldwide market and West Coast fisheries for most species tend to be exvessel price-taking, rather than price-setting. Ex-vessel revenue is the proximate effect of selling fish (or, for recreational fisheries, the expenditures incurred can serve as a minimum measure of willingness to pay for the recreational fishing experience.) The movement of fish or the fishing experience as commodities within the economy, and resulting expenditures from revenues may be considered largely cumulative effects of an action or of the Council's activities as a whole. Other socioeconomic effects of past, present, and reasonably foreseeable future actions, such as the pleasure derived from private recreational fishing, diving, kayaking, or beachcombing, are less quantifiable but may also be considered in Council decision-making.

Below, this section considers the direct and indirect effects of fishery resource availability on fishing communities, what may be known about the cost of participating in West Coast fisheries, and environmental and climate drivers for fishing communities.

4.4.1 Direct and Indirect Effects of Fishery Resource Availability on Fishing Communities

Section 3.4 provides an overview of West Coast fisheries, with figures showing the ports in which landings of managed species groups occur, and discusses factors affecting their timing. Here, the ports selected for each West Coast state were based on their hierarchical contribution to the state's total annual average landings over the 2000-2011 period. Figures 4.3 through 4.8 compare total landings in California, Oregon and Washington with the corresponding overall revenues per pound (the weighted average exvessel price of all landings) to characterize fishery activity in each port in terms of the value to volume ratio. For example the southern California ports of San Pedro, and central Californaia ports of Moss Landing, Port Hueneme and Ventura, where landings are dominated by coastal pelagic species, tend to be relatively low value per unit landed but high volume in nature. Conversely, fishery activity in Monterey and San Francisco, as well as the northern ports of Eureka and Crescent City, where relatively large amounts of crab, groundfish and salmon are landed, tends to be more high value per unit landed but low volume. The Oregon ports of Astoria, Newport and Coos Bay, where groundfish make up the bulk of the landings, can be protrayed as low value but high volume, whereas Brookings, Garibaldi, Columbia River and Port Orford, having relatively higher landings of crab, shrimp and salmon, are more high value but low volume. In Washington, Westport appears to be low value per unit landed but high volume while the ports of Chinook, Bellingham Bay, Seattle, Neah Bay, Blaine, Shelton, Grayland and LaConner, with relatively greater landings of salmon and crab, would be considered high value but low volume in type.

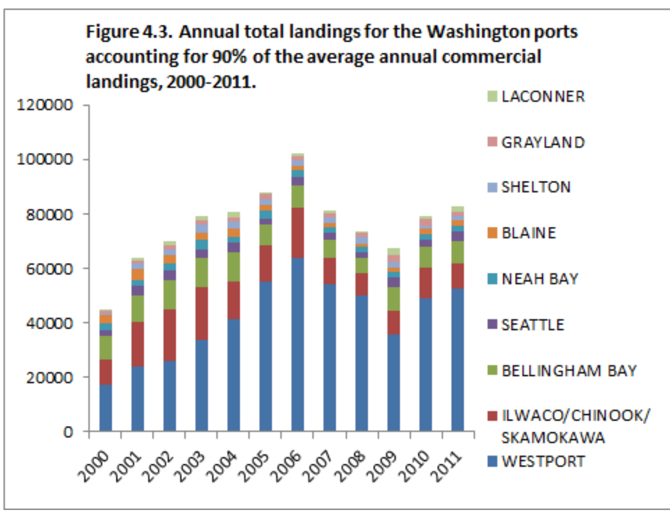


Figure 4.3. Annual total landings for the Washington ports accounting for 90% of the average annual commercial landings, 2000-2011.

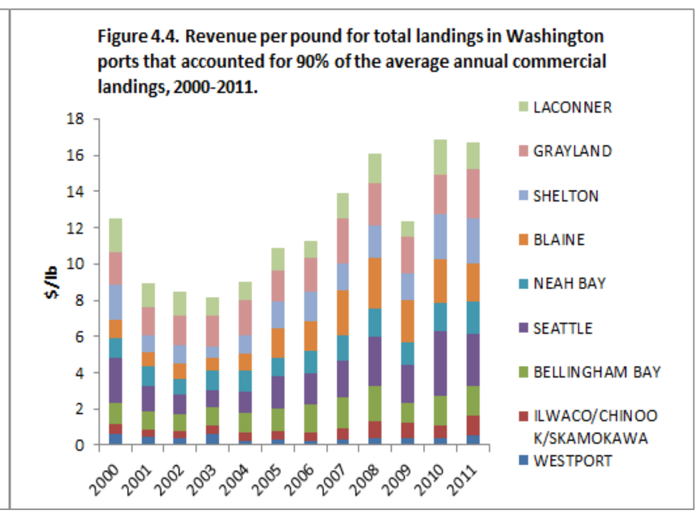


Figure 4.4. Revenue per pound for total landings in Washington ports that accounted for 90% of the average annual commercial landings, 2000-2011.

Figure 4.5. Annual total landings for the Oregon ports accounting for 99% of the average annual commercial landings, 2000-2011.

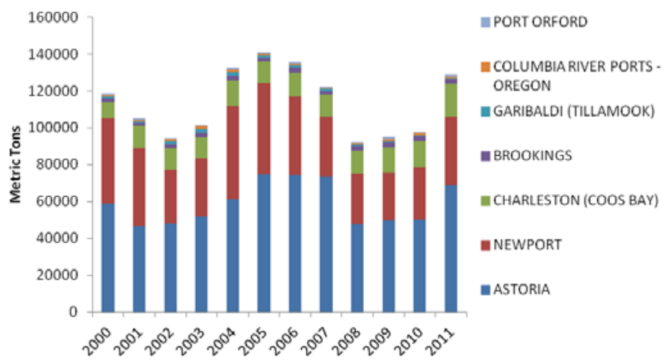


Figure 4.6. Revenue per pound for total landings in Oregon ports that accounted for 99% of the average annual commercial landings, 2000-2011.

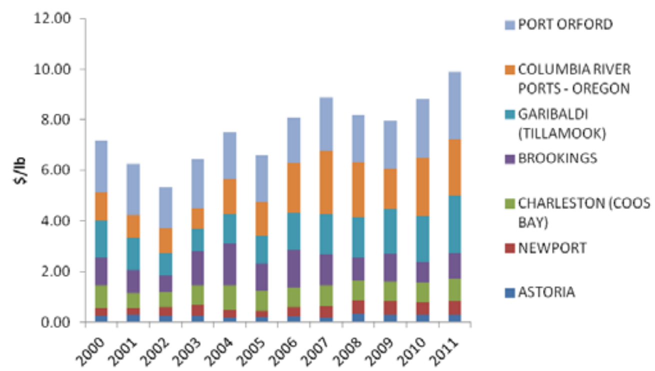


Figure 4.7. Annual total landings for the California ports accounting for 90% of the average annual commercial landings, 2000-2011.

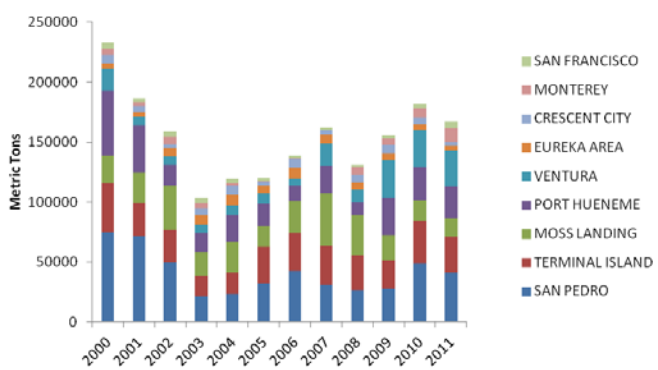
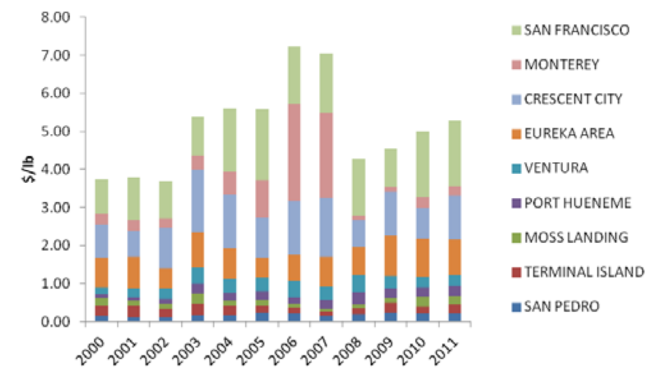


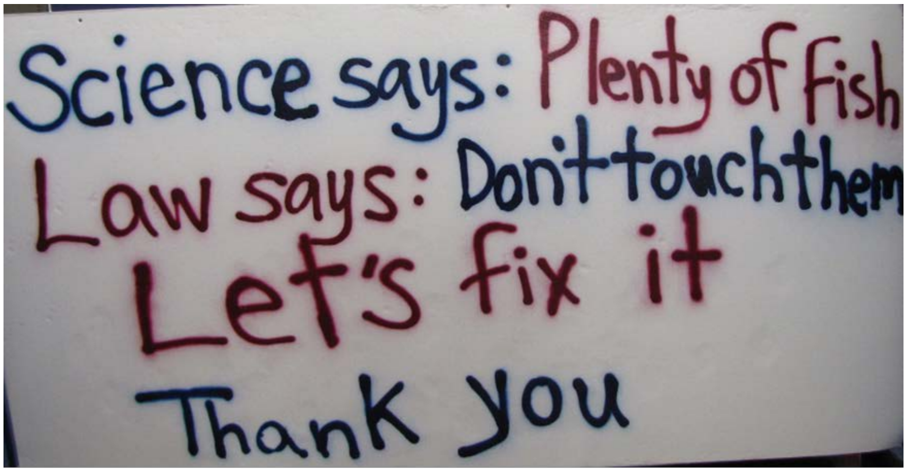
Figure 4.8. Revenue per pound for total landings in California ports that accounted for 90% of the average annual commercial landings, 2000-2011.



While Council decisions primarily affect landings volumes, fishery management programs can also affect the prices commercial vessels receive for their landings, the prices fish processors receive for their processed product, and the volume and prices recreational charterboat operations receive for the charter fishing experiences they offer. The goals and objectives of the Council's groundfish trawl rationalization program, for example, include creating "individual economic stability," and increasing "operational flexibility" (PFMC and NMFS 2010). These broadly worded goals recognize that, when fishermen can plan ahead, and their management programs provide flexibility in when and where they land their fish, they can take better advantage of shifting seafood prices.

For some fisheries, like those for albacore, fishing must occur when the species in question is migrating through a particular region. For other species, like Dungeness crab, fishing must be timed for both biological (avoiding breeding season) and market (avoiding soft-shell season) reasons. Recreational fisheries, particularly those in the northern sections of the coast, are often constrained by seasonal weather. Washington's charterboat operators may be willing to take customers in January, but their customers are less willing to join a January charter than a July charter. The Council can improve stability for fishery participants and fishing communities by developing management programs that provide some level of predictability in available harvest levels and season timing and duration.

The WCGA's 2008 Action Plan identifies many of the indirect effects that losses of fishing opportunities have on fishing communities: aging or declining port facilities and infrastructure, losses of traditional waterfront businesses, increasing housing costs associated with coastal community economic shifts toward attracting tourism revenue and second home buyers, and lack of inland-to-waterfront transportation infrastructure (WCGA 2008). The WCGA's Sustainable Coastal Community Action Team elaborated further on these indirect effects of losses of fishing opportunity. That team's 2011 work plan identified multiple factors that threaten fisheries sustainability and the ongoing existence of coastal-dependent businesses and working waterfronts, including: a lack of a stable regulatory regime, which impedes business planning, lack of understanding from the general public about the land-sea connection, particularly about how degradations of terrestrial habitat may also affect marine species populations, reduced access to ports as a result of lack of funding for dredging and sediment management, insufficiently maintained port infrastructure, and a lack of opportunities to certify and sell locally-sourced seafoods (WCGA 2011).



Polite graffiti found at Monterey Bay (CA) area community fishing festival.

The predominant fishery conservation and management issues facing the Council now and in the future deal with integrating physical, ecological and economic systems into an analytical framework directed toward maximizing the benefits that the CCE is capable of providing society. Society's interest in ecosystem-based fisheries management reflects the total economic value it derives from fishery resources given the full range of goods and services they are capable of providing. Critical in this regard will be appropriate extraction levels for commercially and recreationally targeted species that take into account their interaction with other species having commercial, recreational or charismatic value.

The Council's basic harvest control rule for CPS exemplifies the ecosystem-based fisheries management approach when setting annual harvest quotas by accounting for the importance of CPS as forage for commercially important, recreationally important and protected species predators (PFMC 1998). The challenge at this juncture is to incorporate the economic value of harvested and protected predators into the harvest control rule to achieve optimal use of CPS resources from society's standpoint. For example, if fishery management explicitly considers the economic value of species being harvested or protected, then the ecosystem/economic modeling approach could indicate under what ecological-economic conditions a CPS harvest quota might be reduced to increase the harvest or populations of more valuable predators (Hannesson et al. 2009, Hannesson and Herrick 2010). The ecosystem/economic modeling approach may indicate that it is advisable to reduce harvest levels on low-value feed species (e.g. anchovy and sardine) to provide the potential for increases in the harvest volume and value of species that feed on these species. An ecosystem/economic modeling approach would allow us to include significant ecological and technological interactions among species in the calculation of their optimum yields and the extent to which these interactions affect their relative economic value.
There are numerous types of values ascribed to the organisms populating an ecosystem, and there will be tradeoffs between different ecosystem services or functions in order to achieve optimal use of the marine ecosystem. Recognition of these values and of ecosystem services has given rise to the current move in fisheries governance toward ecosystem-based management. Achievement of ecosystem-based fisheries management will be a lengthy, complicated process, one that engages diverse scientific methodologies in an interdisciplinary exercise to identify and describe all aspects of the linkages between complex natural and socioeconomic systems. The key here is to broaden the focus of traditional fisheries conservation and

management science from a relationship between a target species and a commercial or recreational fishery, to a more comprehensive outlook that embraces all species in terms of their trophic, ecological, habitat and fishery interactions, and most importantly their relationship to all of society. Only when the consequences of human actions and values are highlighted throughout the ecosystem can the entire range of tradeoffs be made apparent and considered in conservation and management decision-making.

4.4.2 Costs of Participating in Fisheries

The economic effects of fisheries management on fishing communities and on the nation as a whole are related to the costs of managing and participating in the fisheries and to the benefits derived not just by fishermen, but also by the larger fishing community, and by U.S. citizens. A thorough cost-benefit analysis requires detailed variable and fixed cost data. Variable costs typically include: labor (crew and hired captain expenses), fuel, trip provisions (food, groceries, etc), expendable gear and equipment, maintenance and repairs, and any other costs that vary with the amount of fishing effort expended. Fixed costs are incurred whether the vessel fishes or not, and typically include: vessel depreciation, interest payments, insurance, legal fees, office expenses, business licenses and fees, fishing permits, professional services, mooring/slip fees, drydock, routine vessel and gear maintenance and related purchases, supplies, salaries, and other. We routinely collect fisheries revenue and landings data, but cost data is often not collected at all, or only collected for specific research projects.

Food bank project poster for salmon collected from ODFW hatchery, canned by Tillamook Bay Boathouse, labeled by Neah-Kah-Nie High School students, and distributed to Tillamook-area food banks. Photo credit: Steve Albrechtsen, Neah-Kah-Nie High School

4.4.3 Environmental and Climate Drivers for Fishing Communities

Environmental and climate drivers that may affect fish abundance are discussed in Sections 4.1.3 and 4.5. Drivers that affect fish abundance also affect harvest levels available to human communities. Beyond the effects of fish abundance on fishing communities (Section 4.4.1) are the topographic and hydrological effects of climate change. Fishing communities are usually geographically located on or near the coast, and coastal communities face a variety of known and unknown challenges that may be associated with global climate change. Documenting all of the potential effects of near-term climate variability and long-term climate change on West Coast fishing communities is beyond the scope of this FEP. However, some major potential concerns for the coastal communities of Washington, Oregon, and California are discussed in this section.

4.4.3.1 Near-term climate variability related to ENSO and PDO

California wildfire. Photo credit: U.S. BLM

As discussed earlier in this FEP, interannual climatic shifts like ENSO, and interdecadal shifts like PDO, can alter both the status of marine stocks, and how humans experience climate on land. During El Niño periods, jet stream winds are often diverted northward, which can result in increased exposure of the U.S. West Coast to subtropical weather systems (Cayan et al. 1999). Along the coastline, this increase in southerly weather systems, coupled with elevated relative sea levels that are also associated with El Niño events, leads to increased storm damage and beach erosion in coastal areas (Storlazzi and Griggs 2000). While such events often cause dramatic shoreline impacts and property damage, we are not aware of studies that have evaluated the direct or indirect impacts to fisheries infrastructure or profitability, although the impacts on species catchability and the resulting profitability of different fishing strategies as a consequence of El Niño have been evaluated and shown to be substantial in case studies. For example, Dalton (2001) showed that El Niño events had positive impacts on the abundance and catch rates of albacore and negative impacts on the abundance of Chinook salmon, sablefish and squid in Monterey Bay, with cascading impacts on both prices and profitability in all of those fisheries.

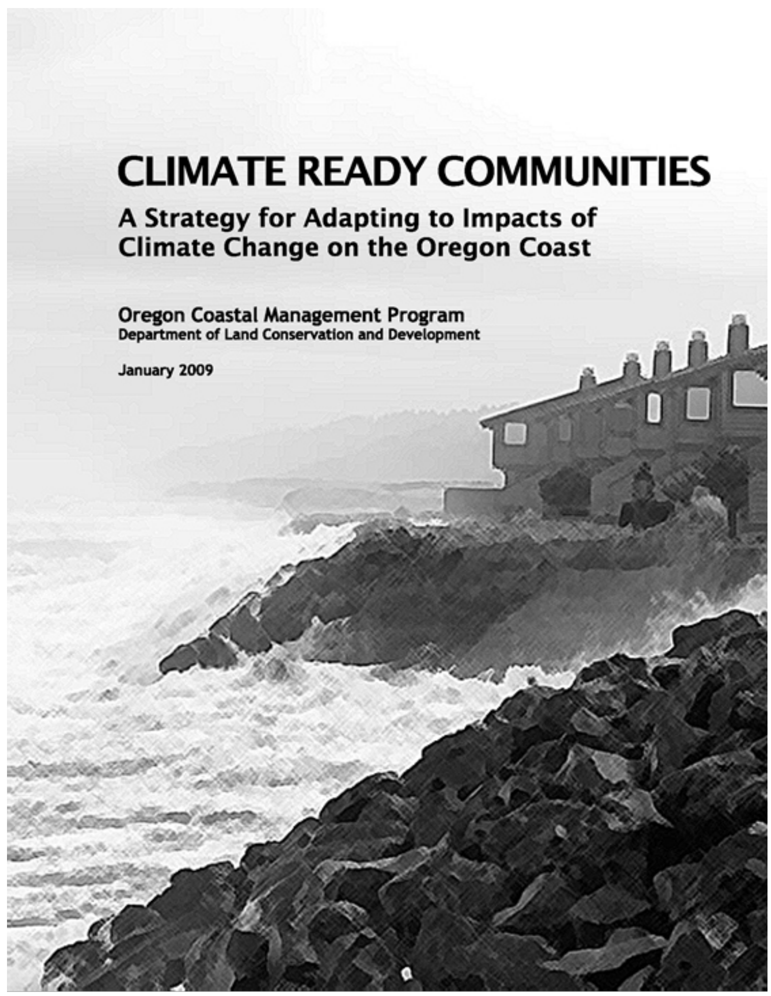
The changes in weather patterns more generally also leads to higher than normal rainfall in the southwestern U.S., with associated flooding and sediment dispersal more likely to occur from central California southward. By contrast, the northwestern U.S. experiences lower than normal precipitation during such events, often resulting in drought conditions both from lack of rainfall in the lowlands and from reduced snowpack in the mountains (Karl et al. 2009). During El Niño periods, the reduced precipitation in the northwestern U.S. has a direct effect on stream levels, reducing spawning and migration habitat for salmon. Drought conditions in the northwest also tend to result in more intense and more frequent forest fires, although northwestern forest fires most frequently occur east of the Cascade Mountain range, away from coastal communities. Conversely, La Niña periods bring unusually dry and hot conditions to the southwestern U.S., and wetter than normal conditions to the northwestern U.S. While the buildup of snowpack associated with La Niña years can be beneficial to salmon during spring snowmelt periods, increased northwest flooding can also move streamwater outside of streambed habitat into areas not hospitable to salmon spawning, such as agricultural fields or roadways. Reduced precipitation in the already dry southwestern U.S. often results in more frequent and more intense forest fires, which can occur in southwestern coastal communities. Reduced precipitation can also lead to more intense conflict over water rights in southwestern water systems that are already oversubscribed by multiple users.

4.4.3.2 Sea-Level Rise in Association with Climate Change

At the large-scale, the U.S. West Coast is relatively high-relief, meaning that the land often rises sharply from the ocean, making inundation from sea-level rise less of a concern for some undeveloped areas of the coast. However, several urban areas, including San Francisco Bay and Puget Sound, are highly developed near low-lying shoreline, and are expected to be vulnerable to sea-level rise in the coming decades (Snover et al. 2007, Cloern et al. 2011). Even less-developed portions of the West Coast may be subject to accelerated erosion in association with sea-level rise, particularly where sandy dunes dominate the coastline.

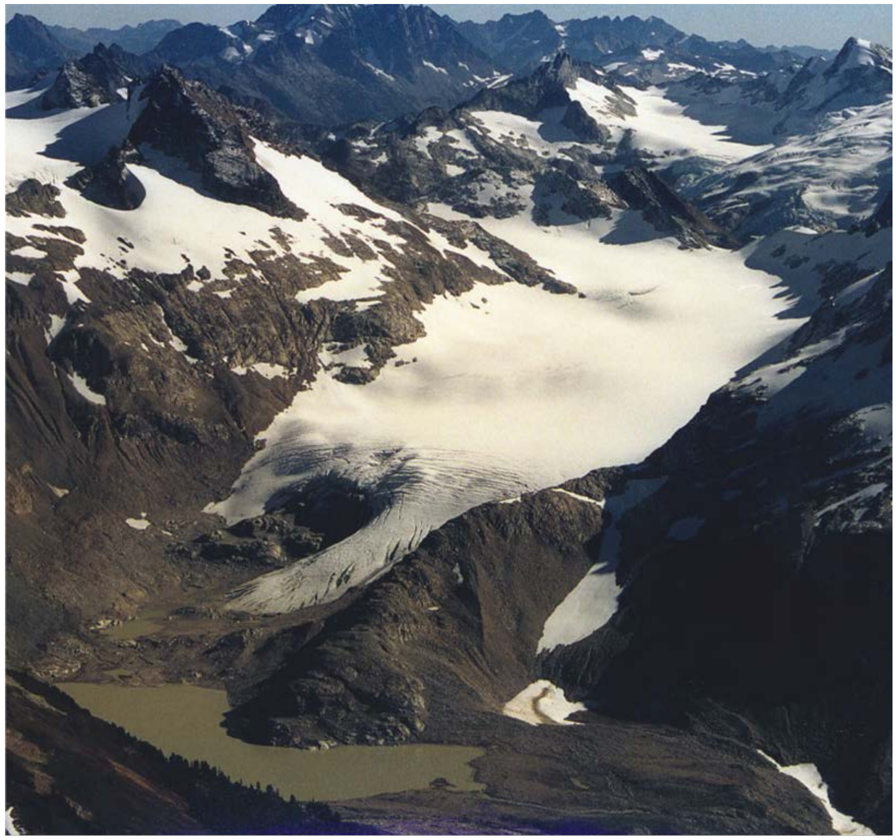
In 2012, the U.S. National Research Council published a report evaluating sea-level rise for the U.S. West Coast in the years 2030, 2050, and 2100, in response to requests from the states of Washington, Oregon, and California for more information on where and how sea-level rise might affect the West Coast (NRC 2012). The report responds to the states' requests for information on the contributors to global sea-level rise, regional and local values for sea-level rise, climate-induced changes in storm-frequency and magnitude, the response of coastal habitats to sea-level rise and storminess, and the role of habitats and natural environments in providing protection from inundation and waves. In general, the report concludes that sea-level rise may have less of an effect north of Cape Mendocino, CA, where an upward-lifting tectonic plate will counteract the effects of melting polar ice, and more of an effect south of Cape Mendocino, where the coast's tectonic plate is sinking relative to surrounding plates. Storm frequency and intensity, however, is expected to increase coastwide, particularly in El Niño years, when Pacific Basin sea surface heights increase along the eastern Pacific Ocean (NRC 2012).

As with near-term climate shifts, fishing communities can start to prepare for sea-level rise by seeking out projections for their particular geographic regions. Projections may be less certain at smaller spatial scale, but can still help communities think about and plan for projected changes for their region. The three West Coast states, both individually and collectively through the WCGA, have been seeking state-level information and are organizing state-level planning on addressing the effects of climate change. Treaty tribes that participate in the Council process are also participants in regional and nation-wide efforts by native peoples to better prepare for sea-level rise and other effects of global climate change (e.g., FSS 2012).



Oregon Coastal Management Program's planning document for sea-level rise. Image credit: ODLCD

4.4.3.3 Hydrologic Cycle Shifts in Association with Climate Change



Glacial retreat in Washington's South Cascade mountains.
Photo credit: WA Dept. of Ecology

Climate change has already had measurable effects on the North American hydrologic cycle in the 20th century, and those effects are predicted to continue through the 21st century. For communities along the U.S. West Coast, hydrologic cycle shifts will differ along the length of the coast. Hot and dry sections of the southwestern U.S., particularly including coastal areas of the Southern California Bight, are predicted to become hotter and dryer, with longer droughts and more floods when rainfall occurs. The Northwest is also predicted to experience more droughts and floods, less precipitation falling as snow, as well as earlier spring snowmelt periods, all of which will together exacerbate longer summertime droughts. Glaciers in U.S. western mountains, including those in Alaska, have been shrinking over the 20th century and are expected to continue to shrink through the 21st century. Freshwater supply conflicts already make water rights allocation difficult throughout the western U.S. As the U.S. population increases, particularly in drier regions, those conflicts are expected to increase (NRC 2012).

4.4.3.4 Shoreline Ecological Shifts in Association with Climate Change

With sea-level rise increasing coastal erosion and encroaching on wetlands, and with rainfall occurring in more brief and dramatic events, more sediment will likely be shifting to and around coastal areas. For some coastal communities, sediment shift may mean loss of beaches and connected tourism income, or loss of estuarine habitat. For other communities, more rapidly shifting sediment may mean increased needs for frequent dredging. More urbanized coastal communities with hardened shorelines may see more landslides and other dramatic erosion events. The western U.S. has been subject to a dramatic infilling and loss of wetlands habitat over the last 150 years, leaving less protection from coastal storms and erosion for humans, and less nursery habitat for fish. Although coastal development mitigation and environmental protection strategies now take better account of the need to retain the ecosystem services provided by wetlands, habitat restoration is unlikely to occur at a fast enough rate to counter the predicted sediment transport effects associated with climate change.

4.5 Aspects of Climate Change Expected to Affect Living Marine Resources within the CCE

Climate change is expected to lead to substantial changes in physical characteristics and dynamics within the marine environment, with complex and interacting impacts to marine populations, fisheries and other ecosystem services (Scavia et al. 2002, Harley et al. 2006, Doney et al. 2012). Three major aspects of future climate change that will have direct effects on the CCE are: ocean temperature, pH (acidity versus alkalinity) of ocean surface waters, and deep-water oxygen. Globally by 2050, ocean temperatures on average are expected to rise at least 1°C (by the most conservative estimates, IPCC 2007), while at the same time, ocean pH in the upper 500m has steadily been decreasing (becoming more acidic, aka "ocean acidification") at a rate of approximately -0.0017 pH per year (Byrne et al., 2010). On a more regional basis within the CCE, deep-water oxygen levels have shown a steady and relatively rapid decrease since the mid 1980's (Bograd et al., 2008, McClatchie et al., 2010). These three factors are linked: ocean temperature affects ocean pH, ocean temperature and deep water oxygen levels both can be controlled by large scale circulation patterns, and primary production can affect both oxygen and pH (Gilly et al. 2013). All three factors show long-term trends and decadal-scale variance similar to changes in the PDO (Mantua et al., 1997) and North Pacific Gyre Oscillation (DiLorenzo et al., 2008) climate signals. In addition to these three large-scale aspects of climate change, some more immediate and localized aspects of climate change observed in coastal marine ecosystem include: intensification of upwelling (Bakun, 1990, Schwing and Mendelssohn, 1997), changes in phenology (Bograd et al., 2009), and changes in the frequency and intensity of existing interannual and interdecadal climate patterns (Yeh et al. 2009, CCIEA 2012, and references therein). Substantial changes in weather and precipitation patterns will also affect snowpack, streamflow, river temperatures and other aspects of freshwater habitat, with tremendous real and potential consequences to the future productivity and sustainability anadromous resources such as salmon (Mantua and Francis 2004, Crozier et al. 2008).

Due to its expected significant impacts, the Council will eventually find it necessary to consider the effects of climate change on Council-managed species, whether those effects include a localized change in prey abundance for one species, or a large-scale shift in species composition within the CCE. The FEP's Ecosystem Initiatives Appendix, in Section A.2.8, the FEP suggests an initiative to help bring Council priorities for the information it needs about future predicted shifts in fish population abundance to the scientists and scientific programs assessing the vulnerability of natural resources and human communities to climate change.

4.5.1 Temperature

Temperature within the CCE is monitored reliably via several methods. Surface temperatures are sampled via satellite on relatively high temporal (daily) and spatial (several km) scales. In situ and some sub-surface temperatures are less frequently monitored by buoys and ship-based measurements. Gliders and shore-stations provide additional measurements at lower spatial coverage. CCE water temperature measurements have been taken for a longer span of time than any other measurements, providing excellent background data to evaluate current and historic trends (e.g. the CALCOFI program).

Increasing temperature will have both direct and indirect effects on all managed species within the CCE. For cold-blooded species, vital rates will change as a function of temperature, specifically growth and development rates, which could lead to changes in size-at-age relationships, and/or changes in egg production rates (Houde, 1989; Blaxter, 1992). Certain species with upper thermal limit tolerances, may become locally extirpated in some areas, or conversely expand into new territories that were once too cold. Other, more mobile species, may change their depth/and or spatial range in response to increasing temperature, typically through a northward shifting of population boundaries. Climate change has already been associated with poleward range expansions of marine species; animals with the highest turnover rates appear to show the most rapid distributional responses to warming (Perry et al., 2005; Burrows et al., 2011), suggesting that those with slower life histories could be more vulnerable to such impacts. Most recently, Hazen et al. (2012) evaluated likely changes in the distribution of available habitat to a suite of higher trophic level predators (including many HMS species), and predicted that available habitat would change by up to 35% for some species, with corresponding northward shift in species ranges and biodiversity across the North Pacific.

Indirect effects on managed species include changes in both basic primary and secondary production rates, and/or community composition of the lower trophic levels which provide the food base for managed species. It is also likely that along with increased warming, there has been an increase in thermal stratification within the CCE (Palacios et al., 2004), which may lead to a decrease in overall primary production, through a reduction in the effectiveness of upwelling bringing nutrients to the surface layers. Thus we may expect system-wide changes in productivity or changes in the centers of productivity over the next 50 years. Related to changes in temperature, there may also be associated changes in the timing of the onset of spring's seasonal upwelling, which could have widespread effects on total production, the match-mismatch of certain trophic interactions, and possible community shifts (Loggerwell et al., 2003; Holt and Mantua, 2009).

4.5.2 Ocean pH

Measurement of ocean pH requires in situ water sampling, and cannot currently be conducted via remote means. However, because of the relatively tight coupling of ocean pH with atmospheric forcing, biogeochemical models may be used in some cases to determine ocean pH at higher temporal and spatial frequency than in situ sampling would allow. In fact, historic ocean pH levels used for calculating long term trends have mostly been calculated using biogeochemical-atmospheric models (Fabry et al., 2008). There is much less data available, both temporally and spatially concerning ocean pH than nearly all other physical-chemical measurements, partly because up until recently, it was believed that the ocean was relatively "self-buffering" and would not undergo significant changes in pH. With the recent recognition that pH is indeed decreasing, and that this may be detrimental to many marine organisms, monitoring of pH has increased, particularly in coastal regions.


Funnel of geoduck clam. Photo credit: WDFW

Decreasing ocean pH (ocean acidification) will have direct effects on certain species within the CCE. Primarily, decreasing pH makes it more difficult for shell-bearing species (such as corals, bivalves, gastropods, and crustaceans) to make their shells (Kleypas et al., 1999; Riebesell et al., 2000; Fabry et al., 2008). Decreased pH may possibly impact the larvae and young stages of fish, although studies documenting such effects on fish are sparse (see Fabry et al. 2008, and references therein). The most significant impact likely for the managed species within the CCE would be if decreasing pH caused changes in plankton productivity or community composition. Currently, the likeliness and extent of such effects are poorly known, but could be considerable. As changes in ocean pH roughly track changes in atmospheric pCO_2 levels, it is expected that as pCO_2 continues to rise, ocean pH will continue to steadily decrease, making changes in ocean plankton production and community structure more likely in the future. It is important to note that there is considerable daily, seasonal, and decadal scale variability in ocean pH, overlain on the overall long-term trend (reviewed in Fabry et al., 2008). Thus many oceanic species are already exposed to considerable variability in ocean pH compared to the rate of long-term change, and thus have some natural resilience to such changes.

Although pH within the surface waters is highly related to atmospheric processes (e.g. the CO_2 content of the air), coastal upwelling may act to further decrease upper ocean pH. Waters at depths from 150-400 m are typically low in pH relative to the surface, since these waters are relatively "older", and hence have had more time for biological processes like respiration to occur, which naturally reduce pH (Feely et al., 2008). When water from these depths upwells towards the surface, as occurs seasonally within the CCE, the pH of the upper water column will decline. This results in a shoaling of the depth at which organisms can no longer make calcareous shells, thus restricting or possibly eliminating (when upwelling is strong enough to reach directly to the surface) their available depth habitat range (Feely et al., 2008). Such effects are temporally variable, as they are directly related to the strength and duration of seasonal coastal upwelling, with surface pH rapidly returning to its pre-upwelling, atmospherically-equilibrated state upon the cessation of upwelling. A recently-convened blue ribbon panel on ocean acidification in Washington State waters noted the potential for upwelling off the Washington coast to exacerbate the near-term effects of ocean acidification on northern CCE nearshore waters (Feely et al., 2012).

4.5.3 Oxygen

Oxygen levels have been measured for many decades throughout the CCE (e.g.CalCOFI), traditionally via in situ sampling, followed by ship-board analysis. Oxygen cannot be measured remotely via satellites or other means. However, recent technological advances have enabled the development of in situ oxygen sensors that can provide fairly rapid subsurface measurements of oxygen (Tengberg et al., 2006). Modeling in situ oxygen levels is problematic in most cases, since it requires complex atmospheric-physical-biological coupled models with accurate mixing schemes, although such models do exist and can be applied in some areas with decent success (Najjar and Keeling, 2000). Thus, modeling may provide a limited ability to fill in data gaps, and make limited predictions of water oxygen content.

Within the CCE, there has been a notable decrease in deep-water oxygen levels since the mid 1980's (Bograd et al., 2008, Chan et al., 2008). Much of this reflects a shoaling of the oxygen minimum zone throughout the Eastern Tropical Pacific, California Current, and North Pacific, in which the depth of the oxygen level thought to be constraining or lethal for most marine species becomes shallower (closer to the surface), compressing the available water column habitat for fishes with high oxygen demands. These low oxygen waters are a natural feature of the Eastern Pacific Rim and other regions characterized by high surface productivity and/or the upwelling of oxygen-poor source waters (Helly and Levin 2004). However, the ongoing decrease in deep water oxygen levels is most likely a result of changes in oxygen content of the source waters of deeper parts of the CCE, more of a basin-wide phenomenon affecting large regions of the CCE (Bograd et al., 2008, Stramma et al. 2011), and one expected to continue or intensify with global change (Rykaczewski and Dunne. 2010). On top of the long term, system-wide changes in deeper water oxygen are regional-scale events that may further decrease oxygen levels. Particularly, strong surface primary production may sink out before being remineralized in surface layers, leading to a higher respiratory demand in deeper waters.

Within the oxygen minimization zone, species diversity declines to a smaller suite of species that have adapted to cope with low oxygen waters. In the CCE, the benthic inhabitants of the oxygen minimization zone are the well known deepwater complex species (Dover sole, thornyheads and sablefish), which have evolved a range of adaptive strategies including metabolic suppression, slow growth rates, late ages at maturity, and ambush (rather than active searching) predation methods (Vetter and Lynn 1997, Koslow et al. 2000). However, the effects of low oxygen levels on marine organisms that are not tolerant of such conditions are fairly well known: death in most cases if the organisms cannot avoid the area, or reduced growth for those species with moderate tolerance. Consequently, the combination of a steady decrease in baseline oxygen levels in deep water, with occasional periods of heightened primary production without concomitant surface grazing, have sometimes led to large hypoxic or even anoxic zones in deeper waters, resulting in massive fish kills (e.g. recent events off Oregon coast; Chan et al., 2008).

Oceanographic data buoy being deployed from R/V Miller Freeman. Photo credit: NOAA.

Over the longer term, the likelihood of oxygen decrease events may increase, as will a more gradual compression of available habitat for less tolerant species. For example, McClatchie et al. (2010) evaluated potential scenarios for hypoxia to affect the habitat of cowcod (*Sebastes levis*), a rebuilding shelf species that is a key management species in the California Current. They found that as much as 37% of deep (240-350 m) cowcod habitat is currently affected by hypoxia, but that if the current trends of a shoaling oxygen minimization zone continue for 20 years, this could increase to 55% of deep habitat, as well as an additional 18% of habitat in the 180 to 240 m depth range. For deeper water species the impacts could be even greater; for example blackgill rockfish (*S. melanostomus*) have a much deeper depth distribution (among the deepest of the larger slope-dwelling Sebastes) and may be at considerably greater risk to the longer-term impacts of shoaling. Moreover, changes in the characteristics and dynamics of the oxygen minimization zone could lead to changes in the forage base for blackgill rockfish, which are described as foraging primarily on mesopelagic fishes that undergo diel migrations from the edge of the oxygen minimization zone to surface waters in order to feed. A comparison of the depth of the oxygen minimization zone and long term records of fish communities suggests that oxygen minimization zone shoaling may be shifting the distribution of blackgill rockfish's mesopelagic prey species (Koslow et al. 2011). Such habitat compression is also likely to affect highly migratory species, such as tunas and marlin, with the irony that such compression could increase the vulnerability of such predators to fishing (by concentrating their habitat), while decreasing their long term carrying capacity and productivity (Prince and Goodyear 2006, Stramma et al. 2011).

4.5.4 Upwelling, Phenology, and Changes in Existing Climate Patterns

As described by Bakun (1990) global warming has led to an intensification of alongshore wind stress, which in turn has led to an intensification of coastal upwelling, as has been documented both around the globe, and specifically within the CCE (Schwing and Mendelssohn, 1997). Within the CCE, this long-term intensification is most notable during April to July, and is of greater magnitude than the typical seasonal variability. Such an increase in upwelling should lead to cooler surface waters and higher productivity, however, the long-term trend of increasing SST has masked this effect, leading to overall net higher water temperatures (Schwing and Mendelssohn, 1997).

There have also been changes in the major existing climate patterns, e.g. the PDO, NPGO, and ENSO(MEI). The MEI (Multivariate ENSO Index), which is an indicator of occurrence and strength of El Niño conditions, has seen an increasing trend, with more positive values since 1977. Positive values are associated with warmer surface water and weaker upwelling. Hence this climate indicator would suggest a relative decrease in productivity of the CCE since 1977. The North Pacific Gyre Oscillation (NPGO) index is a low frequency signal of the sea surface heights over the NE Pacific, and has been linked to salinity and Chl-a within the CCE (Di Lorenzo et al., 2008). Since 1975, the NPGO has seen more extreme and/or longer duration events than previously (CCIEA 2012). Thus chl-a and salinity within the CCE may also be experiencing heightened extremes and durations of those extremes. The PDO is a low frequency signal of SST across the N. Pacific that has been related to biological productivity (Mantua et al., 1997). The PDO has also seen a change since 1977, with generally more positive (indicative of warmer SSTs and hence likely lower productivity) values since that time (CCIEA 2012). However, over the past 7 years, the PDO has declined (albeit with a sharp increase in 2010), thus possibly indicating higher productivity over this shorter time span.

These changes in upwelling and major climate patterns result in changes to the phenology of physical and biological events within the CCE. Within the CCE, since it is primarily an upwelling driven ecosystem, of particular importance is the change in upwelling phenology. This is in addition to the above described change in upwelling intensification. Recent trends over the past 5 years indicate an earlier timing to the start of upwelling in the south, and a later start to upwelling in the north (CCIEA 2012), with an earlier start of upwelling likely leading to higher integrated productivity. In any case, changes in the timing of upwelling may result in match-mismatch between predators and their prey, if those timings are somewhat uncoupled (e.g. salmon entering the ocean may have a different timing set by terrestrial forcing, as opposed to the timing of upwelling initiation). Changes in the timing of upwelling will also likely have impacts all the way up the food chain to the top level predators and consumers, since it is the timing and strength of upwelling that primarily controls primary productivity of the CCE, and thereby overall productivity. However, the exact nature of how upwelling phenology may change is not clear, as it is affected by many factors, such as wind patterns, SST, mixing, stratification, circulation etc., and may vary by region. These physical factors, SST, mixing, wind etc., are in turn controlled by interrelated large-scale patterns – which are undergoing both long-term changes, and changes in their strength and variability as described above – therefore further complicating prediction of ecosystem response. An important secondary effect of changes in upwelling strength and phenology are potential changes in upper ocean pH. As described above, upwelled water may act to further decrease the surface ocean pH. Thus changes in upwelling phenology are also likely to change seasonal and long-term patterns of ocean pH.

Point Reyes (CA) National Seashore. Photo credit: U.S. National Park Service

4.6 Sources for Chapter 4

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5 PFMC Policy Priorities for Ocean Resource Management

The purpose of this chapter is to provide non-Council entities with information on some of the Council's highest priority concerns for non-fishing activities within the West Coast EEZ. It is current as of April 2013, may be modified at any time after that, and must be considered within the larger suite of Council management programs and documents. This chapter discusses species, habitat types, fisheries and ecological functions of particular concern to, or that may strongly drive, the Council's policies for CCE resources. Unlike Chapters 2 and 4, the purpose of Chapter 5 would not be to guide future Council work, but to provide external entities with guidance on Council priorities for the CCE's status and functions. External entities that may be interested in the Council's ecosystem-based management planning process and in the Council's cumulative management priorities may include federal or state agencies conducting activities within the CCE, marine use planning bodies such as the National Ocean Council or West Coast Governors' Alliance on Ocean Health, and international fishery and ocean resource management bodies.

The PFMC is one of eight regional fishery management councils authorized by the MSA and is responsible for the management of fisheries of the living marine resources of the U.S. EEZ (3-200 nm) off the coasts of Washington, Oregon, and California. In addition to having management responsibility for 100+ species of fish and their associated fisheries of the U.S. West Coast EEZ, the PFMC is responsible for reviewing non-fishing activities that may affect EFH for Council-managed species. Cumulatively, EFH for Council-managed species extends throughout the U.S. West Coast EEZ, and inshore of the EEZ to encompass salmon rivers as far east as Idaho. Council priorities for its managed species may be found within its four FMPs. In general, the Council is interested in and may have concerns with any projects that have potential adverse effects on living marine resources, the biological diversity of marine life, the functional integrity of the marine ecosystem, or to important marine habitat or associated biological communities.

5.1 Species of Particular Interest to the Council

The Council has jurisdiction over fish, which the MSA defines as "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds." NOAA and the USFWS administer recovery programs for all species listed as threatened or endangered under the ESA, and administer protection programs for marine mammals under the MMPA. The USFWS manages protection programs for bird species, including seabirds, under the MBTA. The Council is concerned with the potential effects of non-fishing activities that could directly or indirectly harm or kill any of its managed species at any of their life stages, which are identified and discussed in detail in the FMPs. There are, however, some species and species groups that are likely to be more vulnerable to the effects of non-fishing activities on their life cycles and habitats.

5.1.1 Anadromous Species

Among species within PFMC fishery management plans, salmon are unique in that they are obligated to spend the spawning, incubation, juvenile and a portion of both juvenile migration and adult-spawning migration stages of their lives in fresh water. Thus, the survival of individual populations and stocks of salmon are dependent on not only responsible fisheries management practices, but also on conservation of water quality and quantity for each spawning and rearing tributary, and on land-based activities taking into account the unique challenges and life cycles of salmonid species within each tributary.

NOAA and the USFWS work with the states, tribes, municipalities, and private entities to develop recovery plans for salmon species listed under the ESA. Each of these recovery plans is intended to take into account the unique needs of particular runs of salmon within the geographic areas addressed by the plans. Recovery efforts for threatened and endangered West Coast salmon runs guide how and where non-fishing activities may affect salmon populations, and how those activities might be required to mitigate for their effects. For non-fishing activities that may take place within the West Coast EEZ, the Council would be particularly concerned with those activities that:

Pink and chinook salmon in Elwha River. Photo credit: NOAA.

- May block, through physical, chemical, or other means, salmonid access to or from the entryways (mouths) of their tributary rivers;
- Physically harm or directly kill salmon through entrainment in man-made devices;
- Physically or otherwise alter EFH for anadomous species in a way that reduces the functionality of that habitat
- Reduce the availability of salmon prey species through removal by physical, chemical, or other means;
- Serve to alter, through auditory herding or other means, migratory paths of either the anadromous species or their predators such that predators have increased access to wild salmonid populations;
- Introduce non-native species that would compete with, prey upon, have the potential to introduce diseases to, or which could alter the genetic composition of native salmonids;
- Have the effect of concentrating wild stock parasites or diseases.

5.1.2 Species protected through an overfished species rebuilding program

The MSA requires that fishery management councils identify species that are overfished, prevent overfishing, and rebuild those stocks that have been identified as overfished. Since 1998, the Pacific Council has developed and implemented rebuilding plans for several of its managed species. Most of the species protected through overfished species rebuilding programs are long-lived, slow-to-mature rockfish species. Thus, although these species are successfully rebuilding, the life-history characteristics of several rebuilding species prevent swift recovery even when directed fishing for those species is prohibited. For example, target rebuilding years for cowcod and yelloweye rockfish under prohibitions on directed take are 2068 and 2074, respectively (50 CFR 660.40).

For species with solely marine lifecycles (i.e. not anadromous), the Council's rebuilding programs focus on minimizing or eliminating directed catch and minimizing opportunities for incidental catch. Therefore, the Council would be particularly concerned with non-fishing activities taking place within the

West Coast EEZ or within rebuilding species EFH that might jeopardize the ability of managed species to rebuild to their optimum population levels, such as activities that:

- Physically harm or directly kill rebuilding species through entrainment in man-made devices;
- Physically or otherwise alter EFH for rebuilding species in a way that reduces the functionality of that habitat
- Reduce the availability of the prey of rebuilding species through removal by physical, chemical, or other means;
- Serve to alter, through auditory herding or other means, migratory paths of rebuilding species' predators, such that predators have increased access to rebuilding species' populations;

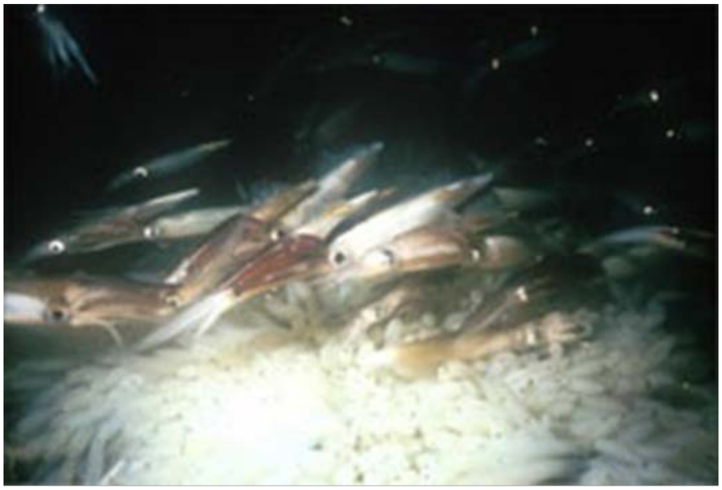
Yelloweye rockfish. Photo credit: NOAA.

- Disaggregate or otherwise disrupt rebuilding species during their spawning, parturition, or larval-settling seasons;
- Introduce non-native species that would compete with, prey upon, have the potential to introduce diseases to, or which could alter the genetic composition of native species

5.1.3 Species dependent upon a fixed habitat type

The Council's FMPs define EFH for managed species. Some species have wide-ranging habitat, while others are dependent on fixed habitat types. Species dependent upon fixed habitat types may range in type from site-loyal rockfish species that, as adults, exist only in particular depth ranges on rocky habitats, to species that are pelagic as adults but which require fixed habitat for spawning, to species that can only exist within a particular seawater temperature range.

For species that are dependent upon a fixed habitat type, the Council would be particularly concerned with non-fishing activities taking place within the West Coast EEZ or within species-specific EFH that might jeopardize the ability of managed species to use that habitat for spawning, feeding, breeding, or growth to maturity. Discussions of non-fishing activities that may affect managed species' EFH may be found within the Council's FMPs and the potential for those activities to affect EFH is not repeated here.



Market squid and their egg cases affixed to the ocean floor. Photo credit: NOAA.

5.1.4 Species and locations with tribal treaty rights to fishing

As discussed in Sections 3.5.2 and 3.5.3, there are numerous western Treaty Tribes that co-manage a variety of fish species and marine areas with the West Coast states and the U.S. government, and which participate in Council management processes. Fishing rights for Treaty Tribes are connected with the Usual and Accustomed (U&A) fishing areas of those tribes, meaning that an action that affects the status of a managed species that occurs within a particular tribe's U&A fishing area must be assessed not just for its effects on the status of the species and its habitat as a whole, *but also for its effects on the availability of that resource to tribal fisheries within the particular U&A fishing area.* For example, a non-fishing activity that does not affect the overall status of the West Coast sablefish stock, but which could reduce the sablefish available for harvest off the northern Washington coast, would be subject to additional scrutiny for its effects on tribal treaty rights. Council managed species that are also caught in tribal treaty fisheries include salmon, Pacific halibut, and groundfish occurring off the northern Washington coast. California tribal fishing rights are associated with Klamath basin salmonids. For tribal treaty species, the Council would have the same concerns as those discussed in 5.1.1 and 5.1.2 under the types of non-fishing activities with the potential to affect salmon and species managed under rebuilding plans, but with particular focus on effects that might occur within tribal U&A fishing areas.

Makah tribal member Jongi Claplanhoo works on his family's boat at Neah Bay, WA. Photo credit: Debbie Ross-Preston, NWIFC

5.1.5 Internationally-managed species

As discussed in Section 3.5.4, several Council-managed species range across the U.S. EEZ boundaries into the EEZs of other nations, or into international waters. Non-fishing activities that may affect the status of internationally-managed stocks could disrupt the nation's participation within a variety of international forums. In addition to salmon, which is discussed as a species group of Council interest in Section 5.1.1, the Council would be particularly concerned with non-fishing activities taking place within the West Coast EEZ or within managed species EFH that might affect the status of Pacific halibut, Pacific whiting, highly migratory species, and sardines. For internationally-managed species, the Council would have the same concerns as those discussed in 5.1.2 under the types of non-fishing activities with the potential to affect species managed under rebuilding plans.

5.2 Fish Habitat

Under the MSA, fishery management councils must describe and identify EFH for managed species. With regard to non-fishing activities that may affect EFH, the Council may comment on activities that may affect fishery resources under its authority, and shall comment on activities that may affect EFH of anadromous species, such as salmon. The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" 16 U.S.C. §1802. That definition, in combination with the diverse life histories of the 100+ species under Council management, has necessarily resulted in a large geographic area defined as EFH for the cumulative group of Council-managed species. As discussed in Section 5.1.3, the Council is concerned with non-fishing activities that may affect species with strong linkages to and dependency upon fixed or particular habitat. Similarly, the Council would be concerned with non-fishing activities that have the potential to affect managed species habitat that is itself vulnerable to long-term alteration. Each of the Council's FMPs, their EFH appendices, and applicable NEPA analyses should be consulted for assessments of the types of human activities expected to have a potential negative effect on EFH for Council-managed species. While all fish habitat is of interest to the Council, some habitat types, the habitat needs of some species, and some types of habitat disturbance are of particular concern to the Council for their effects on the ecosystem as a whole, such as activities that:

Brownsville Dam Removal, Oregon. Photo credit: NOAA

- Disturb or kills structure-forming invertebrates or vegetation in a manner that either prevents those species from recovering within the affected area within their mean generation times, or which reduces the known distribution of those species;
- Alter the geological structure of the habitat such that the habitat cannot maintain or recover its functionality unaided;
- Alter the chemical composition, turbidity, or temperature of the seawater such that the habitat cannot recover to its pre-disturbance state – see also Section 4.5.

5.3 Fisheries

The Council manages the West Coast fisheries for species within its four FMPs: CPS, groundfish, HMS, and salmon. However, participants in the Council process also participate in state-, tribal-, and international-management processes for West Coast species outside of the FMPs. Therefore, while the Council is particularly interested in non-fishing activities that may disturb or prevent fishing activities of Council-managed fisheries, Council process participants are also concerned with non-fishing activities that may affect all fishing opportunities for West Coast fishing communities. Some fishing communities and fishing types may be more vulnerable to disturbance by non-fishing activities than others, as detailed below.

5.3.1 Communities with a Dependency on Fishery Resources

Norman and colleagues (2007) provided summary descriptions of communities that, for West Coast and Alaska fisheries, meet the MSA's definition of a fishing community: "substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (16 U.S.C. §1802). West Coast fishing communities vary in their levels of involvement in fisheries and dependency on fishery resources (Sepez et al. 2007). The Council is charged with not discriminating between residents of different States (16 USC §1851); therefore, it would be concerned with non-fishing activities that disproportionately affect fisheries access to fishery resources in a particular community or geographic area, and with activities that may have a more broad-scale effects. Activities of potential concern to the Council include those that:

- Directly take or otherwise deplete local populations of marine species;
- Block or significantly revise (whether temporarily or permanently) physical access between a fishing community and the marine fishing grounds its vessels commonly use;
- Increase pollutant loads in the habitats of managed species such that those pollutants may bioaccumulate in the flesh of targeted species;
- Increase the hazards to navigation for vessels;
- Have not undergone local consultation with the affected communities before implementation.

Port of Newport, OR. Photo credit: ODFW

5.3.2 Tribal Fishing Communities

As discussed in Section 5.1.4, the fisheries of western treaty tribes are geographically constrained to their U&A fishing areas. As a result, non-fishing activities under consideration for development within a U&A fishing area must be considered for their potential effects on local access to CCE marine resources. Changes in the accessibility of fishery resources to treaty tribes, whether due to ecosystem processes or management policy, have the potential to profoundly affect treaty Indian communities. Fishery resources not only fuel local economies, but also provide a significant portion of treaty tribal members' diets, and are deeply entwined in tribal culture and identity. If an activity affects local access to fishery resources, tribal fleets cannot follow fishery resources beyond U&A boundaries. If changes are extreme, such as with total loss of access to traditional tribal resources, tribal communities would be forced to make revolutionary changes in fishing strategies, dietary habits, and cultural ties. In recent years, treaty tribes that participate in the Council process have joined with U.S. Indian Tribes across the nation to strategize on tribal response and adaptation to climate change, including addressing shifts to or loss of fishery resources (e.g. ICCWG 2009, Swinomish 2010).

AJ Webster, Yurok Tribe/staff, surveying for instream restoration project, Lower Klamath River, CA.
Photo credit: Yurok Tribe

In addition to maintaining local access to fishery resources, treaty tribes are concerned with activities that may increase pollutant loads within the flesh (bioaccumulation) of species targeted by tribal fisheries (Kann et al. 2010). In 2011, the U.S. EPA approved new and stricter water quality standards for Oregon, influenced in part by fish consumption surveys of Oregon and Washington tribes. The State of Oregon found the fish consumption survey conducted by the Columbia River Inter-tribal Fish Commission (CRITFC 1994) to be particularly relevant to Oregon fish consumers generally, recognizing that both tribal and non-tribal Oregonians are likely to consume more fish annually than members of the U.S. population at large (ORDEQ 2008).

5.3.3 Brief Duration Fisheries

Brief duration or derby fisheries occur in situations where harvest levels are low relative to effort levels or fleet capacity. This situation is often exacerbated by reduced seasons, quotas, or harvest guidelines when the abundance of a particular stock declines resulting in a limited harvestable surplus. Historically, commercial and recreational fisheries for Pacific halibut and salmon, as well as commercial fisheries for

Pacific sardine have periodically experienced reduced harvest opportunities resulting in brief duration fisheries.

Brief-duration fisheries often create an economic incentive to participate in a fishery during a narrow and inflexible period of time. The Council generally tries to minimize the occurrence of derby fisheries through license limitation and rationalization programs. Derby fisheries present several challenges, including the possibility that participants will need to fish during unfavorable weather conditions, fishing effort levels, and/or market conditions. However, brief duration fishing opportunities can represent a substantial portion of a fisherman's income and additional challenges from poorly-timed non-fishing activities could be devastating if they limit or curtail a vessel's participation at a critical time. Non-fishing activities that could adversely affect a fishing vessel's participation in a fishery include, but are not limited to, port facility construction or improvement projects, interruptions to necessary supplies (fuel, ice, etc.), and dredging or jetty operations that impede bar crossings.

5.3.4 Location-Constrained Fisheries

Fisheries can be constrained to a limited area due to regulatory restriction (fishery or non-fishery) or due to the biology and/or distribution of the target stock. West Coast groundfish fisheries are often limited to particular depth zones to avoid interactions with overfished species, which at times can force boats to concentrate in near-shore waters or require transit to areas of greater depth. Salmon fisheries often target a particular species or run by fishing in areas near river mouths or in specific depths. Fisheries for Pacific halibut and groundfish can tend to concentrate on areas with benthic structure, such as banks and reefs. Fisheries for coastal pelagic species, particularly market squid and to a lesser extent Pacific sardine, often rely on aggregations of individuals in areas of favorable temperature, food sources, or spawning habitat.

Location-constrained fisheries can be particularly vulnerable to non-fishery ocean uses that also require specific locations (aquaculture facilities, marine protected areas, offshore energy development, military operations, undersea cable placement etc.). The Council would be concerned with non-fishing activities that would restrict or displace fishing opportunities that are place-based and therefore difficult to relocate. The Council regularly engages in ocean zoning matters and participates in regional and national coordination efforts such as the WCGA and other coastal marine spatial planning initiatives. The Council is interested in coordinated spatial planning efforts as a means of considering non-fishing marine activities while preserving fishing opportunities and protecting areas that are critical to location-constrained fisheries.

Market squid boats in Monterey Bay, CA. Photo credit: Deb Wilson-Vandenberg CDFW

5.4 Ecosystem Structure and Function

Ecosystems are in a constant state of change, and an ecosystem's structure and function will change over time regardless of the level of human intervention with that ecosystem. However, there will be some human activities that have immediate and obvious effects on an ecosystem's structure and function, such as a large-scale oil spill. And, there will be some human activities that have had, and may continue to have, increasing effects on an ecosystem's structure and function over time, such as anthropogenic sound in the oceans.

Fishing, by its nature, alters the structure and function of the ecosystem. In the U.S., however, the MSA requires fishing to be managed so that "a supply of food and other products may be taken and that recreational benefits may be obtained, on a continuing basis; irreversible or long-term adverse effects on fishery resources and the marine environment are avoided; and there will be a multiplicity of options available with respect to future uses of these resources." (16 U.S.C. §1802). The MSA's forward looking requirement that we manage fisheries so as to ensure their continuing use by future generations is in keeping with worldwide efforts to characterize sustainable human use of the environment.

The U.N.'s Convention on Biological Diversity specifies that a target of an ecosystem approach to managing human interactions with natural resources is "conservation of ecosystem structure and function should be conserved to maintain ecosystem services" (COP 5 2000). The ecosystem service that most concerns the Council is fishing – in other words, the ability of the CCE to support, on an ongoing basis, sustainable fisheries that provide food and recreation to the nation's human population. While the Council is charged with ensuring that fishing itself is sustainable, it is also concerned with non-fishing activities that may jeopardize the roles of fish, animals, and plants within the CCE, and their dynamic relationships to each other and to humans.

While the Council recognizes that not all human activities within the marine environment are governed by laws that require management to ensure use of the environment by future generations, this is the standard that the Council holds for non-fishing activities that may affect Council-managed species. Therefore, the Council would be concerned with any non-fishing activities that have the potential to jeopardize the Council's short- or long-term ability to manage West Coast fisheries so as to provide food and recreation to this and future generations of Americans.

Young Californians at Berkeley Pier. Photo credit: CDFW

5.5 Sources for Chapter 5

Columbia River Inter-Tribal Fish Commission. 1994. A Fish Consumption Survey of the Umatilla, Nez Perce, Yakama, and Warm Springs Tribes of the Columbia River Basin. Technical Report 94-3. 183 pp. Available online: http://www.critfc.org/tech/94-3report.pdf.

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Swinomish Indian Tribal Community. 2010. Swinomish Climate Change Initiative Climate Adaptation Action Plan. Office of Planning and Community Development. 144 pp.

Washington coast. Photo credit: NOAA

6 Bringing Cross-FMP and Ecosystem Science into the Council Process

Incorporating ecosystem science into the Council process will be a two-part process. The first part is to identify and act on opportunities to improve the quantity and quality of ecosystem information used in the science that supports Council decision-making, particularly stock assessments. The second part is to bring a new whole-picture assessment of the CCE into the Council process. Throughout the development period for this FEP, the Council and its advisory bodies have discussed the type of scientific information and analyses needed to bring more ecosystem considerations into Council decision-making.

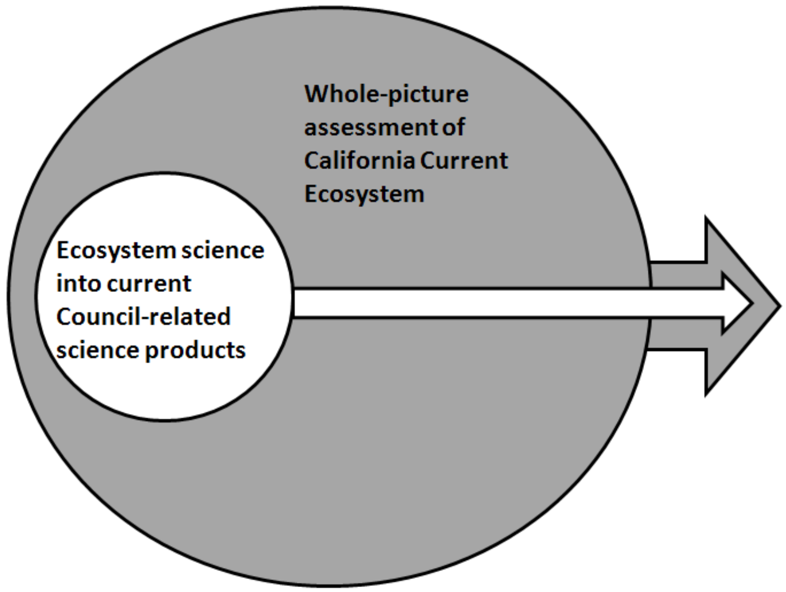

Figure 6.1: Two-part process to bring ecosystem science to the Council

The November 2012 draft version of the FEP included recommendations for ecosystem science that could be conducted to support cross-FMP understanding of the CCE, and to improve ecosystem information available to decision-makers considering issues relevant to particular FMPs. At its November 2012 meeting, the Council moved the ecosystem science recommendations from the draft FEP into its draft 2013 Research and Data Needs document, due for final Council consideration and adoption in March 2013. To address some of the major trends in scientific needs revealed during the FEP development process, the FEP appendix also includes several potential ecosystem initiatives directed at improving the ecosystem science available to Council decision-making.

As discussed in Chapter 1, the FEP's Ecosystem Initiatives Appendix proposes ecosystem-based fishery management process through which the Council and its advisory bodies could analyze a variety of cross-FMP issues to bring a better understanding of the status and functions of the CCE into the Council's policy planning and decision-making processes. Each of the initiatives would require some background scientific work, although some of the initiatives are far more science-focused than policy-focused, including: an initiative on the potential long-term effects of Council harvest policies on age- and size-distribution in managed stocks, a bio-geographic region identification and assessment initiative, a cross-FMP socio-economic effects of fisheries management initiative, and an effects of climate shift initiative. With the exception of an initiative to prevent the future development of fisheries for currently unfished lower trophic level species, the Council has not yet determined whether it wishes to pursue any of the potential ecosystem-based management initiatives.

6.1 Bringing More Ecosystem Information into Stock Assessments

While Council management decisions address a host of issues requiring wide-ranging science support and analysis, stock assessments and other harvest-level support science are the largest category of science products directly used in the Council process. Simultaneous to the FEP development process, the Council's SSC has been considering a process to bring ecosystem considerations into stock assessments.

Recognizing the status of stock assessments as both frequently conducted and heavily used Council-related science, the SSC recommended in September 2010:

> "*. . . that a subset of stock assessments be expanded to include ecosystem considerations. This would likely require the addition of an ecologist or ecosystem scientist to the Stock Assessment Teams (STATs) developing those assessments. The SSC's Ecosystem-Based Management subcommittee should develop guidelines for how ecosystem considerations can be included in stock assessments.*" (H.1.c., Supplemental SSC Report)

Based on this recommendation and on the management and activity cycles (Council Operating Procedure 9) for the Council's four FMPs, the first element of incorporating ecosystem science into the Council process could be addressed by a collaboration between NMFS's science centers and the SSC to bring ecosystem considerations into some portion of near-future stock assessments. There are three means by which ecosystem considerations could be incorporated into near-future stock assessments. First, assessments could include expanded ecosystem information in the overview text of the assessment document, as is currently included in Council stock assessments in a limited fashion and also in the North Pacific Fishery Management Council stock assessments. Assessment documents typically summarize existing research on predator-prey interactions, as well as the impact of climate, habitat and/or predation on natural mortality, growth, fecundity, migrations, recruitment variability, and shifts in distribution that may affect availability to the fishery or survey. These topics could be expanded to more fully incorporate ecosystem considerations.

Second, stock assessment models and/or relevant model sensitivity runs that explicitly include ecosystem interactions, such as those described above, could be developed. The selection of specific stocks for which assessment models with ecosystem considerations are developed should be identified in collaboration with the SSC. There are at least three modeling approaches that might be considered for incorporating ecosystem interactions: 1) modifying relevant model parameters, 2) adding an environmental index of an ecosystem process (i.e. treating the ecosystem information as a data time series with a measure of variance), and 3) modifying the population dynamics equations using an index of an ecosystem process (treating the ecosystem information as known without error). Current stock assessment models have the technical capability to incorporate all of the above approaches given strong scientific evidence for including ecosystem considerations into stock assessment models.

Finally, hypotheses on ecosystem considerations for or impacts on a specific stock could be investigated by using them to define alternative states of nature as the basis for the decision tables within current single species stock assessments, which are provided to managers as guidance for setting catches. Preferred methods for including ecosystem considerations into single species stock assessments should be addressed in the stock assessment terms of reference provided by the Council's SSC. Since the additional expertise necessary to include ecosystem considerations into stock assessments will likely extend beyond that of the current stock assessment teams, single species stock assessments will require the commitment and active participation by agency ecologists and fisheries oceanographers.

6.2 Annual Reports on Ecosystem Indicators

In November of 2012 the EPDT, in collaboration with the California Current IEA Team, provided the first iteration of a Report on the State of the CCE to the Council and its advisory bodies (K.3.a., Supplemental Attachment 1). This report was the result of an EPDT recommendation for bringing additional ecosystem information into the Council process, through the regular delivery of a synthesis of environmental, biological and socio-economic conditions that may act as either drivers or indicators of impacts to the productivity, distribution or socioeconomic conditions of managed fish populations and their associated fisheries. Based on the Council's recommendation, the report was limited to 20 pages in length, and recognized that several additional sources (many of which included greater technical details) on the state of the CCE are in existence, including: the CalCOFI State of the California Current report, PaCOOS quarterly summaries, and the emerging California Current IEA. The intent of the November 2012 Report was to focus on clear, straightforward explanations of the trends and indicators most relevant to Council managed fisheries, particularly with respect to how and why such indicators were relevant to Council consideration.

The report included a relatively modest suite of some of the key physical and lower trophic level indicators commonly associated with changes in physical and biological conditions throughout the CCE over both broad (e.g., basin scale indices, such as the ENSO or the PDO) and more regional spatial scales (regional examples include upwelling indices, copepod biomass anomalies and relative abundance time series of coastal pelagic species). Other indicators included status and trends for salmon and groundfish populations, trends in marine mammal populations, catch statistics for major West Coast fisheries, trends in fleet diversity and a suite of additional indicators of human activities in the CCE (benthic structures, shipping activity, nutrient input to freshwater systems, offshore oil and gas activity). The overarching objective was to concisely synthesize a wide array of both natural and man-made processes that do or may have impacts (both positive and negative) on both the productivity of Council-managed resources and the socioeconomic well-being of the communities that depend upon them.

Although some of the selected indicators in the first report were more intuitive than others, and some that the EPDT or other advisory bodies had suggested for inclusion were not available for the first report, the report was generally well received by advisory bodies and should serve as a template for future efforts. The Council and its advisory bodies also offered considerable advice for improving future reports, which should guide the development of and indicator choices for the November 2013 report called for in Section 1.4 of the FEP. As the SSC noted, “The report is an important first step in providing the Council family with an ecosystem perspective on West Coast fish stocks, fisheries, and coastal communities… The report will likely evolve over time, depending on which indicators are available and best suited to addressing ecosystem concerns identified by the Council” (K.3.c., Supplemental SSC Report). If the state of the ecosystem report becomes a routine product for informing the Council on CCE status and trends, it should help the Council improve its capabilities to bring ecosystem considerations into its decision-making processes.

Brian Wells, NOAA SWFSC, lowering CTD (Conductivity-Temperature-Depth) Sensor into Pacific Ocean. Photo credit: NOAA/SWFSC

PUBLIC REVIEW DRAFT

ECOSYSTEM INITIATIVES APPENDIX TO THE *PACIFIC COAST FISHERY ECOSYSTEM PLAN*

FOR THE U.S. PORTION OF THE CALIFORNIA CURRENT LARGE MARINE ECOSYSTEM

APPENDIX A

PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 101
PORTLAND, OR 97220
(503) 820-2280
(866) 806-7204
WWW.PCOUNCIL.ORG
FEBRUARY 2013

Contents

List of Acronyms and Abbreviations

CCE	California Current Ecosystem, or California Current Large Marine Ecosystem
CEBA	Comprehensive Ecosystem-Based Management Amendment (of the South Atlantic Council)
CFR	Code of Federal Regulations
Council	Pacific Fishery Management Council
CPS	Coastal Pelagic Species
EC	Ecosystem component (species)
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	Experimental Fishing Permit
EPDT	Ecosystem Plan Development Team
ESA	Endangered Species Act
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plan
FMU	Fishery management unit
HAPC	Habitat Area of Particular Concern
HMS	Highly Migratory Species
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	Optimum yield
U.S.	United States of America
USCG	United States Coast Guard

FEP Appendix A cover image: Blue Marble: Next Generation, Reto Stöckli, NASA Earth Observatory

The Fishery Ecosystem Plan and Ecosystem-Based Fisheries Management Initiatives

At its November 2012 meeting, the Pacific Fishery Management Council (Council) reviewed its draft Fishery Ecosystem Plan (FEP) and received comments on the FEP from its advisory bodies and the public. The Council directed its Ecosystem Plan Development Team (EPDT) on revisions needed to the FEP, and requested that the EPDT release a public review draft of the FEP in early 2013. The Council also chose to separate what had been Chapter 7 in the November 2012 draft, a series of example ecosystem-based fisheries management initiatives, and to release them for public review as an appendix to the FEP.

From its *Purpose and Need Statement*, the FEP is intended in part to provide "management policies that coordinate Council management across its Fishery Management Plans (FMPs) and the California Current Ecosystem (CCE)." For FMP policies, the FEP is needed to "identify and prioritize research needs and provide recommendations to address gaps in ecosystem knowledge and FMP policies, particularly with respect to the cumulative effects of fisheries management on marine ecosystems and fishing communities." This appendix's ecosystem-based fishery management initiatives provide examples of how the Council could address issues that affect two or more Council FMPs or coordinate major Council policies across the FMPs to fulfill identified FEP needs. While ecosystem initiatives are likely to be cross-FMP in scope, some initiatives might primarily affect conservation and management measures within a single FMP.

As discussed in Section 1.3 of the FEP, the Ecosystem Initiatives Appendix (Appendix A) is separate from the FEP and may be modified without the Council having to also modify the FEP or reconsider its contents. The Council would, however, have an annual process for reviewing the ecosystem initiatives and assessing whether changes are needed to Appendix A, or whether analyses are needed to provide background work for new ecosystem initiatives. Annually at its November meetings, the Council and its advisory bodies would:

- review progress to date on any ecosystem initiatives the Council already has underway;
- review the list of potential ecosystem initiatives provided in Appendix A to the FEP and determine whether any of those initiatives merit Council attention in the coming year;
- if new initiatives are chosen for Council efforts, request background materials from the appropriate entities; and
- beginning in November 2017, assess whether to initiate a review and update of the FEP.

Except for FEP Initiative 1, the November 2012 meeting was the first that the Council and its advisory bodies had seen the example ecosystem initiatives. FEP Initiative 1 involves consideration of whether and how to restrict potential future fisheries for currently unfished and unmanaged forage fish species. The Council has had considerable discussion regarding FEP Initiative 1, so a process to move forward with this proposal has been fleshed out and included in this draft. However, the other draft examples are presented in a conceptual manner. The Council seeks feedback on all of these initiatives, including comments on the concepts, suggested priorities and rationale, and ideas for additional initiatives for Council consideration. Initiatives A.2.2 through A.2.8 were available for public consideration at the Council's November 2012 meeting; the Council asked that initiative A.2.9. be added to this February 2013 public review draft.

Each of the potential initiatives in Section A.2. includes: 1) a brief discussion of the question or issue considered, with references to relevant discussions within the FEP, 2) suggestions on background analysis or materials the Council may wish to see in advance of developing the potential initiative, and 3) suggestions on the type of personnel and expertise that may be useful in an ad hoc committee tasked with developing the initiative. In June 2011, the Council decided to retain management authority within its FMPs, and to not create regulatory authority within the new FEP. If the Council wished to make changes to its regulatory programs after analysis and discussion of a cross-FMP initiative, the changes would need to be implemented under the authority of one or more of the Council's existing FMPs. Although this Council does not commonly develop comprehensive fisheries management actions under the authorities of more than one of its FMPs, that practice occurs regularly in other fishery management councils nationwide. Relevant examples from the South Atlantic Fishery Management Council include their Comprehensive Ecosystem-Based Management Amendment (CEBA) 1, which addressed the effects of bottom-tending fishing gear across their FMPs on deepwater corals, and CEBA 2, which addressed essential fish habitat (EFH), retention limits for octocorals, sea turtle bycatch measures, and other issues.

A.1 FEP Initiative 1, Protection for Unfished Forage Fish

FEP Initiative 1 is intended to recognize the importance of forage fish to the marine ecosystem off of the U.S. West Coast, and to provide adequate protection for forage fish. The Council's objective is to prohibit the development of new directed fisheries on forage species that are not currently managed by the Council, or the States, until the Council has had an adequate opportunity to assess the science relating to any proposed fishery and any potential impacts to our existing fisheries and communities. The Council is not pursuing a permanent moratorium on fishing for forage fish. Instead, the Council stated that the proposed goal is to not allow new fisheries to begin without adequate opportunity for assessing the science and the potential impacts on existing fisheries and fishing communities. Under the current rules, there is some risk that fisheries could develop before such analysis could be conducted.

A.1.1 Council Policy on the Development of New Fisheries for Unfished Species

Under Title II of the MSA, there is no allowable level of foreign fishing for species currently unfished within the U.S. West Coast Exclusive Economic Zone (EEZ). Fishing vessels and fish processors of the U.S. have the capacity to harvest and process the levels of optimum yield of all species subject to Council FMPs.

U.S. citizens wishing to initiate new fisheries for West Coast EEZ species that are not subject to Council FMPs, nor explicitly permitted by the list of fisheries described in the Magnuson-Stevens Fishery Conservation and Management Act (MSA) at 16 U.S.C. §1855 and in federal regulations at 50 CFR 600.725(v), are urged to approach the Council with an application for an Exempted Fishing Permit (EFP,) accompanied by a science plan for that EFP fishery, describing the data to be collected by the EFP fishery and the likely analyses needed to assess the potential effects of converting the fishery to an FMP fishery over the long-term. EFP fishery data and analyses should, at a minimum, assess: the amount and type of bycatch species associated with the EFP gear, including protected species, such as marine mammals, sea turtles, sea birds, or species listed as endangered or threatened under the Endangered Species Act (ESA); how the gear will be deployed and fished, and its potential effects on EFH, including the portions of the marine environment where the gear will be deployed (surface, midwater, and bottom). The Council and its advisory bodies will review the results of the EFP to assess whether the information provided is adequate to determine the potential effects of the fishery on the Council's conservation and management measures. Depending on the quality of information received, and on the potential effects of the fishery on the Council's conservation and management measures, the Council will either reissue the EFP, or discontinue the EFP and initiate development of an FMP, FMP amendment, or regulatory amendment process to either prohibit the new fishery from the EEZ, or introduce the new fishery to the EEZ.

U.S. citizens wishing to bypass the EFP process to initiate new fisheries for West Coast EEZ species that are not subject to Council FMPs, nor explicitly permitted by the list of fisheries described in the MSA at

16 U.S.C. §1855 and in federal regulations at 50 CFR 600.725, may do so by following the Council notification process described at 50 CFR 600.747. However, that notification is required to be reviewed by the Council and NMFS for the potential effects of new fisheries on the Council's conservation and management measures for, at a minimum, FMP species, protected species, and for the habitat of managed and protected species. A review conducted in the absence of the scientific data that could be provided by an EFP would be necessarily precautionary.

Whether introduced via the EFP process, or via the notification process at 50 CFR 600.747, the Council would view new fisheries as having the potential to affect its conservation and management measures if those fisheries had an effect on:

- Any Council-managed species;
- Species that are the prey of any: Council-managed species, marine mammal species, seabird species, sea turtle species, or other ESA-listed species;
- Habitat that is identified as EFH or otherwise protected within one of the Council's FMPs, critical habitat identified or protected under the ESA, or habitat managed or protected by state or tribal fishery or habitat management programs;
- Species that are subject to state or tribal management within 0-3 miles offshore of Washington, Oregon, or California;
- Species that migrate beyond the U.S. EEZ.

A.1.2 Council Process for Implementing FEP Initiative 1

At its June 2012 meeting, the Council recommended preventing the future development of fisheries for currently unfished forage fish species through a two-stage process: amending and updating the federal list of authorized fisheries and gear, and developing any additional necessary protections for unfished and unmanaged forage fish through recommendations to amend one or more of the Council's FMPs.

A.1.2.1 Amending the Federal List of Allowable Fisheries and Gear

In the first stage, the Council would develop recommendations to NMFS to update the federal list of authorized West Coast EEZ fisheries and gear found in regulation at 50 CFR 600.725(v). The Council's intent is that the updated list identify authorized fisheries and gear in the "most specific and narrow terms possible" (Final Council Action at G.1.d, June 2012). To develop Council recommendations on revisions to that list, the Council should send out a set of proposed amendments to the current list for review by the states and tribes, its advisory bodies and the public. Once the Council has received comments on its proposed amendments and recommendations for any revisions, the Council may finalize its recommended changes to the list of authorized fisheries and gear. The Council may then transmit those recommendations, along with any accompanying analyses, to NMFS, requesting publication of a proposed rule to implement the recommendations. NMFS would then publish the proposed rule and, after an appropriate public comment period, determine whether to approve, disapprove, or partially approve a final rule implementing the Council's recommendations.

Table A.1 provides draft revisions to the list of authorized fisheries and gears for the U.S. West Coast EEZ for Council consideration as the potential draft to be sent out for review by Council advisory bodies and the public. Table A.1 provides the current list of authorized fisheries and gear under 50 CFR 600.725(v) for the U.S. West Coast EEZ, with suggested removals shown in ~~strikeout text~~, and suggested revisions shown in *italic text*. Potential revisions to this table should consider only those fisheries that occur wholly or partially within federal waters (3-200 nm offshore). No revision to the table should have the effect of prohibiting currently legal directed fisheries or incidental catch.

Table A.1: Authorized West Coast EEZ Fisheries and Gear	
Fishery	**Authorized gear types**
1. Washington, Oregon, and California Salmon Fisheries (FMP):	
A. ~~Salmon set gillnet fishery~~ *Commercial fishery*	~~A. Gillnet~~
~~B. Salmon hook and line fishery~~ *Coastwide*	~~B.~~ Hook and line (**Federal definition for "Hook and line" gear: "one or more hooks attached to one or more lines (can include a troll.)")
~~C. Trawl fishery~~ *East of Cape Flattery* (**Fraser Panel fisheries**)	~~C. Trawl~~ *Gillnet, purse seine, reef net, hook and line*
D. Recreational fishery	D. ~~Rod and reel~~ *Hook and line*
2. West Coast Groundfish Fisheries (FMP):	
A. ~~Pacific coast groundfish trawl~~ *Commercial fishery*	A. Trawl, Hook and line, pot, trap, gillnet, spear, and hand collection
~~B. Set gillnet fishery~~	~~B. Gillnet~~
~~C. Groundfish longline and setline fishery~~	~~C. Longline~~
~~D. Groundfish handline and hook-and-line fishery~~	~~D. Handline, hook-and-line~~
~~E. Groundfish pot and trap fishery~~	~~E. Pot, trap~~
F. Recreational fishery	F. Rod and reel, handline, spear, hook and line
3. ~~Northern Anchovy Fishery~~ *Coastal Pelagic Species* (FMP)	Purse seine, *drum seine*, lampara net, hook and line
4. Angel Shark, White Croaker, California Halibut, White Sea Bass, ~~Pacific Mackerel~~ Large-Mesh Set Net Fishery (Non-FMP)	Gillnet
~~5. Thresher Shark and Swordfish Drift Gillnet Fishery (Non-FMP)~~	~~Gillnet~~
5. Highly Migratory Species (FMP)	*Gillnet, hook and line, troll, harpoon, purse seine*
6. Pacific Shrimp and Prawn Fishery (Non-FMP):	
A. ~~Pot and trap fishery~~ *Commercial fishery*	A. Pot, trap, trawl
~~B. Trawl fishery~~	~~B. Trawl~~
7. Lobster and Rock Crab Pot and Trap Fishery (Non-FMP)	Pot, trap
8. Pacific Halibut Fishery (Non-FMP):	
A. ~~Longline and setline fishery~~ *Commercial*	Longline, troll (when taken as allowable incidental catch in the salmon troll fishery)
B. ~~Hook-and-line fishery~~ *Recreational*	Hook and line
9. California Halibut (Non-FMP) ~~Trawl and Trammel Net Fishery~~	Trawl, trammel net, hook-and-line
~~10. Shark and Bonito Longline and Setline Fishery (Non-FMP)~~	~~Longline~~
11. Dungeness Crab Pot and Trap Fishery (Non-FMP)	Pot, trap
12. Hagfish Pot and Trap Fishery (Non-FMP)	Pot, trap
~~13. Pacific Albacore and Other Tuna Hook-and-line Fishery (Non-FMP)~~	~~Hook and line~~
~~14. Pacific Swordfish Harpoon Fishery (Non-FMP)~~	~~Harpoon~~
~~15. Pacific Scallop Dredge Fishery (Non-FMP)~~	~~Dredge~~
~~16. Pacific Yellowfin, Skipjack Tuna, Purse Seine Fishery (Non-FMP)~~	~~Purse seine~~
~~17. Market Squid Fishery (Non-FMP)~~	Purse seine, dip net
18. ~~Pacific Sardine, Pacific Mackerel,~~ Pacific Saury, Pacific Bonito~~, and Jack Mackerel~~ Purse Seine Fishery (Non-FMP)	Purse seine
19. Finfish and Shellfish Live Trap, Hook-and-line, and	Trap, handline, hook and line

Table A.1: Authorized West Coast EEZ Fisheries and Gear	
Fishery	**Authorized gear types**
Handline Fishery (Non-FMP)	
~~**20. Recreational Fishery (Non-FMP)**~~	~~Spear, trap, handline, pot, hook and line, rod and reel, hand harvest~~
~~**21. Commercial Fishery (Non-FMP)**~~	~~Trawl, gillnet, hook and line, longline, handline, rod and reel, bandit gear, cast net, spear~~

A.1.2.2 Protecting Unfished Lower Trophic Level (Forage) Species Through FMP Authority

The Council's draft policy on the development of new fisheries for unfished species, at Section A.1.1, applies to all U.S. West Coast EEZ fish stocks, not just to forage fish species. If the Council receives a notification of a fisherman's intent to begin a new fishery off the U.S. West Coast, that policy is intended to provide advance information to the new fishery proponent of the Council's priorities for evaluating new fisheries against its ongoing conservation and management priorities and programs. By modifying the list of authorized fisheries and gear, and by adopting a policy on the development of new fisheries in the West Coast EEZ, the Council better prepares itself for a potential future new fishery proposal. However, those actions would not wholly prohibit new fisheries from developing without Council consultation. Therefore, the second stage of the Council's guidance on protecting unfished forage fish is to incorporate any additional needed protections into the current suite of FMPs through an FMP amendment process (Final Council Action at G.1.d, June 2012).

Throughout the Council process to develop the FEP and in addition to its work on developing the FEP, the EPDT has also received Council assignments to assess the process for protecting unfished forage fish species. EPDT reports addressing potential protections unfished forage fish species include:

- June 2011, Agenda Item H.1.b., Supplemental EPDT Report on the Ecosystem Fishery Management Plan, http://www.pcouncil.org/wp-content/uploads/H1b_SUP_EPDT_JUN2011BB.pdf
- November 2011, Agenda Item H.2.a., Attachment 1, Draft Pacific Coast FEP at Appendix A, http://www.pcouncil.org/wp-content/uploads/H2a_ATT1_DRAFT_ECO_PLAN_NOV2011BB.pdf
- June 2012, Agenda Item G.1.b., EPDT Report on Authorities to Protect Unfished Species from Future Directed Fisheries, http://www.pcouncil.org/wp-content/uploads/G1b_EPDT_JUN2012BB.pdf

Figure A.1 illustrates the decisions needed to draft a list of forage species suitable for additional Council protections under FEP Initiative 1. First, the Council explicitly called for protections for "forage" fish. In its November 2011 report (Agenda Item H.2.a., at Appendix,) the EPDT recommended defining "forage" fish with the Smith et al. (2011) definition of low trophic level species, which are: *often present in high abundance, forming dense schools or aggregations, and which are generally plankton feeders for a large part of their life cycle.* This definition explicitly excludes species that transition from low trophic roles as juveniles to higher trophic levels as adults. Next, the Council may address only those species under its geographic area of authority. Of those species or species groups that meet the Smith et al. (2011) definition of a low trophic level species, which occur primarily or exclusively within federal waters – the EEZ? Species occurring primarily or exclusively within federal waters are subject to Council authority. Finally, the Council also expressed its intent to target the protections from this initiative to unmanaged species. If a species is already within an FMP, or under the jurisdiction of a state management program of Washington, Oregon, or California, that species would not be subject to this initiative.

Once the Council has broadly defined the set of unmanaged, unfished forage fish species or species groups that fall under its EEZ-based authority, it should next review the connections those species have to FMP fish and fisheries. Are the unmanaged, unfished forage fish species: taxonomically similar to species within any FMP, the prey of any FMP species or species group, bycatch within the fisheries of any FMP or likely to be caught by a gear managed under an existing FMP, or otherwise connected to any

FMP species? After having those connections identified, the Council may then use the FMP amendment process to assign the unfished, unmanaged forage fish species to the appropriate FMP(s) as either fishery management unit (FMU) or ecosystem component (EC) species.

Federal regulations at 50 CFR 600.10 define the term "fishery management unit" to mean: "a fishery or that portion of a fishery identified in an FMP relevant to the FMP's management objectives. The choice of an FMU depends on the focus of the FMP's objectives, and may be organized around biological, geographic, economic, technical, social, or ecological perspectives."

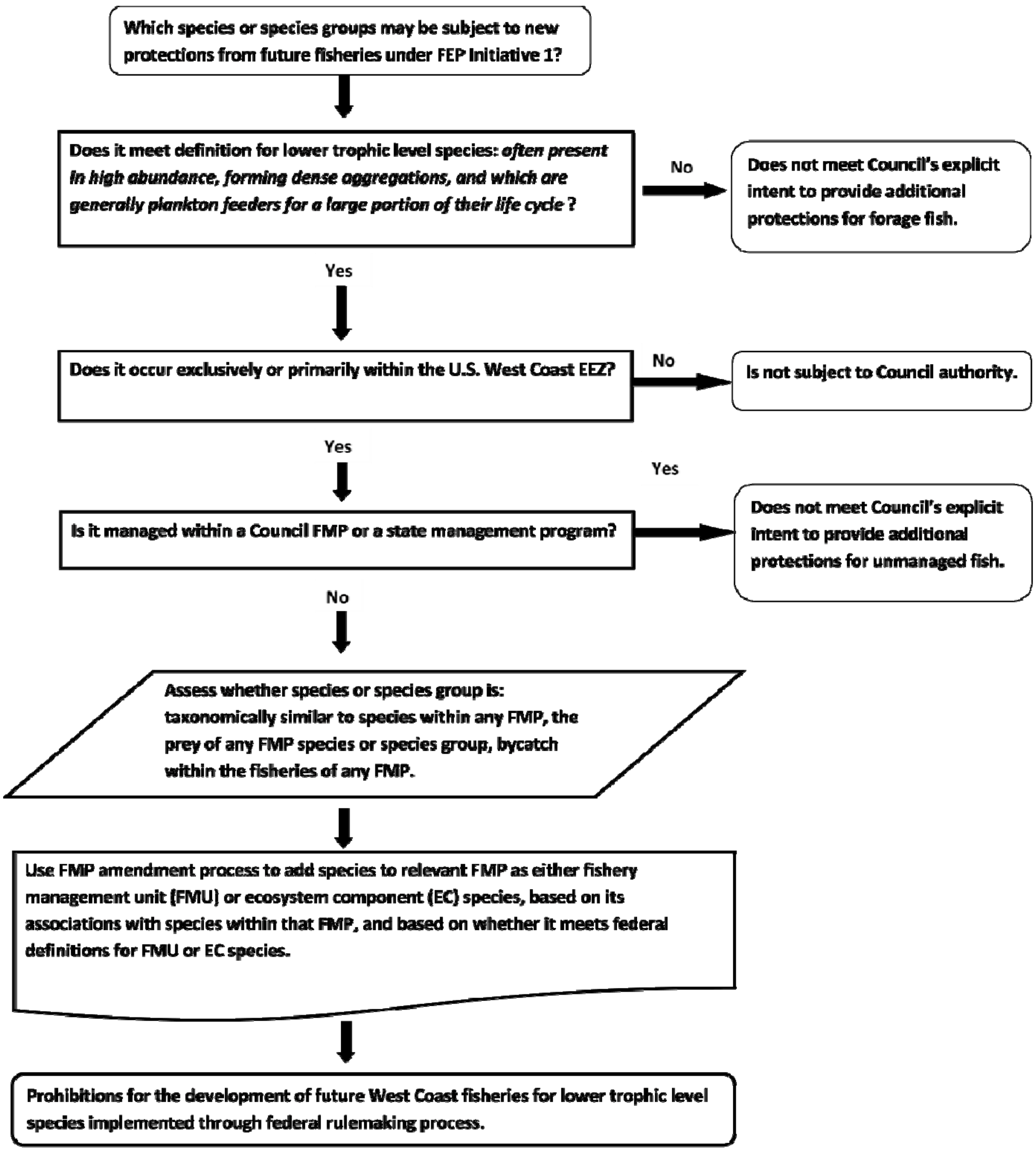

Figure A.1: Process for deciding whether a species qualifies for additional protections from future potential fisheries

Fish stocks that are classified as FMU species are considered to be in the fishery, whether as target or non-target species. Federal regulations at 50 CFR 600.310(d)(3) and (4) provide the following definitions for "target stocks" and "non-target species," both of which are considered FMU species:

> "*Target stocks*" are stocks that fishers seek to catch for sale or personal use, including "economic discards" as defined under Magnuson-Stevens Act section 3(9).
>
> "*Non-target species*" and "*non-target stocks*" are fish caught incidentally during the pursuit of target stocks in a fishery, including "regulatory discards" as defined under Magnuson-Stevens Act section 3(38). They may or may not be retained for sale or personal use. Non-target species may be included in a fishery and, if so, they should be identified at the stock level. Some non-target species may be identified in an FMP as ecosystem component (EC) species or stocks.

At 50 CFR 600.310(d)(5), federal regulations provide details on classifying species as EC species, saying that those species should:

(A) Be a non-target species or non-target stock;
(B) Not be determined to be subject to overfishing, approaching overfished, or overfished;
(C) Not likely to become subject to overfishing or overfished, according to the best available information, in the absence of conservation and management measures; and
(D) Not generally be retained for sale or personal use.

Those same guidelines suggest further that, "Occasional retention of [a] species would not, in and of itself, preclude consideration of the species under the EC classification . . . EC species may be identified at the species or stock level, and may be grouped into complexes. EC species may, but are not required to, be included in an FMP or FMP amendment for any of the following reasons: For data collection purposes; for ecosystem considerations related to specification of [optimum yield] OY for the associated fishery; as considerations in the development of conservation and management measures for the associated fishery; and/or to address other ecosystem issues. While EC species are not considered to be 'in the fishery,' a Council should consider measures for the fishery to minimize bycatch and bycatch mortality of EC species consistent with National Standard 9, and to protect their associated role in the ecosystem. EC species do not require specification of reference points but should be monitored to the extent that any new pertinent scientific information becomes available (e.g., catch trends, vulnerability, etc.) to determine changes in their status or their vulnerability to the fishery. If necessary, they should be reclassified as 'in the fishery'."

After the Council has adopted FMP amendments to add new species or species groups to one or more of its FMPs, and has transmitted those amendments and their accompanying analyses to NMFS, the agency would consider finalizing prohibitions on future fisheries for those species through the federal rulemaking process. Although the Council could choose to add species to just one of its FMPs, it might also consider a comprehensive amendment to add new species to different FMPs through the same discussion and analysis process, and through a combined rulemaking process to address each of the relevant FMPs.

In addition to considering the comprehensive amendment process, occasionally used by other fishery management councils, the Council may also wish to review the North Pacific Fishery Management Council's Amendments 36 and 95/96 to its Bering Sea and Aleutian Islands Groundfish FMP, and Amendments 39 and 87 to its Gulf of Alaska Groundfish FMP. As discussed in the EPDT's June 2012 report at G.1.b, those FMP amendments prohibited fishing for families and orders of forage fish species, rather than identifying prohibited forage fish down to the species level.

Although the EPDT has completed several Council assignments on protecting unfished species, the EPDT was originally organized to support the development of an FEP, and its members include agency personnel with a necessarily broad range of expertise and interests. The Council is considering assigning a new ad hoc committee to more fully develop FEP Initiative 1, so that the Council and the public may receive advice from a body composed of persons with expertise more focused on lower trophic level species and their interactions with fisheries, either directly as target species, or indirectly as bycatch. In working through the process described above and summarized in Figure A.1, the Council has recommended the ad hoc committee tasked with completing FEP Initiative 1 review the EPDT's November 2011 preliminary draft list of lower trophic level species from Appendix A to Agenda Item H.2.a., Attachment 1, Draft Pacific Coast FEP. In that appendix, the EPDT noted that the preliminary draft list focused on pelagic forage fish species, but that further analysis could be focused on benthic zone species. That list, labeled as "Table A-1" in the original November 2011 report, is reproduced below, but labeled as "Table A.2" herein, in keeping with the sequence of tables within this Ecosystem Initiatives Appendix

For the purpose of Table A.2, the term "managed" refers to whether there is active management under state, tribal or federal actions (including both FMP species and ESA listed species,) noting that some species for which management is listed as "none" may have some gear restrictions or other regulatory actions. For simplification, Table A.2 does not include juveniles of species that would otherwise be considered higher trophic level predators, although the role of younger life history stages of all species as forage is critical and the vast majority of predation mortality typically takes place in the larval or juvenile life history stages of most marine species. While the list in Table A.2 is incomplete, it captures a majority of the significant West Coast species and assemblages that could be considered lower trophic level species under the Smith et al (2011) definition, based on a November 2011 review of existing literature.

Although a comprehensive review of every food habits study and result was beyond the scope of the EPDT's November 2011 report, and despite the observation that virtually all of the species listed in Table A.2 are encountered in predator food habits studies at times, the literature suggests that the greatest proportion of energy flow in the CCE appears to be through krill, market squid, northern anchovy, Pacific sardine and Pacific herring. There are few other species (excluding juveniles of non-lower trophic level species) that occur with high frequency and with a comparable significance to the above core group of species. Thus, despite real or potential historical or future conservation problems for some of these species, there is not a high level of unmanaged standing biomass for forage species that could become subject to fisheries targeting over the short term and which are critical to large scale CCE functioning, energy flow, or integrity.

Table A.2: Preliminary summary of select lower trophic level species in the CCE

Common and species name	Relative abundance	Fisheries potential	Role in ecosystem	Managed?
Vertebrates				
Northern anchovy (*Engraulis mordax*)	Low frequency (regime scale) variability over time and space, but typically abundant from nearshore to offshore habitats throughout the CCE	Formerly a major fisheries target (100,000s tons), currently a small scale (largely bait) and incidental catch	Key forage species for wide range of HMS, salmon, groundfish, seabird and marine mammals	CPS FMP
Pacific sardine (*Sardinops sagax*)	Low frequency (regime scale) variability over time and space, but often abundant from nearshore to offshore habitats throughout the CCE	Historically, largest fishery in California Current (100,000s tons), currently a major fisheries target	When abundant, a key forage species for wide range of HMS, salmon, groundfish, seabird and marine mammals	CPS FMP

Common and species name	Relative abundance	Fisheries potential	Role in ecosystem	Managed?
Pacific mackerel (*Scomber japonicus*)	Low frequency (regime scale) variability over time and space, but often abundant from nearshore to offshore habitats throughout the CCE	Historically and currently an important fisheries target (10,000s tons)	When abundant, a moderately important forage species for many HMS and some marine mammals	CPS FMP
Jack mackerel (*Trachurus symetricus*)	Low frequency (regime scale) variability over time and space, but often abundant in offshore habitats (rarely close to shore) throughout the CCE	Occasionally important fisheries target (10,000s tons)	When abundant, a moderately important forage species for many HMS and some marine mammals	CPS FMP
Pacific herring (*Clupea pallasi*)	Abundant to very abundant in nearshore and many estuaries	Fairly high commercial importance (up to 10,000s tons)	Among the more frequently encountered prey in predators such as salmon, hake, rockfish, marine mammals, seabirds	States
Round and thread herrings (*Etrumeus teres* and *Opisthonema libertate*)	Subtropical species that are "reasonably abundant" in the southern part of the CCS. Range likely to expand with global climate change	Unknown in CCS, but in 100,000s tons throughout Eastern Tropical Pacific	Currently key LTL species in core range, could potentially be in CCS with global change	none
American shad (*Alosa sapidissima*)	Anadromous, moderately abundant in rivers, estuaries	CCS landings in 100s tons, com./rec. important elsewhere	An introduced species, moderately important prey for some predators	none
Mesopelagic fishes (Myctophidae, Bathylagidae, Paralepididae, Gonosomatidae; 100s of species in CCS)	Likely the most abundant fish assemblage on the planet. Uncommon inshore but tremendously abundant in mesopelagic (offshore, midwater) waters	Currently limited fisheries potential; despite tremendous abundance, technology is historically infeasible	Important prey for entire mesopelagic food web, many large squids, many tunas and HMS, some rockfish (esp. blackgill, bank), rare in mammal or seabird diets	none
Pacific sandlance (*Ammodytes hexapterus*)	Common, but not abundant, in coastal waters of Pacific Northwest	Important fishery target in other regions (particularly North Atlantic)	Moderately important prey for some fishes, seabirds and marine mammals in the Pacific Northwest	none
Pacific saury (*Cololabis saira*)	Low frequency (regime scale) variability over time and space, primarily an offshore (pelagic) species, often very abundant in offshore waters during cool regimes/periods	Very important fishery off of Japan, elsewhere in North Pacific; presumably a potential large-scale target	Relatively important prey to albacore, sablefish, sharks, other HMS species (rarely found in predators shoreward of shelf break)	none
Silversides (Atherinospsidae; includes grunion, jacksmelt, topsmelt, perhaps 3-5 other rare spp.)	Moderately abundant in nearshore (but considerably less so than osmerids based on larval abundance data)	Historically commercial and recreational targets (up to ~ 1000 tons in 1940s), recent catches relatively modest. Fisheries typically nearshore	Very abundant in some nearshore areas, presumably important forage species in such areas, but rarely encountered in food habits data for key commercial species	none
Eulachon (*Thaleichthys pacificus*)	Anadromous, coastal, formerly fairly abundant, currently rare	Formerly of fairly high commercial/recreational importance (CCS landings in 1000s tons)	Common but not abundant prey item for wide range of predators	ESA

Common and species name	Relative abundance	Fisheries potential	Role in ecosystem	Managed?
Other Osmerid smelts (Osmeridae; includes capelin, surf smelt, whitebait smelt, perhaps 3-5 other spp)	After the clupeids (and exclusive of mesopelagics), among the most abundant family of forage fish species in nearshore; typically less abundant offshore	Some species are of minor to modest commercial significance (surf smelt), or have been the target of major fisheries elsewhere (e.g., Atlantic capelin)	Preyed on by wide range of piscivores (seabirds, marine mammals, Pacific hake, sablefish, rockfish, salmon), but rarely comprise a large fraction of total prey.	none
Shortbelly rockfish (*Sebastes jordani*)	Likely the most abundant Sebastes spp. in Central and Southern California, exhibits low frequency (regime like) variability	Minor incidental landings, potential future fisheries target	Juvenile and adult life history stages are very important to salmon, many groundfish, seabirds and marine mammals.	Groundfish FMP
Sanddabs (*Citharichthys* spp), particularly Pacific (*C. sordidus*) and speckled (*C. stigmaeus*)	One of the more abundant soft-bottom groundfish, also found in water column, typically over shelf.	Substantial commercial and recreational catches (100s to 1000s tons)	Juvenile and adult life history stages are very important to many groundfish, particularly piscivorous flatfish; some seabirds and marine mammals.	Ground-fish FMP
Pacific tomcod (*Microgadus proximus*)	Locally abundant in some nearshore habitats	Trace historical landings, little current fishery interest or potential	Relatively minor importance in most food habits studies.	none
Small croakers (*Sciaenidae*) e.g. white croaker and queenfish **	Fairly abundant, particularly in nearshore waters of the southern CCE	Some commercial and recreational landings (perhaps to 1000s tons)	Somewhat important for some nearshore species; larvae are very abundant in ichthyoplankton, suggesting relatively high abundance in some areas.	none
Invertebrates				
Euphausiids (krill), primarily *Euphausia pacifica* and *Thysanoessa spinifera*	Tremendously abundant throughout coastal and offshore waters, a hugely important component of the food web	Commercial targets in Antarctica, Japan, some small fisheries off British Columbia and other locations; increasing commercial potential.	Key forage species for wide range of both juvenile and adult salmon, groundfish, squid, seabird and marine mammals	Fishing prohibited in CPS FMP
Market squid (*Doryteuthis opalescens*)	Nearshore and shelf distribution (adults relatively rare offshore)	Very important commercial target in CCS (up to, rarely over, 100,000 tons)	Key forage species for wide range of HMS, salmon, groundfish, seabird and marine mammals	CPS FMP (CA state)
Pelagic squids (such as boreal clubhook squid, neon flying squid and Humboldt squid)	Offshore distribution (most spp. rare inshore)	Important commercial target elsewhere in range	These and other squid are key prey for HMS species and marine mammals.	none

** Sciaenidae, excluding white sea bass (*Atractoscion nobilis*) and corbina (*Menticurrhus undulates*) but including small, schooling species such as queenfish (*Seriphus politus*), spotfin croaker (*Roncador stearnsii*), white croaker and potentially others (the latter three are probably the most abundant; note that white seabass is clearly a higher trophic level predator).

A.2 Potential Future FEP Initiatives for Council Consideration

During its development process for the FEP, the Council and its advisory bodies have discussed how a cross-FMP or ecosystem approach to management might assist the Council's long-term planning on a broad range of issues. The following potential future FEP initiatives for consideration by the Council and the public are based on the FEP's Purpose and Need Statement, the FEP's Objectives, and the MSA's national standards and other requirements, including environmental impact analysis under the National Environmental Policy Act (NEPA). Potential initiatives are based in the major themes of the MSA and consider cross-FMP issues, including: harvest level policies and overfished/overfishing, bycatch, EFH, and community effects of fisheries management. For this public review draft of the Ecosystem Initiatives Appendix to the FEP, the Council seeks comments on the initiatives concepts, suggested initiative priorities and rationale for those suggestions, and ideas for additional initiatives for Council consideration.

A.2.1 Initiative on the Potential Long-Term Effects of Council Harvest Policies on Age- and Size- Distribution in Managed Stocks

This cross-FMP initiative, relevant for groundfish, highly migratory species (HMS,) and coastal pelagic species (CPS,) has several goals that could help the Council better address the larger-scale harvest issue of maintaining broad age- and size-distributions in managed fish stocks:

- Conduct a comprehensive literature review of the documented and potential consequences of shifting or truncating age or size structure on population reproductive potential, population stability and variability and interactions between these dynamics and climate variability
- Conduct a review and analysis of long term effects on the truncation of age- and size-distribution of managed stocks under the currently implemented harvest control rules; and
- Conduct a management strategy evaluation that considers the performance of current harvest control rules as well as alternative harvest control rules that incorporate age- and length-structure into Council management reference points.

This initiative would help the Council consider how current harvest control rules behave with respect to the truncation of age- and size-distribution of managed stocks, and possible alternative harvest control rules that incorporate age- and length-structure into Council management reference points. Background work for this initiative should include an evaluation of the established, perceived and potential consequences of moderate to severe shifts in age and size structure to effective egg or larval production, population dynamics and stability. Analysis should also seek to quantitatively (where possible) evaluate the trade-offs between managing for a greater proportion of older and/or larger fish in a population relative to current management strategies that do not explicitly consider age composition. As discussed in the FEP at Section 4.1.1, simulation studies suggest that the consequences of truncation in age and size structure include but are not limited to reduced and/or more variable egg or larval productivity, real or likely increases in population or recruitment variability, and increased variability in catches. These effects in turn may be magnified as a result of changing environmental conditions or changes in the dominant modes of climate variability. Knowing how life histories and changes in population demographic structure could lead to changes in the sensitivity to environmental variability should be help address fisheries management challenges stemming from scientific uncertainty in population-associated stock size estimates.

To implement this initiative, the Council could assemble an ad hoc advisory committee to develop an approach for a review and analysis of the long term effects on the truncation of age- and size-distribution of managed stocks under the currently implemented harvest control rules, an approach for conducting a management strategy evaluation of harvest control rules, and to identify future research needs to help address this initiative. Conducting the management strategy evaluation would not be a small task, and would likely require dedicated time from a team of scientists before it would be ready for presentation to and review by the Council and its advisory bodies. The advisory committee for this initiative could help identify an appropriate team to implement the management strategy evaluation. The advisory committee could consist of federal, state, tribal and academic scientists, and others the Council deems appropriate to the task.

A.2.2 Bio-Geographic Region Identification and Assessment Initiative

Section 3.1.2 of the FEP identified three large scale bio-geographic regions of the CCE that could be further subdivided into finer scale nested sub-regions to provide the Council with a framework for undertaking finer scale fisheries management actions to implement ecosystem-based management and to facilitate linkages with other government policies and processes. One possibility for defining such spatial divisions could be based upon the functional distributions of species, for example:

- Estuarine habitats
- Nearshore habitats
- Inshore demersal habitats
- Offshore demersal habitats
- Pelagic habitats (coastal and offshore)

Within each finer scale sub-region, the Council may wish to undertake assessments of fishery removals, location of fishing activities, fishing capacity, evidence for past or present localized depletion of species as well as future susceptibility to localized depletion, and the impact of freshwater inputs to the CCE as well as land-based human impacts to the coastal ocean (for example the alteration of fresh water flow and nutrient loads). The delineation of finer spatial scale sub-regions is particularly important for nearshore species and fisheries, since the bio-geographic regions identified in the FEP at Section 3.1.2 are likely at too coarse a scale for effective implementation of localized ecosystem-based management. Further identification of smaller scale sub-regions could improve management outcomes and allow for stronger connectivity between biophysical and ecological processes.

Background work for developing this initiative could include identifying finer scale sub-regions to provide a framework for more spatially-explicit management. Serial depletion of species can be investigated by reconstructing catch histories within each fine scale sub-region and by examining changes fishing patterns, for example, latitudinally and with depth. Central to the examination of fishery data is the need for strong, appropriately collected recreational fishing data, particularly in the estuarine and nearshore areas, to support integrated fisheries management at a finer spatial scale. Scientific work developed in support of this initiative could also provide a framework for investigating: 1) how fishing activity affects ecosystem structure and function, particularly spatial and temporal fishing patterns and their relation to changing patterns in the ecosystem (cumulative impacts of all FMP fisheries), 2) the impacts of marine spatial planning efforts on FMP species and fisheries, 3) changes in species distributions and migration patterns, and 4) fishing activity location patterns versus biomass distribution of managed species.

To implement this initiative, the Council could assemble an ad hoc advisory committee to assess: data availability and quality for identifying finer scale sub-regions nested within the large bio-geographic regions of the CCE, and whether any of those finer scale sub-regions are appropriate for smaller-scale ecosystem-based fishery science and management. Identifying finer scale sub-regions within the CCE could help scientists and managers better assess sub-populations, regional management issues, and how the effects of management decisions may vary between sub-regions. Identifying sub-regions could also help the larger natural resource science and management community to better assess and understand connections between terrestrial and marine ecosystems at a smaller than coastwide scale. An advisory committee to develop this initiative could include federal, state, and tribal ecologists and habitat scientists, fishing community representatives, fishery participants from each of the Council's four FMPs, and others the Council deems appropriate to the task.

A.2.3 Cross-FMP Bycatch and Catch Monitoring Policy Initiative

The MSA's National Standard 9 states: *Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.* FMPs are also required to *establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority – (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided* [§303(a)(11].

Catch and bycatch monitoring programs vary between Council fisheries, as does the quantity and quality of information provided by these programs. The Council has historically had greater concern with bycatch in the groundfish and HMS fisheries than in the salmon and CPS fisheries, although salmon fishery management itself is largely a complex effort to conduct fisheries that minimize the bycatch of threatened and endangered runs of salmon. Under this initiative, the Council would take a cross-FMP look at its bycatch minimization and monitoring policies, to share information and methodologies across FMPs, and to develop cross-FMP bycatch minimization goals. A notable challenge with this initiative is that the gear types, fishing methods and locations, and target species of the different FMPs are so distinct from each other that there is a reasonable possibility that bycatch minimization methods that are effective in one fishery will not be effective in other fisheries.

FMP-based bycatch minimization policies necessarily focus on the bycatch within particular fisheries. Responding to the MSA by reducing the volume and rate of bycatch in individual Council-managed fisheries has most likely resulted in an overall reduction in the total volume of incidentally-caught and discarded CCE marine life. However, moving beyond the fishery-by-fishery approach could allow the Council to better assess issues like: the cumulative effects of the bycatch of non-Council species taken in Council-managed fisheries; whether gear innovation programs or products in one fishery could benefit other fisheries; and whether the timing and interactions of multiple Council-managed fisheries increase or decrease the likelihood of bycatch in these fisheries. The Council could also use a cross-FMP look at bycatch to help it prioritize its bycatch monitoring and minimization workload, perhaps prioritizing its work for those fisheries with greater amounts of bycatch, or greater numbers of incidentally caught protected species.

Background work for developing this initiative would require an assessment of the available bycatch monitoring and management information for Council-managed fisheries. Much of this information is already available in Council SAFE documents and in NMFS reports, particularly the National Bycatch Report (NMFS 2011). If agency staff were to review available literature to provide a cross-comparison of bycatch management programs within Council-managed fisheries, including an evaluation of where fisheries management and regulations for different fisheries might intersect to allow bycatch, that review could provide the Council with an initial assessment of where its greatest challenges might lie in reducing cumulative bycatch in Council-managed fisheries. The staff review of bycatch monitoring and management issues should, at a minimum, address:

- which fisheries have bycatch of protected species (mammals, birds, ESA-listed) and the measures taken to minimize bycatch of those species
- which fisheries have bycatch of Council-managed species and, if known, how much

- the state of the literature on unobserved fishing mortalities and applicability to West Coast fisheries
- whether management measures in any one Council-managed fishery affect the amount or type of bycatch in any other Council-managed fishery

To implement this initiative, the Council could assemble an ad hoc advisory committee to assess: commonalities and differences between catch and bycatch monitoring between FMPs, bycatch minimization practices between FMPs, whether regulatory programs under one FMP exacerbate bycatch rates under other FMPs, and the cumulative effects of bycatch in Council-managed fisheries. That committee would then report to the Council on whether there could be benefits to target or non-target species from integrating the Council's bycatch minimization efforts across FMPs, whether amendments to fishery regulations could minimize inter-fishery conflicts that exacerbate bycatch, and whether science and management programs used under one FMP could also be used under any other FMP. That advisory committee could consist of federal, state, and tribal catch monitoring, gear development, and protected species programs; fishery participants from each of the Council's four FMPs and different gear users, enforcement professionals, and others the Council deems appropriate to the task.

A.2.4 Cross-FMP EFH Initiative

The MSA defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" [§3(10)]. All four of the Council's FMPs have described EFH for managed species, with the groundfish FMP having the most detail, including Habitat Area of Particular Concern (HAPC) designations and closed areas to protect EFH. Geographic maps of EFH have been developed for all FMPs, except CPS. The CPS and Salmon FMPs have also recently completed their first 5-year reviews of EFH (50 CFR 600.815(A)(10),) and the Groundfish EFH review is ongoing. Under this initiative, the Council would develop a plan to integrate its work between FMPs in future 5-year EFH review processes.

The Council has been engaged in 5-year EFH reviews for one FMP or another since 2009. The next round of EFH review would start in 2014-2015. An ecosystem-based Council approach to EFH would provide a better understanding of complex overarching issues such as: research needs, common threats to habitat quality, protected species interactions, or ocean acidification. An ecosystem-based EFH review would both provide required updates for FMPs, and would work across FMPs to identify habitat areas that are considered highly productive or biodiverse under more than one FMP. Habitats of importance to species from multiple FMPs could serve as focal points for Council efforts to assess and mitigate for fishing and non-fishing effects on EFH, and for research to better understand the complex interactions between FMP species and their shared habitat. One possible result of an integrated EFH review would be cross-FMP HAPC designations for areas that are important to species from multiple FMPs.

The Council could also expand or alter this initiative to consider spatial management policies more generally. Historically, the Council has implemented spatial management measures under its different FMPs without undertaking a cross-FMP assessment of how those measures may affect fish and fisheries managed under other FMPs. If area closures in various Council-managed fisheries could be better synched between FMPs, the Council could reduce regulatory confusion across fisheries, and better tailor closed areas for benefits under multiple FMPs.

Background work for developing this initiative would require an assessment of the commonalities and differences between how FMPs approach the 5-year EFH review requirements. If agency staff were to provide the Council with a review of the multiple FMP EFH review requirements, that review could help the Council to envision an integrated, cross-FMP EFH review. The staff review of FMP requirements should, at a minimum, address:

- whether the FMPs require species-by-species reviews, or if reviews can be tailored to larger complexes of species;
- the availability of EFH maps and other spatial data, including fishing activity location, for the four FMPs;
- commonalities between FMPs on which types of fishing and non-fishing activities are most likely to affect EFH for Council-managed species;

To implement this initiative, the Council could assemble an ad hoc advisory committee to conduct a post-mortem review of the lessons learned from the current round of EFH reviews. That committee would then develop a plan for the next round of EFH reviews that would allow the Council to consider all of its EFH designations through the same process, and to consider how and whether species within the different FMPs use the same habitats, and perhaps ultimately develop cross-FMP policies and amendments for EFH. That advisory committee could consist of representatives from the Council's current Habitat Committee, Groundfish EFH Review Committee, and EPDT, plus any additional habitat scientists, restoration specialists, mapping specialists, and others the Council deems appropriate to the task.

A.2.5 Cross-FMP Safety Initiative

The MSA's National Standard 10 states: *Conservation and management measures shall, to the extent practicable, promote the safety of human life at* sea. NMFS is considering revising and updating the federal National Standard 10 guidelines at 50 CFR 600.355, to better use and account for modern safety information and technology (77 FR 22342, April 21, 2011). In the EPDT's March 2011 report (Agenda Item J.1.c., Attachment 1,) the team included United States Coast Guard (USCG) West Coast vessel incident data for vessels participating in fisheries targeting species from the Council's four FMPs. That data is updated, including parenthetical comments from USCG, and provided here in Table A.3:

Table A.3: West Coast recorded vessel incidents, by FMP

	CPS	Groundfish	HMS	Salmon
Recorded safety issues, vessel incidents, and mortalities for fisheries under each FMP	USCG District 11 2006-2011 data: 11 squid fishery vessel incidents, from which one life was lost and 8 vessels were lost. USCG District 13 2000-June 2012 data: 4 sardine fishery vessel incidents, from which 2 lives were lost and 4 vessels were lost.	USCG District 11 2006-2011 data: 11 groundfish fishery vessel incidents, from which 2 lives were lost and 9 vessels were lost. USCG District 13 2000-June 2012 data: 12 groundfish fishery vessel incidents, from which 11 lives were lost and 6 vessels were lost. (The F/V Lady Cecilia sinking in March 2012 caused the loss of 4 lives and one vessel.)	USCG District 11 2006-2010 data: 1 tuna fishery vessel incident, no lives nor vessels lost. USCG District 13 2000-2008 data: 11 tuna fishery vessel incidents, from which 2 lives were lost and 10 vessels were lost. (Fatigue continues to be a contributing factor to tuna vessel casualties.)	USCG District 11 2006-2011 data: 8 salmon fishery vessel incidents (3 of which were combination crab/salmon trips,) from which 3 lives were lost and 6 vessels were lost. USCG District 13 2000-June 2012 data: 24 salmon fishery vessel incidents, from which 11 lives were lost and 23 vessels were lost.

The USCG and the National Institute for Occupational Safety and Health (NIOSH) regularly assess the causes of loss of life at sea for U.S. waters nationwide (Lincoln and Lucas 2008, Dickey 2011). With its non-voting seats on fishery management councils nationwide, the USCG regularly brings vessel incident and safety concerns into Council conversations. However, a more directed engagement between the Pacific Council, the USCG, and other members of the West Coast enforcement, safety, fisheries, and weather prediction and advisory communities, could provide more and better information to the Council and the public on safety concerns within its fisheries. In 2010, for example, the USCG responded to a request from the New England Fishery Management Council for an analysis of fishing casualties and fatalities in the Atlantic Scallop fishery (De Cola 2010). That analysis helped that council to see some of the key safety challenges in the New England scallop fishery, and to better consider whether changes to fisheries regulations could help improve the fishery's safety.

An ecosystem-based, cross-FMP safety review would look at the safety implications of not just one fishery, but at all of the injuries and mortalities in West Coast fisheries. Although the Council does not manage the West Coast fishery that is usually considered as highest in mortalities, Dungeness crab (Lincoln and Lucas 2010,) fishermen and vessels from that fishery regularly participate in Council-managed fisheries. By looking across fisheries, the Council and the public will be better able to assess how fisheries regulations interact with each other, and whether those interactions have unsafe results for fishery participants. West Coast fishing vessels commonly engage in multiple fisheries, which means that vessel owners, captains, and crew have to think about the tradeoffs in participating in various fisheries throughout the year. Taking a broad, ecosystem-based approach to a safety review would better account for the challenges fisheries participants face as they plan their work in various West Coast fisheries.

Background work for developing this initiative would require some initial Council coordination with and through the USCG and other members of the Council's Enforcement Consultants. If the USCG and NMFS were to work with NIOSH to develop a safety risk assessment for West Coast fisheries, that assessment could provide the Council with information on where and when fisheries injuries and mortalities are occurring, some of the causes of the mortalities (e.g. vessel flooding, large wave strike, collision, vessel fire, engine failure, crew falls overboard, etc.). The results of that assessment should help the Council to consider whether West Coast fisheries safety could be improved through:

- revisions to fisheries regulations;
- modifications to technological equipment to provide fleets with more and better information on weather and ocean conditions;
- better at-dock compliance with and participation in available safety programs.

To implement this initiative, the Council could assemble an ad hoc advisory committee to develop draft Council actions in support of changes to regulations, or recommendations on changes in technology or on educating fleet participants about available safety resources. That advisory committee could consist of fisheries participants, and enforcement and regulations professionals, and others the Council deems appropriate to the task.

A.2.6 Human Recruitment to the Fisheries Initiative

The MSA's National Standard 8 states: *Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meets the requirements of paragraph (2)* [National Standard 2 requiring the use of best available science], *in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.*

Since National Standard 8 entered the MSA in 1996, many Council decisions have been necessarily focused on meeting the conservation requirements of the Act, with little room in available harvest levels for considering how best to provide for the sustained participation of fishing communities. West Coast fishing communities themselves range from a series of fishing piers within large urban areas with diverse income opportunities to small coastal towns with few economic opportunities beyond industries related to natural resource extraction or tourism. These diverse communities have their own governance structures and planning efforts for their futures that may or may not include considerations for the ongoing presence of the fishing industry within their communities. Under National Standard 4, the MSA also states that *Conservation and management measures shall not discriminate between residents of different States…* For these reasons, the Council's conservation and management measures have, when practicable, focused on minimizing the overall adverse economic impacts of their decisions.

If, however, providing for the sustained participation of fishing communities in fisheries were considered at the coastwide level, the "graying" of West Coast fishing fleets may be a concern for the Council and all of the management entities participating in the Council process. As of October 1, 2012, approximately 94% of the West Coast groundfish trawl quota shares were owned by identifiable individuals, with the remaining 6% owned by corporations or trusts. The average age of groundfish trawl quota share owners, weighted by percentage of shares owned, is 60, and the median age is 59 – meaning that the ages of quota share owners are fairly evenly distributed around a center point of age 59. The average age of the owners of groundfish vessels carrying quota shares, weighted by percentage of vessel owned, is 57, and the median age of those vessel owners is also 57. Initial results from NMFS's Pacific Coast Groundfish Trawl Fishery Social Study also found a strong distribution of both quota and vessel owners in the 51-60 years-of-age decile (Russell et al 2012). Similarly, for permit owners in both Oregon's salmon troll fleet and in its pink shrimp fleet, average age is 58, with a median age of 59. According to U.S. Census data, the median age of Oregonians in 2010 was age 38.

Not all Council- or state-managed fisheries will have data on the ages of fishery participants. However, a cross-FMP look at both the ages of participants and the flexibility of movement between fleets could give the Council better information about the long-term viability of West Coast fleets. The State of Alaska is addressing the aging of its fisheries participants through its legislature (AK CSHCR 18 2012) and with a University of Alaska Fisheries, Seafood and Maritime Initiative to assess current and future maritime workforce needs. There are examples within the U.S. and elsewhere of apprenticeship programs to train new back deck crew and provide ongoing safety and gear training for rising skippers (e.g. DMR 2011, Whitby and District Fishing Industry Training School of the U.K., National Fishing Industry Education Centre of Australia). Educational programs like Clatsop Community College's Maritime Sciences – Vessel Operations program and Seattle's Maritime Academy can train aspiring crew members. There may, however, be longer-term financial and regulatory barriers to entry into and advancement within the fisheries. Council attention to long-term human recruitment to West Coast fisheries could help fishery participants and fishing communities better prepare for the future of the fishery itself.

Background work for developing this initiative would require an analysis of available demographic data on participants in Council-managed fisheries and research into nationwide programs for supporting new fishery entrants. If agency staff were to review available data, literature, and private and government efforts to bring new participants into fisheries, that review could help the Council assess whether the immobility between and entrance into West Coast fisheries is of significant enough concern to merit a new Council effort under National Standard 8. The staff review of human recruitment to the fisheries issues should, at a minimum, address:

- for those fisheries where the age-distribution of participants is known, how that distribution compares to age distribution in coastal counties
- information on costs, where known, of permits and vessels needed to participate in Council-managed fisheries

- what programs, private and public, are available nationwide to facilitate the entrance of new and younger participants into fisheries

To implement this initiative, the Council could assemble an ad hoc advisory committee to assess: mobility within and between Council-managed, and state/tribe-managed fisheries, barriers to entry in Council-managed fisheries, and nationwide efforts to facilitate the upward mobility of skilled crewmen to positions as skippers, vessel owners, and other leadership positions within the fishing fleet. That committee would then report to the Council on potential management programs to improve human recruitment to West Coast fisheries over time, addressing both programs the Council could implement through its FMPs and recommendations the Council could make to government agencies for initiatives outside of the Council's authority (e.g. low interest rate loans for permit purchasers meeting certain qualifications). That advisory committee could consist of fishery participants from each of the Council's four FMPs, representatives from fishing community organizations, social scientists, and federal, state, and tribal management program specialists, and others the Council deems appropriate to the task.

A.2.7 Cross-FMP Socio-Economic Effects of Fisheries Management Initiative

Like A.2.6, this initiative is also intended to support the MSA's National Standard 8, particularly where the standard refers to taking into account the importance of fishery resources to fishing communities by utilizing economic and social data that meets National Standard 2. National Standard 2 states that: *Conservation and management measures shall be based upon the best scientific information available.* Analyses conducted in support of Council actions regularly include socio-economic analyses of the anticipated effects of those particular actions. This initiative, however, would look at the information the Council needs to better understand how communities may be affected by management actions across the FMPs.

This initiative would investigate the seasonality of fishing operations, temporal-spatial landings compositions, vessel displacement and mobility, operational tradeoffs when management decisions made under different FMPs affect the same communities. Readily available commercial landings data can be used to rank fishing ports in terms of their annual landings and exvessel revenues, by species management group and gear type. This information can then be used in conjunction with a regional economic IO model under development for the West Coast commercial fisheries to assess the amount of economic activity generated by fish harvesters and processors operating within an inter-connected system of businesses comprising a particular West Coast port. The types of businesses within that those systems would differ from port to port, depending on the level of local infrastructure development and maintenance.

Beyond assessing the economic effects of cross-FMP Council management programs, this initiative would also develop a framework for a cross-FMP social impact assessment of those programs. In combination with economic analyses of the dependency of West Coast communities on fishery resources, a social impact assessment can assess social factors such as community rates of poverty and personal disruption to assess the vulnerability of communities to changes in availability of fishery resources (Norman and Holland, in press). Social science literature has been developing measures of community well-being and social capital (Helliwell and Putman, 2004), including specific efforts to develop social impact assessment methodologies to specifically look at well-being in and the effects of fisheries management programs on fishing communities (Jepson and Jacob 2007, Clay and Olson 2008, Hall-Arber et al. 2009, Sepez et al. 2007, Ross 2013). Ultimately, more and better information about the particular socio-economic challenges faced by fishing communities can help the Council to understand the cross-FMP effects their actions have on those communities.

Background work for developing this initiative would first require a literature review on the current state of knowledge about metrics used to assess the socio-economic effects of fisheries management on fishing communities, plus any information or analyses conducted specifically on West Coast communities. The Council would need information on whether social scientists could develop both current and ongoing indices of fishing community vulnerability to changes in availability of fishery resources. The Council would also need to know which fishing communities are most closely tied to which fisheries, and whether those communities undergo cyclical within-year effects from shifts in fishery management programs. Should the Council wish to implement this initiative, it could begin with asking agency staffs to provide it with the above-described review of the state of scientific knowledge, including drawing upon information already developed for analyses of FMP actions.

To implement this initiative, the Council could assemble an ad hoc advisory committee to discuss both what is known within in the scientific community, and the concerns of fishing communities with regard to the effects of fisheries management actions on fishing communities. That committee would then develop recommendations for forward-looking scientific investigations into the cross-FMP socio-economic effects of Council regulatory programs on West Coast fishing communities. That advisory committee could consist of economists, anthropologists, sociologists, a geographically diverse set of fisheries representatives, fisheries managers, and others the Council deems appropriate to the task.

A.2.8 Cross-FMP Effects of Climate Shift Initiative

As discussed in Section 3.1.1 and Chapter 4 of the FEP, the CCE is subject to both interannual and interdecadal climate variability that can have significant effects on seasonal and long-term productivity. Over the longer-term, three prominent properties of the environment are predicted to undergo significant change--temperature, ocean surface water pH (acidity versus alkalinity), and deep-water oxygen. Other physical changes are less predictable but relatively likely, including changes in upwelling intensification (generally expected to lead to greater, but potentially more variable, primary and secondary productivity), changes in both the phenology (timing) of the spring transition, and changes in the frequency and intensity of current modes of climate variability (such as the El Niño/Southern Oscillation and the Pacific Decadal Oscillation). Many Council-managed species are known to have developed life-history strategies that respond to shorter-term climate variability, such as large-scale shifts in the abundance of coastal pelagic species, shifts in the distribution of migratory species (including but not limited to most coastal pelagics, Pacific hake, and most highly migratory species), high interannual variability in recruitment rates of most groundfish, and diversified evolutionary strategies in salmon populations.

Under this initiative, the Council would assess and articulate its questions about the longer-term effects of climate change on its managed species, so as to better direct public and private efforts to provide management-relevant science. Whereas individual fisheries management plans will likely examine the potential impacts of climate change on particular species, the focus of this initiative would be on the combined, long-term effects of such changes on multiple species across all management plans. CCE fisheries support, to varying degrees, the economies and social fabric of at least 125 communities in California, Oregon and Washington. As fish populations and the ecosystems that sustain them are altered in response to climate change, there are potentially profound consequences for the fisheries and the communities that they support.

Vulnerability to climate change depends on three fundamental elements: 1) exposure to the physical effects of climate change; 2) the degree of intrinsic sensitivity of fisheries or dependence of the regional economy on socio-economic returns from fisheries, and 3) the extent to which adaptive capacity enables these potential impacts to be offset. Background work for developing this initiative would initially require a literature review on the current state of knowledge about the anticipated effects of climate change on Council-managed species and West Coast coastal communities. Using previous vulnerability assessments as a foundation, this review could focus on measures of exposure, sensitivity and adaptive capacity that best capture the natural and human systems of interest.

Choosing metrics of exposure to climate change, even at the scale of the CCE, is fraught with constraints and assumptions. Information useful to the Council would include a review of what is specifically known about estimated changes in temperature, ocean surface water pH, and deep-water oxygen within the CCE, not just global estimates of those changes. This review could also identify any additional environmental factors of importance to specific fisheries in the CCE that also might experience significant long-term variability. The Council would also need information about the current state of scientific investigations into the estimated effects of climate change on marine species, particularly CCE marine species. This review may also consider the potential for changes in fish species composition as a result of climate changes. For instance, analytical approaches that estimate the vulnerability of each target species to climate change as well as estimates of the probability that new species will expand into a region will be useful. The Council would also need to know how and whether scientists are assessing the effects of climate change on human communities, whether those effects include those from sea level rise, increasing storm intensity, or the loss or change of revenue from natural resource based industries.

The second key set of information useful in this review is sensitivity to the degree of fisheries dependence of communities. NOAA has already conducted an intensive study (Norman et al. 2007) to identify West Coast communities with some dependency on fishery resources. Dependence on commercial, recreational and subsistence fishing is based on information available from the U.S. Census as well as the weight and value of fisheries landings, the number of vessels, and the number of participants in the fisheries. While this study identifies those communities NOAA believes may be accurately characterized as "fishing communities," further work is needed to assess the degrees to which each of those communities have economic dependencies on fishery resources, and the vulnerability of those communities to changes in availability of fishery resources.

Finally, an examination of the adaptive capacity of marine resources and human communities would tie together predicted changes to the environment with anticipated effects on the economies of West Coast fishing communities. Adaptive capacity is dependent on levels of social capital, human capital and governance structures. While there are global analyses of the adaptive capacity that are based on such factors as healthy life expectancy, education, and the size of the economy (Allison et al. 2009), a similar, rigorous assessment of adaptive capacity of CCE fishing communities to climate change has not been conducted.

To develop background information for this initiative, the Council could begin with a request that NOAA provide it with the above-described review of the state of scientific knowledge. To implement this initiative, the Council could assemble an ad hoc advisory committee to discuss both what is known within in the scientific community, and the concerns of fishing communities with regard to the longer-term effects of climate change. That committee would then develop recommendations for forward-looking scientific investigations into the effects of climate change on West Coast fish and fisheries. If that committee concludes that EFH, fisheries safety, or other major Council policy areas could be of concern under future climate-change scenarios, the committee would make recommendations to the Council on ways to address those concerns under the different Council policy arenas. That advisory committee could consist of fisheries, climate, and social scientists, a geographically diverse set of fisheries representatives, fisheries managers, and others the Council deems appropriate to the task.

A.2.9 Indicators for Analyses of Council Actions Initiative

Under NEPA, actions that may have an effect on the environment, such as federal fishery management actions, are required to be analyzed for the significance of the potential direct, indirect, and cumulative impact on the environment. The purpose of this requirement is to inform decisionmakers and the public about the greater potential environmental consequences expected from a proposed action or series of actions, and to ensure that the entities proposing the action evaluate options for mitigating potential negative consequences of the action.

Under federal regulations at §1508.7, cumulative impact is defined as *the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.* Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In Chapter 4, the FEP discusses broad categories of potential effects, whether from human actions or environmental shifts, of changes within the marine environment in areas of Council interest or responsibility: fish abundance within the CCE, the abundance of nonfish organisms within the CCE, changes in biophysical habitat within the CCE, changes in fishing community involvement in fisheries and dependence upon fishery resources, and aspects of climate change expected to affect living marine resource populations within the CCE.

In Chapter 4, the FEP discusses broad categories of potential effects, whether from human actions or environmental shifts, of changes within the marine environment in areas of Council interest or responsibility: fish abundance within the CCE, the abundance of non-fish organisms within the CCE, changes in biophysical habitat within the CCE, changes in fishing community involvement in fisheries and dependence upon fishery resources, and aspects of climate change expected to affect living marine resource populations within the CCE.

The Council, its participating agencies, staff, and advisory bodies all participate to some degree in developing NEPA analyses for Council actions. One major challenge in analyzing the potential impacts of fishery management actions within the context of the cumulative effects of human activities on the environment is measuring and tracking the potential effects of fishery management actions on the structure and function of the CCE. Under this initiative, the Council and its advisory bodies would look for improvements to its process of assessing the direct, indirect, and cumulative impacts of actions taken by the Council on the CCE's structure and function. Ultimately, this initiative could help the Council to assess whether shifts in management measures are needed to help buffer against uncertainties resulting from the cumulative effects of human activities on the environment, and to support greater long-term stability within the CCE and for its fishing communities.

Concurrent with the development of the FEP, the Council has also been considering the form and content of an annual state of the CCE report. The intent of such a report would not be to discuss all known scientific information on the CCE; rather, it would be to report on specific indicators of the environmental or socio-economic conditions that affect or are affected by fisheries. As the Council and its advisory bodies refine the indicators included in the Council's annual state of the CCE report, it may wish to consider identifying indicators useful to the Council's decision-making processes. For example, the FMPs have indicators for major management goals, like tracking stock status against the objective of maximum sustainable yield, and thresholds for identifying when a stock should be considered overfished. Could ecosystem status indicators do more than simply illustrating the current and past states of the ecosystem by also identifying points at which management programs should change?

Background work for developing this initiative could include a cross-FMP assessment of commonalities between how NEPA work is conducted under each of the FMPs. In particular, background information is needed on how the different FMPs assess the effects of fishing activities on the CCE as a whole, both on the state of the CCE as it currently exists, and on the anticipated state of the CCE over time. The Council would need to determine whether ongoing refinements to the annual state of the CCE report should be targeted at providing source material for NEPA analyses on the effects of the fisheries on the status of the

CCE. In addition to background materials on Council NEPA processes, the Council would likely need input from scientists on the availability scientific information on potential indicators of CCE status, and on the utility of such information to the Council's decision-making process.

To implement this initiative, the Council could assemble an ad hoc advisory committee to discuss recommendations for information products needed to support both short-term and long-term understanding of the cross-FMP effects of fishing activities on the CCE and of the biogeographic shifts in the CCE on fishery resource availability to the fisheries. That committee could also recommend improvements to Council NEPA analyses, with a particular emphasis on assessing indirect and cumulative effects and accounting for the interactions between natural changes to the CCE and the effects of human activities on those changes. That advisory committee could consist of NEPA analysts, scientist contributors to the California Current Integrated Ecosystem Assessment, fisheries managers, and others the Council deems appropriate to the task.

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COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON THE FINAL FISHERY ECOSYSTEM PLAN

The Coastal Pelagic Species Management Team (CPSMT) reviewed the draft Fishery Ecosystem Plan (FEP) and its Ecosystems Initiatives Appendix A. The CPSMT commends the Ecosystem Plan Development Team (EPDT) and the Ecosystem Advisory Subpanel (EAS) for their efforts to make the FEP a valuable contribution to ecosystem-based management planning. The plan is very informative and a good synthesis of available information.

At the November 2012 meeting, the Council revised the Purpose and Needs section of the FEP to reflect the Council's intent to use the FEP as an informative rather than a prescriptive document. However, although the initiatives in the appendix lay out an action plan, neither they nor the research and data needs are prioritized. It is also unclear how the Council expects to "use" ecosystem information from the FEP and how the advisory bodies engage in this process.

Overall, the CPSMT offers the following observations and recommendations:

- The Council approve final adoption of the FEP.
- Development of a more detailed description of how the plan will be used in the Council's decision-making process and the roles of its advisory bodies and the public.
- The completion of the revision to the Federal List of Allowable Fisheries and Gear as a separate action item, because it addresses all fisheries and gears, not just forage fish.

Pages two and three of this report contain the CPSMT's detailed comments and recommendations for revisions to the FEP.

In addition to the general comments above, the CPSMT provides the following specific comments and recommendations, organized by Chapter and Appendix:

<u>Chapter 3</u>
To distinguish fisheries from the description of the CCE, it would be helpful to create a new chapter titled Fisheries and Fisheries Management derived from Sections 3.4, and 3.5.

<u>Chapter 4</u>
The CPSMT recommends including other fisheries with longline gear (e.g., spot shrimp) in Section 4.3.2.1 Sablefish and Halibut Longline Fisheries. In Section 4.3.3 Recreational Fisheries, razor clam harvest is described as rather innocuous. However, in Washington the beach is a state highway. Typically beach traffic is minimal; during razor clam openers, it is substantial.

<u>Chapter 5</u>
The CPSMT suggests also providing the material in this chapter as a stand-alone document, in a more user-friendly form. Also, perhaps Sections 5.1.4 and 5.3.2 should be combined into a "Tribal Considerations" section.

Chapter 6

In Section 6.1 Bringing Ecosystem Information into Stock Assessments, three means are identified to bring ecosystem considerations into near-future stock assessments and the CPSMT has the following comments on these:

1) The CPSMT notes that ecosystem science information already included in stock assessments does not appear to be utilized. So, it is unclear how expansion of this information will actually be used to improve management. Also, the CPSMT is concerned about the additional workload for stock assessment authors, if the information is little used. The main source of ecosystem information for Council decision-making appears to be from the FEP and annual State of the CCE reports.
2) Including explicit ecosystem indicators in stock assessments should be a Council consideration in terms of providing direction and allocating resources.
3) It is unclear what is meant by the term "alternative states of nature" as the basis of decision tables within current single species stock assessments.

Appendix

There are no details on how the Council determines whether an initiative deserves moving forward. The CPSMT recommends a process be outlined and set of standards developed to evaluate proposed initiatives for implementation. This process could prioritize candidate initiatives by timeline (whether there is an immediate need, or expected time to conduct background analyses and implementation), relevancy to Council issues, degree of impact, or other considerations. A number of possible initiatives are already identified, and there should be a way to decide which one(s) are to be moved onto the next step.

A.1 FEP Initiative 1, Protection for Unfished Forage Fish

As this section is currently written, it is unclear why there is a risk for new fisheries to develop before analysis of the fisher's proposal could be accomplished. It would help if this risk was explicitly described. In addition, the CPSMT would like to request being involved with future development of A.1, specifically with assessing the science and potential impact on existing fisheries. Minimally the ad hoc committee should include members from the CPSMT, HMSMT, STT and GMT to ensure sufficient fishery-species interaction expertise.

Section A.1.2, Council Process for Implementing FEP Initiative 1

Section A.1.2.1 Amending the Federal List of Allowable Fisheries and Gear

The CPSMT recommends completing the revision to the federal List of Allowable Fisheries and Gear as separate action, under its own initiative, because it addresses all fisheries, not just forage fish. This appears to be a housekeeping issue, not a task that requires involvement of the ad hoc committee for Initiative 1.

Section A.1.2.2 Protecting Unfished Lower Trophic Level (Forage) Species

A two-stage process is described for adding new species to a council FMP. First, the species are identified for FMP management and second, the appropriate FMP is identified to include them. The CPSMT recommends establishing criteria for adding species/groups to FMPs first. This would then inform how any potential addition to any FMP would be evaluated and could inform future additions of species other than forage fish. The ad hoc committee should be tasked with developing these criteria without regard to the specific issue of adding lower trophic level species under Initiative 1.

A.2.8 Cross-FMP Effects of Climate Shift Initiative

So much of our understanding and modeling of current fisheries derives from past patterns of climate change and resource responses. However, current and future changes in climate may differ and could render these understandings useless, or at least not useful to inform management at present. For example, at the recent Sardine Harvest Policy Workshop, the periodicity of large changes in sardine abundance was described over a large time scale, and the past indices of climate trends were unaffected by modern human-driven effects. However, such effects on future climate trends may be critical to our understanding going forward. We need to know how fast things are changing in order to know how much to rely on past events/patterns to inform our thinking.

A.2.9 Indicators for Analyses of Council Actions Initiative

The CPSMT supports the FEP in addressing the cumulative extraction of fish throughout all fisheries and account for all removals.

PFMC
03/22/13

HABITAT COMMITTEE COMMENTS ON ECOSYSTEM BASED MANAGEMENT

At the March 2013 Council meeting, Ms. Yvonne deReynier provided to the Habitat Committee (HC) a presentation that described the updates to and restructuring of the draft Fishery Ecosystem Plan (FEP) since the November 2012 Council. The HC has closely followed the development of the FEP and appreciates the Ecosystem Plan Development Team's (EPDT) efforts in drafting such a comprehensive ecosystem-based fishery management document to guide future Council decisions. The HC also appreciates the EPDT's efforts in including HC comments and suggestions into the draft FEP where appropriate.

The HC recommends the Council adopt the draft FEP (Agenda Item H.1.a, Attachment 1) including the Initiatives Appendix (Agenda Item H.1.a, Attachment 2) and the schedule and process for developing and amending the FEP and the Ecosystem Initiatives Appendix (Appendix A to the FEP).

PFMC
03/22/13

Agenda Item H.1.b
Supplemental EAS Report
April 2013

ECOSYSTEM ADVISORY SUBPANEL REPORT ON THE
FINAL FISHERY ECOSYSTEM PLAN

The Ecosystem Advisory Subpanel (EAS) has reviewed the public draft of the Fishery Ecosystem Plan (FEP). While we have advice on improving this draft, the EAS recommends that the Council approve the plan andthe Appendix, subject to any final changes the Council directs.

The EAS commends the Ecosystem Plan Development Team (EPDT) on its accomplishment in producing this plan. It summarizes a large and diverse body of information applicable to management decisions. Given the complexity of the information, the plan is clearly written and remarkably free of errors.

The EAS supports the EPDT's recommendations for updating the FEP, reviewing the state of the ecosystem, and advancing the initiatives. Those recommendations are presented in Section 1.3, on page 2 of the current draft. We also support the EPDT's recommendations for more fully incorporating ecosystem considerations into the management process, which are summarized in Chapter 6, beginning on page 188.

We do have a concern that the plan overstates the degree to which ecosystem information is already incorporated in management decisions. Nevertheless, the EAS agrees the Council is making progress in this regard, and that the FEP and Initiative 1 are substantial steps forward.

Initiative 1 to protect unfished forage fish supports the Council's broader intent to recognize the importance of forage fish to the marine ecosystem off of theU.S. West Coast, and to provide adequate protection for forage fish. The EAS agrees with the EPDT's recommendation to release the draft revised list of authorized fisheries and gear for review by states, tribes, and Council advisory bodies (Appendix, page A-5). One note in that regard is that a purse seine fishery for Pacific saury is still included on the list, even though this doesnot appear to be an active fishery.

The EAS also supportsthe Council's interest in appointing an ad hoc committee to continue the work of developing Initiative 1 (Appendix, page A-10). The people chosen for this committee should not be limited to those with fisheries expertise, and should include people with expertise on the biology and ecology of the relevant species.

There are some details in the description of Initiative 1 that we think rise to more than editorial concern, and we recommend they be corrected on the way to publishing a final document:

- Text on page A-7 and the decision tree presented in Figure A.1 on page A-8 would limit Council's action on unfished forage species to those that "occur primarily or exclusively" within federal waters. This is an unnecessary constraint and should be omitted in favor of including any species that occurs in federal waters.

- Also on page A-7, the statement that species "under the jurisdiction of a state management program" would not be subject to the prohibition on new fisheries could lead to confusion. For example, Pacific sand lance are listed under Washington's forage fish management plan. There are no actively managed fisheries for this forage species along the west coast, and they could be protected under Initiative 1.
- An alternative definition is needed for the term "taxonomically similar" in the text on A-7 and the decision tree in Figure A.1. For example, the North Pacific Fishery Management Council's amendments cited on page A-9 prohibited fishing for *families and orders* of forage fish species, rather than identifying prohibited forage fish down to the species level.

With regard to section A.2 of the Appendix, which introduces additional initiatives for Council consideration, we have two observations:

- A.2.9 combines the Council's November 2012 requests for two additional initiatives related to indicators – one on core indicators for the state of the ecosystem report, and another to address Amendment 24 to the Groundfish FMP. We do not understand why these were combined.
- The list of proposed initiatives does not address FEP section 6.1on bringing more information into stock assessments. While each FMP will have individualized needs for information, a cross-cutting initiative could specify and assess the ecological factors that should be incorporated into FMPs.

Statement on the future role of the Ecosystem Advisory Subpanel

Should the Council agree that there is an ongoing role for an advisory body associated with the FEP and subsequent ecosystem initiatives, the current members of the EAS are interested in continuing to serve in that role. In addition to providing a "home" for the FEP in the Council structure, the EAS duties associated with the FEP and ecosystem initiatives could include:

1. Advisingthe Council on the informational content associated with the FEP, similar to the role other advisory subpanels play with respect to FMPs.
2. Reviewing and commenting on the draft annual State of the Ecosystem Report as it is being developed for the Council.
3. Reviewing and commenting to the Council on the final State of the Ecosystem report and its application to Council actions.
4. Advisingthe Council on the relative priorities and logical sequence of implementing ecosystem initiatives.
5. Reviewing and commenting to the Council on the work products of ad hoc committees formed to develop the ecosystem initiatives associated with the FEP.
6. Reviewing and commenting to the Council on draft revisions to the FEP.
7. Responding to other requests of the Council associated with the FEP, initiatives, and ecosystem-based management.

A note with regard to fulfilling these duties is that the EAS would benefit from tribal participation on the subpanel.

Additional Comments on the FEP and Appendix

The following comments address parts of the text that could be improved but should not be barriers to approving the FEP and implementing Initiative 1.

1. Climate change and ocean acidification are not adequately dealt with in this version of the FEP, and subsequent editions should include substantial revisions. For example, neither climate change nor ocean acidification are human activities (Table 3.3.1, page 45), nor does climate change cause ocean acidification (A.2.8, page A-21). It is important to separate these concepts to deal with them effectively. Likewise, section 4.2 (pages 166-167) ignores the role of carbon in ocean acidification and can be improved.

2. Page 2: "…if forwarded by the Council, would begin a process to prohibit fishing for unfished lower trophic level (forage) fish species within the U.S. West Coast Exclusive Economic Zone (EEZ); and…" Initiative 1 will "protect"unfished forage species until such time as supportive information is available to justify opening a fishery. It is not an outright prohibition. This section should be consistent with the description in the Appendix.

3. Page 15, Figure 3.2.1: This diagram is aging, but it conveys the complexity of interactions in the ecosystem andpoints to the importance of continuing to compile updated information, produce more accurate models, and convey the findings clearly.

4. Page 18: "Higher trophic level mammals, birds and reptiles represent important sources of predation mortality and energy flow in the CCE." The range of variability in study results and the relatively few studies indicate more work is needed to understand these interactions and their impacts on fisheries.

5. Page 33, Figure 3.3.2: Note that this is a HAPCs map, which does not reflect the current state of knowledge on rocky benthic habitats. The FEP is a good place to incorporate and distribute state-of-the-science basic information like benthic habitat maps, irrespective of Council designations for management purposes (e.g., EFH, HAPCs, etc.) Annual State of the Ecosystem Reports could be used to bring such information forward in between updates to the FEP.

6. Page 34: "The shelf, ranging from shore to depths of about 2000 m, is generally less than 50 nm wide along most of the West Coast, but widens to about 100 nm wide off northern Washington and in the southern California Bight." The 2000m reference appears to be an error. We believe the correct figure is 200m.

7. Page 37: "Four major basins (Main Basin, Whidbey Basin, Southern Basin, and Hood Canal) occur within Puget Sound." Many other sources reference five basins, including the Strait of Juan de Fuca, and that designation is often applied in management contexts (e.g., listed rockfish species in Puget Sound, Puget Sound recovery plans). Is it important that this description is consistent with those others?

8. Page 42: "Hixon and Tissot (2007) found variations between the fish and invertebrate species assemblages and associations in trawled and untrawled areas on Coquille Bank off central Oregon." When it was published this study was considered controversial and perhaps scientifically weak. Can other citations be used to make the same point (e.g., the National Research Council's review:Effects of Trawling and Dredging on Seafloor Habitat (2002))?

9. Page 46: "Washington State has a variety of MPAs managed under the authorities of its different natural resource agencies…" Add: "...with mixed levels of protection for marine habitats and species,.." MPAs in Washington is a complex subject that is not easily summarized, but the graphic and description in the draft present a false impression that the area around the San Juan Islands is managed comparably to MPAs in California and Oregon, which is not the case.

10. Page 47: "The largest MPAs in Oregon's state waters are two adjacent sites south of Port Orford…" In 2012 additional MPAs, including no-take reserves, were designated in Oregon's state waters at Cape Falcon, Cascade Head and Cape Perpetua. While these MPAs have been officially designated, fishing prohibitions are scheduled to be phased-in, in 2014 and 2016, after baseline data are collected.

11. Page 47: California MPAs are treated comprehensively, where MPAs in Oregon and Washington are illustrated by examples. Updates to MPA maps could be brought to the Council via the annual status report.

12. Page 52: "Exploitation continued with the depletion of many salmon populations due to fishing, the massive alteration of their freshwater habitat, and hatchery production." Hatchery production did not "deplete" salmon populations, even though we now recognize the shortcomings of hatcheries as a restoration strategy for native salmon stocks.

13. Page 54: "Salmon fishing preceded sardine fishing as the first major finfish to be exploited throughout CCE (both inland and offshore) waters, and salmon represented the foundation of the livelihoods of native communities for thousands of years prior to settlement by Europeans (McEvoy 1986, Lyman 1988)." This statement's significance would be clearer if the native fishery was mentioned first.

Page 83, etseq: Does this section adequately cover the aging and reduction of permit holders and the corresponding decline of coastal communities and infrastructure? Could it be strengthened by referencing change over time or illustrating more regional data?

14. Page 88, Figure 3.5.1: Does this diagram adequately represent tribal participation in fishery management? Are other processes involved that need to be noted?

15. Page 90, Table 3.5.2: The year references are inconsistent in marking either Council decisions or NMFS decisions, which are not distinguished from one another.

16. Page 153: "As a result, the Council, its advisory bodies, and associated agencies have halibut dto devote considerable energy to identifying groundfish EFH…" Apparent typographic error.

17. Page 154: "Mid-water trawl gear is not intended to as bottom-contacting gear, and effects are generally limited…" Apparent typographic error.

18. Page 160: "The predominant fishery conservation and management issues facing the Council now and in the future deal with integrating physical, ecological and economic systems into an analytical framework directed toward maximizing the benefits that the CCE is capable of

providing society.” Add: "...on a long-term, sustainable basis." Otherwise the implication is that even short-term benefits should drive fishery conservation and management.

19. Page 163: “However, several urban areas, including San Francisco Bay and Puget Sound, are highly developed near low-lying shoreline, and are expected to be vulnerable to sea-level rise in the coming decades (Snover et al. 2007, Cloern et al. 2011).” Many small coastal communities are associated with estuaries & other low-lying landforms, and they face the same risks.

20. Page 166: “Measurement of ocean pH requires in situ water sampling, and cannot currently be conducted via remote means.” Change “remote means” to "remote sensing" to distinguish satellite-derived data from remote in-water sensors.

21. Page A-7: “Inits November 2011 report (Agenda Item H.2.a., at Appendix,) the EPDT recommended defining “forage”fish with the Smith et al. (2011) definition of low trophic level species, which are: *often present in highabundance, forming dense schools or aggregations, and which are generally plankton feeders for a largepart of their life cycle.* This definition explicitly excludes species that transition from low trophic roles asjuveniles to higher trophic levels as adults.” Smith et al. does not *explicitly* exclude species that are plankton feeders in juvenile stages and develop to be predators at higher trophic levels. Clearer language would be: "*Our* definition *generally* excludes..."

PFMC
04/09/13

GROUNDFISH MANAGEMENT TEAM REPORT ON THE FINAL FISHERY ECOSYSTEM PLAN

The Groundfish Management Team (GMT) reviewed the draft Fishery Ecosystem Plan (FEP; Agenda Item H.1.a, Attachment 1) and the Ecosystem Initiatives Appendix A (Agenda Item H.1.a, Attachment 2). The GMT would like to thank the Ecosystem Plan Development Team (EPDT) for taking our previous recommendations into consideration in the latest draft. We do not have additional comments on the main body of the FEP at this time. We hope there will be iterations of the FEP with updates and improvements made periodically on a reasonable time scale.

On that note, the Council will also be considering next steps at this meeting. We did not have time to discuss the matter in detail and provide only the general comment that we support regular attention to the ecosystem initiatives (e.g. either annually or biennially) allowing an opportunity to provide or analyze new information and help develop considerations for prioritizing them. The initiatives all have merit, but may vary considerably in ease, costs, available resources, and other considerations. Likewise, the ability to undertake an initiative or the reasons for prioritizing a given initiative may change over time and would benefit from regular review.

We do have specific comments on Initiative 9, however, which the Council requested be added to the Initiatives Appendix at least partly in response to our request.[1] We think the EPDT captured the gist of the idea well. The Initiative is broadly written and is something to build towards across all fishery management plans (FMPs) over time. Our suggestion has been that the Groundfish FMP is a natural place to start. The idea is to bring in ecosystem expertise to advise on the design of the Tier 1 Environmental Impact Statement (EIS) that is being discussed under Amendment 24. There may be staff, tools, and other resources associated with the Integrated Ecosystem Assessment (IEA), the California Current Ecosystem Report, and the Essential Fish Habitat Synthesis Report that could be directed toward the effort. Pursuing Initiative 9 could provide indicators and other tools that would help ground the Tier 1 EIS and following National Environmental Policy Act analyses in the state-of-the-art ecosystem science being done on this coast. The intent of the ad hoc group we suggested in March was to scope out what resources, tools, and data might be available and how the Tier 1 EIS could be designed accordingly.[2]

PFMC
04/08/13

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[1] November 2012 Agenda Item I.2.b, Supplemental GMT Report, Agenda Item K.1.c, Supplemental GMT Report, Agenda Item K.2.c, Supplemental GMT Report, Agenda Item K.3.c, Supplemental GMT Report.
[2] March 2013 Agenda Item H.4.b, Supplemental GMT Report.

HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON FINAL FISHERY ECOSYSTEM PLAN

The Highly Migratory Species Management Team (HMSMT) reviewed the draft Fishery Ecosystem Plan (FEP) and would like to compliment the plan development team for putting together an attractive and informative document which addresses issues beyond the scope of the four species-focused Council Fishery Management Plans (FMPs). The HMSMT offers the following input on the draft FEP. Underlining is used to indicate proposed edits.

p. 8: "Although there are many ways of thinking about dividing the CCE into sub-regions, Francis et al. (2008) have suggested three large-scale CCE sub-regions"

> *HMSMT Comment:* Francis et al. 2008 is missing from references.

p. 16: "Since sea turtles likely represent one of the most vulnerable taxa in the CCE, and much of this vulnerability lies beyond the control of the PFMC and other U.S. management entities, issues relating to turtle conservation tend to be a high priority with respect to minimizing turtle fisheries interactions."

> *HMSMT comment*: Tapilatu et al. (2013) cite numerous significant factors for the decline in leatherback sea turtle nests in Indonesia, such as local harvesting of eggs and turtles, including artisanal boats observed visiting nesting beaches on a weekly basis and returning with 10,000-15,000 leatherback sea turtle eggs per boat, a set gillnet shark fishery resulting in 2-3 female leatherback deaths per week, and low hatching success due to (1) predation of eggs and hatchlings by introduced pigs and dogs, (2) beach erosion, and (3) elevated sand temperatures. Roughly 20 percent of the Western Pacific leatherback population utilizes the California Current Ecosystem as a foraging area, while the remaining 80 percent are exposed to numerous threats that lie outside of U.S. Exclusive Economic Zone (EEZ) waters. Given the enormity of the nesting site threat to the Western Pacific leatherback population outside of U.S. territorial waters and comparatively low leatherback sea turtle bycatch counts in West Coast U.S. fisheries, there is little potential for reversing the long-term population decline without a multinational holistic strategy (Dutton and Squires, 2011) which addresses all anthropogenic sources of mortality across the full geographic range of the population. Measures of marine turtle Potential Biological Removal (PBR) were recently quantified to provide harvest and population production potential in an effort to establish reference points for marine turtle population conservation and management (Curtis and Moore 2013).

p. 19: The PFMC's HMS FMP is unique in that the impact of fishing activities under the jurisdiction of the PFMC for most HMS are generally modest relative to other regions in the Pacific such as the Western and Central, since many HMS species spend limited time subject to fisheries within the EEZ.

HMSMT Comment: Exceptions where West Coast vessels harvest an appreciable fraction of North Pacific catches include north Pacific albacore, swordfish, common thresher sharks, and blue sharks.

***Proposed HMSMT edits of passages on below-referenced pages*:**

p. 51: That period saw the development of most of the basic foundations of contemporary fisheries science, including functional relationships affecting productivity such as fisheries oceanography, spawner/recruit relationships, as well as population dynamics models such as surplus production models and virtual population analysis that allow hypotheses about the interactions of functional aspects and sustainability of populations to exploitation to be tested.

p. 52: This period is characterized by a gradual and wide recognition that ecosystem factors are important to marine resource science and management, but most management actions tend to be based in an assemblage-based context that integrates single-species assessment model results. While a single-species focus in stock assessment still underpins US fisheries population management, ecosystem based assessment modeling frameworks gaining influence (Lehody et al 2008), providing the ability to quantify changes in ecosystems, particularly as they relate to fishery exploitation.

p. 56: *The HMSMT proposes replacing the following language from the draft FEP with the underlined passage which follows*:

West Coast commercial fisheries landings data is collected within the PSMFC's Pacific Fisheries Information Network (PacFIN) database. Data represent landings recorded on state fish tickets (landings receipts,) but does not include any fisheries' biomass removals that may occur as bycatch to commercial fisheries, nor does it include recreational fisheries' removals.

West coast commercial fisheries landings data are maintained by the PSMFC within the database, Pacific Fisheries Information Network (PacFIN). PacFIN data represent landings recorded on state fish tickets (landing receipts). Recreational fishing activity is maintained by the PSMFC in the database Recreational Fisheries Information Network (RecFIN). This database centralizes data collected from recreational fishing surveys from US Pacific coast states beginning in 1980. Another source of information about recreational fishing catch and effort is the California Department of Fish and Game's Commercial Passenger Fishing Vessel (CPFV) database. This data stream of catch and effort has been collected since 1936. PacFIN does not contain information about bycatch (i.e. animals caught and discarded at sea), but RecFIN and CPFV do contain information about discards.

p. 63: Fish landed or otherwise caught in West Coast tribal fisheries for economic purposes are routed through similar processing chains to those used by the non-tribal fisheries.

HMSMT Comment: We suggest "commercial sale" could be a more accurate description than "economic purposes."

p. 96: Highly Migratory Species (HMS) FMP [sea turtles, marine mammals]

p. 122: The ISC and IATTC also develop proposals for conduct of and coordinate international and national programs of research addressing such species. Member nations of the ISC include

Canada, Chinese Taipei, Japan, Republic of Korea, Mexico, People's Republic of China and the USA, and observing members include the IATTC, FAO, PICES, SPC, and the WCPFC.

p. 135: When adequate data exist, the consequences of fishing are easier to monitor and estimate; however, the subsequent realized or potential effects on predators, prey, or competitors within the ecosystem (and their predators, prey, competitors, etc) are much less identifiable and quantifiable.

P. 135-36: A clear and comprehensive understanding of the possible long term consequences of fishing activity to ecosystems has yet to be developed. Maintaining entire assemblages and communities of fish and invertebrates at certain abundance levels without regard to important population dynamics such as movement, age and sex structure is unlikely to achieve the goals of long-term sustainability.

p. 136: "There is general scientific consensus that overfishing is associated with large scale ecosystem impacts. However, there is less consensus over how to develop a more holistic perspective on the trade-offs between harvest levels that can be modeled as sustainable for single-species and the cumulative effects of harvesting multiple species on ecosystem "health and integrity" (Francis 2001, Longhurst 2006, Gaichas 2008)."

HMSMT Comment: Francis 2001 is missing from references.

P. 146: "Based on the amount of gear still on the animal, this incident was considered a serious injury. As noted above, a single humpback whale serious injury or mortality from fishing gear can be notable as a percent of that species potential biological removal level. Outside of this humpback whale interaction, this sector of the HMS fisheries has a history of increasingly restrictive management measures intended to monitor and reduce bycatch levels for marine mammals and sea turtles."

p. 146: HMS fisheries are subject to monitoring by NMFS-trained observers. NMFS's Southwest Region manages the observer program for HMS fisheries and tracks observed target and incidental catch in both the drift gillnet and deep-set longline fisheries. Though both of these fisheries have been observed to cause entanglement on a rare-event basis and still rarer mortality of ESA-listed species, recent levels of participation and effort in these fisheries have been far below those of the 1990s, reducing the incidence of entanglement and mortality.

p. 150: On average, smaller non-fish organisms grow faster, have shorter generation times, and their population production potential is coupled more directly to environmental variables than higher tropic leveled fish.

p. 153: As a result, the Council, its advisory bodies, and associated agencies have to devote considerable energy to identifying groundfish EFH, even under data poor conditions,

Comments on Appendix Initiatives:

A.2.1 Initiative on the Potential Long-Term Effects of Council Harvest Policies on Age- and Size-Distribution in Managed Stocks

HMSMT Comment: We suggest broadening the scope of this inquiry to include economic considerations. For instance, is it more economically advantageous to harvest an age-0 bluefin tuna or to let it grow to mature size where it contributes to spawning stock biomass and is far more valuable if caught? Generally, how does the age-and-size distribution relate to the economically optimal harvest policy and does this align with optimal harvest policy based on biological considerations?

A.2.3 Cross-FMP Bycatch and Catch Monitoring Policy Initiative

HMSMT Comment: Consider broadening the inquiry regarding bycatch species to all anthropogenic sources of bycatch mortality, including those which lie outside of PFMC control (e.g. leatherback mortality due to egg harvest and coastal gillnet fisheries bycatch of adult females in Indonesia mentioned in Tapilatu et al.).

A.2.6 Human Recruitment to the Fisheries Initiative

HMSMT Comment: Commercial fishermen in HMS fisheries frequently raise a concern about a lack of recruitment of new participants. Research into the demography of U.S. West Coast fisheries, including the age structure of the population of fishermen and the pattern of entry to and exit from participation, could provide useful insights into the impacts of regulations on participation and the sustainability of commercial fishing operations off the West Coast.

A.2.7 Cross-FMP Socio-Economic Effects of Fisheries Management Initiative

HMSMT Comment: The FEP seems advantageously positioned to address cross-FMP socioeconomic effects. One example of interest is the relationship between the open-access albacore fishery and other fisheries subject to occasional closure (e.g. salmon). The albacore fishery may provide an "insurance" benefit by offering an alternative fishery to prosecute when others are unavailable.

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PFMC
04/02/13

Agenda Item H.1.b
Supplemental SSC Report
April 2013

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON THE FINAL FISHERY ECOSYSTEM PLAN

The Scientific and Statistical Committee (SSC) discussed the public draft copy of the Fishery Ecosystem Plan (FEP), its initiatives, and scientific products related to ecosystem-based fisheries management. In March, Ms. Yvonne de Reynier of the Ecosystem Plan Development Team provided a summary of report updates and participated in the discussion.

The SSC considers the scientific information presented in the FEP to be the best available science for advising the Council on ecosystem considerations for management. The Plan provides appropriate flexibility for incorporation of ecosystem considerations in stock assessments and harvest control rules. The SSC will continue to evaluate the science used in analyses of ecosystem condition and effects on Fishery Management Plan stocks. Currently, the SSC can assist this effort in four ways:

1 Review the initiatives in Appendix 1 of the FEP, identifying those that are largely science-driven, feasible with existing tools and data, and most likely to improve management. The Ecosystem Plan Development Team has requested SSC input on prioritization of initiatives.
2 Provide feedback on the State of the California Current report document to improve its utility as an advisory document.
3 Review the Ecosystem Considerations sections added to this year's stock assessments for future standardization of the content of these sections.
4 Meet with the Integrated Ecosystem Assessment teams at Northwest Fisheries Science Center and Southwest Fisheries Science Center to discuss Integrated Ecosystem Assessment products and their incorporation into assessments and other Council documents. This is an important step for FEP implementation.

The SSC discussed its role in the evolving applications of ecosystem-based management by the Council. Some review tasks are straightforward, such as evaluation of the data or analyses used to create the California Current report. A more difficult task is to evaluate and advise on the appropriate use of ecosystem-based indicators and proposed thresholds in harvest control rules. This will require the same scrutiny as the methods used in stock assessments. For example, the SSC recently led a review of the environmental parameters used in the harvest control rule for sardine (Agenda Item I.1). Ecosystem considerations for stock assessments should be developed by stock assessment teams and reviewed through the Stock Assessment Review Panel process.

The SSC identified some outdated information in the FEP about models and data used in economic analyses (Section 4). Suggested corrections have been forwarded to Ms. De Reynier and the Ecosystem Plan Development Team. These edits should be incorporated in the final FEP.

PFMC
04/07/13

From: Susan Mates <S.MATES@comcast.net>
Date: Thu, Mar 14, 2013 at 12:04 PM
Subject: Please protect forage fish
To: pfmc.comments@noaa.gov

To the Pacific Fishery Management Council:

As you forge your Pacific Coast Fishery Ecosystem Plan please make sure that forage species are well protected. I know that it must be difficult to satisfy many factions and demands, but as a critical component of the marine ecosystem it is imperative that forage fish are protected. I support your recommendations as a start to this process, and hope that you will ensure a balanced and productive marine food web by setting aside forage species that aren't currently protected.

Thank you,
Susan Mates
8945 NW Oak Street
Portland, OR 97229

From: Diane Livia <dianelivia@sbcglobal.net>
Date: Fri, Mar 15, 2013 at 2:26 PM
Subject: Adopt the Fishery Ecosystem Plan and Accompanying Ecosystem Initiatives -- Help preserve our Oceans
To: pfmc.comments@noaa.gov

Mar 15, 2013

Chairman Wolford and Council Members

Dear and Council Members,

It is vital for the future diversity of our planet, which is a
one-to-one indicator of human well-being, that our oceans are not
overfished, and that farmed fish are not fed fish from our oceans.

Because good planets are hard to find.

Thank you for agreeing to develop a Fishery Ecosystem Plan. Please adopt the plan and accompanying list of Ecosystem Initiatives in April.

I am a life-long West Coast resident.

The entire population of humandkind benefits from a vibrant ocean.

A sustainable earth depends on a well-functioning marine food web.

The Council itself recognized forage fish as the cornerstone of a healthy ecosystem last June, when it set a goal of prohibiting new fisheries on forage species that aren't currently managed. And the Council has a chance to establish itself as a leader in moving ecosystem-based management from theory into practice.

It only makes sense for the Council to follow through on its mission by enacting firm protections for forage fish that are vulnerable to unregulated fisheries emerging at any time -- as its first official ecosystem initiative.

As a human who has as much right to the ocean as the Council, and as much or more concern for it, I demand you to take this precautionary measure as soon as possible.

The Council's own analysis, conducted in 2011, noted that industrial demand for forage fish is likely to grow more intense because of its value as a global commodity used in feeding livestock, poultry and farmed fish. The Council's top priority should be to make sure it protects forage fish as the linchpin of healthy existing fisheries and coastal communities here on the Pacific coast.

Sincerely,

Diane Livia
6445 Colby St
Oakland, CA 94618-1309

Subject:Item H, Forage Fish
From:Donald Niskanen <dwn@peak.org>
To:pfmc.comments@noaa.gov
Cc:

Dear PFMC,

No regulations and lack of enforcement of regulations have seriously depleted some of our ocean fish stocks. Public pressure and increased enforcement have stopped this tide, but our fish stocks are far from normal numbers. Not regulating or banning the capture of "forage fish" will only reverse any positive attempts the PFMC has done to protect our game fish. This food web is very delicate and any destruction of the lower rungs, do not bode well for the larger species.

The PFMC seems to be headed in the right direction in protecting and regulating the demise of the forage fish.

I support strong regulations that protect these species and ensure a food source for our larger species.

Our generation is not totally responsible for what has happened to our ocean resource. It started long ago. But we are on the edge and very responsible for positive changes on how we treat this resource and protect it for future generations.

I have long been a proponent of banning all fishing on streams that only hold wild fish, even catch and release is a threat to our wild species. Once fish numbers reach a sustainable level, maybe fishing could be allowed. But we just don't have the enforcement to cover all of our streams and fishing boats.

Thank You,

Donald W. Niskanen
Yachats, OR

From: F. J. Taylor <fjtusmc@gmail.com>
Date: Sun, Mar 17, 2013 at 2:07 PM
Subject: Forage fish stocks
To: pfmc.comments@noaa.gov

Sir or Madam,

As NOAA is aware, the forage fish stocks are a critical food source for everything above them on the food web. As NOAA is also doubtless aware, they are in critical status in many places.

With the Fishery Ecosystem Plan for public comment, the Pacific Fishery Management Council has a chance to move ecosystem protection from theory into practice. The Council's June policy objective was to prohibit new fisheries targeting currently unmanaged forage fish because of their role in sustaining a healthy ocean food web.

Likewise, the California Fish and Game Commission adopted a similar policy for state waters within three miles of California's picturesque beaches. However, the best of intentions mean very little without action to back them up.

It's time to enact firm measures to sustain the Pacific marine ecosystem, starting by protecting the ocean food web. Please help move this plan to action. I will be contacting my legislators to help gain support for this plan.

Sincerely,

FJ Taylor
USMC (Ret.)

From: **Nic Callero** <calleron@nwf.org>
Date: Tue, Mar 19, 2013 at 7:23 PM
Subject: Agenda Item H 1
To: "pfmc.comments@noaa.gov" <pfmc.comments@noaa.gov>

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

Re: Agenda item H.1, Adoption of the Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

I am writing today in support of the Council's Fishery Ecosystem Plan (FEP). The National Wildlife Federation is America's largest conservation organization representing over 4 million members and supporters nationally. We work to inspire Americans to protect wildlife for our children's future. We serve as a voice for wildlife, advocating for strong, scientifically sound policy that protects habitat and natural resources.

Our Pacific regional office of NWF covering California, Oregon, Washington and Alaska represents over 527,000 members and supporters dedicated to conserving healthy populations of fish and wildlife for our children's future.

By working to protect and defend wildlife and the wild places they need to survive, NWF helps maintain the integrity of the nation's natural heritage, and enables the continued enjoyment of cherished hunting and angling traditions with a special focus on getting kids outdoors.

As you know Forage fish are an important link in the ocean food chain being consumed by large fish like tuna, cod, endangered salmon and steelhead, seabirds like the endangered marbled murrelet, dolphins and other marine mammals. The availability and abundance of prey in the ocean is directly linked to the success of these species-many of which face a myriad of other obstacles that threaten their declining numbers.

NWF extends its thanks to the Council for taking action in November to adopt the preliminary draft Pacific FEP and release it for public review. We appreciate the Council's decision recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. We ask that you keep on track to fulfill your commitment to prohibit new fisheries targeting forage species that aren't yet being fished, starting with adoption of the FEP.

With the threat of global warming and ocean acidification, it is imperative that we safeguard against these impacts by securing an abundant and diverse prey base in the ocean. Protecting currently unmanaged forage species is a sensible management objective that will ensure we leave enough food in the ocean for salmon, steelhead, tuna, marine mammals and seabirds.

As a fisherman, outdoorsmen and conservationist, I appreciate the Council's recent steps toward ecosystem-based fisheries management and support the Council's efforts to maintain a vibrant marine ecosystem off our west coast. We believe the Pacific Council can be a national leader in advancing ecosystem-based principles in resource management.

Thank you for providing an opportunity for the public to comment. We look forward to tracking your progress and engaging on these important issues.

Sincerely,

Nicholas Callero ><((((º>
National Wildlife Federation
Regional Outreach Coordinator
C: 503.977.5467 O: 206.577.1415

The following comment is indicative of 39 such comments received for the April 2013 Briefing Book

Date: Wed, Mar 6, 2013 at 1:55 PM
Subject: Forage fish
To: pfmc.comments@noaa.gov

Dear PFMC Chair Wolford and Executive Director McIsaac,

Thank you for agreeing to develop a Fishery Ecosystem Plan. Please adopt the plan and accompanying list of Ecosystem Initiatives in April.

As an angler in the Pacific Northwest who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web. The Council itself recognized forage fish as the cornerstone of a healthy ecosystem last June when it set a goal of prohibiting new fisheries on forage species that aren't currently managed. Now, as its first official ecosystem initiative, it makes sense for the Council to follow through by enacting firm protections for forage fish that are vulnerable to unregulated fisheries emerging at any time. In doing so, the Council has a chance to establish itself as a leader in moving ecosystem-based management from theory into practice.

I encourage you to take this precautionary measure as soon as possible. The Council's own analysis, conducted in 2011, noted that industrial demand for forage fish is likely to grow more intense because of its value as a global commodity used in feeding livestock, poultry and farmed fish. The Council's top priority should be to make sure it protects forage fish as the linchpin of healthy existing fisheries and coastal communities here on the Pacific coast.

Sincerely,
James Bennett
bennhaus@comcast.net
Vancouver, WA

RECEIVED

MAR 18 2013

PFMC

3-15-2013

To: Pacific Fishery Mgmt. Council

Re: Fishery Ecosystem Plan

Dear Sirs -

As an involved citizen of marine and bird lover, I want to thank you for acting prudently to set limits on existing already-managed fisheries.

It is important to the environment and the society that you adopt the Fishery Ecosystem Plan at your April 2013 meeting.

We need to have Fish Management Plan-level of protections for unmanaged forage fish. This will greatly protect our marine and bird resources.

Thank you for your support

Grace Bailey -

March 4th, 2013

RECEIVED

MAR 13 2013

PFMC

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

Dear Chairman Wolford and Council Members,

As outdoor enthusiasts and fishermen who care about a productive ocean, we ask that you fulfill the commitment you made a year ago and implement measures to prohibit unregulated fisheries targeting forage fish on the West Coast. It is time for the Council to act.

Fishermen know that bait in the water translates to fish in the boat.

Forage fish form the key link in the marine food web on the Pacific coast, by eating plankton and converting it into protein for bigger fish, seabirds, and marine mammals. Healthy and robust populations of game fish such as salmon, tuna and ling cod, in turn, support a recreational fishing sector that employs over 18,000 people and generates $2.2 billion in annual spending on saltwater fishing and equipment in California, Oregon and Washington.

We also know that wild-caught forage fish is a global commodity, and that worldwide demand is rising to use it for purposes such as feeding livestock, poultry and farmed fish overseas.

We believe the Council's top priority should be to leave enough of these food fish in the water to sustain a balanced and productive marine ecosystem here on the Pacific coast. We are encouraged that the Council has stated its intention to prohibit new fisheries targeting currently unmanaged forage fish such as sand lance, saury and smelt until management plans are in place that fully assess the impacts of any fishing on the ocean food web. Now we ask the Council to fulfill its commitment and put in place management measures to protect these and other important forage species that are vulnerable to unregulated fisheries.

We appreciate the attention the Council has given to forage fish conservation efforts throughout the development of your ecosystem plan. By acting now, the Council has a chance to help ensure a healthy Pacific Ocean for generations to come.

Sincerely,

Karen L. Coulter, Director,
Blue Mountains Biodiversity Project

TU Celebrates 50 Years of Protecting Cold, Clean, Fishable Water.

Oregon Council Trout Unlimited

March 18, 2013

To Pacific Fishery Management Council-

Concerning Agenda item H. 1-Ecosystem based Management-

The Oregon Council Trout Unlimited urges the Council to adapt the Pacific Fishery Ecosystem Plan at the April 2013 meeting. We feel that adopting a well designed FEP is a major step forward in a national transition to an ecosystem –based approach to fisheries management. The top priority of the FEP should be to ensure a healthy ecosystem, and a key part should be to protect the marine food web upon which it depends.

Following the final adoption of the FEP, the Council should move to its first ecosystem based initiative starting the process of providing FMP level protections for unmanaged forage fish. The Council is in the first phase of the initiative- to update the Pacific Fishery Management Council's list of Authorized Fisheries and Gear- is underway. This is not enough to accomplish the Council adopted objective of the initiative.

To make this happen, additional protection for unmanaged forage species must be implemented through a Fishery Management Plan amendment process as called for in the Council's June 2012 motion which started the initiative.

So the Oregon Council TU is supportive and appreciative of the steps in this process you have already taken, such as taking action in November to adopt the preliminary draft Pacific FEP and release it for public review. But this is only the first step and we urge the Council to continue on the path it started on this FEP process.

Sincerely,

Tom Wolf, Chair
Oregon Council Trout Unlimited

Oregon Chapter Sierra Club
1821 SE Ankeny St • Portland, OR 97214
Phone (503) 238-0442 • Fax (503) 238-6281
oregon.chapter@sierraclub.org
www.oregon.sierraclub.org

Sierra Club
Founded 1892

March 19, 2013

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Ste. 101
Portland, Oregon 97220

Re: Agenda Item H.1, Public Comment on Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford and Council members:

I write today on behalf of our 20,000+ members and supporters in Oregon to urge the Council to adopt a final Fishery Ecosystem Plan and start the process toward providing additional protections for unmanaged forage species through a Fishery Management Plan amendment.

The Oregon Chapter of the Sierra Club is a non-profit member-supported, public interest organization that promotes conservation of Oregon's natural environment by influencing public policy decisions—legislative, administrative, legal, and electoral. We have worked to protect Oregon's environment and natural resources since 1978.

We appreciate the Council's move toward ecosystem-based management and believe this is a major step forward in the national transition to an ecosystem-based approach to fisheries management by allowing ecosystem principles to be incorporated in to the decision making process. The top priority of ecosystem planning should be to ensure a healthy ecosystem and the first step should be to protect the marine food web upon which that ecosystem depends. Following adoption of the Fishery Ecosystem Plan in April, the Council should proceed immediately with its first ecosystem-based initiative by beginning the process of providing FMP-level protections for unmanaged forage fish.

We look forward to engaging throughout this process. Thank you for your consideration.

Sincerely,

Rhett Lawrence
Conservation Director
Oregon Chapter, Sierra Club

Port Orford Ocean Resource Team
PO Box 679
351 W 6th Street
Port Orford, OR97465
P: 541.332.0627
F: 541.332.1170
info@oceanresourceteam.org
oceanresourceteam.org

March 18, 2013

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

Dear Mr. Wolford:

The Port Orford Ocean Resource Team (POORT) is a non-profit organization based in beautiful Port Orford, Oregon. At the directive of our board of five local commercial fishermen, we are dedicated to maintaining access to natural resources by people who are fishing selectively, while promoting sustainable fisheries and protecting marine biological diversity. We operate on the triple bottom line: ecology, equity and economics. Our organization combines science, education, conservation, and local knowledge to help our community continue to access healthy, local fisheries. We believe that with proper management and conservation strategies there is a future in fishing at Port Orford and look forward to our children and grandchildren following in our footsteps.

Our community came together to engage in the marine reserve process to have a local say and carve out benefits for Port Orford. In addition, we recently launched a Community Supported Fishery, allowing people from around the state to share in supporting our local fishermen and our sustainable fishing model.

I am writing to you today to express my support of the Council's Fishery Ecosystem Plan and urge the Council to adopt the plan at the April meeting in Portland. The top priority of the Fishery Ecosystem Plan should be to ensure a healthy ecosystem and the first key step should be to protect the marine food web upon which it depends.

Forage fish play a critical role in sustaining a vibrant Pacific Ocean and make up the cornerstone of ocean food webs. Forage fish are vital to well-functioning marine ecosystems. There is huge commercial value to be maintained by leaving forage in the water as food for bigger more lucrative fish, not to mention the benefit of maintaining an especially vibrant marine ecosystem that supports whale-watching, birding, recreational fishing and other forms of eco-tourism. The Lenfest Forage Fish Task Force Report

Port Orford Ocean Resource Team
PO Box 679
351 W 6th Street
Port Orford, OR97465
P: 541.332.0627
F: 541.332.1170
info@oceanresourceteam.org
oceanresourceteam.org

concluded that forage species are worth almost double as supportive value to other commercial fisheries as compared to their value as direct catch.

I am pleased that the Council will consider unmanaged forage species protection under the first ecosystem initiative at the June Council meeting and encourage the Council not to delay in working on this initiative. I urge the Council to take action to ensure that forage fish are adequately protected so that they continue to provide essential food for the marine life we catch, eat and watch at Port Orford.

Our commercial fisheries depend on you taking action to adequately protect the marine ecosystem. Thank you for your attention to this important issue.

Sincerely,

Leesa Cobb

Leesa Cobb
Executive Director

March 19, 2013

Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: Agenda Item H.1.c - Pacific Fishery Ecosystem Plan (FEP) And FEP Initiatives Document

Dear Chairman Wolford and Council Members,

We write to express our support for the Pacific Fishery Management Council's (Council) development of a Fishery Ecosystem Plan (FEP). We urge the Council to take final action at its April meeting to adopt the FEP and to begin implementation of ecosystem-based initiative #1 – the protection of unmanaged forage species. Taking this action will firmly establish the Council as a leader in the national transition to an ecosystem-based approach to fisheries management.

Overview Of FEP Requests

This letter includes our organizational comments on the FEP document itself as well as our comments on the ecosystem-based initiative process and corresponding proposed initiatives. Our main requests regarding these two documents and the FEP process moving forward are summarized below:

- Take final action at the April meeting to adopt the Pacific FEP.
- Begin implementing ecosystem-based initiative #1 - protecting unmanaged forage species - according to the process described in the appendix, starting with formation of the *ad hoc* committee as stated in the Council's November 2012 FEP motion.
- Develop a schedule and process for assigning ecologists to stock assessment teams, starting with Coastal Pelagic Species due to their unique role as prey.
- Establish an annual index of forage abundance and diversity as part of every Annual State of the Ecosystem Report, and work to develop forage thresholds that reflect the Council's ecosystem goals and objectives
- Include removal of the non-Fishery Management Plan (FMP) seine fishery for Pacific saury along with the proposed revisions to the List of Authorized Fisheries and Gear included in FEP appendix.

- Clarify the reasoning behind combining the two initiatives called for in the November 2012 motion (Groundfish Amendment 24 process and development of a core list of ecosystem indicators).[1]

Below please find our more detailed comments on the FEP.

Draft FEP and the November 2012 Motion

We are pleased with the progress that the Council has made on the FEP in general and are optimistic about the ways in which it will enhance and improve existing fisheries management by bringing more ecosystem science, broader ecosystem considerations and coordinated management policies to the table.[2] In particular, we are heartened to see that the recommendations we provided in our public comment[3] at the November 2012 Council meeting have largely been incorporated into this version of the FEP released for public review. These recommendations included:

- An explicit reference to Optimum Yield (OY), as defined by the Magnuson-Stevens Fishery Conservation and Management Act (MSA), in the Objectives section of the FEP. The FEP will be a critical part of advancing the assessment and utilization of OY within the Council's management process.
- Monitoring the status of the forage base as part of the FEP's Annual State of the Ecosystem Report.[4] As stated above, this ecosystem indicator should be assessed annually as part of the Report.
- Prioritizing protection of the marine food web by laying out a process to protect unmanaged forage species through implementation of FEP initiative #1.

We are also pleased with the motion that passed unanimously at the November 2012 Council meeting to adopt the preliminary draft FEP for public review. Moreover, we support the changes to the FEP called for in the motion as they improve upon the draft presented at that meeting.[5] These changes include:

- Decoupling the Ecosystem-Based initiatives section from the FEP and instead creating a stand-alone initiatives document as an appendix to the FEP in order to allow for annual review of and changes to the initiatives document.

[1] PFMC. November 2012. Supplemental WDFW Motion. Agenda Item K.1.e.
[2] PFMC. June, 2012. Draft Pacific Coast Fishery Ecosystem Plan. Agenda Item H.1.a. Page 2
[3] See Pew Charitable Trusts public comment at November 2012 meeting. Agenda Item K.1.d, Page 1.
[4] PFMC. November 2012. Draft Annual State of the California Current Ecosystem Report. Agenda Item K.3.a.
[5] PFMC. November 2012. Draft Pacific Coast Fishery Ecosystem Plan. Agenda Item K.1.a

- Adding a section to the FEP that describes the process for implementation and/or modification of the initiatives and clarifies that the initiative process remains under the umbrella of the FEP
- Inclusion of the draft list of Lower-Trophic-Level species from Appendix A[6] of the November 2011 version of the FEP under initiative #1 in the stand alone document.
- The addition of two new proposals to the initiatives document; the first to analyze the cumulative impacts of fisheries on the ecosystem, pursuant to the National Environmental Protection Act (NEPA) and the MSA; and the second to develop a core suite of indicators to track through the Annual State of the Ecosystem Report. Under section A.2.9 of the initiatives document, these two proposals are combined into a single initiative.

Decoupling the initiatives document from the FEP itself enables the Council to develop and implement the ecosystem-based initiatives without having to revisit or modify the FEP document itself. This allows the Council to respond quickly and effectively to new information or science that can have a direct and beneficial impact for its managed fisheries, while keeping the ecosystem-based initiative process under the umbrella of the FEP itself. For example, proceeding now to implementing initiative #1 and addressing the decisions that need to be made under that process does not require amendments or changes to the actual FEP.

The addition to the FEP of language linking the initiatives document to the FEP itself will help to clarify and make explicit to all stakeholders the process by which the Council will consider, develop and implement the initiatives. It also specifies how new information and/or proposals from the public will be considered by the Council and its advisory bodies for inclusion in the initiatives document. As the Council seeks to increasingly incorporate ecosystem science into the management framework, having stakeholders from all perspectives on the same page as far as process will reduce confusion, shorten timelines and increase effective implementation of the ecosystem-based initiatives in order to better ensure sustainable management of our fisheries.

We were also pleased that the motion directed the Ecosystem Plan Development Team (EPDT) to re-insert the draft list of Lower-Trophic-Level species from Appendix A[7] of the November 2011 draft FEP under initiative #1 in the stand alone initiatives document. While we acknowledge that the draft list is preliminary and will need to be vetted by the EPDT, the Ecosystem Advisory Subpanel, the ad-hoc committee[8] called for in the motion and the Science and Statistical Committee, it is an appropriate starting point for discussion of what species may be eligible for protection under initiative #1. Furthermore, inclusion of this list in the initiatives

[6] PFMC. November 2011. Draft Pacific Coast Fishery Ecosystem Plan. Appendix A. Agenda Item H.2.a.
[7] *Ibid.*
[8] PFMC. November 2012. Supplemental WDFW Motion. Agenda Item K.1.e.

document helps to frame the context of this issue and offer reassurance to industry stakeholders that initiative #1 will not have negative impacts on the Council's managed fisheries because the initiative only addresses species which are not currently being targeted by fisheries.

The Final FEP As Released For Public Comment

This FEP is a solid first step in starting to bring ecosystem science into the Council decision making process, thereby helping to transition from a single-species perspective to an ecosystem-based approach. While the Council has made it explicitly clear that this FEP is meant to be an informational document and that any effect on management decisions is solely at the discretion of the Council[9], we believe that the informational products of the FEP will help improve the overall process and lead to better informed decisions firmly grounded in the best available science, particularly regarding cross-FMP actions intended to address ecosystem-level concerns.

The FEP document does a great job of providing crucial information about the FEP's purpose and objectives, the California Current Large Marine Ecosystem and all that it contains, current and historical West Coast fisheries, human and environmental impacts on the ecosystem, the Council's policy priorities, and lastly how ecosystem information can be incorporated into the management process.

In particular, chapters 4 (on the effects and uncertainties arising from human activity and environmental shifts) and 6 (on the incorporation of cross-FMP and ecosystem science into the Council process) provide information that is useful in considering how the Council can start to make decisions within an ecosystem context. After providing a broad but detailed description of the California Current Ecosystem in Chapter 3, Chapter 4 looks at how changes in human activity can affect the ecosystem and vice-versa, including the effects of climate change on both marine life and human activity. With regard to the removal of fish from the ecosystem due to fishing activity, this chapter demonstrates how the cumulative impacts of various fisheries interact to cause both direct and indirect effects up and down the marine food web. Furthermore, while the FEP acknowledges that there are but a few examples of comprehensive scientific efforts to analyze the cumulative effects of fishing on marine ecosystems, there is progress being made in this area, especially with respect to the ecological and economic effects of fishing on low trophic level (forage) species.[10]

Chapter 6 provides a discussion of how ecosystem information can be brought into the Council decision making process. There are two main points of entry for such information to be

[9] PFMC. November 2012. Supplemental WDFW Motion. Agenda Item K.1.e.
[10] PFMC. February 2013. Pacific Coast Fishery Ecosystem Plan. p. 137.

considered and incorporated. The first is by including ecologists and/or ecosystem scientists on the Council's stock assessment teams. This is a natural and obvious step in shifting to an ecosystem approach. Having ecological expertise on stock assessment teams can help by including ecosystem information (predator-prey interactions, climate and habitat impacts, natural mortality, recruitment variability, etc.) within the assessment document itself. As time series are developed and causal relationships identified, this information will become increasingly relevant for decision makers. As noted in the FEP, stock assessment models that explicitly include ecological considerations can also be developed with such expertise on the assessment teams by incorporating ecosystem-based model parameters, adding ecological indices and/or variable population dynamics. As assessment models become increasingly able to incorporate ecological considerations, decision matrices can be developed to provide decision makers with the likely ecological effects of alternate management strategies. We support moving forward with this endeavor in the near term and request that the Council prioritize bringing ecosystem science into stock assessments according to the process laid out in Chapter 6 of the FEP.

The second point of entry for bringing ecological information into the management framework is through the FEP's Annual State of the California Current Ecosystem Report. This report will ideally provide the Council with an ecosystem context within which to decide how to set annual catch limits and other make important management decisions. We were pleased with the draft Annual Report presented to the Council in November of 2012 and suggest that this format and the core indicators included in it be adopted for future reports.

Specifically, we support the use of a forage indicator, as a stable and ongoing component of the Annual Report, which monitors and tracks the overall status of the California Current forage base, including indices of both forage abundance and forage diversity. As this time series is developed, as ecosystem science expands and predator responses to prey availability are identified, we encourage the Council to establish benchmarks or thresholds of forage abundance against which the forage indicator may be assessed and which are consistent with the Council's ecosystem goals and objectives. Taken as a whole, the ecosystem indicators presented in this initial Annual Report constitute a good start, and we discuss below how to move forward on refining the suit of indicators to best inform management of the Council's FMPs.

Cross-FMP Ecosystem –Based Fisheries Management Initiatives

With the initiative process proposed through the FEP, the Council has an ideal framework in place to begin the evolutionary, incremental process of putting ecosystem-based management into practice. The process described in the FEP allows the Council to be flexible in selecting which initiatives it wishes to pursue according to fishery and ecosystem needs while at the same time enabling the Council to respond to new information and data quickly, with the understanding that any management implications remain at the discretion of the Council. Our comments below focus primarily on initiative #1, then go on to address the other initiatives described in the appendix.

Initiative #1 – Protection of unmanaged forage species

Upon final adoption of the FEP in April 2013, we urge the Council to begin implementation of initiative #1, according the process described in the stand-alone initiatives document and per the Council motion[11] passed in June 2012 establishing the management objective to prohibit new fisheries on unmanaged forage species until it has a chance to assess the science behind the fishery and any potential impacts to the broader ecosystem. As noted in the initiatives document, the Council has discussed how to best implement protections for unmanaged forage species over the course of several years and has developed a clear path forward through an FMP amendment process. With that in mind, we offer the following comments specifically regarding FEP initiative #1.

The description of the initiative provided in the stand-alone document describes a "two-stage process" for establishing protections for unmanaged forage species. The first step is to revise and update the federal List of Authorized Fisheries and Gear for the West Coast (List), which would implement a notification requirement for any potential new fishery. The second step is to develop additional necessary protections through an amendment to one or more of the Council's FMPs.[12] Regarding this two-stage process, the description in the stand-alone document states:

> *By modifying the list of authorized fisheries and gear, and by adopting a policy on the development of new fisheries in the West Coast EEZ, the Council better prepares itself for a potential future new fishery proposal. However, those actions would not wholly prohibit new fisheries from developing without Council consultation. Therefore, the second stage of the Council's guidance on protecting unfished forage fish is to incorporate any additional needed protections into the current suite of FMPs through an FMP amendment process.*[13]

This statement clearly shows that in order to achieve the Council's management objective adopted in June 2012, additional protections for unmanaged forage species – above and beyond those provided by a revised List – are needed and that they must be implemented

[11] PFMC. June 2012. Supplemental Revised Council Action on Consideration of Further Protection of Currently Unmanaged Forage Species. Agenda Item G.1.d.
[12] *ibid.*
[13] PFMC. February 2013. Pacific Coast Fishery Ecosystem Plan. Public Review Draft of Ecosystem Initiatives Appendix. Page A-7.

through an FMP amendment process. We look forward to participating in this process along with the *ad hoc* committee tasked with completing initiative #1 in order to ensure robust protections for the unmanaged component of the forage base upon which our fisheries and coastal communities depend.

The revisions to the List suggested in the initiatives document appear to mirror those suggested in the draft FEP presented to the Council in November 2012. We support those changes with one exception that we noted in our public testimony during the November 2012 meeting. The draft revisions presented in this document maintain a pre-authorized, non-FMP seine fishery on Pacific saury. We are concerned about the fact that this fishery was not stricken from the List for two reasons. First, we are unaware of any existing commercial fishery on Pacific saury, so its inclusion in the List is perplexing as the stated intent of this task was to identify "fisheries and authorized gears for Federal fisheries operating in the U.S. Exclusive Economic Zone (EEZ) off each state in the most specific and narrow terms possible, for incorporation into the updated List.[14]" Second, we are concerned because according to the draft list of Lower-Trophic-Level species included in the initiatives document, Pacific saury is an unmanaged forage species that would otherwise be eligible for protection under initiative #1.[15] For these reasons we request that this fishery be removed from the List, along with the other revisions proposed in the appendix.

Future Initiatives For Council Consideration

In addition to the protection of unmanaged forage species, the stand-alone initiatives document describes several other compelling cross-FMP initiatives that have the potential to greatly improve existing fisheries management and aid in the transition to an ecosystem-based approach. While all of the initiatives in the appendix have merit, there are several proposed initiatives, including the two added through the November 2012 motion that were combined into a single initiative, that have particular merit and should be prioritized by the Council.

<u>A.2.9 - Develop a list of core ecosystem indicators to be tracked through the Annual Report</u>

The draft Annual State of the California Current report presented to the Council in November 2012 does a good job of summarizing and synthesizing critical environmental, biological and socio-economic indicators as they relate to the California Current Ecosystem. The information presented in this report provides an ecosystem context within which the Council will be able to make informed decisions about setting catch-levels and other management measures. As the Integrated Ecosystem Assessment (IEA) process upon which this report is based becomes more

[14] PFMC. June 2012. Supplemental Revised Council Action on Consideration of Further Protection of Currently Unmanaged Forage Species. Agenda Item G.1.d.
[15] PFMC. February 2013. Pacific Coast Fishery Ecosystem Plan. Public Review Draft of Ecosystem Initiatives Appendix. Page A-11.

refined, and as particular indicators are correlated with changes in productivity and distribution of managed species and associated fisheries, the utility of this report will great increase, thus allowing the Council to better achieve OY from each managed fishery.

As stated in the introduction of the report, more evaluation should be done to determine the most appropriate suite of indicators that will best meet the Council's information needs. While some information, such as the abundance and diversity of the forage base, may be critical across FMPs and should be included in every annual report, other data and time series may be more directly applicable to a single FMP or during a particular timeframe. For this reason we are pleased that the Council and the IEA team plans to hold a workshop[16] to determine what core indicators may be appropriate to best inform the Council's decision making process each and every year, and those indicators that may be applicable to a single FMP or under certain oceanographic conditions. As noted above, this proposal has merit on its own, but has also been combined with the following proposal described below.

A.2.9 - Cumulative effects of Council harvest policies

The initiatives document describes a similar process to the one discussed above, yet from the perspective of a National Environmental Policy Act (NEPA) style, cumulative effects analysis. The difference between the two initiatives appears to be that while the indicators presented in the Annual Report seek to inform the annual specifications process, the indicators described in section A.2.9 seek to inform an analysis of the additive and cumulative impacts of all the Council FMPs and other regulatory actions, rather than looking at each management action in isolation.

While the Council will continue to manage fisheries through its species-specific FMPs, having an understanding of the cumulative effects of all the Council's FMP policies on the ecosystem will greatly improve management and help to provide an ecosystem context for the decision making process. To this end, we concur with the following statement from the Groundfish Management Team:

> *"…we suggest that the Council consider how to use the information produced in IEAs to stay abreast of the state of the ecosystem and use that information to inform management. This may also provide information on cumulative impacts that would help improve National Environmental Policy Act (NEPA) analyses (e.g. as contemplated under the Amendment 24 process under the groundfish fisheries management plan).[17]"*

[16] PFMC. November 2012. NWFSC and SWFSC Report. Agenda Item K.2.b
[17] PFMC. November, 2012. Groundfish Management Team on Draft Pacific Coast Ecosystem Plan. Agenda Item K.1.c.

This section of the initiatives document poses a question that is central to the matter of how and why to develop ecosystem indicators:

> *"Could ecosystem status indicators do more than simply illustrating the current and past states of the ecosystem by also identifying points at which management programs should change?"*

The answer to this question is a resounding yes!

<u>A.2.1 - Long-term effect of Council harvest policies on age- and size- distribution</u>

Maintaining age and size diversity within managed fish stocks is an important objective for fishery managers because we know in general that older, larger female fish have higher fecundity, are more productive, and help buffer against the effects of climate change by maintaining resilience within the stock.[18]

The idea with this initiative would be to conduct an analysis of the effects of all of the Council's current harvest control rules on the age- and size- distribution of those species managed through federal FMPs to determine if those rules and management approaches pose a risk to long-term productivity of the stock or to the ecosystem as a whole. Additionally, through this initiative the Council could conduct a management strategy evaluation to look at alternative harvest control rules that incorporate age- and size- structure reference points, and see how they perform against Council established metrics.

This initiative is particularly compelling because not only does it have the potential to minimize risk to long-term stock productivity, but it also has the potential to increase fishery yield over the long term:

> *…simulation studies suggest that reductions in fishing mortality, from current spawning biomass targets, would achieve increases in effective larval output and yield, suggesting that managing for age structure can increase both resilience and yield in fished stocks (Berkeley 2006).*[19]

<u>A.2.2 - Bio-geographic region identification and assessment</u>

Chapter 3 of the FEP identifies three separate bio-geographic regions within the California Current Ecosystem. The Northern sub-region extends from Cape Flattery in Washington to Cape

[18] Berkeley, S.A. Pacific rockfish management: are we circling the wagons around the wrong paradigm? Bull. Mar. Sci., 78(3): 655-668.
[19] PFMC. November 2012. Draft Pacific Coast Fishery Ecosystem Plan. Agenda Item K.1.a. Page 162.

Blanco in Oregon. The Central sub-region extends from Cape Blanco to Point Conception in California. The southern sub-region, also known as the Southern California Bight, extends from Point Conception to the Mexico border. Within these regions are various types of habitats that, if identified, catalogued and mapped could allow the Council to manage fisheries on a finer spatial scale, thus helping to implement an ecosystem-based approach to management.

Identification of sub-regions and associated habitats could also help provide a framework for spatially-explicit management of fisheries to better prevent localized or serial depletion of regionally and/or seasonally critical species, such as many of the forage species that our commercially important species depend upon at specific spatiotemporal junctures throughout a given season. As noted in the initiative document:

> *Identifying finer scale sub-regions within the CCE could help scientists and managers better assess sub-populations, regional management issues, and how the effects of management decisions may vary between sub-regions. Identifying sub-regions could also help the larger natural resource science and management community to better assess and understand connections between terrestrial and marine ecosystems at a smaller than coastwide scale.*[20]

A.2.3 - Cross-FMP bycatch and monitoring

National Standard 9 requires that regional councils seek to minimize bycatch and bycatch mortality to the extent practicable.[21] Precise and accurate monitoring of bycatch is a necessary component of any strategy to meet this standard. As stated in the initiatives document, one focus could be to look at best practices and results across FMPs in order to develop Council wide bycatch monitoring and minimization goals and objectives. This cross-FMP approach would better enable the Council to address cumulative bycatch issues, whether an innovation in one fishery could be applied to another, or whether there are temporal and/or spatial overlaps or interactions with bycatch encountered in fisheries managed under separate FMPs.

While the Council's concern over bycatch has focused on its groundfish and highly migratory species fisheries, the salmon fishery has additional concerns with minimizing impact to endangered salmon runs. Additionally, the fact that much of the sardine fleet fishes predominantly in the area of the Columbia River plume raises the issues of the extent to which sardine seine gear interacts with both adult and juvenile salmonids.

[20] PFMC. February 2013. Pacific Coast Fishery Ecosystem Plan. Public Review Draft of Ecosystem Initiatives Appendix. Page A-14.
[21] 50 C.F.R. § 600.350.(a)(1) & (2)

A.2.4 - Cross-FMP essential fish habitat (EFH) identification

The Council has established EFH for each of its 4 FMPs and reviews each EFH designation every 5 years. The idea with this initiative would be to integrate this process across FMPs for future 5-year reviews. Having an ecosystem-based, cross-FMP approach to EFH identification and protection would provide a broader view of EFH for all Council managed fisheries and would help to develop research needs, identify interactions between protected species, and broad threats to habitat quality such as ocean acidification. This initiative could also provide a venue to address complex EFH issues such as those that involve species managed under multiple FMP's. For instance, the abundance and availability of a species managed under one FMP may have significant EFH effects on a species managed under a different FMP. The availability of forage, and the question of whether forage fish, or more precisely the presence of forage fish, should be considered a component of EFH for predator species, is a classic example of this dynamic, and one recognized in federal regulation. Specifically, the Interim Final Rule for EFH issued on December 19, 1997 states,

> *"The statutory definition of EFH includes ''feeding'' as an ecological function of EFH necessary to a species. Therefore, presence of adequate prey is one of the biological properties that can make a habitat essential."*[22]

Perhaps most importantly, this initiative could identify EFH for more than one FMP by mapping those habitats that are important for more than one FMP. With this information the Council could focus protection efforts to minimize adverse impacts to EFH identified in multiple FMPs, and help to better understand the interactions between habitat and multiple FMP species. For example, the CPS fishery establishes EFH based on ocean temperature rather than spatially. As this EFH changes both seasonally and inter-annually, identifying when and where CPS EFH overlaps with EFH for other species we can learn more about foraging patterns and predator hot-spots to better inform a spatially informed, ecosystem-based approach to management.

Management of Forage Species and Achieving Optimum Yield

National Standard 1 (NS1) Guidelines state that the benefits of ecosystem protection result from among other things, "maintaining adequate forage for all components of the ecosystem."[23] The guidelines go even further by directing that in FMPs, "consideration should be given to managing forage stocks for higher biomass than B_{MSY} to enhance and protect the marine ecosystem."[24] In short, forage conservation is a primary component of ecosystem-based

[22] See EFH Interim Final Rule published in Federal Register 12/19/97 available at http://www.gpo.gov/fdsys/pkg/FR-1997-12-19/pdf/97-33133.pdf , page 66541
[23] 50 C.F.R. § 600.310(e)(3)(iii)(C).
[24] 50 C.F.R. § 600.310(e)(3)(iv)(C).

fishery management[25] and should be a major focus of the research, monitoring and assessment activities called for in the FEP, as well as the way in which its implementation will enhance management.

The MSA mandates that FMPs seek to achieve OY in order to provide the greatest overall benefit to the Nation, particularly with respect to food production, recreational opportunities and protecting marine ecosystems.[26] Under the MSA, Optimum Yield is defined as Maximum Sustainable Yield (MSY) reduced by relevant social, economic and ecological factors.[27] The incorporation of these factors into the determination of catch levels is thus a requirement of FMPs.[28] Clearly, a major objective of the FEP is to assist the Council in identifying, assessing and explicitly incorporating these factors into its existing FMPs as an adjustment from MSY to establish OY.

These factors are particularly crucial for the management of forage species, due to their supportive role as prey for commercially and recreationally valuable species. In order to fully assess the economic factors necessary to establish OY, the management of forage species should consider new scientific studies evaluating the economic value of forage species as prey for other recreationally and commercially important species relative to their economic value as commercially targeted stocks.[29] Moreover, economic and social OY adjustments must be carefully designed so that they do not overlook the possible negative impacts of forage fish depletion on fisheries for marine predators in higher-trophic levels (e.g., salmon and tuna). Additionally, these adjustments must incorporate long-term economic impact assessments on all stakeholders for fisheries which are dependent on forage species.

In regards to ecological OY considerations for single-species management, the FEP should provide guidance to help assess the relative contribution of the particular forage stock to the diets of key predators with respect to population trends and ocean conditions in order to manage the fishery in a way that maintains that ecological contribution. Last, informational products from the FEP (i.e. cumulative impact analysis, ecosystem considerations in stock assessments, IEA modeling efforts, etc.) should analyze alternative forage management strategies to identify and minimize any potential negative impacts to existing fisheries and the ecosystem.

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[25] See also: Warren, Brad. 2007. *Sea Change: Ecological Progress in U.S. Fishery Management.* A report jointly commissioned by the Marine Conservation Alliance and the Institute for Social and Economic Research and the University of Alaska Anchorage. July, 24, 2007.
[26] 16 U.S.C. 1851 § 301(a)(1)
[27] 16 U.S.C. 1802 § 3(33)(B).
[28] 50 C.F.R. § 600.310(e)(3)(iv)(C).
[29] Hannesson, R., & Herrick JR, S. 2010. The value of Pacific sardine as forage fish. *Marine Policy*, *34*(5), 935-942.

Similar to utilization of ecosystem indicators developed through the Annual State of the Ecosystem Report, the FEP should identify and evaluate ecological and economic tradeoffs and alternative management scenarios. As these tradeoffs are identified, a framework must be in place to ensure that this information is considered and utilized in the decision-making process that currently occurs within the context of single-species/species complex FMPs. Establishing this framework will be an essential part of ensuring a transparent and explicit derivation of OY.

Conclusion

We'd like to commend the Council for its development of the Pacific FEP and its stated intent to utilize the FEP to aid in the transition to an ecosystem-based approach to fisheries management. As our knowledge of the marine ecosystem grows, so too will our ability to protect ecosystem structure and function while at the same time managing sustainable fisheries. The first and most crucial step in this process is to conserve the marine food web, and this priority is reflected in the Council's current focus on protecting unmanaged forage species.

Forage species populations fluctuate dramatically in response to ocean conditions and face increasing pressure from climate change and other forces beyond the control of the Council. At the same time, we know that fishing pressure exacerbates these stressors and can result in forage populations reaching unnaturally low-levels.[30] While the Council can't stop global warming or regulate non-fishing impact on the marine environment, it can seek to minimize negative impacts to the ecosystem from the fisheries it does control. Adopting a meaningful FEP that is utilized in the decision making process will enable the Council to achieve our established national goal of transitioning to an ecosystem-based approach to fisheries management.

We appreciate the Council undertaking this endeavor and look forward to working with all stakeholders to maintain healthy oceans and sustainable fisheries.

Thank you in advance for your time and consideration.

Sincerely,

Steve Marx
The Pew Charitable Trusts

[30] Hsieh et al. 2006. Fishing elevates variability in the abundance of exploited species. Nature 443:859-862. Doi:10.1038/nature05232

March 19, 2013

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

RE: **Integrating Fishery Ecosystem Plan (FEP) Information and Initiatives into Council Fishery Management Decisions**

Dear Chairman Wolford,

Wild Oceans (formerly the National Coalition for Marine Conservation or NCMC) is celebrating 40 years of bringing fishermen and environmentalists together to keep the oceans wild for the future of fishing. We firmly believe that conserving a healthy reserve of forage fish, and with it the predator fish and associated commercial and recreational fisheries they sustain (along with many marine mammals and seabirds), is sound environmental *and* economic policy. It's a win-win result for all of us, whether we fish for recreation, to make a living, enjoy seafood or simply value marine life in all its infinite variety.

We strongly support the Pacific Fishery Management Council's move to an ecosystem-based approach to fishery management (EBFM). And we commend the council for its recent actions, which provide a solid framework for EBFM, as we discuss below. We encourage the council going forward to focus on integrating the FEP information and initiatives into the fishery management process.

We are especially pleased that the council recognizes the need to consider the status of the California Current Ecosystem (CCE) forage base when making future management decisions. To maintain a healthy CCE, we need to monitor and measure the health of the overall west coast forage base; conserve those prey species, like sardine, squid and mackerel, that we fish for; and prevent new fisheries for unmanaged species until we fully understand the impacts of fishing on the broader food web.

With this in mind, we strongly urge the Pacific Fishery Management Council to:

- Approve the Final Fishery Ecosystem Plan (FEP) and Ecosystem Initiatives (Appendix A) at the April 2013 meeting;

- Appoint an Ad Hoc Committee of Forage Species Experts to recommend a regulatory means for implementing FEP Initiative 1, a prohibition on fishing for unmanaged species, for council action at the June meeting;

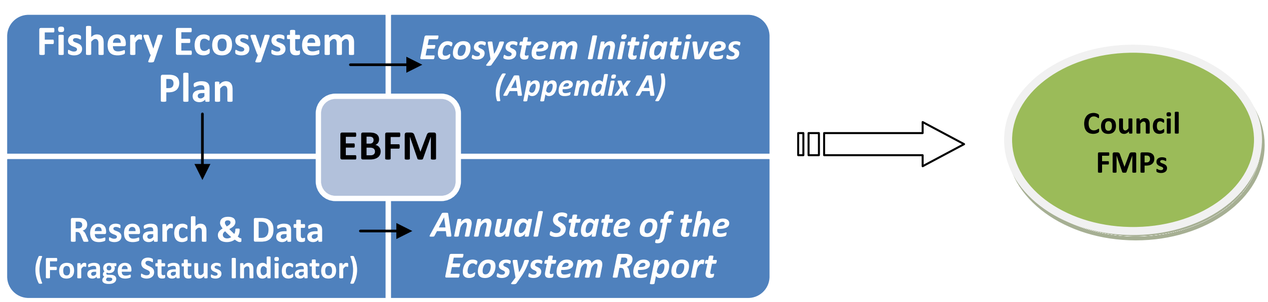
- Enlist the experts on this same Ad Hoc Committee to begin laying the groundwork for an index of forage status that would be used to inform future council decision-making, a task that was identified under the highest priorities for EBFM in the 5-year Research and Data Needs plan adopted in March; and lastly,

- Initiate a full management strategy evaluation (MSE) for sardine and other coastal pelagic species (CPS) relative to meeting new standards for forage fish protection and the CPS plan goal of providing adequate forage for dependent species.

Making EBFM Operational

The simplest, and therefore probably the best, definition of EBFM can be found in the old Chinese saying that nature is not composed of things, but of relations. **In taking an ecosystems-approach, the council needs to consider each component as part of the whole** (see *Figure 1*); **to look at how all the parts relate to each other and how they will work together. Ultimately, that means outlining the pathways that will bring EBFM into the species-group fishery management process and make it operational.**

Figure 1



The council has assembled the four cornerstones of a solid foundation for EBFM, each with a critical role, all interrelated. The council's **Fishery Ecosystem Plan** (FEP) serves as the umbrella document, containing the council's goals and objectives for ecosystem-based fishery management and articulating its guiding principles.

The FEP's Appendix A, **Ecosystem Initiatives**, serves as a means to translate FEP objectives into desired management actions, beginning with Initiative 1, restrictions on fishing for currently unmanaged forage species. A process for adding new Initiatives, such as ecosystem indicator development, is described.

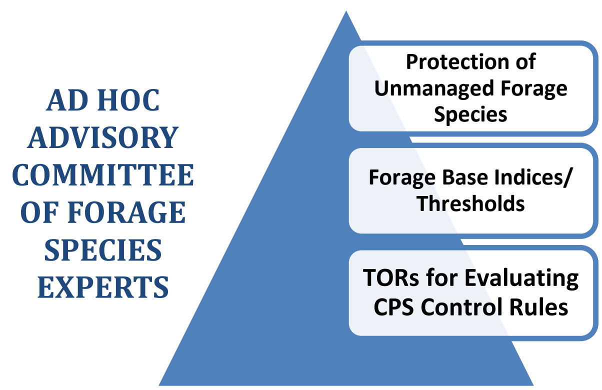
The FEP's "purpose and needs" determine science priorities as laid out in the **Ecosystem Research & Data Needs** (part of the council's approved 5-Year Research Plan). Among these priorities is development of ecosystem status indicators, such as overall abundance of forage fish (including un-fished, unmanaged species) as well as abundance of the CPS (coastal pelagic species) assemblage of actively managed species.

The **Annual State of the Ecosystem Report** is the mechanism for interpreting research and data, e.g., applying values to ecosystem status indicators, and presenting it to the council in a way that will inform decisions made under species-group fishery management plans.

An Ad Hoc Committee of Forage Species Experts

The Ecosystem Initiatives document suggests broad use of ad hoc advisory committees to develop future Initiatives. Such a committee was recommended in the November 2012 motion approving the FEP for public review, a committee of forage species experts assigned to examine the regulatory options for protecting unmanaged species. Because EBFM requires considering the entire forage base, both fished and un-fished species, we urge the council to form an Ad Hoc Committee of Forage Species Experts (see *Figure 2*) to perform the following tasks: a) determine criteria for identifying unmanaged species and develop recommendations for action to protect them at the June 2013 meeting; b) lay the groundwork for an index of forage status to which "reference points" could be applied for management use; and, c) suggest Terms of Reference for evaluating sardine and mackerel harvest guidelines, through a Management Strategy Evaluation (MSE), for their effectiveness in "maintaining adequate forage for the ecosystem" as the Magnuson-Stevens Act National Standard 1 Guidelines advise.

Figure 2



Thank you for considering our views.

Sincerely,

Ken Hinman
President

Pam Lyons Gromen
Executive Director

March 19, 2013

Pacific Fisheries Management Council
Via email: pfmc.comments@noaa.gov

Re: Adoption of the Fishery Ecosystem Plan - Agenda Item H.1

Dear Council Members,

The Environmental Action Committee of West Marin is a grassroots environmental advocacy organization committed to the protection of the wildlife, wildlands and waters of West Marin since 1971. We offer the following comments in support of the adoption of the Fishery Ecosystem Plan (FEP).

Thank you for taking action in November to adopt the preliminary draft Pacific FEP and release it for public review. Thank you also for reinserting the draft list of California Current forage species into the section on FEP Initiative #1 and creating an initiative to develop a list of core ecosystem indicators to be tracked through the Annual Report. As the Council discussed in November, one core indicator should monitor the status of the forage base.

We urge the Council to take final action on adopting the FEP at your meeting this month. Adopting a meaningful FEP constitutes a major step forward in the national transition to an ecosystem-based approach to fisheries management.

The top priority of the FEP should be to ensure a healthy ecosystem, and the first key step should be protection of the marine food web. Following final adoption of the FEP, the Council should proceed with its first ecosystem-based initiative by beginning the process of providing FMP-level protections for unmanaged forage fish.

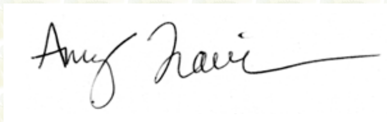
The first FEP initiative is to prohibit new fisheries on currently unmanaged forage fish until the Council can assess any potential impacts to existing fisheries and communities. We understand that the first phase of that initiative - to update the Pacific Fishery Management Council's List of Authorized Fisheries and Gear – is underway. In the FEP's discussion of this initiative, it is noted that the first phase (described above) alone is not enough to accomplish the Council adopted objective of the initiative.

Environmental Action Committee of West Marin
PO Box 609 Point Reyes, California 94956
www.eacmarin.org 415.663.9312

Therefore, in order to accomplish that objective, additional protections for unmanaged forage species must be implemented through a Fishery Management Plan (FMP) amendment process as called for in the Council's June 2012 motion that established this initiative.

Thank you very much for your consideration of our comments, and for your work to protect our priceless wild fisheries, beginning with forage fish.

Respectfully submitted,



Amy Trainer, Executive Director

Environmental Action Committee of West Marin
PO Box 609 Point Reyes, California 94956
www.eacmarin.org 415.663.9312

Northwest Power and Conservation Council

November 28, 2012

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

Dear Chairman Wolford and Council Members:

Under the Northwest Power Act of 1980, and as representatives of the governors of Washington, Oregon, Idaho, and Montana, the Northwest Power and Conservation Council is responsible for protecting and enhancing fish and wildlife in the Columbia River Basin. Our Fish and Wildlife Program directs more than $250 million annually to address the impacts of hydropower, primarily on anadromous fish. We are writing to the Pacific Fishery Management Council to express the need for a healthy marine ecosystem and support of your recent decision to protect forage fish species on which anadromous fish depend.

Last year in a report on Columbia River Basin food webs, the Independent Scientific Advisory Board, a panel of 11 scientists who advise the Power Council and NOAA Fisheries, called the Columbia River's plume and estuary "exceptionally important" in sustaining salmon and steelhead fisheries, largely due to the presence of small plankton-consuming marine fish. The rate of survival in the estuary and plume is crucial in determining the proportion of salmon smolts that will return to the river as spawning adults, according to these scientists. The ISAB report also noted that predatory seabirds (that can consume up to 1 in 5 smolts) and marine mammals congregate along the edge of the plume and that forage fish, when plentiful, serve as "alternative prey" providing coverage for juvenile salmonids leaving the river. Conversely, when forage fish are scarce, salmon mortality can be expected to rise, threatening our investment in this precious economic, historic, and cultural resource.

We are encouraged that the Pacific Fishery Management Council is taking new measures to conserve forage-fish species, especially in light of worldwide demand to convert forage species to secondary uses such as animal feeds and bait for overseas fisheries. We commend your work in agreeing to set aside these non-managed forage species as soon as possible -- before a new fishery begins with inadequate understanding of the effect on dependent species like anadromous fish.

851 S.W. Sixth Avenue, Suite 1100
Portland, Oregon 97204-1348
www.nwcouncil.org

Steve Crow
Executive Director

503-222-5161
800-452-5161
Fax: 503-820-2370

Thanks again for your leadership in protecting forage fish species as the cornerstone of a healthy marine ecosystem.

Sincerely,

Phil Rockefeller

Phil Rockefeller, Chair, Fish & Wildlife Committee
Washington Council Member
Northwest Power & Conservation Council

Bill Booth

Bill Booth
Idaho Council Member
Northwest Power & Conservation Council

Bill Bradbury

Bill Bradbury
Oregon Council Member
Northwest Power & Conservation Council

Rhonda Whiting

Rhonda Whiting, Council Chair
Montana Council Member
Northwest Power & Conservation Council

Association of Northwest Steelheaders

6641 SE Lake Rd. • Milwaukie OR 97222
503-653-4176 • 503-653-8769 (fax)
office@anws.org • www.nwsteelheaders.org

Established 1960

Feb. 25, 2013

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

Dear Chairman Wolford and Council Members,

The Association of Northwest Steelheaders is the Northwest's most effective voice for sportfishing conservation with 1,500 members working on behalf of fish and fisheries. We ask that you fulfill the commitment you made a year ago and implement measures to prohibit unregulated fisheries targeting forage fish on the West Coast. It is time for the Council to act. Concerned public beyond fishermen are increasingly aware that bait in the water translates to fish in sport and commercial boats alike.

Forage fish form the key link in the marine food web on the Pacific Coast by eating plankton and converting it into protein for bigger fish, and other predators. Healthy and robust populations of game fish such as salmon, tuna and ling cod, in turn, support a recreational fishing sector that employs over 18,000 people and generates $2.2 billion in annual spending on saltwater fishing and equipment in California, Oregon and Washington.

We are concerned that forage fish are a global commodity with a worldwide demand that is increasing for purposes such as feeding livestock, poultry and farmed fish overseas. We believe the Council's top priority should be to leave enough of these food fish in the water to sustain a balanced and productive marine ecosystem here on the Pacific coast. We are encouraged that the Council has stated its intention to prohibit new fisheries targeting currently unmanaged forage fish such as sand lance, saury and smelt until management plans are in place that fully assess the impacts of any fishing on the ocean food web. Now we ask the Council to fulfill its commitment and put in place management measures to protect these and other important forage species that are vulnerable to unregulated fisheries.

We appreciate the attention the Council has given to forage fish conservation efforts throughout the development of your ecosystem plan. By acting now, the Council has a chance to help ensure a healthy Pacific Ocean for generations to come.

Respectfully

Norm Ritchie

Norm Ritchie
Oregon Government Affairs Director

South Coast Tours LLC

27436 Hunter Creek rd.
Gold Beach, OR 97444
www.southcoasttours.net
541 373-0487

South Coast Tours LLC

Dear Chair Wolford and Council Members:

I am writing today to congratulate the council on it's efforts to better manage the Pacific ocean fisheries in a more holistic way using ecosystem based management. I am pleased to see more emphasis on the forage fish and how they play into the larger picture. Now that there is a plan garnering public comment I hope the council adopts and implements the plan which should help the whole Pacific ocean ecosystem be more sustainable for us and the future ocean users.

As many folks know the forage fish are vital to many different facets of our use of the ocean. Their abundance or lack there of play into commercial fishing, recreational fishing, non-consumptive ocean recreation and help to support many different types of wildlife in the ocean.

My personal reasons reasons for supporting the protection of forage fish are based around two important facets of my life. Recreational fishing and my kayak tour business.

Abundant forage fish stimulate the health of my favorite fish to catch in the creeks and rivers of the south coast of Oregon, Salmon. It goes without saying how important these little fish are to the growth and health of young salmonids. Minimizing catch of forage fish can only help the endangered Salmon and other anadromous fish that return each year to our south coast waterways. I have great memories of my grandpa and my father teaching me to fish on the Columbia river and I am currently creating similar memories with my son on the creek that we live on. Reasonable exploitation of forage fish will help to sustain those iconic Salmon memories for many years.

My kayak tour operation also relies on healthy and abundant forage fish populations in two distinct ways. The kayak angling side is obviously dependent on healthy stocks for the main targets of Rockfish and Lingcod, but the wildlife viewing also needs ample supplies of forage fish for the many creatures my clients love to see while kayaking on the southern coast of Oregon. It is truly amazing to see a Puffin or Pigeon Guillemot return to the surface with their beaks full of forage fish and it is those moments that make my tours more than just a paddle.

Please use the precautionary principle in establishing forage fish quotas and approach new forage fisheries with the same caution and care so that we can all enjoy a healthy ocean ecosystem for many years to come.

Thank you for your efforts,

Dave Lacey
Owner: South Coast Tours LLC

seaturtles.org

Turtle Island Restoration Network • PO Box 370 • Forest Knolls, CA 94933
P: 415.663.8590 • F: 415.663.9534
www.SeaTurtles.org • www.tirn.net • www.sharkstewards.org • www.SpawnUSA.org • www.GotMercury.org

March 28, 2013

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

Re: April 2013 PFMC Agenda Item H.1.c, Adoption of the Fishery Ecosystem Plan (FEP)

Turtle Island Restoration Network is writing on behalf of our 60,000 members and supporters to urge the Pacific Fishery Management Council to finalize the new Fishery Ecosystem Plan and move forward with your initiative to place protections on currently unmanaged forage fish.

We urge the Council to take final action on adopting the FEP at your April 2013 meeting in Portland, OR. Adopting a meaningful FEP constitutes a major step forward in the national transition to an ecosystem-based approach to fisheries management. This approach has the potential to benefit forage fish, commercial fisheries and protected marine mammals that rely on forage fish as their primary prey species.

The top priority of the FEP should be to ensure a healthy ecosystem, and the first key step should be protection of the marine food web. Following final adoption of the FEP, the Council should proceed with its first ecosystem-based initiative by beginning the process of providing FMP-level protections for unmanaged forage fish.

The Council is wise to include the protection of unmanaged forage fish as its first Ecosystem Initiative. The first FEP initiative is to prohibit new fisheries on currently unmanaged forage fish until the Council can assess any potential impacts to existing fisheries and communities.

Therefore, in order to accomplish that objective, additional protections for unmanaged forage species must be implemented through a Fishery Management Plan (FMP) amendment process as called for in the Council's June 2012 motion establishing this initiative.

We urge the Council to adopt the Fishery Ecosystem Plan, and quickly move to achieve the goals of its first initiative by ensuring that forage fish are protected as the key link in a healthy and resilient marine food web.

Sincerely yours,

Teri Shore

Teri Shore
Program Director

Darrell Ticehurst
25 Joyce Road
Hillsborough, CA 94010
e-mail: d.ticehurst@comcast.net
Ph: 650 347-5919 Fax: 650 343-7744

March 28, 2013

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

Subject: Fishery Ecosystem Plan, Agenda item H.1

Dear Mr. Wolford,

I am writing to express my support for the adoption of the subject Fishery Ecosystem Plan. Forage fish are the heartbeat of the ocean, providing the bridge between the masses of phytoplankton and zooplankton and the higher level species important to a healthy ocean, capable of supporting the harvestable and renewable species that are a critical source of protein for human consumption. We have long been in need of protection for these forage fish if we want a healthy and productive ecosystem and this plan will provide that support.

Sincerely,

Darrell Ticehurst
Retired Chairman, Coastside Fishing Club
Former member, PFMC

Agenda Item H.1.c.
Supplemental Public Comment
April 2013

California Wetfish Producers Association
PO Box 1951 • Buellton, CA 93427 • Office: (805) 693-5430 • Mobile: (805) 350-3231 • Fax: (805) 686-9312 • www.californiawetfish.org

March 28, 2013

Mr. Dan Wolford, Chair
And Members of the Pacific Fishery Management Council
7700 NE Ambassador Place #200
Portland OR 97220-1384

RE: Agenda Item H.1.c. Final Fishery Ecosystem Plan

Dear Mr. Wolford and Council members,

The California Wetfish Producers Association (CWPA) represents the majority of coastal pelagic species 'wetfish' fishermen and processors in California.

We commend the Ecosystem Plan Development Team (EPDT) for yeoman efforts to compile a comprehensive Fishery Ecosystem Plan (FEP), and we thank the EPDT for incorporating many of our earlier suggestions. We have again reviewed this public draft, as well as earlier CPSAS recommendations and the CPSMT Report submitted for the Council's April 2013 briefing book. We appreciate this opportunity to present further comments on the document on behalf of CWPA and California's wetfish industry.

First, we note that this FEP appears **not** to highlight the ecosystem considerations currently incorporated into CPS harvest control rules. In our November comments, both CWPA and the CPSAS requested inclusion of explicit evidence of precautionary CPS management, i.e. (excerpt from Agenda K.1.c. Supplemental CPSAS Report, Nov. 2012)

> *…the FEP should acknowledge findings from the Lenfest Forage Fish Task Force Report appendices (Figures E.5.1 and E.5.5) and other studies (i.e. Horne et al) showing that CPS fisheries in the CC Ecosystem remove less than two percent of the productivity of small and large planktivorous fishes.*

Graphs based on current CPS management measures were also submitted to the Council in public comment from Dr. Richard Parrish in November 2012. For example, please see the figure on the top of page 2, which Dr. Parrish compiled to illustrate the small fraction of the various CPS species actually harvested with the existing CPS management framework.

We believe acknowledgement of the Council's existing CPS management is important to include in the FEP, and we ask for the Council's concurrence that this information be included in the final FEP to set the record straight.

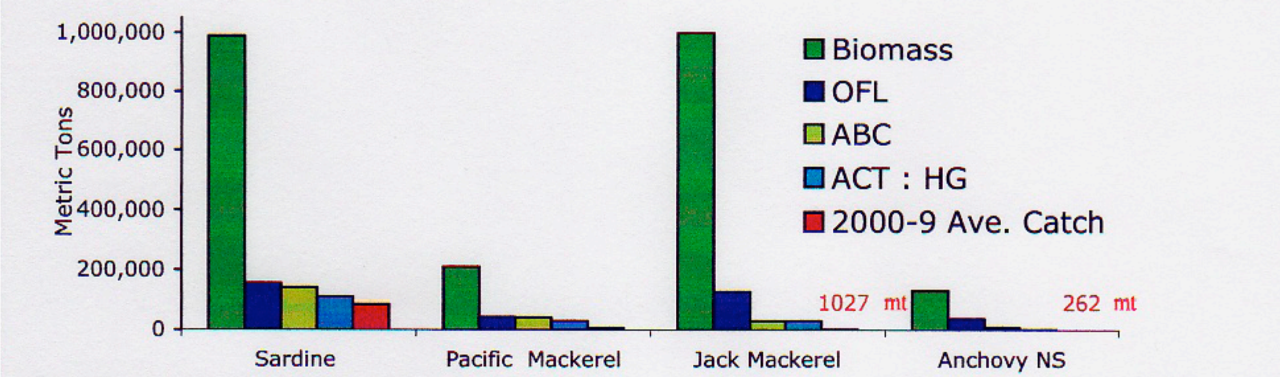


Figure 1. Current biomass estimates and reference points for CPS in the U.S. fishery: overfishing limit (OFL), acceptable biological catch (ABC), annual catch targets or harvest guideline (ACT/HG), and 2000-2009 average annual U.S. catch of CPS. Red numbers refer to catch in metric tons.

We also call the Council's attention to comments from the CPSAS in November 2012, which were reiterated in essence in the recent CPS management team report, noting the lack of clarity in this FEP regarding how the management team should "use" the ecosystem information in the FEP, in light of existing (but largely unacknowledged) ecological considerations now embedded in CPS harvest control rules and the annual CPS SAFE document. Again quoting from the CPSAS November 2012 statement:

> *It is unclear to the CPSAS how the FEP, integrated with the Integrated Ecosystem Assessment (IEA) and California Current (CC) Annual Report, will be used to inform in the management of CPS. ...* ***A comprehensive explanation of the interaction among these documents is needed to clarify how ecosystem-fishery information, such as status, trends and possible trade-offs for dynamic species such as CPS will be considered between the year-year updates of the FEP.***

We concur with these recommendations, as well as other recommendations in the CPSMT Report:

- Revise the Federal List of Allowable Fisheries and Gear as a separate action item from Initiative 1 because it addresses all fisheries (not just "forage fish").
- Utilize or at least reference in the FEP ecosystem science information already included in stock assessments and the annual CPS SAFE document.
- Re: Protecting unfished LTL forage species (Sec. A.1.2.2), establish criteria for adding species / groups to FMPs first, prior to identifying the appropriate FMP.

We support the management team's request for inclusion in an ad hoc committee to flesh out further development of Initiative 1. We also note that the CPSMT thoroughly reviewed the Smith et al LTL list (Appdx. A) and found that no species on the unmanaged list interact with existing CPS or occur as significant bycatch in CPS fisheries.

We do not support transforming the CPS FMP into a "forage" FMP and ask for the Council's consideration in this regard.

Attached for the Council's consideration are further comments with specific Chapter / page references. One last (but critical) point that I would like to highlight in these general comments is the following:

There is no doubt that the defining challenge of our time is climate change, and specifically the future impacts (now unknown) to the ecosystem and fishery resources, as well as fishing communities.

In light of the unprecedented rate at which the California Current is becoming corrosive, and considering the EPDT finding in FEP Appendix A Public Review Draft, page A-10 (information submitted to the Council earlier):

> *"…despite real or potential historical or future conservation problems for some of these species, there is **not** a high level of unmanaged standing biomass for forage species that could become subject to fisheries targeting over the short term and which are critical to large scale CCE functioning, energy flow, or integrity."*

we suggest the highest priority initiative should be **A.2.8 Cross-FMP Effects of Climate Shift Initiative.** Quoting from the FEP (FEP Appendix A: Public Review Draft page A-21) :

> *"Over the longer-term, three prominent properties of the environment are predicted to undergo significant change--temperature, ocean surface water pH (acidity versus alkalinity), and deep-water oxygen."*

It is worth noting that the California Current is already experiencing negative impacts seasonally on calcifiers such as oysters and scallops from increasing ocean acidification. Current science suggests that key elements at the bottom of the food web, i.e. pteropods, are also in jeopardy. Problems are occurring at a far greater rate than the IPCC predicted. The latest model predictions (Bopp et al, *Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models*) now find:

> "For the "business-as-usual" scenario RCP8.5, the model-mean changes in 2090s (compared to 1990s) for sea surface temperature, sea surface pH, global O2 content and integrated primary productivity amount to +2.73 °C, −0.33 pH unit, −3.45% and −8.6%, respectively."

Predicted changes, including the total loss of the Arctic ice cap seasonally within the next decade, and resultant impacts from OA, are clearly the most critical challenge of our time, and an "all hands on deck" initiative to understand and address this inevitable transformation of the ocean (and planet) should be the highest priority of resource managers.

The west coast is now developing strategies and plans to monitor and ultimately address looming impacts from OA. The California Current Acidification Network (C-CAN) is now coordinating a coast-wide monitoring network and facilitating collaboration among various stakeholders, from scientists to agencies to shellfish growers and fishermen, to improve understanding of the linkages between oceanographic conditions and biological responses. We ask for the Council's support to include reference to C-CAN, and this unprecedented collaboration, in the FEP. You'll find more information at http://c-can.msi.ucsb.edu and in my detailed comments, attached.

Thank you very much for your consideration.

Best regards,

Diane Pleschner-Steele
Executive Director

FEP Notes
Compiled by CWPA, March 11, 2013

Chapter 4
4.1.1 Direct and Indirect Effects of Fishing on Fish Abundance
p. 136 *From an ecosystem perspective, fisheries remove fish and other organisms from the sea that would have otherwise entered energy or nutrient pathways within their food web.*

However, people and fisheries are as much a part of the ecosystem as birds, mammals and so forth.
Under the MSA, OY includes fisheries as well as forage.

p. 137 *There is also some empirical and model-based evidence of consequences to overall ecosystem productivity and yield when those are evaluated in multi-species models, rather than a suite of single-species models (May 1979, Walters et al. 2005, Steele et al. 2011), which indicates that exploiting lower trophic level species at maximum rates will lead to reduced productivity of higher trophic level species. More recently, both empirical and model-based research has demonstrated that dependent predators are likely to be notably affected when their prey populations are depleted to levels lower than the typical thresholds adopted by fisheries managers (Cury et al. 2011, Smith et al. 2011); examples from the California Current were included in both of these analyses.*

It should be noted here that Smith et al found impacts of CPS fisheries on ecosystem were LOW. It should also be noted that CPS harvest limits are far below MSY!

For example, Kaplan et al. (2012) evaluated the extent to which different fishing fleets (targeting different assemblages of species) acted in either an additive or combined (cumulative) manner using an Atlantis model of the California Current. They found a range of indirect effects of different fisheries on species other than those targeted. Their simulations indicated that increased fishing for Pacific whiting led to increases in the relative abundance of small planktivores, large flatfish, shortbelly rockfish and pandalid shrimp. By contrast, changes in the effort of the purse seine fleet (targeting small planktivores) led to a range of responses; increases led to increased productivity of krill, salmon and myctophids. With respect to cumulative effects, they found that the biomass of small planktivores (forage fishes) was lowest when all fishing was ceased, due to the increased abundance of higher trophic level piscivorous fishes.

Why is the CPS example "by contrast" when both examples led to increases in forage species (and in the case of CPS, led to increased productivity of salmon also)?? Both of these examples suggest benefits to the ecosystem, or at least the forage pool, and should be characterized as benefits.
We suggest using a different conjunctive phrase instead of "by contrast" to link the two examples, i.e. Moreover, furthermore, in addition etc.

By the way, what did the increased abundance of higher trophic level piscivorous fishes eat if biomass of small planktivores was reduced due to cessation of forage fisheries?
The FEP should explain that the natural world is not static and abundances of various species are influenced by far more important cycles than fishing, especially given the fishing rates the west coast is subjected to. In other words, the ecosystem can't both have its cake and eat it too!

4.4 Changes in Fishing Community Involvement in Fisheries and Dependence Upon Fisheries Resources

P. 157 *Council decisions affect how much of which species of fish are taken within larger-scale geographic areas, but do not control whether and how coastal municipalities maintain harbor facilities, coastal community investments in attracting industries other than fishing, transportation infrastructure between fish landing facilities and major fish markets, or myriad other factors that affect income generated and quality of life within fishing communities.*

However, it is important to understand that allocations between regions do affect the viability of various ports. Figure 3.4.13 on page 72 clearly illustrates the importance of CPS to fishing communities.

P. 158 *For example the southern California ports of San Pedro, and central California ports of Moss Landing, Port Hueneme and Ventura, where landings are dominated by coastal pelagic species, tend to be relatively low value per unit landed but high volume in nature. Conversely, fishery activity in Monterey and San Francisco, as well as the northern ports of Eureka and*

Crescent City, where relatively large amounts of crab, groundfish and salmon are landed, tends to be more high value per unit landed but low volume.

<u>This is incorrect</u>: Monterey harbor is now dominated by CPS, similar to Moss Landing. According to DFW port statistics:

Port	2010 Wetfish % of Total Port Landings	2010 Wetfish % of Total Port XV Value
Monterey Harbor	96.8%	80.5%
Moss Landing	97.2%	81.9%

This needs to be corrected to reflect the situation today and likely to persist in the future!
Please correct this section to reflect today's reality. Thanks!
Also it is important to acknowledge that "volume" fisheries, i.e. **Coastal pelagic species comprise the foundation of many harbor communities; the volume crossing the dock is critically important to maintain harbor infrastructure and dockside employment.**

P. 159 *While Council decisions primarily affect landings volumes, fishery management programs can also affect the prices commercial vessels receive for their landings, the prices fish processors receive for their processed product …*

This seems to contradict the statement on page 157.

P. 160 *The Council's basic harvest control rule for CPS exemplifies the ecosystem-based fisheries management approach when setting annual harvest quotas by accounting for the importance of CPS as forage for commercially important, recreationally important and protected species predators (PFMC 1998). The challenge at this juncture is to incorporate the economic value of harvested and protected predators into the harvest control rule to achieve optimal use of CPS resources from society's standpoint. For example, if fishery management explicitly considers the economic value of species being harvested or protected, then the ecosystem/economic modeling approach could indicate under what ecological-economic conditions a CPS harvest quota might be reduced to increase the harvest or populations of more valuable predators (Hannesson et al. 2009, Hannesson and Herrick 2010). The ecosystem/economic modeling approach may indicate that it is advisable to reduce harvest levels on low-value feed species (e.g. anchovy and sardine) to provide the potential for increases in the harvest volume and value of species that feed on these species.*

What's missing from this discussion is the Hanesson and Herrick finding, quoted from the abstract: *"Taking the value of sardines as forage into account does not necessarily mean an either-or situation for the fishery. As long as there is some measure of net value from the fishery and net value from predation, both benefit society at large. "*

Also missing: the finding in Smith et al that the current CPS fishery already has a "low impact" on the ecosystem. Also from Horne et al : CPS fisheries represent less than 2% of the planktivorous forage pool.

As stated, the highlighted narrative opens the door for anti-fishing groups to selectively quote these passages to lobby for further restrictions in CPS fisheries – when best available science finds that existing harvest limits are ultra precautionary and having NO measurable impact on the ecosystem!!

Please add the additional information and references to balance this section. Thanks!

P. 160 *An ecosystem/economic modeling approach would allow us to include significant ecological and technological interactions among species in the calculation of their optimum yields and the extent to which these interactions affect their relative economic value.*

As acknowledged by modelers and stated elsewhere in this FEP, ecosystem models are currently incapable of modeling the dynamics of CPS, and are not appropriate for use in setting harvest quotas. The highlighted statement seems to imply otherwise and should be tempered to reiterate the caveat, as noted elsewhere in the FEP, that models are not intended for use in setting quotas.

One further point that should be emphasized here and isn't yet: CPS FMP Amend. 8 Option J provided the highest mean biomass and most sustainable fishery over time (in analysis over 1,000 years), by careful combination of max. cap, cutoff and harvest rate. This visionary management strategy was and continues to be a win-win for both the ecosystem and the fishery / fishing communities. It bears repeating: OY considers both forage and fisheries!

4.4.3 Environmental and Climate Drivers for Fishing Communities

P. 161-164
Preliminary discussion on ocean acidification and potential impacts to calcifiers and the food chain (i.e. pteropods, increased HABs etc. etc.) should be included in this section, as well as in Sec. 4.5. You can find a wealth of information on research now ongoing in the CA Current Ecosystem by visiting the California Current Acidification Network website: http://c-can.msi.ucsb.edu

4.5 Aspects of Climate Change Expected to Affect Living Marine Resources within the CCE
p. 167 *A recently-convened blue ribbon panel on ocean acidification in Washington State waters noted the potential for upwelling off the Washington coast to exacerbate the near-term effects of ocean acidification on northern CCE nearshore waters (Feely et al., 2012).*

Please also mention that a collaboration between shellfish industry, scientists, government agencies and resource managers formed the California Current Acidification Network (C-CAN) in 2010 with a goal to develop a coastwide OA monitoring network. More information is available on the C-CAN website: http://c-can.msi.ucsb.edu

FEP Appendix A

A.1 FEP Initiative 1, Protection for Unfished Forage Fish

> *The Council's objective is to prohibit the development of new directed fisheries on forage species that are not currently managed by the Council, or the States, until the Council has had an adequate opportunity to assess the science relating to any proposed fishery and any potential impacts to our existing fisheries and communities. <u>The Council is not pursuing a permanent moratorium on fishing for forage fish</u>. Instead, the Council stated that the proposed goal is to not allow new fisheries to begin without adequate opportunity for assessing the science and the potential impacts on existing fisheries and fishing communities.*

A.1.2 Council Process for Implementing FEP Initiative 1

> *At its June 2012 meeting, the Council recommended preventing the future development of fisheries for currently unfished forage fish species through a two-stage process: amending and updating the federal list of authorized fisheries and gear, and developing any additional necessary protections for unfished and unmanaged forage fish through recommendations to amend one or more of the Council's FMPs.*

P. A5 *No revision to the table should have the effect of prohibiting currently legal directed fisheries or incidental catch.*

A.1.2.2 Protecting Unfished Lower Trophic Level (Forage) Species Through FMP Authority

> *The Council's draft policy on the development of new fisheries for unfished species, at Section A.1.1, <u>applies to all U.S. West Coast EEZ fish stocks, not just to forage fish species</u>.*
>
> *<u>If a species is already within an FMP, or under the jurisdiction of a state management program of Washington, Oregon, or California, that species would not be subject to this initiative.</u>*
> *Once the Council has broadly defined the set of unmanaged, unfished forage fish species or species groups that fall under its EEZ-based authority, it should next review the connections those species have to FMP fish and fisheries. Are the unmanaged, unfished forage fish species: <u>taxonomically similar to species within any FMP, the prey of any FMP species or species group, bycatch within the fisheries of any FMP or likely to be caught by a gear managed under an existing FMP, or otherwise connected to any FMP species</u>? After having those connections identified, the Council may then use the FMP amendment process to assign the unfished, unmanaged forage fish species to the appropriate FMP(s) as either fishery management unit (FMU) or ecosystem component (EC) species.*

Sentences above are highlighted for emphasis. It would help if these concepts are also incorporated in the FEP narrative when forage / CPS fisheries are discussed.

Also to be noted, the CPSMT thoroughly reviewed Appendix. A - the original list of LTL forage species compiled by the EPDT, and found that none interact with or associate with CPS fisheries, thus should not be included in the CPS FMP. We would appreciate it if the Council would keep this in mind when moving forward on this "unfished forage species" initiative.

One last request re: priorities: Perhaps the defining challenge of our time is climate change, and specifically the future impacts (now unknown) to the ecosystem and fishery resources, as well as fishing communities.

In light of the unprecedented rate at which the ocean, and specifically the California Current, is becoming corrosive, and considering the EPDT finding in FEP Appendix A Public Review Draft, page A-10 (information submitted to the Council earlier):

> *"… despite real or potential historical or future conservation problems for some of these species, there is not a high level of unmanaged standing biomass for forage species that could become subject to fisheries targeting over the short term and which are critical to large scale CCE functioning, energy flow, or integrity."*

We suggest the highest priority initiative should be **A.2.8 Cross-FMP Effects of Climate Shift Initiative.**
Quoting from the FEP (FEP Appendix A: Public Review Draft page A-21) :

> *"Over the longer-term, three prominent properties of the environment are predicted to undergo significant change-- temperature, ocean surface water pH (acidity versus alkalinity), and deep-water oxygen."*

It is worth noting that the California Current is already experiencing negative impacts seasonally from increasing ocean acidification on calcifiers such as oysters and scallops. Current science suggests that key elements at the bottom of the food web, i.e. pteropods, are also in jeopardy. Problems are occurring at a far faster rate than the IPCC predicted. The latest model predictions (Bopp et al, *Multiple stressors of ocean ecosystems in the 21st century: projections with CMIP5 models*) now find:

> "For the "business-as-usual" scenario RCP8.5, the model-mean changes in 2090s (compared to 1990s) for sea surface temperature, sea surface pH, global O2 content and integrated primary productivity amount to +2.73 ◦C, −0.33 pH unit, −3.45% and −8.6%, respectively."

Improving understanding of predicted changes, including the total loss of the Arctic ice cap seasonally within the next decade, and resultant impacts from OA, are clearly the most critical challenge of our time, and should be the highest priority initiative of resource managers.

March 28, 2013

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

Re: Agenda Item H.1.c, Adoption of the Fishery Ecosystem Plan (FEP)

Myself, and everyone at ilovebluesea.com want to thank you for taking action in November to adopt the preliminary draft Pacific Fishery Ecosystem Plan (FEP) and release it for public review. Thank you also for reinserting the draft list of California Current forage species into the section on FEP Initiative #1 and creating an initiative to develop a list of core ecosystem indicators to be tracked through the Annual Report. As the Council discussed in November, one core indicator should monitor the status of the forage base.

We urge the Council to take final action on adopting the FEP at your meeting this month. Adopting a meaningful FEP constitutes a major step forward in the national transition to an ecosystem-based approach to fisheries management.

The top priority of the FEP should be to ensure a healthy ecosystem, and the first key step should be protection of the marine food web. Following final adoption of the FEP, the Council should proceed with its first ecosystem-based initiative by beginning the process of providing FMP-level protections for unmanaged forage fish.

The Council is wise to include the protection of unmanaged forage fish as its first Ecosystem Initiative. The first FEP initiative is to prohibit new fisheries on currently unmanaged forage fish until the Council can assess any potential impacts to existing fisheries and communities. We understand that the first phase of that initiative - to update the Pacific Fishery Management Council's List of Authorized Fisheries and Gear – is underway. In the FEP's discussion of this initiative, it is noted that the first phase alone is not enough to accomplish the Council adopted objective of the initiative.

Therefore, in order to accomplish that objective, additional protections for unmanaged forage species must be implemented through a Fishery Management Plan (FMP) amendment process as called for in the Council's June 2012 motion establishing this initiative.

We urge the Council to adopt the Fishery Ecosystem Plan, and quickly move to achieve the goals of its first initiative by ensuring that forage fish are protected as the key link in a healthy and resilient marine food web.

Sincerely,
Matthew Carreira
Co-founder & Director of Sales | www.ilovebluesea.com

Heal the Bay
1444 9th Street
Santa Monica CA 90401
ph 310 451 1550
fax 310 496 1902
info@healthebay.org
www.healthebay.org

March 29, 2013

Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: Agenda Item H.1.c, Adoption of the Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members,

On behalf of Heal the Bay, a non-profit environmental organization with over 13,000 members dedicated to making Santa Monica Bay and southern California coastal waters and watersheds safe and healthy for people and local ecosystems, we respectfully submit our comments in support of adopting the Pacific Fishery Ecosystem Plan (FEP) at your April meeting. We appreciate your work on the draft FEP and believe that it represents concrete leadership in transitioning U.S. fisheries management to an ecosystem-based approach. We urge the Council to take final action on adopting the FEP at your meeting this April.

Thank you for reinserting the draft list of California Current forage species into Initiative 1 in the FEP, and for creating an initiative to develop a list of core ecosystem indicators to be tracked through the Annual Report. As the Council discussed in November, we suggest that one core indicator include monitoring the status of the forage base, as forage fish are the key link in a healthy and resilient marine food web and the top priority of the FEP should be to ensure a healthy ecosystem. Following final adoption of the FEP, the Council should proceed with its first ecosystem-based initiative by beginning the process of providing Fishery Management Plan (FMP)-level protections for unmanaged forage fish.

We applaud the Council for including the protection of unmanaged forage fish as its first Ecosystem Initiative, which will prohibit new unmanaged forage fisheries until the Council can assess potential impacts to existing fisheries and communities. We understand that the first phase of the initiative, to update the Council's List of Authorized Fisheries and Gear, is underway. However, the first phase alone is not enough to accomplish the Council-adopted objective of the initiative. Therefore, additional protections for unmanaged forage species must be implemented through a FMP amendment process, as called for in the Council's June 2012 motion.

Thank you for your consideration of our comments and for taking action last November to adopt the preliminary draft FEP. The Council's commitment to advancing the role of ecosystem-based management is reflected in the public comment draft FEP and Cross-FMP Ecosystem-based Fisheries Management Initiatives Document. These documents will put the Council in an important position to protect ecosystem structure and function while managing sustainable, economically strong Pacific fisheries. We urge the Council to adopt the FEP and achieve the goals of its first initiative by ensuring that forage fish are protected. Adopting a meaningful FEP constitutes a major step forward in the national transition to an ecosystem-based approach to fisheries management.

Please contact us if you have any questions regarding our comments.

Sincerely,

Sarah Abramson Sikich
Coastal Resources Director

Dana Roeber Murray
Marine & Coastal Scientist

21 March 2013

To PFMC,
Re: Agenda Item H.1

It is with great enthusiasm that I write to support the Council's newly proposed Fishery Ecosystem Plan. Protection of forage fish species is critical in supporting numerous species and a healthy ocean food web.

You are to be commended for proposing the new direction in management, and I encourage you to move forward with the adoption of the FEP at your April meeting.

Thank you for your service and the important work you're doing to ensure vibrant, healthy ecosystems in our California Current waters.

Sincerely,

JoAnn Barton
Newport, Oregon

March 29, 2013

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

RE: Agenda Item H.1.c - Pacific Fishery Ecosystem Plan and Initiatives Document

Dear Mr. Wolford,

The Pew Charitable Trusts has collected 3,472 comments from residents of California, Oregon, Washington and Idaho encouraging the Council to adopt the proposed Fishery Ecosystem Plan and accompanying appendix of Ecosystem Initiatives. Please include the enclosed petition in the supplemental briefing book web site.

The petition itself is included with all the names and cities of individual signers that were gathered as of March 27. The council may continue to receive additional comments in the days ahead. Please note that many of the individual petitions included here have been personalized or include additional comments.

Thank you,

Erik Robinson
The Pew Charitable Trusts

March 27, 2013

Chairman Dan Wolford
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

Subject: Please Adopt the Fishery Ecosystem Plan and Accompanying Ecosystem Initiatives

Dear Chairman Wolford and Council Members,

Thank you for agreeing to develop a Fishery Ecosystem Plan. Please adopt the plan and accompanying list of Ecosystem Initiatives in April.

As a West Coast resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web. The Council itself recognized forage fish as the cornerstone of a healthy ecosystem last June, when it set a goal of prohibiting new fisheries on forage species that aren't currently managed. Now, as its first official ecosystem initiative, it makes sense for the Council to follow through by enacting firm protections for forage fish that are vulnerable to unregulated fisheries emerging at any time. In doing so, the Council has a chance to establish itself as a leader in moving ecosystem-based management from theory into practice.

I encourage you to take this precautionary measure as soon as possible. The Council's own analysis, conducted in 2011, noted that industrial demand for forage fish is likely to grow more intense because of its value as a global commodity used in feeding livestock, poultry and farmed fish. The Council's top priority should be to make sure it protects forage fish as the linchpin of healthy existing fisheries and coastal communities here on the Pacific coast.

Sincerely,

Luisa Agostini	Pacifica	CA	
Cat Allen	Los Olivos	CA	
Martin Ansell	West Hollywood	CA	
David Arnson	Los Angeles	CA	*This important to me.*
Dale Aaronson	Vernon	CA	
Mary Able	Mcarthur	CA	
June Abner	San Diego	CA	
Margaret Adam	Corona	CA	
Sondra G Adam	Walnut Creek	CA	
Eileen Adams	Berkeley	CA	
Victor Afanasiev	La Grange	CA	
Adriana Aguilera	Cudahy	CA	
Marco Aguilera	Carlsbad	CA	
Edwin Aiken	Sunnyvale	CA	
Cheryl Albert	Freedom	CA	
Denise Alcazar	Northridge	CA	
Gary Alderette	Santa Rosa	CA	
Masha Aleskovski	El Cerrito	CA	
Natalie Alexander	Irvine	CA	
Joan Alioto	Davis	CA	
Janis Alldis	Scotts Valley	CA	
John Allen	Lafayette	CA	
Julie Alley	Long Beach	CA	
Donna Alleyne-Chin	Montara	CA	
Bobbi Allison	Bay Point	CA	
Sonia Alvarez	Laguna Niguel	CA	
Nicole Amato	Vacaville	CA	
Kristine Andarmani	Saratoga	CA	
Jon Anderholm	Cazadero	CA	
Audrey Anderson	Los Altos	CA	
Dave Anderson	Berkeley	CA	
Donna Anderson	Westchester	CA	
Judith S Anderson	Long Beach	CA	
Joan Andersson	Topanga	CA	
Gordon Andrews	Mountain View	CA	
Melanie Andrus	Calimesa	CA	
J Angell	Rescue	CA	
Robert Anger	Santa Monica	CA	
Alex Anshus	Escondido	CA	
Craig Keith Antrim	San Pedro	CA	
Susan Apgar	Tujunga	CA	
Susaan Aram	Laguna Beach	CA	
Adriana Arambula	Daly City	CA	
Douglas Arana	San Bernardino	CA	
Billy Arcila	Pasadena	CA	
Anthony Arcure	Fresno	CA	
Brian Armer	Bakersfield	CA	
Anthony Arn	West Hollywood	CA	
Charles Arnold	Lompoc	CA	

Julie Arnold	Penryn	CA	
Maris Arnold	Berkeley	CA	
Dolores Arond	Northridge	CA	
Luke Asbury	Ventura	CA	*YOU must ACT to stop the ongoing destruction of our planet!*
Florence Assalit	Monterey	CA	
Debra Atlas	Redding	CA	
Delayne Auerbach	Aptos	CA	
Shirley Auerbach	Laguna Woods	CA	
Candi Ausman	Fremont	CA	
Emma Ausman	North Hollywood	CA	
Maryann Avila	Arroyo Grande	CA	
Diana Aylward	Woodland Hills	CA	
Mari Azuras	San Bruno	CA	
Edward Bennett	Berkeley	CA	
Diane Butler	Glendora	CA	
Paula Ba	Gilroy	CA	
Christina Babst	W Hollywood	CA	
Sacha Badame-Oldani	Oakland	CA	
Rosa Baeza	Reseda	CA	
Angie Bahris	Santa Monica	CA	
David Bailey	Alhambra	CA	
Jennifer Bailey	Visalia	CA	
Kelly Bain	Monterey Park	CA	
Kelsey Baker	Novato	CA	
Barbara Baldock	Monterey	CA	
Michael Baldwin	Irvine	CA	
Tanya Baldwin	Los Gatos	CA	
Nada Ballator	Redwood City	CA	
Dan Ballinger	Alameda	CA	
Michael Ballot	Stockton	CA	
Ranko Balog	Irvine	CA	
Robert Banever	Duarte	CA	
Margo Bangert	San Carlos	CA	
Clara Barber	Oroville	CA	
Rebecca Barker	Glendora	CA	
Joel Barlow	San Francisco	CA	
Scott Barlow	Sunnyvale	CA	
Candice Barnett	Santa Monica	CA	
Cara Barnhill	Coarsegold	CA	
Steven Barrett	Walnut Creek	CA	
Elizabeth Barris	Topanga	CA	
Alfredo Barroso	San Diego	CA	
Joan Basore	San Anselmo	CA	
Abigail Bates	Los Angeles	CA	
Gail Bates	Cupertino	CA	
Robert Bates	San Diego	CA	
Candace Batten	Los Angeles	CA	
Terri Bauer	Long Beach	CA	
Linda Baumann	Davis	CA	

Robert Bausch	Belmont	CA
Denise R. Be Cotte	Long Beach	CA
H Beadman	Los Angeles	CA
Bryce Beal	San Francisco	CA
Carol Beam	San Diego	CA
Diane Beaulaurier	Placerville	CA
Jeff Beck	Los Angeles	CA
Jerllyn Beck	Arcadia	CA
Ariane Beck-Manning	Campbell	CA
Carol Becker	Sherman Oaks	CA
Christine Becker	Laguna Woods	CA
Hope Becklund	Healdsburg	CA
Mark Beckwith	Berkeley	CA
Peter Bedard	Los Angeles	CA
Elise Bell	Oakland	CA
Jodi Bell	Rancho Cucamonga	CA
Bree Belyea	Goleta	CA
Barbara Benane	Novato	CA
Sally Benardo	Huntington Beach	CA
Melanie Bender	Fair Oaks	CA
Martha Benedict	Los Angeles	CA
Mercedes Benet	Carlsbad	CA
Corey Benjamin	Los Angeles	CA
Barbara Bennigson	Palo Alto	CA
Beth Bennion	Mckinleyville	CA
Richard Benson	Lawndale	CA
Cheryl Bentley	Santa Cruz	CA
Karen Benzel	Carmel By The Sea	CA
Oliver Beqaj	Venice	CA
Karen Berger	Montrose	CA
Darcy Bergh	San Diego	CA
Madeleine Berke	Monte Rio	CA
Madeleine Berke	Monte Rio	CA
Diane Berliner	Los Angeles	CA
Marcia Berman	Berkeley	CA
Benjamin Bernhardt	Santa Ana	CA
Katherine Bernhardt	Santa Ana	CA
Barbara Bernhart	Daly City	CA
Cheryl Bernstein	Irvine	CA
Maureen Besancon	Woodland Hills	CA
Elizabeth Bettenhausen	Cambria	CA
Dirk Beving	Los Angeles	CA
Blaze Bhence	Cypress	CA
Meg Bider	Woodland Hills	CA
Karen Bien	Clovis	CA
Helen Bierlich	Los Angeles	CA
Nicole D Bilotti	San Francisco	CA
Dianr Binder	Moreno Valley	CA
Alexander Birrer	Santa Ana	CA

Mark Biskeborn	Venice	CA	
Jill Bittner	San Francisco	CA	
Daren Black	Los Angeles	CA	
Teresa Black	San Rafael	CA	
Theo Black	San Bernardino	CA	
RB Blair	San Jose	CA	*Our oceans are a precious resource.*
Russell Blalack	Cupertino	CA	
Carol Blaney	Redlands	CA	
Rollin Blanton	Los Angeles	CA	
Robert And Judith Blomberg	Berkeley	CA	
Daniel Blum	Gilroy	CA	
Casey Bodden	Citrus Heights	CA	
Sondra Boes	Campbell	CA	
Ronald Bogin	El Cerrito	CA	
Stephen Bohac	Twain Harte	CA	
Donna Boland	San Rafael	CA	
Jose Ricardo Bondoc	San Francisco	CA	
Bill Bonini	Sacramento	CA	
Andrea Bonnett	Altadena	CA	
A Bonvouloir	Sunnyvale	CA	
Joseph Boone	San Luis Obispo	CA	
Carolyn Boor	Rancho Cucamonga	CA	
Brian Boortz	Los Gatos	CA	
Barbara Boros	Santa Barbara	CA	
Amy Bostick	Wildomar	CA	
Vic Bostock	Altadena	CA	
Renee Boteilho	Los Angeles	CA	
David Bott	Sacramento	CA	
Cyril Bouteille	Mountain View	CA	
Joyce Bower	Citrus Heights	CA	
Candy Bowman	Sacramento	CA	
Jon Boyden	Los Angeles	CA	
Henry Boyle	Berkeley	CA	
Jen Bradford	Spring Valley	CA	
Zack Bradford	Pacific Grove	CA	
Angela Bradford	Long Beach	CA	
Susan Bragg	Los Angeles	CA	
Kevin Branstetter	Applegate	CA	
Allen Bratcher	San Diego	CA	
Eric Bratcher	Hayward	CA	
Joseph Braus	Burbank	CA	
Chris Brazis	San Francisco	CA	
Joseph Breazeale	Concord	CA	
Bonnie Breckenridge	San Diego	CA	
Joan Breiding	San Francisco	CA	
Mary E Breitlow	Richmond	CA	
Nancy Brenner	Murrieta	CA	
Lisa Breslauer	San Jose	CA	
Rosalind Bresnahan	San Bernardino	CA	

Julie Brickell	Fullerton	CA	
Barbara Britton	Pleasant Hill	CA	
Bill Britton	Livermore	CA	
Myrna Britton	Santa Cruz	CA	
Robert Brosius	Tarzana	CA	
CT Bross	Walnut Creek	CA	
C. Wayne Brown	Fresno	CA	
Damon Brown	Los Angeles	CA	
Gordon Brown	San Diego	CA	
Patricia Brown	San Carlos	CA	
Roderick Brown	San Diego	CA	
Vera Brown	Redwood City	CA	
Pam Brown, MFT	Willits	CA	*I know how important these fish are to this entire web of life.*
Susan Browne	Portola Valley	CA	
Deirdre Brownell	Burbank	CA	
Leonard Bruckman	Granite Bay	CA	
Robert Bruno	Hollister	CA	
Rose Bruno	Hollister	CA	
Linda Bruton	Saratoga	CA	
Lauren Bryant	La Crescenta	CA	
Robert Buchanan	La Mesa	CA	
Margaret Buck	San Clemente	CA	
Laurie Buckley	N Hollywood	CA	
Edie Buckman	Roseville	CA	
Joseph Buhowsky	San Ramon	CA	
Stephanie Bui	Alameda	CA	
Terri Bumgardner	Vista	CA	
Derek Bunyan	Granada Hills	CA	
Lorna Buratto	Carlsbad	CA	
Robert Burk	Los Angeles	CA	
Bonnie Margay Burke	San Diego	CA	
Ken Burke	Oakland	CA	
Paul Burks	San Rafael	CA	
Jeff Burns	Van Nuys	CA	
Joan Bush	Spring Valley	CA	
Sharon Bushman	Los Angeles	CA	
Nancy Byers	Berkeley	CA	
Sabina Caliguri	San Diego	CA	
Stacie Charlebois	Santa Rosa	CA	
Kurt Cruger	Long Beach	CA	
Otto Cache	Torrance	CA	
Patricia Cachopo	Santa Clara	CA	
Chelsea Cahan	San Diego	CA	
Barbara Cain	Concord	CA	
Drue Cali	Calimesa	CA	
Ronald Calvisi	Toluca Lake	CA	
Jennifer Cambra	San Francisco	CA	
Chris Camp	Oakland	CA	
David Camp	Burbank	CA	

Dionna Campbell	Carmichael	CA	
Dudley And Candace Campbell	Valley Glen	CA	
Karen Campbell	Citrus Heights	CA	
Norma Campbell	Campbell	CA	
Rafael Canton	Ventura	CA	
Diane Cantwell	Los Angeles	CA	
Marina Capella	San Pedro	CA	
Mark Cappetta	San Mateo	CA	
Junko Card	Exeter	CA	
Geraldine Card-Derr	Exeter	CA	
Richard Cardella	Hydesville	CA	
Sylvia Cardella	Hydesville	CA	
Michael Cardoza	Los Angeles	CA	
Jered Cargman	Los Angeles	CA	
Joan Carl	Sherman Oaks	CA	
Gary Carpenter	Pacifica	CA	
Laurie Carr	Mira Loma	CA	
Donna Carr, M.D.	Encinitas	CA	
Martha Carrington	Santa Cruz	CA	
Mark Carroll	San Diego	CA	
Mary Carroll	San Jose	CA	
Reidun Carstens	Los Angeles	CA	
Jennifer Cartwright	Costa Mesa	CA	
Don Casavant	Nevada City	CA	
Pam Cassidy	Rohnert Park	CA	
Robert Cassinelli	Sacramento	CA	
Jamie Castaneda	Claremont	CA	
Deb Castellana	Berkeley	CA	
Marco Castellucci	San Francisco	CA	
William Castle	Loomis	CA	
Alan Castner	Emeryville	CA	
Gail Caswell	San Francisco	CA	
Jennifer Cedar-Kraft	San Francisco	CA	
Tristan Celayeta	Mill Valley	CA	*As a former salmonid habitat surveyor I am profoundly aware of the continuing abuse and ever increasing dangers facing fishery ecosystems. Change MUST take place.*
Lillian Cervantes	San Diego	CA	
Kim Chamberlain	Fortuna	CA	
R Chan	Granite Bay	CA	
Janet Chaney	San Bernardino	CA	*As stewards for our environment, it is up to humans to preserve and protect our oceans for all wildlife that lives here.*
S. Chapek	San Francisco	CA	
Susan Chapman	Los Angeles	CA	
Felicia Chase	Encino	CA	
Janelle Chase	San Francisco	CA	
Ana Chavez	Riverside	CA	
Julian Chazin	Oakland	CA	
Pamela Check	Chico	CA	
Ted Cheeseman	Saratoga	CA	
Allan Chen	Alameda	CA	

Jo Chen	Newbury Park	CA	
Mich Chen	Fremont	CA	
Cari Chenkin	Citrus Heights	CA	
Suzy Chersky	Fountain Valley	CA	
Robert Chirpin	Northridge	CA	
Richard Chogyoji	Los Angeles	CA	*As a scuba diver and a Southern California resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
Mary Christlieb	Santa Rosa	CA	
Gay Chung	San Francisco	CA	
Dervla Church	Palo Alto	CA	
Susan Ciaramella	Sylmar	CA	
Barbara Clark	Sebastopol	CA	
Barri Clark	Los Angeles	CA	
Irina Clark	San Diego	CA	
Matthew Clark	Tarzana	CA	
Cynthia Cleese	Los Angeles	CA	
Scott Clements	Davis	CA	
Janet Clinger	Grass Valley	CA	*An Ecosystem plan makes sense, not only in financial terms, but in the well-being of the marine life for whom we are responsible as stewards of the earth.*
Heather Clough	Ventura	CA	
Scott Coahran	Los Banos	CA	
Portland Coates	San Francisco	CA	
Maureen Cohen	Northridge	CA	
Mitch Cohen	Berkeley	CA	
Barbara Cohn	Carlsbad	CA	
Anne Cole	Santa Barbara	CA	
Elizabeth Cole	Burlingame	CA	
Lissa Coleman	Redwood City	CA	
Amy Colla	Los Angeles	CA	
Gerry Collins	Murrieta	CA	
Sandy Commons	Sacramento	CA	
Laura Condominas	Berkeley	CA	
Sylvia Condon	Davis	CA	
Karen Connell	Harbor City	CA	
Cherie Connick	Crescent City	CA	
Tacey Conover	Redding	CA	
Lori Conrad	Davis	CA	
Harald Conradi	Los Angeles	CA	
Thomas Conroy	Manhattan Beach	CA	
Barbara Consbruck	Sylmar	CA	
Trudy Considine	Atherton	CA	
Matthew Conti	Roseville	CA	
Craig Cook	Santa Rosa	CA	
Geoffrey Cook	Berkeley	CA	
Florence Cooley	Santa Barbara	CA	
Anita Coolidge	Cardiff By The Sea	CA	
Arlene Cooper	San Francisco	CA	
Margaret Copi	Oakland	CA	

Carlos Cordova	San Diego	CA
Peter Corkey	San Francisco	CA
Christopher Cornish	San Francisco	CA
Pamela Corradini	Simi Valley	CA
Jim Corriere	Brawley	CA
Sean Corrigan	Trinity Beach	CA
Maria Corvalan	Brea	CA
Fernando Costa	Daly City	CA
Edward Costello	Santa Monica	CA
Karin Costello	Santa Monica	CA
Leslee Cotlow	San Francisco	CA
Anna Cottle	Santa Clarita	CA
Elizabeth Cotton	Encinitas	CA
Paul Couillard	San Diego	CA
Sandi Covell	San Francisco	CA
Leticia Cowan	San Jose	CA
Caryn Cowin	South Pasadena	CA
Richard Cramer	Glendale	CA
Sheilagh Creighton	Fairfax	CA
Phillip Cripps	Cathedral City	CA
Alfred Cross	San Francisco	CA
Marian Cruz	Hollister	CA
Eleanor Cuevas	Sonoma	CA
Kermit Cuff	Mountain View	CA
Sherrell Cuneo	Los Angeles	CA
Debra Cunningham	Encinitas	CA
Eithne Cunningham	Grass Valley	CA
Jim Curland	Moss Landing	CA
Kevin Curtis	Fullerton	CA
Joe Cuviello	Solana Beach	CA
Carla Davis	Corte Madera	CA
Ronald Dahl	Long Beach	CA
Susan Dailey	Pleasanton	CA
Rhea Damon	Calabasas	CA
Lawrence Danos	Hayward	CA
Denise Dardarian	Los Angeles	CA
Lisa Dare	Tujunga	CA
Michael Darling	Frazier Park	CA
Elizabeth Darovic	Monterey	CA
Robert Davenport	Lakewood	CA
Dorothy L. Davies	San Francisco	CA
Jill Davine	Culver City	CA
Cheryl Davis	Concord	CA
Clark Davis	Los Osos	CA
Jessica Davis-Stein	Sherman Oaks	CA
Christopher Dawson	Playa Del Rey	CA
Wayne Day	San Francisco	CA
Bro. Noel De Bruton, Sdb	Bellflower	CA
Victoria De Goff And Family	Berkeley	CA

C De Mirjian	Valley Glen	CA
Elisse De Sio	Redwood City	CA
Vic Deangelo	San Francisco	CA
Regina Defalco Lippert	Martinez	CA
John Deland	Carlsbad	CA
Margaret Demott	Sacramento	CA
Rayline Dean	Ridgecrest	CA
Michael Decker	Los Angeles	CA
D Dee	North Hollywood	CA
Beatriz Del Favero	Huntington Beach	CA
Dean Del Favero	Huntington Beach	CA
Kelly Del Valle	Woodland Hills	CA
M. Delatte	Long Beach	CA
Carmen Dello Buono	San Jose	CA
Brian Dempsey	San Rafael	CA
James Denison	Long Beach	CA
Michael Denton	San Leandro	CA
Karen Descamps	Lompoc	CA
Connie Devine	San Jose	CA
Barbara Diiorio	Santa Rosa	CA
Richard Dimatteo	San Diego	CA
Denise Dipasquale	Hermosa Beach	CA
Francisco Diaz	Richmond	CA
Jeffrey Dickemann	Richmond	CA
Cathe Dietrich	Albany	CA
Kendall Dinwiddie	Palo Alto	CA
Laura Divenere	Los Angeles	CA
Katherine Doberne	Winnetka	CA
Rachel Docherty	Boyes Hot Springs	CA
James Doeppers	Mill Valley	CA
Bonnie Dombrowski	Pasadena	CA
James Domenico	San Francisco	CA
John R Donaldson	Fresno	CA
Geraldine Donigan	San Diego	CA
Valeska Donoso	Santa Monica	CA
Kristine Dove	Indian Wells	CA
Lenore Dowling	Los Angeles	CA
Amy Dowsett	San Francisco	CA
Laurance Doyle	Mountain View	CA
Nikki Doyle	Oakland	CA
Rebekah Driessen	Oakland	CA
Gabriele Drozdowski	Santa Barbara	CA
Carol Dubovick	Concord	CA
Marjorie Dunham	Garden Grove	CA
Rikki Dunsmore	Santa Cruz	CA
Frances Dupont	Richmond	CA
Samuel Durkin	Fairfield	CA
Marjorie Dworak	Napa	CA
Ruth Dyke	Foresthill	CA

Tonya Dysart	San Diego	CA	
Eric Ericson	Pacific Palisades	CA	
Claudia Eads	Fawnskin	CA	
Lee Eames	Long Beach	CA	
Julia Earl	Larkspur	CA	
Linda Eberle	Venice	CA	
Jenn Eckerle	Santa Barbara	CA	
John Ecklund	Thousand Oaks	CA	
Jay Edgerton	Rancho Palos Verdes	CA	
John Edman	Emeryville	CA	
Teresa Edmonds	Carmel Valley	CA	
Nancy Edmonson	San Francisco	CA	
Pandora Edmonston	Mariposa	CA	
Carole Ehrhardt	Pebble Beach	CA	*Ocean fish are an important food and a healthy one. However our fish are being depleted so that there will be none. We need a healthy ecosystem.*
Steve Eklund	Salinas	CA	
Marguerite Elia	Sacramento	CA	
Ken Elie	Cotati	CA	
Denis Elliott	Arcadia	CA	
Lana Ellis	Half Moon Bay	CA	
Robert Ellis	Oakland	CA	
Carlin Ellison	Daly City	CA	
Lora Elstad	Los Angeles	CA	
Frances Emanuel	Simi Valley	CA	
Stephanie Embrey	Lakewood	CA	
Lorrie Emery	Bonny Doon	CA	
David Enevoldsen	San Jose	CA	
Jane Engelsiepen	Carpinteria	CA	
Suzanne Erickson	Sonora	CA	
Pat Ericson	La Verne	CA	
John Ertel	Scotts Valley	CA	
Deborah Escoto	Riverside	CA	
Randall Esperas	Cupertino	CA	
Dan Esposito	Manhattan Beach	CA	
Malka Essig	Oakley	CA	
John Essman	Healdsburg	CA	
Benjamin Etgen	Sacramento	CA	
Chad Evans	Glendale	CA	
Christopher Evans	Berkeley	CA	
Michael W Evans	Los Angeles	CA	
Maxine Ewig	Temecula	CA	
Janet Eyre	San Francisco	CA	
Edward Fairchild	San Jose	CA	
Stephanie Falzone	Alameda	CA	
Lorna Farnum	Rossmoor	CA	
Daniel Farr	Simi Valley	CA	
Elissa Faye	North Hollywood	CA	
Cassandra Fazio	Cotati	CA	
Lorif Fedele	Sun City	CA	

Emily Feingold	Concord	CA
Ruth Feldman	Alamo	CA
Ruth Feldman	Fair Oaks	CA
Grace Feldmann	Santa Barbara	CA
Robin Fellner	Mckinleyville	CA
James Ferguson	Fallbrook	CA
Linda Ferland	Ventura	CA
Cynthia Fernandez	Point Richmond	CA
Elisabeth Fiekowsky	Sebastopol	CA
Aixa Fielder	Los Angeles	CA
Deborah Filipelli, Ph. D.	The Sea Ranch	CA
Veronika Fimbres	San Francisco	CA
Jason Fish	Rocklin	CA
Margaret Fish	Boonville	CA
Ted Fishman	San Jose	CA
Todd Fisk	San Diego	CA
Stan Fitzgerald	San Jose	CA
Donna Flade	Beverly Hills	CA
Emily Flaxman	Walnut Creek	CA
Jude Fletcher	Oakland	CA
Cherie Flint	Springville	CA
John Flitcraft	Cambria	CA
Regina Flores	Lake Elsinore	CA
Brian Florian	Beverly Hills	CA
David Ford	Pasadena	CA
Brett Forray	Turlock	CA
Kim Forrest	Los Banos	CA
Sharie Foster	Tujunga	CA
Kathi Fotinos	Martinez	CA
Caroll Fowler	Hayward	CA
Jonathan Fox	Culver City	CA
Mark Foy	Berkeley	CA
Lynne Francovich	Ventura	CA
Zachary Frank	Los Angeles	CA
Constance Franklin	Los Angeles	CA
Megan Franklin	Brea	CA
Forest Frasieur	Benicia	CA
Carolyn Frazee	Eureka	CA
Barbara Frazer	Sacramento	CA
Jana Frazier	Redondo Beach	CA
Robert Frcek	Los Angeles	CA
Reuben Freed	Burbank	CA
Nancy Freedland	Big Bear City	CA
Dale Freeman	Auburn	CA
Kyri Freeman	Barstow	CA
Michael Frey	Santa Barbara	CA
Marian Fricano	San Jose	CA
Dean Frick	San Francisco	CA
Leanne Friedman	Davis	CA

Leslie Friedman	Mountain View	CA	*As part of the general public, I recognize the vital importance of what you call forage fish. I also see how information about the balance of the ecosystem works is now spread throughout the population. If you allow industrial, unmanaged fisheries to take whatever they can, you will allow the collapse of species and the network that sustains them. It is time for the Council to act on its knowledge and abilities. Please take on this most significant responsibility.*
Jackie Fritz	Irvine	CA	
Jack Frost	Calabasas	CA	
Kristina Fukuda-Schmid	Culver City	CA	
Ann Fuller	Petaluma	CA	
Nancy Fuller	Los Angeles	CA	
Laura Fung	Nevada City	CA	
Robert Furst	Joshua Tree	CA	
Gilda Fusilier	Sacramento	CA	
Gloria Gallagher	Yorba Linda	CA	*There was a long ago time when nature did not need humans to keep the natural balance and rhythm of this earth...but that was before humans in their ignorance and arrogance did not consider that the earth has a living and breathing planet...and with no fore thought to the consequences proceeded to tear apart the find tuned balance of nature...now our planet needs helping hands...*
Ellen Gachesa	Napa	CA	*Once they're gone -- they're gone.*
Horace Gaims	Los Angeles	CA	
Christine Gallagher	Palm Springs	CA	
Glenn Gallagher	Simi Valley	CA	
Thomas Gallagher	Burlingame	CA	
Alex Gallipeau	Redondo Beach	CA	
Mayra Galutza	Sun Valley	CA	
John F. Gannon	Los Angeles	CA	
Sharma Gaponoff	Grass Valley	CA	
Sonya M. Garbutt	Davis	CA	
Armando A. Garcia	Paramount	CA	
Deisha Garcia	San Jose	CA	
Jeffery Garcia	Mendocino	CA	
David Gardner	Santa Monica	CA	
Frank Gardner	Arroyo Grande	CA	
Andrew Garnett	Foster City	CA	
Megan Garrett	Sacramento	CA	
Tudy Garrett	Glen Ellen	CA	
Janet Garvin	Fairfax	CA	*PLEASE PROTECT FORAGE FISH.*
Dylan Gasperik	Beverly Hills	CA	
Gina Gatto	Castro Valley	CA	
Lionel Gazeau	Monte Rio	CA	
Dee Gee	North Hollywood	CA	
Lisa Gee	La Crescenta	CA	
Kat Gelles	San Francisco	CA	
Kim Gentes	Woodland Hills	CA	
Mija Gentes	Saratoga	CA	
Ernest George	Irvine	CA	
Gordon Gerbitz	Santa Barbara	CA	
Joann Gerfen	Santa Maria	CA	

David Gerry	Los Angeles	CA	
Nick Giantt	Escondido	CA	
Layla Gibbon	San Francisco	CA	
Thomas Gibson	Escondido	CA	
Jean Giedt	Mariposa	CA	
Karyn Gil	Sacramento	CA	
Julie Gilbert	Redwood City	CA	
Ayesha Gill	Oakland	CA	
Thomas Gillespie	Lamirada	CA	
Dana Ginn	Temecula	CA	
Mark Giordani	Woodland Hills	CA	
Cara Givens	San Francisco	CA	
Jean Gladstone	Eureka	CA	
Craig D. Glasser	Magalia	CA	
Joe Glaston	Desert Hot Springs	CA	
Debra Gley	Trabuco Canyon	CA	
Janice Gloe	Oakland	CA	
Courtney Glondeniz	El Cajon	CA	
Claire Godwin	Sebastopol	CA	
Hester Goedhart	Redwood City	CA	
Warren Gold	Mill Valley	CA	
Sarah Goldbaum	San Francisco	CA	
Nancy Goldberg	Los Angeles	CA	
Susan Goldberg	Glendale	CA	
Joseph Golinveaux	Berkeley	CA	
Natalie Gonzales	Pomona	CA	
Alan Gonzalez	Long Beach	CA	
Terry Gonzalez	Whittier	CA	
Rosalind Goodfellow	Burbank	CA	
C.R. Goodman	Los Gatos	CA	
Diana Goodman	San Francisco	CA	*We all benefit from a vibrant ocean whether we live near it or not. I happen to live near it. I love it.*
Sue Goodrich	San Dieog	CA	
Edward Goral	Montrose	CA	
Mildred Gordon	Oceanside	CA	
Dara Gorelick	Van Nuys	CA	
Terry Goss	San Jose	CA	
Ela Gotkowska	LODZ	CA	
Mark Gotvald	Pleasant Hill	CA	
Mark Gould	San Francisco	CA	
Valerie Gould	Belmont	CA	
Deana Graff	San Diego	CA	
Jess Graffell	Yucaipa	CA	
Lauren Graham	San Francisco	CA	
Robert Grand	Oceanside	CA	
Caryn Graves	Berkeley	CA	
Joel Graves	Encino	CA	
H Gray	Hayward	CA	
Alexandra Graziano	Thousand Oaks	CA	
Amy Green	San Francisco	CA	

June Green	Belmont	CA	
Marilyn Green	Manhattan Beach	CA	
William Green	Thousand Oaks	CA	
Lee Greenawalt	Merced	CA	
Brigette Greener	San Jose	CA	
Jerry Greenstein	San Rafael	CA	
Ken Greenwald	Santa Monica	CA	
Ginnie (Aka Virginia) Gregg	Tehachapi	CA	
Marc Gregory	Beverly Hills	CA	
Arthur Gribben	Van Nuys	CA	
Mercy Grieco	Fresno	CA	
John Griesgraber	Finley	CA	
Irma Grieve	San Rafael	CA	
Erica Griffin	San Francisco	CA	
Tamhas Griffith	Martinez	CA	
Russell Grindle	Fairfield	CA	
Robert Groff	Campbell	CA	
Malcolm Groome	Topanga	CA	
Kurt Gross	San Diego	CA	
Adriana Guidi	Sherman Oaks	CA	
Valerie Guinan	Cupertino	CA	
Tim Guisinger	Camarillo	CA	
Jere Guldin	Los Angeles	CA	
Monte Gullo	Sacramento	CA	
J. Barry Gurdin	San Francisco	CA	
Nancy Gutierrez	Palm Desert	CA	
Harold Guy	Ojai	CA	
Carl Gwinn	Goleta	CA	
Lois H	Claremont	CA	
Cynthia Hernandez	Ukiah	CA	
Richard And Vivian Haas	Fresno	CA	
Todd Hack	Chula Vista	CA	
Leah Hackenson-Allers	Los Angeles	CA	*As a West Coast resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
Sarah Hafer	Sacramento	CA	
Alan Haggard	San Diego	CA	
David M Hagler	Salinas	CA	
Brenda Haig	Long Beach	CA	
Trevolyn Haines	Chino Hills	CA	
Charles Hall	Nevada City	CA	
Gregory Hall	San Marcos	CA	
Julie Hall	Chico	CA	
Linda Hall	Fontana	CA	
Natalie Hall	Encino	CA	
Rosemary Hall	Huntington Beach	CA	
Sarah Hall	Burbank	CA	
Jacqueline Haller	Belmont	CA	
Teresa Haller	Orangevale	CA	
Candace Hallmark	Belmont	CA	

Suzanne Haltman	Huntington Beach	CA	
Lisa Hammermeister	Granada Hills	CA	
David Hammond	Willits	CA	
Marcella Hammond	San Diego	CA	
Sharon Hamolsky	Solana Beach	CA	
James Hampson	San Francisco	CA	
Lisa Handschumacher	Redondo Beach	CA	
Sherry Handy	Lincoln	CA	
Kim Hanks	Sacramento	CA	
Steve Hanlon	Los Angeles	CA	
Heather Hanly	Oakland	CA	
Helen Hanna	Sacramento	CA	
Ann Hannant	Sebastopol	CA	
Katherine Hannibal	Chatsworth	CA	
Marilyn Hansen	Santa Rosa	CA	
Joseph Hardin	Santa Monica	CA	*Thank you for all of your har work*
Kathryn Hardy	Petaluma	CA	
Cathy Hardymon	Garden Grove	CA	
Betts Harley	Costa Mesa	CA	
Vince Harper	Orange	CA	
Maria Harrington	Benicia	CA	
Christine Harris	San Francisco	CA	
Zoe Harris	San Anselmo	CA	
Blanche Hartman	San Francisco	CA	
Carolyn Harvey	San Diego	CA	
Joe Harvey	Twain Harte	CA	
Richard Harvey	Paso Robles	CA	
Anita Harwardt	West Covina	CA	
David Haskins	San Diego	CA	
Lindalee Hatch	Paradise	CA	
Susan Hathaway	Pico Rivera	CA	
Peter Havel	Winters	CA	
Paula Hawkins	San Diego	CA	
Christine Hayes	Upland	CA	
Jennifer Hayes	Modesto	CA	
Walter Hays	Palo Alto	CA	
Sharon Haywood	Laguna Beach	CA	
Yuriko Hazlett	Oxnard	CA	
Jennifer Head	Irvine	CA	
Kris Head	Garden Grove	CA	
Julie Heath Elliott	Los Angeles	CA	
Deborah Hecht	Berkeley	CA	
Nancy Heck	Santa Maria	CA	
Curtis Hedges	Montebello	CA	
Lin Heidt	San Diego	CA	
Jon Heiken	Napa	CA	
Bridgett Heinly	San Diego	CA	
Christian Heinold	Oakland	CA	
Beta Heist Morello	Fort Bragg	CA	

Andre Helfenstein	Los Angeles	CA	
Dolores Helman	Berkeley	CA	
Kathleen Helmer	Woodland Hills	CA	
Steven Henderson	Cathedral City	CA	
John Hendra	Los Angeles	CA	
C Hendrickssen	Los Angeles	CA	
Wanda Hendrix	Morro Bay	CA	
Charlene Henley	San Jose	CA	
Dakota Hennessey	Los Angeles	CA	
Christina Heon	Arroyo Grande	CA	
Samuel Hergenrather	Sebastopol	CA	
Bill Herman	Oceanside	CA	
Birgit Hermann	San Francisco	CA	
Jesus Hernandez	Saint Helena	CA	
Ana Herold	Pacifica	CA	
Vickie Hershberger	San Pedro	CA	
William Hewes	Simi Valley	CA	
Dale Hickman	Nevada City	CA	
Robert Hicks	Long Beach	CA	
Nancy Hiestand	Davis	CA	
Julie Higgins	Mendocino	CA	
Violet Highley	Santa Cruz	CA	
Frank Hill	North Hollywood	CA	
Valerie Hill	Long Beach	CA	
James Hilsinger	San Luis Obispo	CA	
Divina Himaya	Claremont	CA	
Susan Himes-Powers	San Francisco	CA	
Brien Hindman	Montrose	CA	
Jeremy Hinkson	Sacramento	CA	
Charles Hochberg	Philo	CA	
Dirk Hoekstra	San Francisco	CA	
Rebecca Hoeschler	El Segundo	CA	
Sabrina Hogan	Monrovia	CA	
John Hogben	Belmont	CA	
Cathy Holden	Sacramento	CA	
Patti Holden	Vista	CA	
Victoria Holder	Walnut	CA	
Sidney J.P. Hollister	San Francisco	CA	
Saundra Holloway	El Cajon	CA	
Stephen Holman	San Francisco	CA	
Tina Holman	Monrovia	CA	
Vicky Holman	Carmel	CA	
Christine Holmes	San Francisco	CA	*These forage fish fisheries are being created because we have overfished our larger species, so it is easier and more profitable to fish for the forage fish. But by doing so we are further decimating all fisheries (as well as avian and marine mammal populations) by eliminating their food source. It is ignorant to do this. You need to take this precautionary measure as soon as possible.*
Virginia Holmes	Menlo Park	CA	
Kirsten Holmquist	Sunnyvale	CA	

Jon Holstein	San Diego	CA
William Holt	Pleasanton	CA
Norbert Holter	San Francisco	CA
Betsy Holzhauer	Saint Helena	CA
R Hondrick	Sacramento	CA
Celeste Hong	Los Angeles	CA
Val Hongo-Whiting	Laguna Niguel	CA
Wiliam Honsa	Eureka	CA
Clare Hooson	Belmont	CA
Michael Hoover	Los Angeles	CA
Kathleen Hopkins	Oakland	CA
Maryelen Horeftis	San Diego	CA
Sandra Hornsby White	Rough and Ready	CA
Michael Horton	South San Francisco	CA
Martin Horwitz	San Francisco	CA
Barry Hottle	Roseville	CA
Chris House	Playa Del Rey	CA
Lynn Howard	San Diego	CA
Emma Howe-Andrews	Newark	CA
Sally Howlett	Berkeley	CA
Zoe Huang	Oakland	CA
Cynthia Hubach	Los Angeles	CA
Natalie Hubbard	Folsom	CA
Fred Vance Hubbell	Bakersfield	CA
Lesley Hudak	Orinda	CA
Molly Huddleston	Santa Rosa	CA
John Hughes	Hesperia	CA
Sharon Hull	Aptos	CA
David Humphrey	Three Rivers	CA
Richard Hundley	North Fork	CA
Paul Hunrichs	Santee	CA
Shannon Hunter	San Jose	CA
Ann Hunter-Welborn	Encinitas	CA
Ann Hunter-Welborn	Encinitas	CA
Janine Hurd-Glenn	La Mesa	CA
Linda Hurley	Anaheim	CA
Patrick Hurley	San Diego	CA
Jeffrey Hurwitz	San Francisco	CA
Renee Hutchins	Concord	CA
Terrance Hutchinson	California City	CA
Frank Huttinger	Pasadena	CA
Jinx Hydeman	Trabuco Canyon	CA
Keith Ignatowicz	Cupertino	CA
Karen Ingenthron	Oakland	CA
Zia Islam	Winnetka	CA
Steve Iverson	Corona Del Mar	CA
Tonya Ivey	Sherman Oaks	CA
Cheri Johnson	Los Gatos	CA
Dion Jackson	Tustin	CA

Elizabeth Jackson	Elk Grove	CA
James Jackson	Oakdale	CA
Kati Jackson	San Francisco	CA
Maria Jackson	San Luis Obispo	CA
Brenda Jaime	San Jose	CA
Tina Jaime	San Jose	CA
Katherine Jain	San Rafael	CA
Damian James	Oakland	CA
Lorie James	Petaluma	CA
Kimberly Jannarone	San Francisco	CA
Audrey Jansen	Redlands	CA
Theresa Jaquess	Huntington Beach	CA
Andres Jaramillo	North Hollywood	CA
Marilyn Jasper	Loomis	CA
Joyce Jeckell	Sunnyvale	CA
Lynne Jeffries	Laguna Niguel	CA
Bruce Jenkins	Sunnyvale	CA
Craig Jennings	Ventura	CA
Claire Joaquin	Pollock Pines	CA
Asali Johnson	Cupertino	CA
Beverly Johnson	San Juan Capistrano	CA
Diane Johnson	Escondido	CA
Helen Johnson	Ventura	CA
Judy Johnson	Hayward	CA
Stephen Johnson	San Diego	CA
Wayne Johnson	San Francisco	CA
Jane Jolivette	Antioch	CA
Kyana Jones	Berkeley	CA
Linda Jones	Ontario	CA
Mark Jones	Fremont	CA
Nina Jones	Oakhurst	CA
Robert Jones	Alameda	CA
Hadi Jorabchi	Encino	CA
Lil Judd	Sylmar	CA
Ruth Judkins	Altadena	CA
Jen Kahn	Redondo Beach	CA
Dana Kaiser	Ontario	CA
Jessica Kaiser	Pasadena	CA
Jan Kampa	Soquel	CA
Jordan Kaplowitz	Pacific Palisades	CA
Patricia Karr	Carpinteria	CA
Cathy Katsoulis	Woodland hills	CA
Dawn Kauffman	Walnut Creek	CA
Andrea Kaufman	Guerneville	CA
Kimberly Kehl	Canyon Country	CA
Larry Keller	Santa Cruz	CA
Lauren Kelley	Pasadena	CA
Rachel Kelley	Santa Monica	CA
Gerald Kelly	Santa Monica	CA

Nancy Kelly	Fresno	CA	
Jane Kelsberg	Antioch	CA	
Arthur Kennedy	Isla Vista	CA	
Gretchen J. Kenney	Redwood City	CA	
Michael Keough	San Francisco	CA	
Elena Kermani	San Diego	CA	
Alicia Kern	Palos Verdes Peninsula	CA	
Nicky Keyes	Willits	CA	
Mha Atma S. Khalsa	Los Angeles	CA	
Katherine Kiceniuk	Santa Paula	CA	
Meaghen Kidd	Palo Alto	CA	
Elizabeth Kiely	Winnetka	CA	
Connie Kiernan-Henifin	Citrus Heights	CA	
Natalie Kilmer	Oakland	CA	
Jennifer Kim Zeller	Pacific Palisades	CA	
Kim King	Nevada City	CA	
Tinamarie King	Paradise	CA	
John Kirk	Modesto	CA	
James Kirks	Chico	CA	
Saran Kirschbaum	Los Angeles	CA	*It is imperative that the ocean food web be protected NOW, there is no time to waste.*
Julie Klabin	Los Angeles	CA	
Tracey Kleber	Los Angeles	CA	
Anne & Joseph Klein	Benicia	CA	
Howard Klein	San Bruno	CA	
Walt Kleine	Emeryville	CA	
George F. Klipfelli	Cathedral City	CA	
Pete Klosterman	San Mateo	CA	
Paul Klunder	La Honda	CA	
Deanna Knickerbocker	Mountain View	CA	
Diane Knight	West Hills	CA	
Mayumi Knox	Pasadena	CA	
Karl Koessel	Blue Lake	CA	
Laura Kohn	Hillsborough	CA	
Jean Kohut	Camarillo	CA	
Ellen Koivisto	San Francisco	CA	
Greg Korelich	Santa Rosa	CA	
Margaret Koster	Willits	CA	
Sheila Kothari	Palo Alto	CA	
Lynn Kouzel	San Pedro	CA	
Natalie Kovacs	San Clemente	CA	
Daga Krackowizer	Laguna Beach	CA	
Joan Kramer	Los Angeles	CA	
Joshua Krasnoff	Oak View	CA	
Kevin Kratzke	Redding	CA	
Irene Kraus	Mission Viejo	CA	
Anne Krause	Daly City	CA	
Stephan Krause	San Rafael	CA	
Lisa Krausz	Tiburon	CA	
Paula Kren	Martinez	CA	
Patricia Krout	Santa Barbara	CA	

K Krupinski	Los Angeles	CA	
Peter Kuhn	San Diego	CA	
Dan Kuklo	Berkeley	CA	
Maynard Kuljian	Healdsburg	CA	
Richard Kuntze	Monterey	CA	
Anneliese Kupfrian	Santa Cruz	CA	
Celia Kutcher	Capistrano Beach	CA	
Sheri Kuticka	Concord	CA	
Charlotte L. Pruitt	Los Angeles	CA	
Ileana Liel	Riverside	CA	
Debra Lucchesi	Adelanto	CA	
Tim Lytsell	Los Osos	CA	
Isabella La Rocca	Berkeley	CA	
Isabella La Rocca	Berkeley	CA	
Roberta Lafrance	San Leandro	CA	
Maryann LaNew	San Clemente	CA	*Thank you in advance for doing the best thing for our precious environment and for all of us now!*
Sharon Laabs	La Jolla	CA	
Alice Labaly	Benicia	CA	
Jason Laberge	Malibu	CA	
Nellie Lacy	Big Bear City	CA	
Barbara Lafaver	Concord	CA	
Samantha Laffie	Stockton	CA	
Corinne Lambden	Alameda	CA	
J Lane	Sebastopol	CA	
Judy Lane	Novato	CA	
Valerie Lane	Ridgecrest	CA	
Jim Lansing	San Francisco	CA	
Emerald Lanto	Los Angeles	CA	
Catherine Lanzl	Encinitas	CA	
Scott Lape	Chico	CA	
Larry Lapuyade	San Anselmo	CA	
Pam Larkin	Livermore	CA	
Lucy Larom	San Diego	CA	
Areil Larsen	San Luis Obispo	CA	
Jane Larsen	Encinitas	CA	
Fran Larson	Pacifica	CA	
J Lasahn	El Cerrito	CA	
Lisa Lashaway	Montrose	CA	
Michael Lasky	Santa Cruz	CA	
Jillana Laufer	Studio City	CA	
Gabriel Lautaro	Oakland	CA	
Timothy Lawnicki	Long Beach	CA	
Victor Lawrence	Thousand Oaks	CA	
Jason Lawson-St.Hill	Walnut Creek	CA	
Ometh Layton	Los Angeles	CA	
Sharon Ledbetter	Santa Rosa	CA	
Evelyn Ledesma	Rialto	CA	
Ed Lee	Santa Clara	CA	
Peter Lee	San Francisco	CA	

Shirley Lee	Fullerton	CA	
Kyra Legaroff	Richmond	CA	
Susan Leihy	Santa Rosa	CA	
Bill Leikam	Palo Alto	CA	
Miranda Leiva	Sherman Oaks	CA	
Doug & Karen Lenier	Valley Glen	CA	
Steve Lerman	Sacramento	CA	
B. Lerner	San Jose	CA	
Michaeleric Lerner	San Jose	CA	
Jim Leske	North Hollywood	CA	
Marjorie Lev	Sacramento	CA	
Mary Levendos	San Jose	CA	
Sandy Levine	Pasadena	CA	
Nicole Levinson	San Diego	CA	
Judie Lewellen	Pearblossom	CA	
Cheryl Lewis	San Francisco	CA	
George M. Lewis	Los Osos	CA	
Patrick Lewis	Emeryville	CA	
Dorothy Li Calzi	Santa Monica	CA	
Aiely Liao	Saratoga	CA	
Helena Liber	Oakland	CA	
Andrea Lieberman	Los Angeles	CA	
Kortney Lillestrand	Laguna Beach	CA	
Joseph Lilli	Pacific Palisades	CA	
Carol Lillis	Albion	CA	
Olivia Lim	Davis	CA	
Christopher Lima	Camarillo	CA	
Christina Lin	South Pasadena	CA	
Megan Lin	Sunnyvale	CA	
Stephanie Linam	Benicia	CA	
Kj Linarez	Carmichael	CA	
Paula Kay Lindauer	Santa Rosa	CA	
Christopher Lish	Olema	CA	
Judith Little	Arcata	CA	
Elaine Livesey-Fassel	Los Angeles	CA	
Diane Livia	Oakland	CA	*I am a life-long West Coast resident. The entire population of humankind benefits from a vibrant ocean. A sustainable earth depends on a well-functioning marine food web. As a human who has as much right to the ocean as the Council, and as much or more concern for it, I demand you to take this precautionary measure as soon as possible.*
Ivan M. Llata	Cudahy	CA	
James Lobdell	Santa Rosa	CA	
Colleen Lobel	San Diego	CA	
Peggy Loe	Magalia	CA	
Dona Longacre	Rsm	CA	
Wally Longshore	Riverside	CA	
Jon Longsworth	Aptos	CA	
Nelly Lopez	Los Angeles	CA	
Nicole Lopez-Hagan	Pacifica	CA	

Ray Lorenson	Fremont	CA	
Hilary Lorraine	Kensington	CA	
Catherine Loudis	San Anselmo	CA	
Erin Loury	Oakdale	CA	*As a fish biologist, I want to thank you for agreeing to develop a Fishery Ecosystem Plan.*
Patsy Lowe	Palm Springs	CA	
Avila Lowrance	Grass Valley	CA	
Danielle Lowry	San Diego	CA	
Kristen Lowry	Sacramento	CA	
Lorraine Lowry	Sacramento	CA	
Luis Lozano	Long Beach	CA	
Jerome Lubin	Los Angeles	CA	
K Lucas	Westminster	CA	
Suzanne Ludlum	Oakland	CA	
Brenda Luebke	Mountain View	CA	
Richard Luke	Los Altos Hills	CA	
Rick Luttmann	Rohnert Park	CA	
Linda Lyerly	Cardiff	CA	
Erin Lynch	Los Angeles	CA	
Michal Lynch	Santa Barbara	CA	
Wendy Lynch	Los Angeles	CA	
Georgia Lynn	Bakersfield	CA	
Jay Lynn	Richmond	CA	*Whales and dolphins are excellent for promoting California tourism. The famous rock musician "Sting" has endorsed the cover of the book, 'The Vertical Farm' by Dr. Dickson Despommier and Majora Carter. Use this book to create vertical farms in California. Millions of tourists could visit these buildings to learn about Marine Ecosystems. They could also watch large screen videos of "Sting" giving speeches with Dr. Dickson Despommier and Majora Carter about Vertical Farms and indoor fisheries. Tourists could 'rock out' to his video performances in front of thousands. He packs stadiums around the world. Leonardo DiCaprio's film, 'The 11th Hour' could attract tourists to visit these Vertical Farms. Another possibility: show videos of people who raise their own small fish (in indoor aquariums) for 'dinner.' Small white fish named (Tapia), or a similar name. This small, white (Tapia) fish may be useful for feeding pet cats, and pet chickens, (kept for producing eggs). Many professional chefs will volunteer videos on how to prepare the fish in various recipes, in order to help promote their own cookbooks and websites. Ask kids and teens to help design new presentations for tourists every month. This could help any tourist destination from becoming "stale." d dolphins are excellent for promoting California tourism. The famous rock musician "Sting" has endorsed the cover of the book, 'The Vertical Farm' by Dr. Dickson Despommier and Majora Carter. Use this book to create vertical farms in California. Millions of tourists could visit these buildings to learn about Marine Ecosystems. They could also watch large screen videos of "Sting" giving speeches with Dr. Dickson Despommier and Majora Carter about Vertical Farms and indoor fisheries. Tourists could 'rock out' to his video performances in front of thousands. He packs stadiums around the world. Leonardo DiCaprio's film, 'The 11th Hour' could attract tourists to visit these Vertical Farms. Another possibility: show videos of people who raise their own small fish (in indoor aquariums) for 'dinner.' Small white fish named (Tapia), or a similar name. This small, white (Tapia) fish may be useful for feeding pet cats, and pet chickens, (kept for producing*

eggs). Many professional chefs will volunteer videos on how to prepare the fish in various recipes, in order to help promote their own cookbooks and websites. Ask kids and teens to help design new presentations for tourists every month. This could help any tourist destination from becoming "stale."

Rhonda Lynn	Sacramento	CA
Marsha Lyon	Escondido	CA
Martin Macor	San Francisco	CA
Catherine Magill	Palo Alto	CA
Alison Merkel	Oak Park	CA
Jean Merritt	North Hollywood	CA
Chris Morano	Guerneville	CA
Alex Maccollom	Carmichael	CA
Diane Macinnes	Tujunga	CA
Michelle Mackenzie	San Carlos	CA
Chris Mackrell	Long Beach	CA
Sara Mackusick	Berkeley	CA
Hannah Maclaren	Altadena	CA
Donald Mackay	South Pasadena	CA
Claudia Mackey	Stockton	CA
Diana Madoshi	Rocklin	CA
Michael Maharry	Fairfield	CA
Vicki Maheu	San Diego	CA
Gloria Linda Maldonado	Redwood City	CA
Nora Maldonado	Glendale	CA
Karen Malley	Anaheim	CA
Sonja Malmuth	Santa Ynez	CA
Robert Mammon	Richmond	CA
June Manners	Pasadena	CA
Audrey Mannolini	Huntington Beach	CA
Dana Mantle	Los Gatos	CA
Lorretta Marcel	San Francisco	CA
Richard Marchick	Orinda	CA
Martin Marcus	San Diego	CA
Beatrice Marino	Rancho Palos Verdes	CA
Virginia Mariposa	Santa Barbara	CA
Saul Markowitz	Burbank	CA
Diane Marks	Bass Lake	CA
Joan Marks	Tehachapi	CA
R Marks	San Jose	CA
Mary Markus	Garden Grove	CA
Patricia Marlatt	Los Angeles	CA
Pat Marriott	Los Altos	CA
Marla Marsh	Cool	CA
Rebecca Marshall	Grover Beach	CA
Kenneth Martin	Oakland	CA
David Martinez	Concord	CA
Jennifer Martinez	Sunnyvale	CA
Michele Martinez	Hayward	CA
Ray Martinez	Covina	CA

Richard B Maselow, Cpa, Cgma	Encino	CA	
Cheryl Maslin	Alameda	CA	
Eileen Massey	Oakland	CA	
Barbara Mastej	Venice	CA	
Thomas Masterson	Chico	CA	
Rebecca Mastoris	Watsonville	CA	
Dale Matlock	Santa Cruz	CA	
Dale Mattes	Pasadena	CA	
Tamara Matz	Los Angeles	CA	
Tim Maurer	Anaheim	CA	
Casee Maxfield	Los Angeles	CA	
Todd Mayer	Soquel	CA	
Brian Mc Credie	Ridgecrest	CA	
Janet Mccalister	Paradise	CA	
Louis Mccarten	Glendale	CA	
Tom Mccarter	San Jose	CA	
Dale Mccauley	Carmel Valley	CA	
Kelly Mcclanahan	Ventura	CA	
Janet Mila Mcclarren	Paradise	CA	
Kristin Mccloy	Oakland	CA	*As a West Coast resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
John Mccollum	Irvine	CA	
Priscilla Mccomb	Escondido	CA	
Sandra Mcconnell	West Sacramento	CA	
Melissa Mccormick	Huntington Beach	CA	
Dan Mccoy	Carlsbad	CA	
Maureen Mccoy	Templeton	CA	
Robin Mccoy	Castro Valley	CA	
James Mccullough	San Jose	CA	
Marie Mcdonough	Raymond	CA	
Rebecca Mcdonough	Menlo Park	CA	
Don Mcenhill	Healdsburg	CA	
Ron Mcgill	Irvine	CA	
David Mcglocklin	Davis	CA	
Kerri Mcgoldrick	Castro Valley	CA	
Peggy Mcguire	Gerber	CA	
Jerry Mckee	La Mesa	CA	
John Mckee	Reseda	CA	
David Mckeever	Redwood City	CA	
Marshal Mckitrick	Sacramento	CA	
Shoshanah Mcknight	Santa Cruz	CA	
Michael Mcmahan	Huntington Beach	CA	
Charles Mcmahon	Los Angeles	CA	
Susan Mcmullen	Lemon Grove	CA	
Randy Mcnea	Spring Valley	CA	
Ash Mcneely	Burlingame	CA	
Cathy Mcpeek	Palm Springs	CA	
Susan Mcreynolds	San Leandro	CA	
Kelly Mcvey	Anaheim	CA	

Michael Mcvicar	San Diego	CA
Rohana Mclaughlin	San Anselmo	CA
Lindsey Mcmanus	Long Beach	CA
Howard Md.	San Mateo	CA
Nancy Mead	Santa Cruz	CA
Ernest Medeiros	Forestville	CA
Raquel Medina	San Rafael	CA
O Medzihradsky	La Jolla	CA
Apryl Mefford-Hemauer	Santa Monica	CA
Michelle Mehlhorn	Richmond	CA
Edward Meisse	Santa Rosa	CA
Marianna Mejia	Soquel	CA
Hillary Melin	Culver City	CA
Rose Marie Menard	Orange	CA
Molly Mendez	Oakley	CA
Richard Mercer	San Rafael	CA
Jane Merkel	Eureka	CA
Jacob Merkin	Claremont	CA
Irene Merrill	Salinas	CA
Robert Merrill	Fresno	CA
Joanne Mershon	Anaheim	CA
Joel Meza	San Francisco	CA
Megan Michaels	Napa	CA
Yolande Michaels	Topanga	CA
Renee Milburn	Wrightwood	CA
Charles Milkeweicz	Martinez	CA
Blair Miller	San Diego	CA
Bob Miller	Woodland Hills	CA
Carole Miller	North Hollywood	CA
Charles Keith Miller	Berkeley	CA
Francesca Miller	Shadow Hills	CA
Kenneth Miller	Topanga	CA
Melissa Miller	Santa Clara	CA
Robert Miller	Aliso Viejo	CA
Steven Miller	Lakeside	CA
Victoria Miller	San Pedro	CA
Melva Mills	Sacramento	CA
Michael Mills	San Francisco	CA
Randy Mills	Culver City	CA
Pat Mimeau	San Francisco	CA
Adolfo Miralles	San Dimas	CA
Lore Miranda	Carlsbad	CA
Melissa Miranda	Aliso Viejo	CA
Desiree Mitchell	San Francisco	CA
Gary Mitchell	SN Dimas	CA
Ina Mitchell	Van Nuys	CA
Linda Mitchell	San Rafael	CA
Eileen Mitro	Ukiah	CA
Michael Mitsuda	Fremont	CA

Carol Mock	Fremont	CA	
Lisa Moeller	Santa Barbara	CA	
Michael Moeller	Hemet	CA	
Luis Mon	Laguna Niguel	CA	
Dean Monroe	North Hollywood	CA	
James R Monroe	Concord	CA	
Christine Moore	Oakland	CA	
Howard Moore	San Diego	CA	
Mary Moore	Oakland	CA	
Shea Moore	Gilroy	CA	
Karla Morales	Valley Village	CA	
Rosy Morales	Rancho Palos Verdes	CA	
Tanya Morales	Valley Vlg	CA	
Sharon Moran	Visalia	CA	
Linda Morgan	San Pablo	CA	
Vanessa Morganstern	Elk Grove	CA	
Leba Morimoto	El Cerrito	CA	
Mariel Morison	Blue Lake	CA	
Norman Morley	San Pablo	CA	
Keith Morris	Los Angeles	CA	
Patricia Morris	Santa Cruz	CA	
Steve Morris	Los Angeles	CA	
Margaret Morrison	Santa Barbara	CA	
Mark Morrissette	Eureka	CA	
Susanne Mortensen	Newport Beach	CA	
Marjorie Moss	Del Mar	CA	
Robert Most	Menlo Park	CA	
Peter Mounier	Morro Bay	CA	
Mark Mulder	San Jose	CA	
James Mundy	Inglewood	CA	
Jeanne Munoz	San Francisco	CA	
Gordon Munro	Napa	CA	
Lauren Murdock	Santa Barbara	CA	
Verona Murray	Oroville	CA	
Catherine Murty	San Francisco	CA	
Nathan Myers	Davis	CA	
Renee Nadalin	Carmel	CA	
Nikki Nafziger	Vallejo	CA	*And please, ban long line/gil nets as well as shrimp trawlers.... there is no such thing as bycatch ... it is murder!*
Jerry Nailon	Sacramento	CA	
James Nakata	Citrus Heights	CA	
Tom Nash	Rohnert Park	CA	
Thomas Nass	Pioneer	CA	
Maurita Nations	Templeton	CA	
Sandra Nealon	Laguna Beach	CA	
Mary Nelson	Mission Viejo	CA	
Richard Adrian Nelson, Jr.	Santa Barbara	CA	
Cipra Nemeth	Los Angeles	CA	
Alice Neuhauser	Manhattan Beach	CA	
Roberta E. Newman	Mill Valley	CA	

Carol Newton	Los Angeles	CA	
Roger Newton	Los Angeles	CA	
Tran Nham	Long Beach	CA	
Penny Nichols	Middletown	CA	
Sharon Nicodemus	Sacramento	CA	
Randi Nielsen	Richmond	CA	
Sandra Noah	Los Angeles	CA	
Nina Noble	Encinitas	CA	
Katherine Nolan	Cupertino	CA	
Dale Noonkester	Potrero	CA	
James Noordyk	San Diego	CA	
Laila Noori	San Jose	CA	
Richard North	Valencia	CA	
Jaye Northcote	Bloomington	CA	
Paul Norup	Crescent City	CA	
Britney Nucci	Manhattan Beach	CA	
Carlos Nunez	Reseda	CA	
Nadia Nunez	San Fernando	CA	
Cathleen O'Connell	Boulder Creek	CA	
Carita O'Connor	Los Alamitos	CA	
Polly O'Malley	Los Angeles	CA	
Elizabeth Ohara	Roseville	CA	
Chris Omeara Dietrich	San Jose	CA	*It is good stewardship for the Council to enact firm protections for forage fish that are vulnerable to unregulated fisheries emerging at any time.*
Bruce Odelberg	Kirkwood	CA	
Rollin Odell	Orinda	CA	
Judith Oechel	Jamul	CA	
Daniela Ogden	San Francisco	CA	
Rick Ohren	Berkeley	CA	
Liesl Okuda	Stevenson Ranch	CA	
Dylan Oldenburg	Pacific Palisades	CA	
Dennis Oliver	Kelseyville	CA	
Simone Oliver	San Francisco	CA	
Scott Olsen	Los Angeles	CA	
Chris Olson	Fair Oaks	CA	
Janet Olson	Glen Ellen	CA	
Frances Onesti	Lawndale	CA	
Gerald Orcholski	Redondo Beach	CA	
Karen Ornelas	San Pedro	CA	
Stephen Orsary	Corte Madera	CA	
Lionel Ortiz	Bayside	CA	
Don Osborne	Orland	CA	
Jessie Osborne	Vista	CA	
Wendy Oser	Berkeley	CA	
Pamela Osgood	Grass Valley	CA	
Okiyo Ososaka	Oakland	CA	
Joni Ostler	Menlo Park	CA	
Gail Overton	Winterhaven	CA	
Julie Owen	Davis	CA	

Rebecca Ozeran	San Luis Obispo	CA
Kristin Palmejar	San Diego	CA
Apostolos Papapostolou	Irvine	CA
Jennifer Parker	Los Angeles	CA
Robert Parker Stellato	Redwood City	CA
Grace Padelford	Los Angeles	CA
Urmila Padmanabhan	Fremont	CA
Michelle Palladine	Palm Springs	CA
Francis Palmer	Sacramento	CA
Kathleen Palmer	Healdsburg	CA
Jessica Pancoast	San Francisco	CA
Robert Pann	Los Angeles	CA
Jennifer Pardini	Fremont	CA
Melina Paris	Rolling Hills Estates	CA
Anna Parker	Fresno	CA
Elaine Parker	Berkeley	CA
Laura Parks	Ben Lomond	CA
Patricia Parsons	Sacramento	CA
Jeannie Pascuzzi	Orange	CA
Tatjana Patitz	Los Olivos	CA
Carol Patton	Kensington	CA
James Patton	Los Altos	CA
Elizabeth Paulson	Hesperia	CA
Laura Pavloff	Big Sur	CA
Jerry Peavy	Chico	CA
Carlos Peeler	San Francisco	CA
Suzanne Pena	Fullerton	CA
Lauren Pepper	Gilroy	CA
Dan Perdios	Palm Springs	CA
Rayza Perez	Brawley	CA
Rich Perez	Torrance	CA
James Perkins	Costa Mesa	CA
K Perlman	Aptos	CA
Marilyn Perona	Lake Forest	CA
Maureen Perron	Half Moon Bay	CA
Cyrle Perry	Orinda	CA
Maryann Peters	Los Angeles	CA
Kimberly Peterson	Cloverdale	CA
Nancy Peterson	Scotts Valley	CA
Robin Peterson	Madera	CA
Kyle Petlock	Los Angeles	CA
Teresa Petrillo	Rowland Heights	CA
Carolyn Pettis	Santa Clarita	CA
John Pham	Encinitas	CA
Long Pham	Westminster	CA
Tami Phelps	Redding	CA
Regina Phillips	Winnetka	CA
Adrienne Picchi	Pasadena	CA
Janet Pielke	Claremont	CA

Deborah Pierce	San Francisco	CA	
Nuri Pierce	La Mesa	CA	
Dee Pierce	San Francisco	CA	
Amy Pierre	Oakland	CA	
Anke Pilz	Redlands	CA	
Ed Pinson	Monrovia	CA	
Tina Pirazzi	Long Beach	CA	
Jayne Pitchford	Santa Monica	CA	
Jeanne Pitts	Redwood City	CA	
J Pizzo	Monterey	CA	
Nicole Planchon	Clearlake Oks	CA	
Robert Platt	San Rafael	CA	
Alice Polesky	San Francisco	CA	
Melissa Polick	Mill Valley	CA	
Carol Polk	Dana Point	CA	
Stephen Pollaine	Middletown	CA	
Jackie Pomies	San Francisco	CA	
Beverly Poncia	Lower Lake	CA	
Kerry Pontrelli	San Diego	CA	
Stina Pope	Pacifica	CA	
Terry Poplawski	Ukiah	CA	
Kathy Popoff	San Pedro	CA	
Susan Porter	Pasadena	CA	
Renee Potik	Fresno	CA	
Meredith Potter	Los Angeles	CA	
Lynne Powell	San Francisco	CA	
Kamal Prasad	Santa Rosa	CA	
Lynne Preston	San Francisco	CA	
Laurie Price	Redwood City	CA	*It is really great you agreed to develop a Fishery Ecosystem Plan. Please adopt the plan and accompanying list of Ecosystem Initiatives in April. Without all those little fish and plankton, there would not be the larger fish and other marine life. The ocean plays a huge role in the health of the entire ocean. Please make sure the forage fish are kept safe from industries that use it in feeding livestock, poultry and farmed fish. The farmed fish should grow their own forage fish, in fact.*
Rosemary Prichard	Los Angeles	CA	
Basia Priga	Tarzana	CA	
Stephanie Proctor	Van Nuys	CA	
Steven Proe	Greenwood	CA	
Diane Propster	Los Angeles	CA	*We all depend on the sea. If we do not take care of it it will not only effect other fish, but literally the air we breathe.*
Lauri Provencher Provencher	Los Angeles	CA	
James Provenzano	Los Angeles	CA	
Charlotte Prozan	San Francisco	CA	
Mary Prubant	San Jose	CA	
Laurel Przybylski	Oakland	CA	
Richard Puaoi	Novato	CA	
Steve Purvis	Santa Monica	CA	
William Putnam	Vallejo	CA	
Brad Putz	Sonora	CA	

Matthew Quellas	Los Angeles	CA
Patricia Quimby	Los Angeles	CA
D.Michael Quinn	Rancho Cucamonga	CA
Teresa Ramos	Long Beach	CA
Mel Randall	Studio City	CA
Dominique Reimann	San Diego	CA
Fran Reyes	Los Banos	CA
Sarah Rabkin	Soquel	CA
Leila Raim	Fairfax	CA
Angelica Ramirez	Los Angeles	CA
Paul Ramos	Solvang	CA
John Rand	Tehachapi	CA
Dee Randolph	Chico	CA
Maria Rausis	Mountain View	CA
George Raymond	Palm Springs	CA
Joseph Razo	Camarillo	CA
Nicolas Razo	Berkeley	CA
Patricia Re	Penngrove	CA
Mark Reback	Los Angeles	CA
Maryellen Redish	Palm Springs	CA
Linda Redman	West Hollywood	CA
Robert Reed	Lake Elsinore	CA
Brenda Reese	Campbell	CA
Gary Reese	San Clemente	CA
George Reeves	Stockton	CA
Lea-Ann Refregier	San Jose	CA
Andrew Reich	Los Angeles	CA
Serena Reid	Los Angeles	CA
Don Reinberg	Mill Valley	CA
Julie Reiner	Santa Cruz	CA
Robin Reinhart	San Diego	CA
Emil Reisman	Encino	CA
Gayla Reiter	Benicia	CA
Ann Rennacker	Fort Bragg	CA
Kristen Renton	North Hollywood	CA
Kevin Reynolds	Hayward	CA
Tessa Reynolds	Studio Ciity	CA
Mary Riblett	Culver City	CA
Chris Rice	Los Angeles	CA
David Rice	Los Angeles	CA
Jay Rice	Novato	CA
James Rich	Los Angeles	CA
Matt Richardson, Dpt	San Francisco	CA
Lynette Ridder	Concord	CA
Crystal Riggleman	Sacramento	CA
Brent Riggs	Inglewood	CA
Callie Riley	Citrus Heights	CA
Marilyn Riley	Oceanside	CA
Martin Riley	Corona	CA

Zorine Rinaldi	Santa Monica	CA
Arlene Rinaldo	San Jose	CA
Sean Ring	Santa Cruz	CA
Jen Rios	San Jose	CA
Robert Rippetoe	Rancho Mirage	CA
Joseph Rissetto	Chula Vista	CA
Alisa Risso	Rsm	CA
Donna Ritola	Petaluma	CA
Julie Rivera	Huntington Beach	CA
Barbara Robbin	Studio City	CA
Lance Robert	San Diego	CA
Cristina Roberts	El Centro	CA
Gail Roberts	Jamul	CA
Katherine Roberts	San Francisco	CA
Steve Roberts	Oceanside	CA
Jacqueline Robertson	Petaluma	CA
Merilie Robertson	Canoga Park	CA
Nadia Robertson	North Hollywood	CA
Steve Robey	Berkeley	CA
Lisa Robie	San Lorenzo	CA
Etta Robin	Bakersfield	CA
Lois Robin	Santa Cruz	CA
Dawn Robinson	Mill Valley	CA
Richard Robinson	Fresno	CA
Priscilla Rocco	Costa Mesa	CA
Candace Rocha	Los Angeles	CA
Marykay Rodarte	Phelan	CA
Terrell Rodefer	Van Nuys	CA
Colleen Rodger	San Francisco	CA
Mary Rodriguez	Redwood City	CA
Christina Roe	Fresno	CA
James Rogers	Richmond	CA
Kathleen Rogers	Paramount	CA
Kelly Rogers	San Jose	CA
Margaret Rogers	Redwood City	CA
Patricia Rogers	Pleasanton	CA
Kathi Rolbeck	Placerville	CA
Lee Romero	Penngrove	CA
Valerie Romero	Quincy	CA
Van Rookhuuyzen	San Francisco	CA
Diane Rooney	El Cerrito	CA
Barbara Root	Mckinleyville	CA
Charlene Root	Whittier	CA
Richard And Carolyn Rosenstein	Los Angeles	CA
Glenn Ross	Eureka	CA
Wilson Ross	San Francisco	CA
M Rossi	Santee	CA
Michael Rotcher	Mission Viejo	CA
Julie Roth	Hermosa Beach	CA

Ronald Rotter	Berkeley	CA	
Patrick Rowe	Glendale	CA	
Susan Rowe	Coarsegold	CA	
Allen Rozelle	Santa Cruz	CA	
Suzanne Rubenstein	Los Angeles	CA	
Mark Rudningen	Citrus Heights	CA	
Rikje Maria Ruiter	Utrecht	CA	
Claudia Ruiz	Alameda	CA	
Sylvia Ruiz	Los Angeles	CA	
Thomas Rummel	Los Angeles	CA	
Michael Russell	San Francisco	CA	
Penny Rutishauser	Tuolumne	CA	
Ben Ruwe	Felton	CA	
Anne Ryan	San Francisco	CA	
Paul Ryan	Napa	CA	
Therese Ryan	Palmdale	CA	
Carmen Sanchez Sadek	Los Angeles	CA	*¡¡¡Muchísimas gracias!!!*
Ernest Scholz	San Francisco	CA	
Jake Schwartz	Petaluma	CA	
Linda Seeley	San Luis Obispo	CA	
Gail Sabbadini	Lakeside	CA	
David Sabbas	Vista	CA	
Darla Sadler	Campbell	CA	
Nina Sagheb	San Diego	CA	
Don Saito	San Jose	CA	
Gabriel Salazar	Upland	CA	
Joe Salazar	Santa Rosa	CA	
Lisa Salazar	Foster City	CA	
Rocio Salazar	Los Angeles	CA	
R Salido	La Habra	CA	
Gloria Sall	Dana Point	CA	
Barry Saltzman	Los Angeles	CA	
Ralph Sanchez	Soquel	CA	
Gustavo Sandoval	San Mateo	CA	
Kathryn Santana	Bradbury	CA	
David Saperia	Santa Monica	CA	
Marijeane Sarraille	Pittsburg	CA	
Jon Sasano	Hillsborough	CA	
Julie Sasaoka	Concord	CA	
Nancy Sato	Belmont	CA	
Linda Savage	San leandro	CA	
Patricia Savage	Mammoth Lakes	CA	
Toni Saviez	Calistoga	CA	
Barbara Sawicki	Foster City	CA	
Buckland Sawyer	Oxnard	CA	
Buckland Sawyer	Oxnard	CA	
Carol Sawyers	Santa Cruz	CA	
Kim Saxelby	Upland	CA	
Fred Sayre	Mokelumne hill	CA	

Beverly Scaff	Walnut Creek	CA	
Rodolfo Scarpati	Castro Valley	CA	
Carolyn Scarr	Berkeley	CA	
Kira Schabram	Valley Springs	CA	
Elena Schak	Oakland	CA	
Mark Schecter	Cayucos	CA	
Karen Scheuermann	Cottonwood	CA	
Lauren Schiffman	El Cerrito	CA	
Ylvia Schleimer	Pasadena	CA	
Henry Schlinger	Burbank	CA	
Mauricio Schrader	Chico	CA	
Dawn Schrey Colvin	San Pablo	CA	*Please protect the ocean food web!*
Brandy Schumacher	Citrus Heights	CA	
Bonny Schumaker	La Canada Flt	CA	
Ron Schutte	San Diego	CA	
Riochard Schwager	Santa Barbara	CA	
Eric Schwartz	Santa Barbara	CA	
Joseph Schwartz	Glendale	CA	
Randy Schwartz	Mountain View	CA	
Dena Schwimmer	Los Angeles	CA	
Celia Scott	Santa Cruz	CA	
David Scott	Ontario	CA	
Nan Scott	Norco	CA	
Katharine Scripps	Sunnyvale	CA	
Deanna Seagraves	Soquel	CA	
Russell Sedat	San Clemente	CA	
Richard Sedivy	Los Angeles	CA	
Frank Seewester	Fairfield	CA	
John Sefton	Trabuco Canyon	CA	
Evalyn Segal, Phd	Walnut Creek	CA	
Janet Seldon	San Francisco	CA	
Winke Self	La Jolla	CA	
Vic Selten	Palm Springs	CA	
Meg Seltzer	Studio City	CA	
Rob Seltzer	Malibu	CA	
Patrick Sennello	South Lake Tahoe	CA	
Jon Senour	San Diego	CA	
Cathie Serletic	San Francisco	CA	
Mari Serrano	Santa Clarita	CA	
Neena Sessa	South San Francisco	CA	
Brianna Settle	Fairfield	CA	
Danae Shadburn	Solana Beach	CA	
Elizabeth Shafer	Huntington Beach	CA	
Casey Shaffer	Chico	CA	
Gerald Shaia	Sun Valley	CA	
Timothy Shanahan	Fountain Valley	CA	
Susie Shapira	Manhattan Beach	CA	
Marc Shargel	Felton	CA	
Lynn Shauinger	San Francisco	CA	

Raymond Shaw	San Jacinto	CA	
Gabriel Sheets	Merced	CA	
Shirley Sheffield	Oakland	CA	
Kacie Shelton	Pasadena	CA	
Dodie Shepard	Burbank	CA	*WE SIMPLY MUST CARE FOR OUR PLANET BEFORE ANYTHING. ALL ELSE TAKES A BACK SEAT. NO PLANET AND NO NEED FOR WHAT EVER IS ENDANGERING IT.*
Marilyn Shepherd	Trinidad	CA	
George Sheridan	Garden Valley	CA	
Wayne Sheridan	San Francisco	CA	
Marcia Sherman	Santa Barbara	CA	
Nina Sherman	San Francisco	CA	
Richard Sherman And Family	Berkeley	CA	
Nicholas Shestople	Temecula	CA	
Beverly Shields	Long Beach	CA	
Rebecca Shirley	Daly City	CA	
Ellen Shively	San Diego	CA	
Laura Shrewsbury	Venice	CA	
Lois Shubert	Camarillo	CA	
Joseph Shulman	San Diego	CA	
Mary Lou Shurtleff	Sacramento	CA	
Marguerite Shuster	Sierra Madre	CA	
John Shutt	Marina Del Rey	CA	
Ashley Sibus	Palm Desert	CA	
Mercy Sidbury	Sebastopol	CA	
Rick Siegfried	Eureka	CA	
Sheila Silan	Somerset	CA	
Daniel Silver	Los Angeles	CA	
Marc Silverman	Los Angeles	CA	
Ed Simmons	San Diego	CA	
Twikie Simms	Anaheim	CA	
Thomas Simonian	San Francisco	CA	
E Sylvia Simpson	Helendale	CA	
Vidya Sims	Orick	CA	
Paul Sinacore	Tujunga	CA	
Scott Sinclair	Kensington	CA	
D. Singer	Oakland	CA	
Scottie Singer	Hemet	CA	
Loni Sipes	Sacramento	CA	
Kate Sky	Gualala	CA	
Nancy Slanger	Piedmont	CA	
James Slark	Dana Point	CA	
Julie Slater-Giglioli	West Hollywood	CA	
Sue Sloan	Shell Beach	CA	
Alfredo Smith	Encinitas	CA	
Alice Smith	Irvine	CA	
Casey Smith	Arcata	CA	
David A. Smith	Irvine	CA	
Edwina Smith	San Francisco	CA	
Edwina Smith	San Francisco	CA	

Judith Smith	Oakland	CA	
Julie Smith	Los Osos	CA	
Kathleen Smith	Concord	CA	
Lee Smith	California Hot Springs	CA	
Robert Smith	Venice	CA	
Victor Smith	Pleasant Hill	CA	
Sam Smolker	West Hollywood	CA	
Gretchen Smurr	Woodland	CA	
Mara Solomon	San Leandro	CA	
Mirna Solorzano	Moreno Valley	CA	
Erica Sommers	Ventura	CA	
Andrea Sorini	Anaheim	CA	
Gabriela Sosa	Los Angeles	CA	
Paul P. Soucek	Venice	CA	
Michael Souza	San Diego	CA	
Mary Ann Sowards	San Diego	CA	
Michael Spadoni	Rail Road Flat	CA	
Debbie Spafford	North Hollywood	CA	
Donita Sparks	Los Angeles	CA	
Rick Sparks	Toluca Lake	CA	
Kathryn Spence	San Francisco	CA	
Julie Spickler	Menlo Park	CA	
Karen Spiegel	Burbank	CA	
Dollie Spinks	Concord	CA	
Jere Springer	Glendora	CA	
Rick St. John	San Francisco	CA	
Simone Stclare	Martinez	CA	
Steven Standard	Bellflower	CA	
Relf Star	Claremont	CA	
Ken Statham	Placentia	CA	
Paul Statman	Santa Monica	CA	
Carrie Staton	Santa Cruz	CA	
Cheryle Steele	Whittier	CA	
Jon Steenhoven	Santa Rosa	CA	
Charleen Steeves	Topanga	CA	
Eric Steffen	Richmond	CA	
Debbie Steglic	Ramona	CA	
Joseph Steinberger	San Francisco	CA	
Therese Steinlauf	Marina Del Rey	CA	*Thank you for caring!!*
Dorothea Stephan	Winzer	CA	
Kathleen Stephens	Victorville	CA	
Lauren Stephens	Los Angeles	CA	
John Steponaitis	San Francisco	CA	
Sandi Sternberg	Marina Del Rey	CA	
Christine Stewart	Escondido	CA	
Dana Stewart	La Mesa	CA	*As members of the top of the food chain, we don't like any weak links! Thank you for being aware of every part of the food web.*
Dana Stewart	Lakeside	CA	
Michael Stewart	Elk Grove	CA	
Richard Stewart	Westminster	CA	

Joanna Stiehl	San Francisco	CA	
Holly Still	Menlo Park	CA	
Paul Stillman	Santa Monica	CA	
Ron Stock	Paso Robles	CA	
Connie Stomper	Santa Barbara	CA	
Peter Stone	Rancho Santa Fe	CA	
Mika Stonehawk	Tustin	CA	
Lori Stoneman	San Ramon	CA	
Michelle Storace	Danville	CA	
Emily Storar	Sacramento	CA	
Judy Strain	Berkeley	CA	
Shar Strand	Redondo Beach	CA	
Marisa Strange	Long Beach	CA	
Anthony Stratton	Elk Grove	CA	
Paul Strecker	Sonoma	CA	
Mary Ellen Strote	Calabasas	CA	
Vladimir Strugatsky	Sebastopol	CA	
Catherine Sturgeon	Los Angeles	CA	
Carol Suchecki	Culver City	CA	
Steven Sugarman	Malibu	CA	
Ann Sullivan	Lakeside	CA	
Edward Sullivan	San Francisco	CA	
Robert Sullivan	Manhattan Beach	CA	
Patrice Summers	Santa Barbara	CA	
Sarah Sundquist	Sherman Oaks	CA	
Andrew Sutphin	Westlake Village	CA	
Constance Sutton	Berkeley	CA	
Erin Suyehara	Torrance	CA	
Kathryn Swartz	Thousand Oaks	CA	
Lavon Switzer	Ramona	CA	*This is a wonderful thing you are doing for us and all the generations to follow.*
Angee Sylvester	Lancaster	CA	
Joseph Szabo	Los Angeles	CA	
Andrea Szeto	Berkeley	CA	
Justine Tilley	Los Angeles	CA	
Petrus Townsend	San Lorenzo	CA	
Cody Trimble	Highland	CA	
Kenneth Tabachnick	Woodland Hills	CA	
Jaycel Tacchi	San Rafael	CA	
Barbara Tacker	Camarillo	CA	
Carol Taggart	Menlo Park	CA	
Mark Takaro	Berkeley	CA	
Steve Tapia	Claremont	CA	
Marian Tarbox	San Francisco	CA	
Carol Taylor	Miranda	CA	
Deborah Taylor	San Jose	CA	
Jennifer Taylor	Arcata	CA	
Liz Taylor	Encinitas	CA	
Robert Taylor	Porterville	CA	
Timothy Taylor	Los Angeles	CA	

John Teevan	Chula Vista	CA	
James Teiper	Oceanside	CA	
Cindy Tejeda	Los Angeles	CA	
Michael Terry	Santa Monica	CA	
Terelle Terry	Sacramento	CA	*I understand the plan and applaud it. Whales need krill, I don't need it in my medicine cabinet, as an example.*
Naella Tesch	Los Angeles	CA	
Lynn Thayer	American Canyon	CA	
Carrie Thomas	Huntington Beach	CA	
Leonard & Beverly Thomas	Antelope	CA	
Pamala Thomas	Santa Monica	CA	
Barbara Thompson	Calabasas	CA	
Lawrence Thompson	Livermore	CA	
Mara Thompson	Santa Monica	CA	
Robert Thornhill	Los Angeles	CA	
L B Thornton	Laguna Beach	CA	
Nadya Tichman	Oakland	CA	
Amber Tidwell	Los Angeles	CA	
Eric Tilenius	Hillsborough	CA	
Susan Tinel	San Diego	CA	
Jude Todd	Santa Cruz	CA	
Jm Tolonen	Soquel	CA	
Mark Tolson	lagunaNiguel	CA	
Richard Tomaselli	Berkeley	CA	
Pela Tomasello	Santa Cruz	CA	
Michael Tomczyszyn	San Francisco	CA	
Barbara Tonsberg	Angwin	CA	
Tatiana Torres	Los Angeles	CA	
Ofelia Torres	Thousand Oaks	CA	
Sharon Torrisi	Hermosa Beach	CA	
Jennifer Toth	Santa Clarita	CA	
Gloria Towers	Oceanside	CA	
Carlos Townsend	Fountain Valley	CA	
Chase Toy	Bakersfield	CA	
Meghan Tracy	Long Beach	CA	
Carol Tredo	Eureka	CA	
Kandeda Trefil	Albion	CA	
Dennis Trembly	Los Angeles	CA	
L Tremmel	San Francisco	CA	
Heidi Trinkle	PG	CA	
Tia Triplett	Los Angeles	CA	
Susan Trivisonno	San Jose	CA	*As a lifelong California resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
Mary Trujillo	Alhambra	CA	
Joel Trujillo Jr.	West Covina	CA	
Lonni Trykowski	Carmel	CA	
Anne Tuddenham	El Cerrito	CA	
Trish Tuley	Idyllwild	CA	
Joy Turlo	Redondo Beach	CA	

Mary Tuteur	Rohnert Park	CA	
Steve Tyler	Orange	CA	
S. Tyroler	Watsonville	CA	
Luci Ungar	Sonoma	CA	
Jason V	Los Angeles	CA	
Chanda Vad	San Mateo	CA	
Erika Vadopalas	Moss Beach	CA	
Timothy Vago	San Jose	CA	
Consuelo Valenzuela	Paradise	CA	
Keaven Van Lom	Truckee	CA	
Robin Van Tassell	San Rafael	CA	
Mike Vandeman	San Ramon	CA	*Wildlife MUST be given top priority, because they can't protect themselves from us.*
Randolph Vanderford	San Francisco	CA	
Julie Vandergrift	Fullerton	CA	
Gretchen Vanderlip	Clayton	CA	
Dorothy Varellas	San Francisco	CA	
Sherry Vatter	Los Angeles	CA	
Ayesha Vavrek	Berkeley	CA	
Reuben Veek	Mountain View	CA	
Amy Veloz	Van Nuys	CA	
Sherri Venezia	Davis	CA	
Deborah Veneziale	San Mateo	CA	
Paul Vesper	Berkeley	CA	
Micah Vetter	Northridge	CA	
Vicki Laken	Agoura Hills	CA	
Barbara Viken	San Francisco	CA	
Sonia Vila	Emeryville	CA	
Kerry Vineberg	San Francisco	CA	
Julia Voce	Seal Beach	CA	
Nancee L Volpi	Stockton	CA	
Siamak Vossoughi	San Francisco	CA	
Cody Walters	Bakersfield	CA	
Julia Weaver	Forest Knolls	CA	
Victoria Wierig	San Diego	CA	
Sara Wilson	Los Angeles	CA	
Dean Wagner	Napa	CA	
Ed Wainio	San Diego	CA	
Harold Wakefield	Woodland Hills	CA	
Aurea Walker	Los Angeles	CA	
David Walker	Santa Maria	CA	
Deb Walker	Concord	CA	
Jeanne Walker	Oxnard	CA	
Kim Walker	Oakland	CA	
Laura Walker	San Francisco	CA	
Nancy Walker	Arcata	CA	
Tabitha Walker	Chatsworth	CA	
Theresa Walker	Chatsworth	CA	
Leticia Wallace	Merced	CA	
Margaret Wallace	Royal Oaks	CA	

Aleta Wallach	Santa Monica	CA	
Violet Wallach	Venice	CA	
Shirley Wallack	Santa Rosa	CA	
Robert Waller	San Diego	CA	
William Wallin	Richmond	CA	
Abby Wanamaker	Woodland Hills	CA	*WE NEED A HEALTHY OCEAN. FORAGE FISH HAVE AN IMPORTANT NICHE IN A HEALTHY OCEAN ECOSYSTEM. AS SUCH THEY MUST BE PROTECTED.*
Vivian Wang	Fountain Valley	CA	
Dee Warenycia	Roseville	CA	
Ollie Warner	San Pablo	CA	
Tim Warner	Los Angeles	CA	
Ronald Warren	Glendale	CA	
Scott Warwick	Monrovia	CA	
Kristine Waters	Indian Wells	CA	
Ray Waters	Hermosa Beach	CA	
Courtney Watson	Corona Del Mar	CA	
Fran Watson	Spring Valley	CA	
Susan Watts	Riverside	CA	
Joan Weaver	Chatsworth	CA	
Natasha Weaver	San Diego	CA	
Glenn Webb	Pinole	CA	
Patricia Webber	Coronado	CA	
Rhonda Weber	Hercules	CA	
Henry Weinberg	Santa Barbara	CA	
Mark Weinberger	San Francisco	CA	
Joan Weiner	San Anselmo	CA	
Nona Weiner	San Jose	CA	
Peter Weiner	Sugarloaf	CA	
Rhonda Weir	Carson	CA	
Jody Weisenfeld	Petaluma	CA	
Russell Weisz	Santa Cruz	CA	
Jeannette Welling	Thousand Oaks	CA	
Mona Wells	Los Angeles	CA	
Margaret Wessels	Aptos	CA	
Alice Wetterlund	Los Angeles	CA	
Luann Wherry	San Diego	CA	
Linda Whetstine	Poway	CA	
Gretchen Whisenand	Santa Rosa	CA	
Pat Whitaker	Encinitas	CA	
Lori White	Sacramento	CA	
Vilma White	Temecula	CA	
T.W. White-Henry	Carmel	CA	*At last, an intelligent response to the need for thoughtful protection of the denizens of our seas and skies. Let's stop the continual destruction of our ecosystems...and save our planet's resources for us and for our children.*
Carol Whitehurst	Mckinleyville	CA	
Hollis Whiting	Pacific Grove	CA	
Laura Whitnell	El Dorado Hills	CA	
Christina Whittemore	Oceano	CA	

Sherri Whittenburg	Antioch	CA	
Jill Wiechman	Newbury Park	CA	
Chuck Wieland	San Ramon	CA	
Katherine Wiese	Carmel Valley	CA	
Richard Wightman	Arcadia	CA	
Antoinette Wilcox	Sunnyvale	CA	
Robert Wilkerson	San Diego	CA	
Susan Wilkinson-Bacchi	Pilot Hill	CA	
Jennifer Will	Morgan Hill	CA	
J.L.T. Williams	Huntington Beach	CA	
Jayna Williams	Pomona	CA	
Michael Williams	Burbank	CA	
Sara Williams	Cherry Valley	CA	
Shawn Williamson	Studio City	CA	
Georgann Wilmot	Volcano	CA	
Carol Wilson	Mckinleyville	CA	
Chris Wilson	Aptos	CA	
Mary Ann Wilson	Los Angeles	CA	
Merlin Wilson	Salinas	CA	
Tamar Diana Wilson	La Jolla	CA	
Arlene Wiltberger	San Carlos	CA	
Olga Winbush	Lancaster	CA	
Ken Windrum	Los Angeles	CA	
Amanda Withrow	Los Angeles	CA	
Melissa Witte	San Anselmo	CA	*RHINOCEROUS AUKLETS AND TUFTED PUFFINS NEED FOOD, TOO!*
Andreas Wittenstein	Woodacre	CA	
Wendy Wittl	Santa Barbara	CA	
Michael Wittman	Thousand Oaks	CA	
Bruce Wodhams	Concord	CA	
Marc Woersching	Valley Village	CA	
Maurice Wolf	Laguna Woods	CA	
Charles Wolfe	Sylmar	CA	
Loretta Womack	Nuevo	CA	
Michelle Wong	South Pasadena	CA	
Lauren Wood	Los Angeles	CA	
Monica Wood	Calabasas	CA	
Stephanie Wood	Antioch	CA	
Chris Worcester	Truckee	CA	
Edmund Wright	Trinidad	CA	
Jim Wright	Murphys	CA	
Madeline Wright	Los Angeles	CA	
Aimee Wyatt	Long Beach	CA	
Ashley Wyatt	Los Angeles	CA	
Lawrence Yard	Lompoc	CA	
Bryann Ybarra-Weckmann	Willows	CA	
Dennis Young	Pismo Beach	CA	
John D. Zoidberg	Irvine	CA	
Leonard Zoll	Escondido	CA	
Stephen Zaharias	Lompoc	CA	

Guy Zahller	Aptos	CA	
Eric Zakin	San Mateo	CA	
Lynn Zamarra	Berkeley	CA	
Joan Zawaski	Oakland	CA	
Jamie Zazow	Santa Monica	CA	
Tim Zemba	Los Angeles	CA	
Paula Zerzan	Sonoma	CA	
Alysha Zgrabik	Thousand Oaks	CA	
R. Zierikzee	San Francisco	CA	
Cindy Zimmermann	Imperial Beach	CA	
Katie Zukoski	Chico	CA	
Suzanne A'Becket	Cupertino	CA	
Bev Abbey	Morro Bay	CA	
Vinaya Alahan	Guerneville	CA	
Dave Alexander	Bellflower	CA	
Dennis Allen	Santa Barbara	CA	
Kathy Anaya	Studio City	CA	
Emily Anderson	San Francisco	CA	
Marsha Armstrong	Los Gatos	CA	
Mirdu Arya	Fremont	CA	
Ed Atkins	Boulder Creek	CA	
Lynda Austin	Sacramento	CA	
Mabel Ayotte	Santa Ana	CA	
Ter Badger	Paso Robles	CA	
John Balsano	Winnetka	CA	
Carol Banever	Los Angeles	CA	
Joyce Banzhaf	Grass Valley	CA	
Patricia Barnes	Concord	CA	
Dennis Barrett	Sunnyvale	CA	
Julie Barrett	Chico	CA	
Melissa Beckoff	Hesperia	CA	
Gail Bedinger	Rio Vista	CA	*Now is the time to protect our Pacific marine species for the future.*
Jorge Belloso-Curiel	Richmond	CA	
Annie Belt	San Jose	CA	
Shauna Bernie	Agua Dulce	CA	
Judith Bernstein	Arroyo Grande	CA	
Elizabeth Bias	Concord	CA	
Henry Biggins	Ukiah	CA	
Jane Biggins	Ukiah	CA	
Megan Bishop	Walnut Creek	CA	
Julie Bohnet	Willits	CA	
Sarah Brady	Los Angeles	CA	
Jason Brock	Los Angeles	CA	
Jeff Brown	Felton	CA	
Myrna Brown	Rosemead	CA	
Babette Bruton	Los Gatos	CA	
Kay Bushnell	Palo Alto	CA	
Vicki Call	Santee	CA	
George Capacete	Pico Rivera	CA	

Victor Carmichael	Pacifica	CA
Gaile Carr	Mount Shasta	CA
Steven Carr	Littlerock	CA
Nicole Carson	Calabasas	CA
Lillyan Cendejas	Brea	CA
Danny Chan	Sherman Oaks	CA
Beth Chaney	Galt	CA
Johanna Chavez	San Leandro	CA
Kim Chavez	Aptos	CA
Katrina Child	San Francisco	CA
Laura Collins	Sacramento	CA
Uma Cox	Brentwood	CA
Cecile Crane	S Lake Tahoe	CA
Tara Crimin	Redondo Beach	CA
Namita Dalal	Los Altos	CA
Sue Davies	Philo	CA
Matthew Davila	Modesto	CA
Renee De Vicq	Fullerton	CA
Dayna Deblanc	Quail Valley	CA
Baudouin Debrabandere	Santa Cruz	CA
Sheedy Dehdashti	Del Mar	CA
Gail Demirtas	Thousand Oaks	CA
Yolande Derenesse	Los Angeles	CA
Carol Dickason	Sonoma	CA
Aaron Dickens	Spring Valley	CA
Carla Dimondstein	Fort Bragg	CA
Colin Donohue	Fountain Valley	CA
Jennie Douglass	San Francisco	CA
Mynka Draper	Los Angeles	CA
George & Phyllis Drummond	Brentwood	CA
Richard Duran	Chino	CA
Eric Dynamic	Oakland	CA
Bita Edwards	Woodacre	CA
Denice Eldridge	Vacaville	CA
Nancy Ellestad	El Cajon	CA
John Elliott	Berkeley	CA
Glenn Embrey	Redondo Beach	CA
Angie Emery	Indio	CA
Robert Engelhard	Costa Mesa	CA
Dinda Evans	San Diego	CA
Lauren Ford	Venice	CA
Louis Fox	san geronimo	CA
K. Francis	Oakland	CA
Rex Franklyn	Tiburon	CA
Cec Frazier	Diamond Bar	CA
Sabine Freudiger	Oakland	CA
Erin Garcia	Sherman Oaks	CA
Karen Garnett	Sacramento	CA
Matthew Gilstrap	Long Beach	CA

Mark & Susan Glasser	Los Angeles	CA
Art Godinez	Chino Hills	CA
Roz Goldstein	Greenbrae	CA
Gus Gomez	San Francisco	CA
David Goodyear	San Francisco	CA
Nancy Gowani	Winnetka	CA
Beverly Graf	Shingle Springs	CA
Nina Greenberg	Los Angeles	CA
Barbara Gregorio	San Diego	CA
Probyn Gregory	Tujunga	CA
Jonathan Guerra	Sherman Oaks	CA
Josh Gutier	Monrovia	CA
John Harris	Pittsburg	CA
Nancy Hartman	Lafayette	CA
Deni Havercroft	Placerville	CA
Jason Hay	San Pedro	CA
Gary Hennemuth	San Francisco	CA
Susan Herting	Oakland	CA
Bruce Hirayama	Los Angeles	CA
Bernard Hochendoner	Patterson	CA
Kyva Holman	Oakland	CA
Elaine Huff	San Francisco	CA
Yvonne Hyatt	San Francisco	CA
Donald Ja	Redding	CA
Quinton C James	Los Angeles	CA
Darynne Jessler	Valley Village	CA
Tania Jesus	Newport Beach	CA
Frederique Joly	Venice	CA
Lee Kaplan	Encino	CA
Mike Kappus	San Francisco	CA
Jumpei Kato	Culver City	CA
Rich Kekule	El Sobrante	CA
Craig Kleber	Los Angeles	CA
Diana Kliche	Long Beach	CA
Joyce Kolasa	Springville	CA
Rebecca Koo	San Jose	CA
Vicki Kopinski	Menifee	CA
Julie Kramer	San Francisco	CA
Doug Krause	Fargo	CA
Heather Krish	San Diego	CA
Sharon Lacy	Sebastopol	CA
William Lawson	Calimesa	CA
Vicki Leidner	San Francisco	CA
Linda Lemieux	Lakewood	CA
Nicholas Lenchner	Santa Rosa	CA
Maxine Lewis	Oakland	CA
Barb Lincoln	Walnut Creek	CA
Lindsey Loperena	Santa Cruz	CA
Patty Lotz	Santa Monica	CA

Jaclyn Loughbom	Manhattan Beach	CA
Janet Maker	Los Angeles	CA
Jacquie Malette	West Covina	CA
Elise Mallove	Topanga	CA
Jesse Marcus	Santa Monica	CA
John F Martinez	Los Angeles	CA
Janus Matthes	Sebastopol	CA
Ronald Maxson	Los Angeles	CA
Mickey Mccarthy	San Francisco	CA
Julian Mcintyre	Laguna Beach	CA
Blue Mcright	Venice	CA
Michael Meredith	Palmdale	CA
Tracy Meyers	Oceanside	CA
Annika Miller	Mill Valley	CA
Francie Mitchell	Alamo	CA
Melinda Montano	Carson	CA
Patricia Moore	Los Angeles	CA
Mary Etta Moose	San Francisco	CA
Alecia Morgan	Felton	CA
Maria Muldaur	Mill Valley	CA
J Neal	Rutherford	CA
Pam Nelson	Warner Springs	CA
Amanda Oetzel	San Francisco	CA
K Olson	Bodega Bay	CA
James Page	Petaluma	CA
Susie Park	Long Beach	CA
John Pasqua	Valley Center	CA
Lynne Pateman	Los Angeles	CA
Karin Peck	Carmichael	CA
Daniel Penunuri	Bellflower	CA
Anne Perkins	Santa Monica	CA
E Perkins	Talmage	CA
Judy Perry	Fremont	CA
Jerry Persky	Santa Monica	CA
Lautreen Picciani	Fort Bragg	CA
Pam Plummer	Long Beach	CA
Jeri Pollock	Altadena	CA
Judith Pope	Venice	CA
Ds Powell	Clairmont	CA
Leslie Rabb	West Hollywood	CA
Sidney Ramsden Scott	Carmel By The Sea	CA
Natalie Reed	Carlsbad	CA
Steven Richards	Fremont	CA
Dale Riehart	San Francisco	CA
Michael Rifkind	Santa Cruz	CA
Nancy Riggleman	Tollhouse	CA
James Roberts	Sugarloaf	CA
Les Roberts	Fresno	CA
Brandy Romero	Whittier	CA

Monica Romero	San Francisco	CA	
Sam Romero	Stockton	CA	
Rob Rondanini	Roseville	CA	
Ralph Roug	Lake Forest	CA	
Linda Rudin	Daly City	CA	
Susan Rudnicki	Manhattan Beach	CA	*As a resident of Manhattan Beach, CA, and a member of the Marine Mammal Center and International Bird Rescue, two locally acting waystations for rescuing and re-habbing stranded sea creatures, I have seen first-hand the difficult time these animals have when their food supply is inadequate. Stranded seal pups, skeletal pelicans, starving whales -- the stripping of the oceans by factory ships of forage fish is a reality. I do not subscribe to the notion that all this suffering is simply "La Nina or El Nino" weather patterns. Homo sapiens is wreaking havoc by indiscriminate and unsustainable fishing practices facotry ship fishing. In no part o fNature is the wholesale stripping of life without restraint going to continue for long.*
Jan Salas	Kentfield	CA	
M Sanders	Petaluma	CA	
Selga Sanders	Venice	CA	
Michael Sarabia	Stockton	CA	
Steve Scheiblauer	Monterey	CA	
Jon Schell	Los Angeles	CA	
Jon Schroeder	Novato	CA	
Jo Sebern	Fallbrook	CA	
Yoko Senesac	Torrance	CA	
Sandra Sheehy	Dublin	CA	
Sundae Shields	Oxnard	CA	
Jon Siegfus	Norwalk	CA	
Jim Slaybaugh	Clovis	CA	
Jon Spar	Palo Alto	CA	
Whit Sparks	Novato	CA	
Lori Stayton	sherman oaks	CA	
Barry Stelling	Sonoma	CA	
Alice Stottko	Santa Clarita	CA	
Jewels Stratton	San Francisco	CA	
Donald Struggles	Oceanside	CA	
Gary Stuart	Studio City	CA	
Kirsten Sullivan	Cloverdale	CA	
Sean Sullivan	Woodacre	CA	
Melissa Ta	San Leandro	CA	
Michael Tanz	San Jose	CA	
Melvin Taylor	Sacramento	CA	
Geraldine Teitelbaum	Garberville	CA	
Simon Tejada	Baldwin Park	CA	
John Thies	San Rafael	CA	
Pauline Thom	Santa Ana	CA	
Dave Tindel	Capitola	CA	
Karen Toyohara	La Mesa	CA	
Aiting Tung	Newbury Park	CA	
Marcy Vaj	Venice	CA	
Anne Van Oppen	Palos Verdes Estates	CA	

Mathias Van Thiel	Hayward	CA	
Elijah Van Wormer	Napa	CA	
'Gina Vanegas	Encino	CA	
Anne Veraldi	San Francisco	CA	
Enrico Verga	Seal Beach	CA	
Joe And Mary Volpe	Ventura	CA	
Pat And Bruce Von Alten	Yreka	CA	
Victoria Von Keyserling	Santa Rosa	CA	
Victoria Wallace	Dulzura	CA	
Steve Walworth	La Crescenta	CA	
Carolyn Watkinson	Atwater	CA	
Vincent Weis	Sacramento	CA	
Philip Welanko	Vallejo	CA	
Heather Wilber	Santa Cruz	CA	
Doris Ann Wilcox	Burbank	CA	
Wandis Wilcox	Aptos	CA	
Bernie Williams	Canoga Park	CA	
Bennye Willis	Los Angeles	CA	
Robin Wilmoth	pebble beach	CA	
Betty Winholtz	Morro Bay	CA	
Joie Winnick	Sherman Oaks	CA	
Elaine Wohl	Fresno	CA	
Scott Woker	San Diego	CA	
Cybele Wolf	Soquel	CA	
Shirley Wong	San Francisco	CA	
Enel Woods	El Segundo	CA	
Kate Woods	Paicines	CA	
Linda Wright	Hornchurch	CA	
Pam Wright	Pasadena	CA	
Sheila Wyse	Sherman Oaks	CA	
Paul Yaninas	San Francisco	CA	
Lorraine Yee	San Francisco	CA	
Katrina Zaleski	Corona	CA	
Silvana Zelmanovich	Bsas	CA	
Naomi Zuckerman	Whitethorn	CA	
Cassie Bianchi	Clinton	CA	
Jason Barlow	Boise	ID	
Jane Beattie	Ketchum	ID	
William Blair	Boise	ID	
Amanda Campbell	Meridian	ID	
Joy Cassidy	Coeur D Alene	ID	*WE MUST PROTECT THE ENVIRONMENT OR RISK LOSING EVERYTHING INCLUDING OUR HEALTH AND WELFARE.*
Lisa Comtaruk	Bellevue	ID	
Cheryl Costigan	Spirit Lake	ID	
Barb Crumpacker	Coeur D Alene	ID	
Gloria D'Andrea	Cataldo	ID	
Linda Erdmann	Ketchum	ID	
Kenneth Fisher	Pinehurst	ID	
Bob Fitzgerald, M.A.	Tetonia	ID	
Stephen Hackney	Grangeville	ID	

Shawna Harbaugh	Jerome	ID
Grace Himmelberger	Boise	ID
Max K. Hueftle	Pocatello	ID
Don Johnson	American Falls	ID
Thomas Keenan	Coeur D Alene	ID
Gene Mc Govern	Troy	ID
Al Mcglinsky	Nampa	ID
Katherine Noble	Hailey	ID
Melita Pepper	Post Falls	ID
Tari Price	Pocatello	ID
Rick Priebe	Pinehurst	ID
Dieter Reger	Nürnberg	ID
Ronda Reynolds	Idaho Falls	ID
Lynn Savonen	Careywood	ID
Sue Schmidt	Idaho Falls	ID
Melissa Sharp	Eagle	ID
Kathleen Sylva	Hansen	ID
Earth Thunder	Boise	ID
Dale Turnipseed	Twin Falls	ID
K Vincent	Blackfoot	ID
Doug Wagoner	Post Falls	ID
Mark Weber	Twin Falls	ID
Mandy Weeks	Nampa	ID
Cynthia Williams	Boise	ID
Mark Berria	Eagle	ID
Lori Bevan	Boise	ID
Tom Kovalicky	Grangeville	ID
Susan Rooke	Boise	ID
Gustaf Sarkkinen	Moscow	ID
Vadim Melerzanov	Brooklyn	NY
Steven Adcock	Portland	OR
Harriet Adams	Eugene	OR
Mike Allen	Troutdale	OR
Vincent Alvarez	Milwaukie	OR
Hector R. Amaro	Salem	OR
Darryn Ambrose	Portland	OR
Carol Ampel	Medford	OR
Diana Anderson	Roseburg	OR
Nikki Anderson	Portland	OR
Sue Anderson	Aloha	OR
Kthryn Andrew	La Grande	OR
Terry Andrews	Gold Beach	OR
George Angus	Warrenton	OR
Barbara Arlen	Corvallis	OR
Susanna Askins	Portland	OR
Steve Aydelott	Bend	OR
Betty Bahn	Yachats	OR
Sugata Bhattacharya	Portland	OR
Scott Bandoroff	Ashland	OR

Peter Barry	Joseph	OR	
Emily Bartha	Portland	OR	
Anna Becker	Hillsboro	OR	
Margaret Bell	Portland	OR	
Bonnie Bennett	Eugene	OR	
B Bentley	Medford	OR	
Corie Bento	Albany	OR	
James Bernard	Portland	OR	
Sarah Bice	Portland	OR	
Karen Blasche	Hillsboro	OR	
Dana Bleckinger	Yachats	OR	
Sheila Bob	Portland	OR	
William Bodden	Redmond	OR	
Rob Bodner	Portland	OR	
Patty Bonney	Portland	OR	
Paul Borcherding	La Grande	OR	
Tatiana Boyle	Portland	OR	
Karen Brandenburger	Tigard	OR	
Claudia Brandow	Bend	OR	
Jody Brassfield	Portland	OR	
Rene Breier	Portland	OR	
John Brennan	Troutdale	OR	
Bryan Brock	Portland	OR	
Tuleen Brown	Hillsboro	OR	
Cassandra Browning	Salem	OR	
Marie Burcham	Portland	OR	
Sharon Burge	Salem	OR	
Melissa Burke	Lake Oswego	OR	
Carol Burnett	Medford	OR	
Kirsten Burt	Portland	OR	
Susan Buswell	Milwaukie	OR	
Scott Carpenter	Portland	OR	
P. J. Carter	Corvallis	OR	
Therese Cartwright	Klamath Falls	OR	*Help support Klamath Basin Dam Removals.*
M.V. Cassell	Eugene	OR	
Kathy Casson	Portland	OR	
Rita Castillo	Springfield	OR	
Maxine Centala	Seal Rock	OR	
Heather Chapin	Portland	OR	
Hellene Chapman	Roseburg	OR	
Eileen Chieco	Ashland	OR	
Veroune Chittim	Selma	OR	
Caroline Choquette	Philomath	OR	
Mlou Christ	Portland	OR	
Rod And Rosemary Christensen	Eugene	OR	
Mary Cody	Ashland	OR	
Claire Cohen	Lake Oswego	OR	
Elizabeth Collins	Portland	OR	
Demelza Costa	Sweet Home	OR	

Alison Cottrill	Sisters	OR	
John Cox	Portland	OR	
Edward Craig	Eugene	OR	
Donna Crane	Eugene	OR	
Rebekah Creswell	Bend	OR	
Brayden Criswell	Lincoln City	OR	
Scott Crockett	Florence	OR	
Sara Crowley	Portland	OR	
Cheyne Cumming	Portland	OR	
Emily Dana	Nehalem	OR	
Amy Danielson	Portland	OR	
Wanda Darland	La Pine	OR	
Jody De La Vergne	Portland	OR	
Tony DeFalco	Portland	OR	*I am heartened to hear of the initial steps you have taken to protect forage fish species. I am an affected party in the management of these vitally important species because I am an avid birdwatcher, seafood eater and supporter of vibrant coastal economies. As you know, without healthy populations of forage fish the ecosystem breaks down. Forage fish convert primary production to energy for commercially important species like salmon and tuna, whose numbers have already been drastically reduced (due to mis-management). Please don't repeat the mistakes of the past! Take unmanaged species off the table. Elevate protection of currently managed species, including prohibitions. With factors like climate change affecting marine ecosystems in unknown ways, we can't afford to f around with these species.*
Christine DeMoll	Yachats	OR	*As the President of Ocean Haven Corporation, an Oregon Ocean Tourism business which depends on the benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
Susie Deagle	Milwaukie	OR	
D. Deloff	Beaverton	OR	
Margaret Denison	Corvallis	OR	
Lori Dennis	Eugene	OR	
Glyn Deputy	Ashland	OR	
Kacey Donston	Westlake	OR	
R. Stephen Dorsey	Dexter	OR	
D Draper	Albany	OR	
Patricia Dunham	Eugene	OR	
Valerie Eakins	Lake Oswego	OR	
Ben Earle	Portland	OR	
Elisa Edgington	Portland	OR	
Meaghan Edwards	Portland	OR	
Willow Elliott	Portland	OR	
Dianne Ensign	Portland	OR	
Paula Eppler	Portland	OR	
Manuela Felkl	Springfield	OR	
Angela Fazzari	Portland	OR	
Melanie Feder	Blodgett	OR	
Virginia Feldman	Portland	OR	
Lisa Field	Newport	OR	
Jamie Fillmore	Beaverton	OR	
Doby Finn	Monmouth	OR	

Cheryl Fisher	Milwaukie	OR	
Laurie Fisher	Tigard	OR	
Elizabeth Flake	Hood River	OR	
Laura Fleming	Eagle Point	OR	
Nancy Fleming	Portland	OR	
Rick Foster	Myrtle Point	OR	
Jen Fox	Albany	OR	
Tristan Francis	Portland	OR	
Doug & Mackenzie Freeman	Lake Oswego	OR	
John Fry	Salem	OR	
Sharon Fuller	Milwaukie	OR	
Lyle Funderburk	Portland	OR	
Tara Gallagher	Portland	OR	
Mary Garcia	Scotts Mills	OR	
Stockton Garver	Dallas	OR	
Marceline Gearry	Portland	OR	
Jim Geear	Medford	OR	
Toni Geer	Seal Rock	OR	
Gary Gilardi	Hood River	OR	
Lauren Gill	Portland	OR	
Monica Gilman	Estacada	OR	
Richard Glass	Eugene	OR	
Gene Gossett	Portland	OR	
Michael Gotmer	Eugene	OR	
Patrick Grady	Grants Pass	OR	
Charlie Graham	Hillsboro	OR	
Donnamae Grannemann	The Dalles	OR	
David Grant	Medford	OR	
L. Griffiths	Beaverton	OR	
Dena Grubaugh	Salem	OR	
Robert M. Hughes	Corvallis	OR	*As a West Coast resident, fishery biologist, and fish consumer who benefits from a healthy ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
George Hague	Astoria	OR	
Ron Hahn	Madras	OR	
Elizabeth Hale	Portland	OR	
Claudia Hall	Beaverton	OR	
Ross Hanig	Portland	OR	
Laura Hanks	Portland	OR	
Jo Hannan	Salem	OR	
Phil Hanson	Portland	OR	
Keeley Harding	Portland	OR	
Bill Harris	Portland	OR	
Ashley Harvey	Portland	OR	
Bobby Hayden	Portland	OR	
Helen Logan Hays	Oregon City	OR	
Bruce Hellemn	Portland	OR	
Travis Herb	Ashland	OR	
David Hermanns	Portland	OR	
Peggy Hess	Milwaukie	OR	*Please do ALL you can to protect the marine food web. The future of wildlife needs your help.*

Richard Heymann	Portland	OR	
Suzan Hill	Portland	OR	
Terry Hodgin	Veneta	OR	
Sharon Holford	Portland	OR	
Ann Hollyfield	Seal Rock	OR	
Lindsay Hope Kern	Portland	OR	
Tom Hopkins	Milwaukie	OR	
Karen Horton	Independence	OR	
Sondra Huber	Hillsboro	OR	
Jay Humphrey	Estacada	OR	
Tinsley Hunsdorfer	Portland	OR	
Gaylene Hurley	Medford	OR	
Bryce Hutchinson	Rogue River	OR	
Steven Jacobs	Portland	OR	
J Millynn James	Portland	OR	
Erica John	Hillsboro	OR	
Edward Johnson	Cannon Beach	OR	
Emily Johnson	Eugene	OR	
Devon Johnstone	Portland	OR	
Jennifer Jones	Portland	OR	
Ninette Jones	Portland	OR	
Sandra Joos	Portland	OR	
Thomas Kostes	Portland	OR	
Brad Kalita	Chiloquin	OR	
Franklin Kapustka	Aloha	OR	
Joel Kay	Milwaukie	OR	
Margaret Keene	White City	OR	
Annelise Kelly	Portland	OR	*A healthy, self-sustaining ecosystem is crucial to ensuring the survival of a diversity of marine fish, mammals and other creatures. Please preserve the populations of forage fish by engaging in careful, scientific protections.*
Julie Kelly	Portland	OR	
Mary Kimsey	Portland	OR	
Rebecca Kimsey	Sublimity	OR	
Joyce Kitzmann	West Linn	OR	
Randal Klefbeck	Milwaukie	OR	
Basey Klopp	Bend	OR	
Bette Koetz	Dexter	OR	
Meryle A. Korn	Portland	OR	
Marjorie Kundiger	St. Helens	OR	
Sharon Lee	Bend	OR	
Patricia Lakin	Eugene	OR	
Rick Lambert	Independence	OR	
Jesse Laney	Portland	OR	
Thomas Lange	Portland	OR	
G L Leblanc	Eugene	OR	
Pat Lebaron	Medford	OR	
Joyce Leggatt	Portland	OR	
Susan Lemer	Elmira	OR	
Candy Lenigan	Rockaway Beach	OR	

Jonathan Levy	Eugene	OR	
Kimberly Lewis	Eugene	OR	
Alicia Liang	Portland	OR	
Erin Lindholm	Portland	OR	
John M Long	Redmond	OR	
Karla Long	Albany	OR	
Charles Looney	Scappoose	OR	
Gerald Lorenz	Salem	OR	
Dean Loros	Eagle Point	OR	
Patricia Lovejoy	Helix	OR	
Diane Luck	Portland	OR	
Karen Mahan	Portland	OR	
William Mahoney-Watson	Lake Oswego	OR	
Emilie Marlinghaus	Bend	OR	*Thank you for considering these comments on a topic with such essential importance to developing and maintaining truly sustainable fisheries.*
Erin Marshall	Portland	OR	
Sarah Martin	Portland	OR	
Setsuko Maruki-Fox	Grants Pass	OR	
John Maré	Turner	OR	
Angie Mason	Phoenix	OR	
Rik Masterson	Portland	OR	
Lynne Matejcek	Ashland	OR	*Please consider your second step to protect our oceans from corporate negligence by enacting harsh laws, fines and funding for lawsuits to prevent toxic dumping, oil and gas pipelines and military actions that destroy sustainable ocean ecosystems globally.*
Jerry Mayo	Portland	OR	
Anne Mcavoy	Portland	OR	
Kate McCourt	Portland	OR	*As an Oregon resident of over 20 years, I've developed a strong personal interest in the health and protection of our oceans. Outside of my own feelings of attachment, it has become clear to me that the stability of our environment overall is severely impacted by the decisions we make nationally and internationally in business, energy and agricultural production. It's long past time to promote responsibility for the health and habitat of our national environment through our policies, and to mandate businesses to factor their practice's environmental impacts into their decision making at the highest level of priority. We are all responsible for the stewardship and preservation of the fragile environmental health of the United States, it's inhabitants - be they human or animal - and our shared oceans.*
Emily Mcgehee	Portland	OR	
Wendy Mcgowan	Eugene	OR	
Kenneth Mecham	Gresham	OR	
Corinne Meehan	Eugene	OR	
Warren Menges	Tillamook	OR	
Char Messinger	Aloha	OR	
Jayme Miller	Oregon City	OR	
Irene Mills	Portland	OR	
Gregory Monahan	Lake Oswego	OR	*Forage fish are an important part of the ocean ecosystem. Protecting them is important to the health and well being of many other animals.*
Melda Montgomery	Yamhill	OR	

Chris Moser	Corvallis	OR	
Gerald Moss	Unity	OR	
Roy Moss	Grants Pass	OR	
Stuart Moyle	Port Orford	OR	
April Muilenburg	Milwaukie	OR	
Mark Mullbock	Portland	OR	
Kate Mullins	Portland	OR	
Grace Neff	Albany	OR	*What would our Oceans be without forage fish? More of our larger fish would go extinct without food to sustain them.*
Zachary Nelms	Portland	OR	
Kimber Nelson	Portland	OR	
Michael Nelson	Monroe	OR	
Saren Nelson	Corvallis	OR	
Randall Nerwick	Milwaukie	OR	
David S. Nichols	Portland	OR	
N Niswonger	Salem	OR	
Emma Nolan	Portland	OR	
Kay Novak	Corvallis	OR	
Barry O'Farrell	Otis	OR	
Maureen O'Neal	Portland	OR	
Barry Oaks	Eugene	OR	
Stephen Oder	Corvallis	OR	
Stephen Oder	Corvallis	OR	
Sandra Oliver-Poore	Salem	OR	
Samuel Orchard	Yachats	OR	
Paul Ordway	Eugene	OR	*As a former shrimper on the West coast, I witnessed large catches of bait fish in the trawls we used and would like to see a fish extrusion method developed to reduce the by-catch. If it did not reduce the total shrimp take, it would be helpful for the fish and also would reduce the work load for the deck hands.*
Ananda Osterhaus	Portland	OR	
Anita Parish	Sweet Home	OR	
Jacqui Parker	Portland	OR	
Jennifer Parks	Portland	OR	
Richard Pasichnyk	Eugene	OR	
Carol Pattee	Hillsboro	OR	
Deneen Peckinpah	Ashland	OR	
Martha Perez	Portland	OR	
Mary Peterson	Newport	OR	
Jackie Pierce	Salem	OR	
Lona Pierce	Warren	OR	*I am an Oregon resident who wants a sustainable marine ecosystem, and forage fish are a critical component. We cannot continue to increase consumption of fish stocks without eventual collapse of not only forage fish, but of all the species that depend on them. We could lose species like tuna, salmon, bass, rock fish, swordfish and other large fish, as well as marine mammals and seabirds.*
Julie Pittenger-Stanley	Oak Grove	OR	
R. David Poehner	Beavercreek	OR	
Christopher Pond	Glide	OR	
Diana Portwood	Lincoln City	OR	
Dee Potter	Bend	OR	

Melissa Presa	Astoria	OR	
Steven J. Prince	Eugene	OR	
Dean Pryer	Eugene	OR	
Margaret Quentin	Portland	OR	
Phoebe Quillian	Talent	OR	
Cherie Reeves-Rutledge	Central Point	OR	
Jay Richards	Bend	OR	
Leilani Roberts	Eugene	OR	
Corinne Randall	Portland	OR	
Jill Riebesehl	Portland	OR	
Robert J Walker	Brightwood	OR	
Brock Roberts	Portland	OR	
Mary Roberts	Portland	OR	
Berklee Robins	Lake Oswego	OR	
Kathryn Robinson	Gladstone	OR	
Cassie Robles	Hillsboro	OR	
Janice Rogers-Levy	Portland	OR	
Lisette Root	Cave Junction	OR	
Eric Ross	Sweet Home	OR	
Lee Ann Ross	Bend	OR	
Meg Ruby, M.S.	Portland	OR	*I live near the Pacific Ocean on the West Coast. I fish and gather mollusks and am an avid birder. Fish and birds and I benefit greatly from a vibrant ocean. As a scientist, I know a sustainable ecosystem depends on a well-functioning marine food web.*
Stephanie Rufner	Beaverton	OR	
Kathleen Sand	Yachats	OR	
Stuart Sandler	Portland	OR	
Debra Saude	Sweet Home	OR	
Dan Sauer	Salem	OR	
David Saul	Eugene	OR	
Ellen Saunders	Manning	OR	
Maria Sause	Newport	OR	
Robert And Dolores Scheelen	Medford	OR	
Debbie Schlenoff	Eugene	OR	
Jaylen Schmitt	Portland	OR	
Casey Schnaible	Medford	OR	
Linda Schwartz	Cannon Beach	OR	
William See	Portland	OR	
Peter Sergienko	Portland	OR	
Susan Shampo	Brookings	OR	
Laura Sharp	Saint Helens	OR	
Marybeth Sharp	Grants Pass	OR	
Stuart R. Shaw	Salem	OR	
Sheila Shearer	Hood River	OR	
Steve Sheehy	Klamath Falls	OR	
Ian Shelley	Portland	OR	
Gabriel Sheridan	Portland	OR	
S Siegner	Portland	OR	
Karen Sinclair	Grants Pass	OR	
Daiv Skinner	Salem	OR	

Katherine Skirvin	Pendleton	OR	
Debby Smith	Portland	OR	
Jessica Smith	Sweet Home	OR	
Kristin Smith	Portland	OR	
Shirley Smith	Veneta	OR	*Thank you for your time and consideration in this urgent matter.*
Linda Snyder	Salem	OR	
Tammy Spencer	Beaverton	OR	
Paul Spindel	West Linn	OR	
Nathan Stang	Portland	OR	
Nicole Staudinger	Portland	OR	
Donna Steadman	Portland	OR	*PLEASE ACT BEFORE IT'S TOO LATE!*
Christine Steele	Portland	OR	
Katherine Stewart	Eugene	OR	
Mariya Stimson	Beaverton	OR	
Wade Stoddard	Portland	OR	
J Stufflebeam	Oregon City	OR	
John M. Sully	Ashland	OR	
Violet Sunderland	Dallas	OR	
Kristen Swanson	Springfield	OR	
Jenny Sweeney	Portland	OR	
John Tangney	Happy Valley	OR	
F. Taylor	Waldport	OR	
Marci Taylor	Tigard	OR	
Oakley Taylor	Bend	OR	
Sarah Teubner	Portland	OR	
Bob Thomas	Myrtle Creek	OR	
Kimberly Tice	Portland	OR	
Ann Tiedeman	Beaverton	OR	
A. Todd	Eugene	OR	
Laurie Todd	Portland	OR	
Debora Tramposh	Portland	OR	
Robert Tull	Medford	OR	
Shawn Tvrz	Milwaukie	OR	
J. Gregory Twain	Portland	OR	
James Tyree Ii	Portland	OR	
Michelle Unger	Hillsboro	OR	
Natalie Van Leekwijck	Beaverton	OR	
Satya Vayu	Portland	OR	
Mary Lyn Villaume	Portland	OR	*Please do this in April, don't put it off*
Sarah Vito	Eugene	OR	
Travis Walters	Portland	OR	
Jeff Walton	Bend	OR	
Rose Wasche	Lake Oswego	OR	
Larry Watson	Salem	OR	
Susan Wechsler	Corvallis	OR	
Wendy Welborn	Medford	OR	
Bob Welsh	Salem	OR	
Katharine Wert	Dundee	OR	
Marlies Wessbecher	Brookings	OR	

Mark Wheeler	Portland	OR	
Jeffrey White	Forest Grove	OR	
Lois White	Grants Pass	OR	
Shirley White	Springfield	OR	
Gary Wickham	Port Orford	OR	*As a West Coast resident and a member of the Redfish Rocks Marine Reserve Community Team, I believe a sustainable ecosystem depends on a well-functioning marine food web.*
Sarah Wiebenson	Portland	OR	
Kelly Wieber	Portland	OR	
Jeff Wieland	Bend	OR	
Genevieve Windsor	Talent	OR	
John Witte	Portland	OR	
Keith Woelbing	Eugene	OR	
Alex Woolery	Portland	OR	
Shannon Zambito	Portland	OR	
Linda Zigich	Medford	OR	
Laura Zimmerman	Springfield	OR	
Susan Zimmerman	Gilchrist	OR	
Roy Adsit	Portland	OR	
Jerry Anderson	Portland	OR	
Bruce Bauer	Gold Hill	OR	
Janet Belisle	Eugene	OR	
Patricia Carcasses	Portland	OR	
Ann Cobb	Portland	OR	
Jonnel Covault	Portland	OR	*It is WRONG to feed ocean sustaining sardines to chickens, livestock and farm fish!!!!*
Shane Daugherty	Bandon	OR	
Sarah Daus	Portland	OR	
Ed Davie	Forest Grove	OR	
Michele Dickson	Portland	OR	
Jessamyn Johns	Portland	OR	
Kathleen Johnson	Beaverton	OR	
Loretta Johnson	Portland	OR	
Janet Karas	Portland	OR	
Sharla Keith	Aloha	OR	
Diana Kekule	Florence	OR	
Carolyn Latierra	Corvallis	OR	
Ric Levendosky	Oregon City	OR	
Stu Lips	Eugene	OR	
Betty Lowman	Scotts Mills	OR	
William Mac Bean	White City	OR	
Michele Mcferran	Lake Oswego	OR	
Max Mensing	Yachats	OR	
Patricia Misner	Cannon Beach	OR	
Jan Nelson	Eugene	OR	
Tina Palmer	Drain	OR	
Michele Paul	Gleneden Beach	OR	
Debra Poscharscky	Portland	OR	
Theo Ramey	Portland	OR	
Dana Robinson	Portland	OR	

Ryan Rounkles	Eugene	OR	
Fabian Smith	Portland	OR	
Tonie Tartaglia	Newport	OR	
Susie Thomson	Siletz	OR	
Annie Van Domelen	Fairview	OR	
Ann Watters	Salem	OR	
Sandra Wiley	Eugene	OR	
Carl Yoshida	Gresham	OR	
Marguery Lee Zucker	Eugene	OR	
Mike Acker	Vancouver	WA	
Winnie Adams	Bellingham	WA	
Crystal Aguilar	Bellevue	WA	
Colleen Albert	Covington	WA	
Gary Albright	Snohomish	WA	*Please, do not allow the marine food chain in the Pacific Ocean to collapse. That would be a horrible event that would take many years to undo.*
Debi Aldrich	Covington	WA	
Joan Allen	Seattle	WA	
Paul Allen	Olympia	WA	
Terri Allen	Deming	WA	
Toby Allphin	Ellensburg	WA	
Glen Anderson	Lacey	WA	
Christine Armond	Shelton	WA	
David Arntson	Bothell	WA	
Connie Arveson	Lake Tapps	WA	
April Atwood	Seattle	WA	
Linda Bainbridge	Greenbank	WA	
Norman Baker	Sequim	WA	
Robert Ball	Spokane Valley	WA	
Raymond Ballweg	Bellingham	WA	
Brian Baltin	Seattle	WA	
Robert Bamford	Seattle	WA	
Wesley Banks	Vancouver	WA	
Lynne Bannerman	Seattle	WA	
Nick Barcott	Lynnwood	WA	
Margery Barlow	Packwood	WA	
Allison Barr	Everett	WA	
Faye Bartlett	Bellingham	WA	
Megan Batch	Everett	WA	
Janine Baughn	Spanaway	WA	
Herbert A Beddoe	Bothell	WA	
Earlene Benefield	KIrkland	WA	
Gary Bennett	Bellingham	WA	
Patricia Bereczki	Vancouver	WA	*Please take care of our ecosystem.*
Susan Berta	Greenbank	WA	
Betty Bigelow	Seattle	WA	
Rachael Bigham	Seattle	WA	
Scott Bishop	Olympia	WA	
Anna Blake	Seattle	WA	
Mindy Blaski	Seattle	WA	

David Boggs	Washougal	WA	
Christian Bookter	Goldendale	WA	
Jc Bower	Sumner	WA	
Shary Bozied	Seattle	WA	
Tobi Braverman	Olympia	WA	
John Bremer	Bellingham	WA	
Cassy Brown	Nine Mile Falls	WA	
Lindsey Brown	Everett	WA	
Robert Brown	Fircrest	WA	
John Bryan	Kelso	WA	
Wally Bubelis	Seattle	WA	
Tony Buch	Seattle	WA	
Julie Budd	Bellingham	WA	
Janis Bunch	Olympia	WA	
Dl Bunting	Gig Harbor	WA	
Sherry Bupp	Redmond	WA	
WP Lyssie Burden	Port Townsend	WA	*Courageous and effective action to protect forage fish is needed NOW!*
Jack Burg	Seattle	WA	
Tim Burns	Federal Way	WA	
Eric Burr	Mazama	WA	
Lowell Bushey	Pullman	WA	
Beatrice Calame	Bothell	WA	
Rev Callahan	Yelm	WA	
Cami Cameron	Vancouver	WA	
Karen Campbell	Renton	WA	
Gary Carone	Vancouver	WA	
Sue Carpenter	Sequim	WA	
Glen Carroll	Seattle	WA	
Scott Cecile	Everett	WA	
Betty Chan	Seattle	WA	
Philip Chanen	Seattle	WA	
Noryne Chappelle	Vancouver	WA	
David Cheney	Steilacoom	WA	
Jerry Chilson	Enumclaw	WA	
Wayne Clark-Elliott	Renton	WA	*If this measure is not implemented we will be in danger of the whole fishery industry in our country.*
Marcia Clarke	Bothell	WA	
Robyn Cleaves	Tacoma	WA	
Judith Coates	Tacoma	WA	
Annapoorne Colangelo	Clinton	WA	
Sandra Cole	Vancouver	WA	
Timothy Coleman	Republic	WA	
Steven Coles	Everett	WA	
Susan Collicott	Seattle	WA	
Amy Collins	Seattle	WA	
Lyle Collins	Yakima	WA	
Randall Collins	Seattle	WA	
Mike Conlan	Redmond	WA	
Patrick Conn	Kent	WA	

James Cooke	Kennewick	WA	
Emily Copeland	Renton	WA	
Conor Corkrum	Seattle	WA	
Allison Cox	Vashon	WA	
Kenneth Crandall	Bellevue	WA	
Lia Craven	Tacoma	WA	
Lisa Critchlow	Lummi Island	WA	
Mary Crittendon	Vancouver	WA	
Norman Crouter	Seattle	WA	
Beth Dannhardt	Zillah	WA	
Roger Darden	Vancouver	WA	
Ruth Darden	Seattle	WA	
Margaret Davies	Pullman	WA	
Amanda Davis	Seattle	WA	
Galen Davis	Seattle	WA	
Suska Davis	Olympia	WA	
Trish Davis	Tacoma	WA	
Susan Dawson	Renton	WA	
Brandie Deal	Bothell	WA	
Francis Deering	Seattle	WA	
Martha Delaney	Seattle	WA	
Ben Demar	Seattle	WA	
Penny Derleth	Deer Park	WA	
Eileen Deutsch	Port Townsend	WA	
Donna Diduch	Seattle	WA	
Eli Dimond	Shoreline	WA	
Del E. Domke	Bellevue	WA	
Rowena Donelson	Ferndale	WA	
Taryn Dorsey	Seattle	WA	
Lina Downes	Friday Harbor	WA	
Eleanor Dowson	Mill Creek	WA	
Shelli Drummer	Olympia	WA	
Sandra Dubpernell	Coupeville	WA	
John Dunn	Vashon	WA	
Tim Durnell	Rice	WA	
Danny Dwinell	Shoreline	WA	
Leslie Eickemeyer	Spokane	WA	
Ted Ebert	Coupeville	WA	
Jonathan Edwards	Edmonds	WA	
Stephen Eichelberger	Tacoma	WA	
Leah Eister-Hargrave	Seattle	WA	
Stephen Ekholm	Bainbridge Island	WA	
Glenn Eklund	Oak Harbor	WA	
Jan Ellis	Gig Harbor	WA	
Carol Else	Lakewood	WA	
Don Ely	Tacoma	WA	
Esmeralda Espinaco	Bellevue	WA	
Keith Fabing	Seattle	WA	*As a practicing aquatic ecologist, I thank you for agreeing to develop a Fishery Ecosystem Plan.*
Gill Fahrenwald	Olympia	WA	

Kathleen Faulkner	Anacortes	WA	
Phino Fernandez	Olympia	WA	
Sharon Fetter	Puyallup	WA	
Jane Finch	Seattle	WA	
Carolyn Fletcher	Issaquah	WA	
Ashley Fowler	Seattle	WA	
Larry Fox	Freeland	WA	
Rodolfo Fralnco	Seattle	WA	
Kathleen Francis	Sedro Woolley	WA	
Paul Franzmann	Walla Walla	WA	
Roxann Fraser	Seattle	WA	
Glen Freeman	Vancouver	WA	
Nancy Friday	Kenmore	WA	
Steve Friedrick	Steilacoom	WA	
Ann Frodel	Poulsbo	WA	
Kramer Fry	Olympia	WA	
Gail Fuhlman	Spanaway	WA	
Carol Fulcher Hepburn	Shelton	WA	
Charles Gadway	White Salmon	WA	
Maradel Gale	Bainbridge Island	WA	
Sergey Galushko	Edmonds	WA	
Craig Garcia	Friday Harbor	WA	*The commercial and non-commercial fish food pyramid relies on the forage fish to exist and with their demise come the collapse of the commercial fishing industry.*
Suz Garcia	Bellevue	WA	
Hannah Gardner	Brier	WA	
Jim Gayden	Vancouver	WA	
Craig Geiger	Olympia	WA	
Steve Gibbs	Seattle	WA	
John Gieser	Seattle	WA	
Ivy Giessen	Marysville	WA	
Stuart R Gillespie	Oroville	WA	*We are involved in work to provide more spawning habitat for returning salmon and steelhead in the Similkameen River tributary to the Okanogan River. Insuring that salmonids will have the sustaining energy to reach these spawning habitats depend upon the availability of rich forage food before they make their journey home to spawn. Again, I urge you to take action to protect forage fish off the Pacific Ocean coastline to give salmonids the energy they need to return home.*
Hal Glidden	Bellingham	WA	
Richard Glynn	Bremerton	WA	
Randy Godfrey	Bellingham	WA	
Alice Goss	Clinton	WA	*This would be a great start for management and protections*
Joyce Grajczyk	Kent	WA	
Lee Ann Greaves	Spokane	WA	
Holly Green	Anacortes	WA	
Bonnie Gretz	Coupeville	WA	
Jenny Gronholt	Tacoma	WA	
Antonia Guerra	Camano Island	WA	
Sheila Gunerius	Mount Vernon	WA	
Rand Guthrie	Snohomish	WA	

Anita Gwinn	Amboy	WA	
Margaret Hashmi	Bellingham	WA	
Lynn Hays	Langley	WA	
Janet Hada	Snohomish	WA	
June Hale	Lakewood	WA	
Carolyn Hall	Renton	WA	
Heather Hall	Seattle	WA	
Suzanne Hamer	Woodinville	WA	
Jason Hann	Redmond	WA	
Jens Hansen	Bellingham	WA	
Donna Hanson	Pullman	WA	
Lera Hanson	Tacoma	WA	
Bruce Harpham	Federal Way	WA	
Nathaniel Harrison	Seattle	WA	
Thomas Hart	Seattle	WA	
Lorraine Hartmann	Seattle	WA	
Florence Harty	White Salmon	WA	
Anne Harvey	Coupeville	WA	
Jo Harvey	Pacific	WA	
Lloyd Hedger	Tacoma	WA	
Jill Hein	Coupeville	WA	
Jill Heishman	Seattle	WA	
Domingo Hermosillo	Kent	WA	
Amy Heyneman	Bainbridge Island	WA	
Elizabeth Hickman	Auburn	WA	
Richard Hieronymus	Friday Harbor	WA	
Deborah Hill	Tacoma	WA	
Michael And Barbara Hill	Elbe	WA	
Karen Hiller	Kelso	WA	
Sally Hodson	Olga	WA	
Lehman Holder	Vancouver	WA	*We all know that fisheries are extremely important to America's west coast.*
Janice Holkup	Seattle	WA	*The Japanese earthquake and tsunami with the tsunami debris now washing up on our west coast shores should be a wake up call that we are all connected and interdependent. Little fish support bigger fish.*
Julie Holtzman	Snohomish	WA	
Deborah Homenko	Port Angeles	WA	*It is an absurdity to ignore the value of these small fish.*
Blair Hopkins	Kennewick	WA	
Kat Hostetlerlo.L.Llo	Vashon	WA	
William Howald	Marysville	WA	
Monique Huang	Issaquah	WA	
Carole Huelsberg	Port Townsend	WA	
Raymond Hutchinson	Seattle	WA	
Thomas Hutton	Bellingham	WA	
Winfield Hutton	Seattle	WA	
Jausen Hyldahl	Seattle	WA	
Lura Irish	Lakebay	WA	
Danya Jablon	Mercer Island	WA	*Thank you for doing this important work.*
Nancy Jacques	Bainbridge Island	WA	

Jennie Jaeger	Kirkland	WA	
Jane Jaehning	Oak Harbor	WA	
Gayle Janzen	Seattle	WA	*We can't keep decimating forage fish and expect the ocean food chain not to collapse. These fish feed many other fish which feed many other mammals, including humans. And now with so many fish farms taking over with the need for forage fish to feed them, they need all the protections they can get. I urge you to enact these measures as soon as possible.*
Sue Jarrard	Castle Rock	WA	
Anna Jarvis	Shelton	WA	
Donnie Jenkins	Renton	WA	
Pam Jenkins	Olga	WA	
Paul Jenkins	Renton	WA	
Patricia Jerrells	Shelton	WA	
Lisa Jester	Vancouver	WA	
Jeanne Joannides	Fox Island	WA	
Angie Johnson	Seattle	WA	
Brittany Johnson	Seattle	WA	
Leslie Johnson	Vancouver	WA	
Mary Johnson	Seabeck	WA	
Stephen Johnson	Vancouver	WA	
Robert Johnston	Flagstaff	WA	
Alwyn Jones	Lopez Island	WA	
Clayton Jones	Seattle	WA	
Randy Jones	Eltopia	WA	
Dorothy Jordan	Lynden	WA	
Brookie Judge	Seattle	WA	
Brandon Juhl	Mercer Island	WA	
Kevin Kreiss	Seattle	WA	
Blair Kangley	Seattle	WA	
Marla Katz	Seattle	WA	
Robert And Julia Kenny And Glover	Clinton	WA	
Peg Keough	Sammamish	WA	
Kathy Kestell	Spokane	WA	
Kristine Kibbee	Castle Rock	WA	
Sara King	Auburn	WA	
Mary Ann Kirsling	Pasco	WA	
Walt Kloefkorn	Loon Lake	WA	
Stephen Koepp	Mukilteo	WA	
Ellen Kohjima	Tacoma	WA	
Shirley Konizeski	Snohomish	WA	
Summer Kozisek	Bonney Lake	WA	
Robb Krehbiel	Seattle	WA	
Geri Kromminga	Vancouver	WA	
Mark Krukar	Seattle	WA	
Mike Lyman	Colville	WA	
Nadine Lavonne	Seattle	WA	
Corbin Lambeth	Seattle	WA	*As a biologist I am deeply concerned with the fragmentation and deterioration of our "web of life". I believe a sustainable ecosystem and the prosperity of our nation depends on a well-functioning marine food web.*

Tanya Lasuk	Kennewick	WA	
Charlene Lauzon	Lynnwood	WA	
Julie Lawell	Seattle	WA	
Gene Lawson	Lynnwood	WA	
Lora Lehner	Port Orchard	WA	
Hugh Lentz	Olympia	WA	
Brian Lewis	Marysville	WA	
James Lewis	Puyallup	WA	
Eric Lind	Seatac	WA	
Robert Lindberg	Vancouver	WA	
P Lindsay	Seattle	WA	
Virgene Link	Anacortes	WA	
Robert Lix	Graham	WA	
Delphi Locey	Seattle	WA	
Saab Lofton	Seattle	WA	
J. Logan	Redmond	WA	
Sammy Low	Ferndale	WA	
Richard Lunt	Seattle	WA	
David Luxem	Burien	WA	
K Lyle	Gig harbor	WA	
Greg Lyman	Kirkland	WA	
Mary Mcmackin	Vancouver	WA	
Vicky Miller	Edmonds	WA	
Anne Mack	Mercer Island	WA	
Justin Maddox	Lake Stevens	WA	
Michaelene Manion	Port Orchard	WA	
Robin Mann	Covington	WA	
Lynda Maraby	Spokane	WA	
Scott Marckx	Port Townsend	WA	
Shannon Markley	Seattle	WA	
Kristin Marshall	Auburn	WA	*Healthy forage fish and their habitat is vitally important to me not only intrinsically, but I know it is important to the Puget Sound economy and tourism. It is essential for species throughout the food chain.*
Linda Martin	Colville	WA	
Millard Martin	Hansville	WA	
Rob Masonis	Seattle	WA	
Linda Massey	Seattle	WA	
Stephen Matera	Seattle	WA	
Pat Matheny-White	Tumwater	WA	
Marietta Matthews	Ellensburg	WA	
Christopher Matthias	Seattle	WA	
Barbara Matthiessen	Port Orchard	WA	
Nancy Mattson	Seattle	WA	
Donna Maupin	Seattle	WA	
Elizabeth Maupin	Seattle	WA	
Sheila Mccandlish	Mount Vernon	WA	
Ai Mccarthy	Redmond	WA	
Bonny Mccormick	Vancouver	WA	
Evan Mccoy	Seattle	WA	

Malinda Mcdonnell	Seattle	WA	
Rev. L G Mcduffie	Seattle	WA	
Rebecca Mcelhiney	Rochester	WA	
William Mcgunagle	Spokane	WA	
Megan Mcinnis	Snoqualmie	WA	
Barbara Mckee	Vancouver	WA	
Janice Mclaughlin	Bellingham	WA	
Christine Mclean	Gig Harbor	WA	
Linda Mcphee-Zitter	Sammamish	WA	
Audrey Meade	Seattle	WA	
Ramona Menish	Bellingham	WA	
Alexey Merz	Seattle	WA	
Raelyn Michaelson	Seatac	WA	
Claire Mikalson	Farmington	WA	
Carole Miller	Vancouver	WA	
Dave Miller	Camas	WA	
John Miller	Bellingham	WA	
Kristina Miller	Seattle	WA	
Jim Milstead	Bellingham	WA	*IT'S WHERE WE EVOLVED!!!!!!! Let's hope we never become dry behind our ears.*
Shelley Minden	Seattle	WA	
Dave Moazed	Leavenworth	WA	*It would be tragic not to safeguard forage fish that salmon and steelhead depend on while continuing to spend millions of dollars restoring those same ESA listed species.*
Betty Montgomery	Vancouver	WA	
Jodie Ann Mori	Seattle	WA	
Ali Mosa	Poulsbo	WA	
Tina Mulcahy	Bothell	WA	
James Mulcare	Clarkston	WA	
Diane Mulholland	Port Hadlock	WA	
Julie Munoz	Mountlake Terrace	WA	
Kathleen Murphy	Newcastle	WA	
LIndsay Myers	Concrete	WA	
Rhema Neas	Snohomish	WA	
Danne Neill	Bellingham	WA	
Katherine Nelson	Kent	WA	
Matthew Nelson	Kent	WA	
Joe Neumann	Seattle	WA	
Jen Newcomb	Seattle	WA	
Bridgid Persephone Newman-Henson	Seattle	WA	
Tu-Quyen Nguyen	Bellingham	WA	
John Niendorf	Friday Harbor	WA	
Jerry Nokes	Newman Lake	WA	
Janet Norem	Lake Forest Park	WA	
Tara Noteboom	Longview	WA	
Mary-Margaret O'Connell	Olympia	WA	
Julie O'Donnell	Seattle	WA	
Michael O'Neill	Tacoma	WA	
Pam Obst	Seattle	WA	
J B Oedarce Sr	Seattle	WA	

Marylin Olds	Kingston	WA
Lynne Oulman	Bellingham	WA
Elaine Packard	Seattle	WA
Nicholas Page	Ferndale	WA
Jeffrey Panciera	Seattle	WA
Christy Papadakis	Bellevue	WA
Jeannie Park	Seattle	WA
Dorothy Parshall	Langley	WA
Sharon Parshall	Fall City	WA
Adina Parsley	Ferndale	WA
Hiroko Patterson	Silverdale	WA
Fay Payton	Carnation	WA
Phil Pennock	Seattle	WA
Karen Peralta	Kenmore	WA
Lela Perkins	Everett	WA
Nicole Perkins	Kirkland	WA
Shelly Peterson	Lakewood	WA
Ana Petrus	Seattle	WA
Joanne Pflepsen	Seattle	WA
Robert Pitman	Vancouver	WA
Johni Prinz	Ocean Shores	WA
Kelly Ragsdale	Longview	WA
Kelly Ragsdale	Longview	WA
Susan Ragsdale	Spokane	WA
Patrica Ranstrom	Vashon	WA
Pat Rasmussen	Olympia	WA
Lisa Read	Seattle	WA
Mark Redmond	Seattle	WA
Melissa Rees	Spokane	WA
Bill Rehberg	Bellevue	WA
Sarah Richards	Mukilteo	WA
James Roberts	Palouse	WA
Barbara Robinson	Spokane	WA
Kit Robinson	Woodinville	WA
Anne Roda	Seattle	WA
Forrest Rode	Seattle	WA
Patricia Rodgers	Kirkland	WA
Carol Rolf	Colville	WA
J Roo	Seattle	WA
Maggie Rose	Seattle	WA
Melissa Rose	Malo	WA
Barbara Rosenkotter	Deer Harbor	WA
Alina Rossano	Seattle	WA
Wonono Rubio	Port Townsend	WA
James Russell	Ocean Park	WA
J. S.	Woodinville	WA
Carol Scott	Bellingham	WA
Ivy Sacks	Vashon	WA
Zandra Saez	Spokane	WA

Ron And Marya Santi	Medina	WA	
Charles Sarin	Bellingham	WA	
Taen Scherer	Seattle	WA	
Jon Schill	Kirkland	WA	
Eileen Schimpf	Spokane	WA	
Dan Schneider	Seattle	WA	
David Schneider	Bellingham	WA	*We must be careful to protect the food sources for the higher trophic levels of fish which are important for commercial fisheries. If industrial demand for these lower trophic levels as feed for feeding livestock and poultry increases greatly the food chain of hte marine ecosystem will become seriously out of balance. We should focus on keeping the marine ecosystem in balance and not let commercial interests for other human uses of parts of this food chain overwhelm the system.*
Rick Schoen	Fox Island	WA	
Amy Schoppert	Tacoma	WA	
Ursula Schuh	Redmond	WA	
Ronlyn Schwartz	Langley	WA	
Denee Scribner	Ellensburg	WA	
Cathy Seay	Everett	WA	
Mary Sebek	Seattle	WA	
Spencer Selander	Castle Rock	WA	
Gregory Severson	Lynnwood	WA	
Paula Shafransky	Sedro Woolley	WA	
Fuoad Shashani	Normandy Park	WA	
Diane Shaughnessy	Tacoma	WA	
Heidi Siegelbaum	Seattle	WA	*As a West Coast tourism business and resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web. These measures are not just feel good actions but are indispensable to a functioning, sustainable economy. Fishing, nature based tourism and wildlife viewing (with conservation and historic preservation) are worth over $3 trillion/annually in the US and millions here in Washington State. A failure in the marine food system has dramatic and unintended effects on many other parts of the economy.*
Victoria Simmons	Clinton	WA	
Joseph Slepski	Renton	WA	
Angela Smith	Seatac	WA	
Darren Smith	Bainbridge Island	WA	
Devin Smith	Seattle	WA	
Diana Smith	Seattle	WA	
Leslie Smith	Bellingham	WA	
Mike Smith	Seattle	WA	
William Sneiderwine	Vancouver	WA	
Ronda Snider	Gig Harbor	WA	
John Spencer	Edmonds	WA	
Elicia Spotts	Spokane	WA	
Patricia St August	Wenatchee	WA	
Darlene St. Martin	Mount Vernon	WA	
Kim Stanley	Bainbridge Island	WA	
Jack Stansfield	Stanwood	WA	
Jeff Steenbergen	Seattle	WA	
Monica Stephenson-Dailey	Vancouver	WA	

Carol Stevens	Mill Creek	WA	
Bob Stoddard	Spokane	WA	
Kim Streeter	Gig Harbor	WA	
Cathy Strum	Olympia	WA	
Jay Sullivan	Gig Harbor	WA	
Linda Swan	Snohomish	WA	
Daniel Swink	Vancouver	WA	
Rob Switalski	Mountlake Terrace	WA	
Thomas Swoffer	Ravensdale	WA	
Elizabeth Taylor	Seattle	WA	
Jeanne Taylor	Bellingham	WA	
Joe Thompson	Kalama	WA	
Debbie Thorn	Kirkland	WA	
Vaclav Tomek	Seattle	WA	
Stephanie Trasoff	Blaine	WA	
Teri Travis	Seattle	WA	
Ted Treanor	Poulsbo	WA	
Lynne Treat	Chehalis	WA	
Dennis Tudos	Kent	WA	
Alexandra Tufnell	Bothell	WA	
John Tuxill	Bellingham	WA	*I reside less than 1/2 mile from the Puget Sound shoreline. The health of our marine ecosystems and our fisheries depend on an intact, healthy food web.*
William Ulich	Seattle	WA	
Ceharra Uebler	Buckley	WA	
Tim Upham	Tumtum	WA	
Steve Uyenishi	Seattle	WA	
Lisa Vandermay	Renton	WA	
Fabiola Vasquez	Seattle	WA	
Louis Vestuto	Tumwater	WA	
Karen Vincent	Burlington	WA	
Renee Vincent	Eastsound	WA	
John Vinson	Olympia	WA	
Jennifer Wheeler	Gold Bar	WA	
Jean Wa	Bellingham	WA	*We already face damaging ocean acidification and other climate change effects -- let's not add harvests of forage fish.*
Jeriene Walberg	Seattle	WA	
Kyle Waller	Puyallup	WA	
Sara Wallick	Enumclaw	WA	
Jonathan Walter	Tumwater	WA	
Jo Walters	Sprague	WA	
Scott Washburn	Seattle	WA	
Ardeth L. Weed	Edmonds	WA	
Diane Weinstein	Issaquah	WA	
Marie Weis	Fox Island	WA	
Wendi Werner	Everett	WA	
Preston Wheaton	Olympia	WA	
Earl White	Kent	WA	
Nancy White	Spokane Valley	WA	
Jack Whitney	Brush Prairie	WA	

Thomas Wicks	Bellevue	WA	
Scott Widdas	Silverdale	WA	
Stephen Wille	Vancouver	WA	
Irene Willey	Snohomish	WA	
Joseph And Diane Williams	Lacey	WA	
Perry Williams	Tacoma	WA	
Kevin Willson	Port Angeles	WA	
Julie Wilson	Longview	WA	
Susan Wilson	Kent	WA	
Kathleen Wolfe	Des Moines	WA	
Craig Wollam	Mukilteo	WA	
Andrew Wollman-Simson	Deming	WA	
Susan Woltz	Burien	WA	*We must protect our planet; we have only one!*
Ken Woolard	University Place	WA	
Patti Wright	Bellingham	WA	
Jennifer Wyatt	Mountlake Terrace	WA	
Douglas Yearout	Lake Stevens	WA	
K. Youmans	Roslyn	WA	
Alex Zecha	Bellingham	WA	
Lauren Atkinson	Greenbank	WA	
Trina Cooper	Federal Way	WA	
John Corr	Des Moines	WA	
Diane Crummett	Soap Lake	WA	
Mercedita Del Valle	Port Townsend	WA	
Don Dicken	Ellensburg	WA	
Richard Donner	Eastsound	WA	
John Eschen	Grand Coulee	WA	
Laurie Geller	Camas	WA	
Delia Gerhard	Seattle	WA	
Charles Greenberg	Woodway	WA	
Cortney Greenlsw	Lakewood	WA	
Gaye Guida-Dennis	Seattle	WA	
Thomas Hall	Bellingham	WA	
Don Houck	Vancouver	WA	
John Huskinson	Seattle	WA	
Jeri Ichikawa	Renton	WA	
Erne Kegel	Colville	WA	
Catherine Keys	gig harbor	WA	
Thom Laz	Seattle	WA	
Connie Lloyd	Greenbank	WA	
David Ludden	Seattle	WA	
Nate Marino	Bellingham	WA	
Andrew Marshall	Seattle	WA	
Clayton Medeiros	Bellingham	WA	
Ronnie Mitchell	Bellingham	WA	
Madelaine Moir	Sequim	WA	
Jon Noggle	Bellingham	WA	
Lozz Kay	Warrington	WA	
Aa R	Olympia	WA	

Miguel Ramos	Bellingham	WA
Joyce Rauch	Auburn	WA
Nora Regan	Port Townsend	WA
Delaven Richardson	Ferndale	WA
David/Ms Molly Robinson/Detweiler	Curlew	WA
Constance Rodman	Seattle	WA
Francesca Rossellini	Port Orchard	WA
John Seeburger	Lakewood	WA
L Sherwood	Bellingham	WA
Baker Smith	Burien	WA
Mollie Smith	Chehalis	WA
William Smothers	Nordland	WA
Dan Stabel	Aberdeen	WA
Kat Thomas	Seattle	WA
Amy Walter	Seattle	WA
Ashley Williams	Seattle	WA
Sally Windecker	Clinton	WA

OCEANA | Protecting the World's Oceans
222 NW Davis Street, Suite 200
Portland, OR 97209 USA
+1.503.235.0278
oceana.org

March 29, 2013

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

RE: Agenda Item H.1. Final Fishery Ecosystem Plan

Dear Chairman Wolford and Council members:

Oceana commends the Pacific Fishery Management Council, the Ecosystem Plan Development Team (EPDT), and Ecosystem Advisory Subpanel (EAS) for the hard work and dedication to developing the first ever Fishery Ecosystem Plan for the California Current marine ecosystem. This Fishery Ecosystem Plan (FEP) has been a long time in the making: the Council first voted to move forward with incorporating ecosystem-based fishery management principles through an Ecosystem-Based Fishery Management Plan in November 2006. Over this time Oceana has had the opportunity to serve on the EAS and to help inform the purpose, goals and objectives of this plan. It is our view that this plan advances ecosystem-based fishery management in the Pacific Region and that the Council should adopt and finalize the FEP at this April 2013 meeting. Further, we urge you to commence with FEP Initiative 1 to protect unmanaged forage species.

This FEP does not replace the existing Fishery Management Plans (FMPs), but it does advance fishery management under its four existing FMPs by introducing new Council objectives, new theories, new scientific findings, and new ecosystem initiatives to coordinate "management policies…across its Fishery Management Plans (FMPs) and the California Current Ecosystem (CCE)."[1] The FEP describes the needs for ecosystem-based management, including the need to "provide adequate buffers against the uncertainties of environmental and human-induced impacts to the marine environment by developing safeguards in fisheries management measures, and develop new and inform existing fishery management measures that take into account the ecosystem effects of those measures on CCE species and habitat..."[2]

While we ask that you finalize the FEP at this meeting, it is imperative that the Council continue to advance the purpose of this FEP. We request that the Council:

1. **Commence "FEP Initiative 1" by establishing an ad hoc committee that would immediately begin the process to prohibit fishing for unmanaged lower-trophic level (forage) fish, by simultaneously:**

    a. Amending the federal list of allowable fisheries and gear, and

    b. Protecting forage species through existing FMP authority.

[1] PFMC, February 2013. Pacific Coast Fishery Ecosystem Plan, Public Review Draft, Purpose and Need at 1.
[2] Id.

2. **Continue to schedule annual State the California Current Ecosystem reports, including an annual index of forage abundance, diversity, and thresholds to assess the ecosystem-level impacts of fishing on prey availability.**

3. **Develop an "optimum yield" initiative that would assess and specify ecological factors used in developing Status Determination Criteria, Annual Catch Limits, and Annual Catch Targets for management in the existing FMPs.**

Oceana supports the Council's "intent to recognize the importance of forage fish to the marine ecosystem off our coast, and to provide adequate protection for forage fish." Furthermore we support the declared Council objective "to prohibit the development of new directed fisheries on forage species that are not currently managed by our Council, or the States, until we have an adequate opportunity to assess the science relating to the fishery and any potential impacts to our existing fisheries and communities."[3] While it will be beneficial for multiple reasons to revise the list of allowable fisheries and gear so that it more specifically reflects the actual fisheries and gear currently used in federal fisheries, it is clear that the mechanism to prohibit the development of new fisheries on forage species, hence meeting the Council objective, is through an FMP amendment process.

As recognized in the initiatives document and by the Council, the list of authorized fisheries and gear "would not wholly prohibit new fisheries from developing without Council consultation. Therefore, the second stage of the Council's guidance on protecting unfished forage fish is to incorporate any additional needed protections into the current suite of FMPs through an FMP amendment process (Final Council Action at G.1.d, June 2012)."[4] Therefore, we ask that the Council at this meeting complete any necessary actions so that it can initiate such as plan for an FMP amendment process at the June 2013 meeting, as previously agreed.

As your Ecosystem Plan Development Team has emphasized, global finfish and shrimp aquaculture are increasing faster than any other food sector, and this industry is dependent on feeds derived from wild-caught forage fish (i.e., lower trophic level species). As stated in the November 2011 PFMC Draft Ecosystem Plan:

> *Demand for LTL [lower trophic level] species in the production of fishmeal has mainly been driven by the spectacular growth of global aquaculture, which is expected to continue into the foreseeable future (Tacon and Metian 2008, Shamshak and Anderson 2008, Herrick et al. 2009). The production of many aquaculture species depends on LTL species fisheries to supply the raw ingredients in today's aquafeeds. In the recent boom in capture-based aquaculture, demand has increased for whole live/fresh/frozen LTL species for pen fattening aquaculture operations (Zertuche-Gonzales et al. 2008)… Given limited potential for increased fishmeal production from traditional LTL species, prices for fishmeal and fish oil will continue to rise (Figure A5). This makes the prospect for fisheries developing on the minor LTL species all that more*

[3] PFMC Decision, June 2012.
[4] PFMC February 2013. FEP Appendix A, at A-7.

> *attractive, as higher fishmeal prices are sure to translate into higher exvessel prices for the raw ingredients.*[5]

It is only a matter of time before the ever-increasing demand for fish meal and fish oil from the rapidly growing global aquaculture industry increases the price of these raw materials, hence making any species from which these products can be extracted economically viable, even if they do not appear viable today. In fact, we are already seeing this play out as the price of fish meal has increased substantially in recent years, as aquaculture's use of forage fish has more than doubled in the last two decades[6] and the global supply has decreased, largely due to the decline in landings from the Peruvian anchoveta fishery (the main global source of commodity fish meal and fish oil). We are already aware of international efforts to develop fisheries for some of the same forage species that are currently unmanaged off the U.S. West Coast (e.g., myctophids, saury, etc.).

Prohibiting forage fish fisheries from developing before they start is much easier politically and economically than closing fisheries after capital investments are made. Such prohibitions if properly designed can also provide clarity to parties interested in potentially developing such fisheries. Yet, like the Council's unanimous action in 2006 to prohibit directed fishing for krill, these precautionary actions are necessary *"to maintain the integrity of the ecosystem and to minimize the risk of irreversible adverse impacts on managed fish stocks and other living marine resources..*." [7] As such it is our view that no forage species should be excluded from a list of species for which fisheries could potentially develop. We support developing measures to protect the unmanaged forage fish identified in Table A-2 of Appendix A to the FEP.[8]

We do have concerns with the FEP Initiative 1 decision process described on page A-7 and A-8. Principally this section implies that the Council only has authority over a species if it occurs "exclusively or primarily within the U.S. West Coast EEZ." There is no logical or legal merit for this as the Council and NOAA clearly do have management responsibilities and authority over marine species that migrate into the West Coast EEZ for part of their life history and for species that do not "exclusively" reside in the West Coast EEZ.

Many of the Council's managed highly migratory species do not occur exclusively or primarily within the West Coast EEZ and yet NOAA and the Council still have management responsibilities and authority for them. Other species managed under the coastal pelagic species plan, groundfish plan and salmon plan also migrate in and out of the West Coast EEZ and some of these are in no way exclusive to or primarily within the EEZ. We see no logical or legal basis for including this specific criterion in the decision tree and we request that it be removed before final action is taken. In fact, this would set a negative precedent for the conservation of species, such as round and thread herrings that are primarily sub-tropical species yet are reasonably abundant off southern California and likely to expand their range due to global climate change. Similarly, Pacific saury which are at times in high abundance off the U.S. West Coast have a

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[5] PFMC Agenda Item H.2.a Attachment 1. November 2011. Draft Fishery Ecosystem Plan, page 32.
[6] Tacon, A.G.J., and Metian, M. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects. Aquaculture 285:146-158
[7] PFMC 2008. Management of Krill as an Essential Component of the California Current Ecosystem. Amendment 12 to the Coastal Pelagic Species Fishery Management Plan. Environmental Assessment. February 2008, at page 1.
[8] PFMC February 2013, FEP Appendix A, at A-10, A-11.

trans-Pacific distribution. Regardless of whether such species occur exclusively or primarily within the US West Coast EEZ, they may serve as key forage species for California Current predators, hence it is imperative that the Council include all forage species in its forage initiative.

Finally we are reminded that in taking final action on Groundfish FMP Amendment 23 and Coastal Pelagic Species Amendment 13 in 2010, the Council specifically voted to amend both FMPs to consider ecological factors in developing status determination criteria, annual catch limits, and annual catch targets. Status determination criteria include the maximum sustainable yield catch level and the overfishing levels. Such ecological factors should include species interactions, bycatch, predator-prey relationships, cross-cutting initiatives across FMPs, and maintaining the ecological roles of species under Council management. We believe bringing ecosystem science and consideration of ecological factors into the existing management framework are critical functions of this FEP. Despite the Council motion and amendments to the plans, we have yet to see any explicit consideration of ecological factors when determining catch levels and status determination criteria. We recommend a future “optimum yield” initiative that would assess and specify ecological factors used in determining optimum yield, status determination criteria and annual catch limits. The initiative would look at the ecological effects of fishing across FMPs with a bridge to the existing FMPs and the annual catch specifications processes.

Ultimately, since the FEP does not currently have regulatory authority, its value as a tool for ecosystem-based management will depend on the Council actively advancing its initiatives and spending future time and resources integrating the FEP with its existing FMPs, and potentially transitioning the FEP into a Fishery Management Plan with regulatory authority in the future. We look forward to continuing to work with the Council on such efforts. However, at this meeting it is essential that the Council adopt the FEP to set the stage for initiating the Forage Initiative at the June meeting.

Thank you for furthering the conservation of forage species and advancing ecosystem-based fishery management. We look forward to continuing to work with you.

Sincerely,

Ben Enticknap
Pacific Campaign Manager and Senior Scientist

1528 Castillo Street
Santa Barbara, CA 93101

Ocean Conservancy
Start a Sea Change

805.687.2322 Telephone
www.oceanconservancy.org

March 29, 2013

Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: Pacific Fishery Ecosystem Plan (FEP) And Ecosystem-based Fisheries Management Initiatives Document

Dear Chairman Wolford and Council Members:

Ocean Conservancy[1] is pleased to support final adoption of the Pacific Fishery Ecosystem Plan (FEP) at your April meeting, and urges the Pacific Fishery Management Council (Council) to proceed with implementation of Cross-FMP Ecosystem-based Fishery Management Initiative #1 to protect unmanaged forage species. In combination with ongoing efforts to identify and develop additional tools and strategies to assist in better incorporating ecosystem considerations into Council management, the FEP represents concrete leadership in ensuring the long term viability of fisheries on the West Coast. We appreciate the thorough effort involved in preparing the draft FEP and in developing related, supportive efforts such as the Annual State of the Ecosystem Report. We also commend the Council on identifying recommended procedures for linking the FEP and its Cross-Fishery Management Plan Ecosystem-based Fishery Management Initiatives (Initiatives) to ongoing Council decisions. We urge your final adoption of the FEP in April.

Our recommendations, in summary, are as follows:

- Adopt as final the public comment draft of the FEP and ecosystem-based initiatives document.
- Implement as soon as possible Initiative #1 to protect unmanaged forage species through FMP amendments and changes to the federal List of Authorized Fisheries and Gear. We urge development of a forage indicator with benchmarks and thresholds to track forage condition.
- Begin bringing ecosystem information and expertise to the stock assessment process through the process described in Chapter 6.
- Adopt the format and core indicators found in the inaugural report as permanent components of the Annual State of the Ecosystem Report.

[1] Ocean Conservancy is a non-profit organization that educates and empowers citizens to take action on behalf of the ocean. From the Arctic to the Gulf of Mexico to the halls of Congress, Ocean Conservancy brings people together to find solutions for our water planet. Informed by science, our work guides policy and engages people in protecting the ocean and its wildlife for future generations.

- Prioritize Cross-FMP ecosystem-based fishery management initiatives A.2.9, A.2.1, A.2.3, and A.2.4 to develop and apply the more well-defined and most applicable Initiatives early in the FEP process.

The large, productive California Current Large Marine Ecosystem is subject to a number of stressors such as large-scale fishing, climate change, coastal development and pollution. A growing body of science has begun to identify significant implications of these and other stressors for fisheries sustainability. Agencies with stewardship responsibility for natural resources across the United States are working to address and incorporate these considerations in support of their management decisions, integrating recent scientific information to more fully achieve the goals of economic and ecological sustainability.[2] The FEP is a sound, well-documented step in this process, identifying concrete ways to augment current management approaches with ecological context, dynamics and solutions. Though a non-regulatory document at this time, the FEP establishes a valuable foundation for better, more broadly informed choices, including those ecosystem-level concerns that are most appropriately addressed through cross-FMP actions.

Below we provide specific recommendations regarding the draft FEP, its proposed products, and future application in the long-term management and conservation of marine resources in the Pacific.

I. Implement Initiative #1

We urge final adoption of the public comment draft of the FEP and Initiatives document and immediate implementation of FEP Initiative #1.[3] Initiative #1 would provide protections for unmanaged forage species through FMP amendments, make changes to the federal List of Authorized Fisheries and Gear, and set the stage for the crucial step developing a forage indicator with benchmarks and thresholds. We urge development of this indicator tool.

Ocean Conservancy is encouraged by the work of the Council in refining the draft FEP and clarifying its structure and role at the November 2012 Council meeting. Establishing the ecosystem-based initiatives section as a stand-alone document, linked to but made more flexible than the FEP itself, will allow flexibility, refinement and evolution of the initiatives as new and additional data emerge and as capacity builds to develop and apply initiatives over time. Including the draft list of forage ("lower trophic level species") under initiative #1 will retain momentum in near-term work to address unmanaged fishing on forage species. Adding proposals to analyze cumulative fishing impacts, and developing a suite of ecosystem indicators to track under the Annual Report, brings specifics and continuity to the process of advancing ecosystem-based management.

The FEP's initial chapters provide valuable context to guide the integration of ecological information regarding the California Current Large Marine Ecosystem into Council management decisions. These opening chapters acknowledge the relative lack of established scientific procedures to quantify and analyze the relationship and cumulative effects of fishing on marine food webs, but recognize the significant progress being made regarding, for example, the ecosystem effects of fishing on lower-trophic prey species. Indeed, as the FEP illuminates, forage considerations represent an ideal initial step in operationalizing ecosystem-based fisheries management. As

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[2] See, for example, the National Fish, Wildlife and Plants Climate Adaptation Strategy: *National Fish, Wildlife and Plants Climate adaptation Partnership ,2012,* at
http://www.wildlifeadaptationstrategy.gov/pdf/NFWPCAS-Final.pdf

[3] *See* FEP Appendix A: Public Review Draft, A-4 (February 2013).

described, full implementation of Initiative #1 necessarily entails both modifying the federal List of Authorized Fisheries and Gear and developing additional protections through modification of one or more Council FMPs. We urge earliest possible initiation of the work to make these changes and bring forage base composition, abundance and distribution into the Council's decision making process by implementing ecosystem-based initiative #1.

II. Bring ecosystem information and expertise to the assessment process as described in Chapter 6

Chapter 6 identifies informational products that can inform Council decisions across a range of fisheries and management issues and proposes refinements to better incorporate ecosystem science into the Council process. An equally critical way Council decisions can be informed by ecosystem information, as described in Chapter 6, is to include ecological expertise within the Council's stock assessment teams. Including ecosystem scientists and ecologists on stock assessment teams will strengthen the multi-disciplinary process to developing assessments, and help to apply information such as trophic relationships, climate-driven recruitment variability, and habitat impacts. We urge the Council to begin bringing ecosystem information and expertise to its assessment process as soon as possible through the process described in Chapter 6.

III. Adopt the format and core indicators found in the inaugural report as permanent components of the Annual State of the Ecosystem Report

The FEPs Annual State of the Ecosystem Report (Annual Report) described in Chapter 6 should contain the ecosystem information most relevant to Council decision-making, and we urge adoption of the format and core indicators found in the first report for future reports. We also support development and use of a forage indicator as a permanent Annual Report component, and urge that, over time, this indicator be combined with benchmarks or thresholds of forage abundance against which to track and guide Council decisions.

IV. Cross-FMP ecosystem-based fishery management Initiatives

Several potential Initiatives have been identified in the FEP as meriting future work. The following are especially relevant for prioritization:

- Developing a list of core ecosystem indicators (A.2.9, Initiatives Document) to be tracked in the Annual Report would help establish structure for the Initiatives effort and help ensure the greatest utility of the Annual Report to the Council. Such a list would guide data gathering and the evolution of the foundational Integrated Ecosystem Assessment (IEA), as well as assist development of guiding benchmarks and thresholds that will optimize the role of indicators in the Council decision making process.

- The process described in the Initiatives document (section A.2.9)of assessing cumulative effects of Council catch policies merits prioritization, as it will allow the Council to evaluate the additive effects of fishing across FMPs and on an ecosystem scale and refine its catch policies to manage those impacts and achieve single-species and ecosystem-based management objectives.

- Prioritization of an initiative assessing the effects of catch policy on age- and size-distribution of fished species (A.2.1) is consistent with a growing body of scientific information on the importance of population demographics for productivity and sustainable yields. This initiative, therefore, has high relevance to the Council's management goals and objectives.

- A cross-FMP bycatch monitoring initiative, as described in the Initiatives Document (A.2.3), could serve to provide feedback to the Council to help address cumulative bycatch across FMPs and management strategies, and to apply management strategies and practices from a single FMP across the range of fisheries.

- The cross-FMP essential fish habitat identification initiative (A.2.4) would bring additional integration to essential habitat designations for all four Council FMPs, helping develop a sense of how these areas integrate and interact, aiding identification of research needs, and helping focus habitat issues facing species managed under multiple FMPs.

V. Conclusion

Ocean Conservancy thanks the Council for its commitment to ensuring the future viability of West Coast fisheries by advancing an ecosystem-based approach to management as reflected in the FEP and Cross-FMP Ecosystem-based Fisheries Management Initiatives Document. These documents provide the Council a stronger foundation for protecting ecosystem structure and function necessary to support sustainable, economically productive Pacific fisheries. We appreciate the opportunity to comment on these important matters, and look forward to working with the Council to continue developing and implementing comprehensive management approaches that ensure the continued viability of fisheries on the West Coast.

Sincerely,

Greg Helms
Manager, Pacific Program

Ivy Fredrickson
Staff Attorney, Conservation Programs

NATURAL RESOURCES DEFENSE COUNCIL

March 29, 2013

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

RE: Adopt Final Fishery Ecosystem Plan and Move Forward with Ecosystem-Based Initiatives

Dear Chairman Wolford and Council Members:

Please accept the following comments on behalf of the Natural Resources Defense Council (NRDC), in regard to Agenda Item H.1, adoption of the final Fishery Ecosystem Plan.

NRDC urges the Council to adopt the Pacific Coast Fishery Ecosystem Plan (FEP) at this meeting, along with Appendix A, the list of Ecosystem Initiatives. Substantial time and expertise have gone into preparing the FEP, and there is wide agreement that the information contained in that document will be helpful in understanding Pacific fisheries. Chapters 3 and 4 of the FEP helpfully bring together information on the California Current Large Marine Ecosystem, as well as on the effects of human activity and environmental changes. NRDC believes this broad perspective is useful, and we support the FEP as a tool for moving toward ecosystem-based fisheries management.

Once the FEP is adopted, the Council must start to integrate its recommendations into the management process. Chapter 6 of the FEP outlines two primary ways this can occur—by incorporating ecologists and ecosystem perspectives into the stock assessment process, and by using the annual State of the Ecosystem reports as a basis for decision-making. NRDC believes both of these ideas are good ones, and encourage the Council to adopt them. In doing so, the Council should specifically request that a forage indicator or index to be contained in the State of the Ecosystem reports. Providing this information year after year will create a useful benchmark in understanding forage patterns in the California Current.

We also strongly encourage the Council to move forward with the initiatives listed in the FEP Appendix, in particular Initiative 1, the protection of unmanaged forage species. We understand the effort to revise the Federal List of Allowable Fisheries contained at 50 C.F.R. § 600.725(v) is already underway, and we support finishing this work quickly, as well as doing other preparatory work so that the Council is situated to start working on FMP-level protections for forage species at its June meeting, consistent with the timetable provided in its June 2012 motion. Preparatory work should include forming an ad-hoc advisory committee of experts on the topic of forage, charged with developing recommendations for Council regulatory action and presenting those recommendations to the Council at the June 2013 meeting. This timeframe is realistic because much of the primary investigation and idea-generation has already taken place, and is in the record of Council materials from past meetings.

We hope these comments are helpful, and thank you for your consideration.

Sincerely,

Seth Atkinson
Oceans Program Attorney
Natural Resources Defense Council
111 Sutter Street, 20th Floor
San Francisco, CA 94104
(415) 875-6100

Pacific Seabird Group

DEDICATED TO THE STUDY AND CONSERVATION OF PACIFIC SEABIRDS AND THEIR ENVIRONMENT

PSG Website: www.pacificseabirdgroup.org

Douglas J Forsell
Chair
Point Arena, California
DJForsell@aol.com

Jo Smith
Chair-Elect
Smithers, British Columbia
josmith@birdsmith.ca

Stanley Senner
Vice-Chair for Conservation
Portland, Oregon
ssenner@oceanconservancy.org

March 30, 2013

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

Re: Agenda Item H.1 – Adoption of the Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford and Pacific Fishery Management Council Members:

The Pacific Seabird Group (PSG) strongly supports adoption of the Pacific Fishery Management Council's (Council) Fishery Ecosystem Plan (FEP). We urge the Council to take final action at its April meeting to adopt the FEP and to begin implementation of ecosystem-based initiative #1— the protection of unmanaged forage species.

The PSG is an international, non-profit organization that was founded in 1972 to promote the knowledge, study, and conservation of Pacific seabirds. It has a membership drawn from the entire Pacific basin, including Canada, Mexico, Russia, Japan, China, Australia, New Zealand, and the USA. The PSG's members include biologists and scientists who have research interests in Pacific seabirds, government officials who manage seabird refuges and populations, and representatives of nongovernmental organizations and individuals who are interested in marine conservation.

As a group, seabirds are now recognized as the most endangered birds in the world.[1] Thirty-percent face some threat of extinction[2,3] and many are exceptionally vulnerable to climate change.[4] Millions of seabirds, including at least 25 species during the breeding season and at

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[1] Croxall, J. et al. 2012. Seabird conservation status, threats and priority actions: a global assessment. Bird Conservation International 22:1-34.
[2] IUCN. 2010. Red List. http://www.iucn.org/about/work/programmes/species/red_list/
3 Newton, K., D. Croll, H. Nevins, Scott R. Benson, J. Harvey, B. Tershy. 2009. At-sea mortality of seabirds based on beachcast and offshore surveys. Marine Ecology Progress Series 392: 295–305, 2009
[4] North American Bird Conservation Initiative, U.S. Committee. 2010. The State of the Birds 2010 Report on Climate Change, United States of America. U.S. Department of the Interior: Washington, DC.

least an additional 35 species during their nonbreeding seasons, inhabit the area covered by the FEP—the U.S. portion of the California Current Large Marine Ecosystem.

Forage fish, like herring, smelt, sand lance, and eulachon, play a critical role in marine ecosystems, including supporting seabird populations. As a precautionary measure, the North Pacific Fishery Management Council acted in 1997 to prevent development of commercial fisheries on forage species, including capelin, sand lance and euphausiids, and to establish limits on maximum retainable bycatch amounts in directed fisheries.[5] Reliable stock-specific abundance estimates are needed before fisheries are developed, including baseline population estimate and trends over time. More information continues to be needed on the role of forage fish in the marine food web.

The Lenfest Forage Fish Task Force[6] recently completed its final report and recommendations regarding the management of forage fish fisheries that account for their unique life histories and ecological roles. One key recommendation was "an operational precautionary approach that defined levels of knowledge about stock health and ecosystem effects and appropriate limit and target reference points that should apply for each level."

The PSG is interested in this matter primarily for two reasons: seabirds require substantial quantities of prey for survival and reproduction, and seabirds are extremely sensitive to changes in prey abundance. Commercial fisheries may compete for prey species by changing the quantity of prey available to seabirds. There is significant evidence that the collapse of forage fish populations following fisheries exploitation have caused seabird breeding failures and population declines: for example, after the collapse of the anchovy fishery in South America (1950-1960s), the herring fisheries in Norway (1970s) and the capelin fisheries in the Barents Sea (1980s).[7]

Thresholds for the amount of prey have been recently estimated for 14 seabirds across seven ecosystems. Published in *Science*, the study by Cury et al. estimated that one-third of the maximum marine prey biomass is required to maintain seabird productivity.[8] Below that threshold, seabirds experience consistently reduced and more variable productivity.

The Marbled Murrelet provides one example of how a precautionary approach to protect unmanaged forage fish from exploitation could benefit seabirds. The murrelet, which is listed as threatened from California to Washington under the U.S. Endangered Species Act, forages predominately in the nearshore on a variety of forage fish, including small schooling fishes, such as sand lance, anchovy, herring, osmerids, and seaperch. While murrelets also forage on euphausiids and mysids during winter and spring, the fish portion of their diet is during summer and coincides with the nesting and fledging period. Changes in the abundance, distribution and

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[5] North Pacific Fishery Management Council. 1998. North Pacific Fishery Management Council agency report. Retrieved from: http://www.psmfc.org/tsc2/98_TSC_rpt/Npfmc98.html
[6] Pikitch, et al. 2012. Little fish, big impact: managing a crucial link in ocean food webs. Lenfest Ocean Program. Washington D.C., pp.108.
[7] Sydeman,W, J. Piatt, H. Browman, eds. 2007. Seabirds as indicators of marine ecosystems. Marine Ecology Progress Series 352: 199–204.
[8] Cury et al. 2011. Global seabird response to forage fish depletion—one third for the birds. Science 334: 1703-06.

quality of marine prey have been identified as factors in the decline of Marbled Murrelets[9], and ensuring an adequate prey base should be a priority going forward.

The PSG urges the Council to take final action at its April meeting to adopt the FEP and to begin implementation of ecosystem-based initiative #1—the protection of unmanaged forage species. These steps will help maintain the diversity and abundance of seabirds in the U.S. portion of the California Current Large Marine Ecosystem.

Please let me know if you have questions or if the PSG can provide additional information or perspectives.

Sincerely,

Stanley Senner
Vice-Chair for Conservation
4189 SE Division St.
Portland, OR 97202

---

[9] Recovery Implementation Team. 2012. Report on Marbled Murrelet Recovery Implementation Team meeting and stakeholder workshop. U.S Fish and Wildlife Service, Lacey, WA.

2310 SE Hawthorne Blvd
Portland, OR 97214
(503) 260-6552
oregonfreshfish@gmail.com

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

Re: Agenda Item H.1, Adoption of Pacific Coast Fishery Ecosystem Plan

Dear Council Members:

I am writing today to urge the Council to adopt the final Fishery Ecosystem Plan at the meeting in Portland and encourage you to immediately proceed with the first ecosystem-based initiative - providing additional protections for unmanaged forage species. Flying Fish Oregon is a local, family run business and we are proud to sell all sustainable seafood.

As a consumer, you have seafood choices. Not all fish and shellfish available in today's markets and restaurants are good choices from an environmental perspective. Populations of seafood vary over time, both naturally and depending on how heavily they are fished. Some are in good shape due in part to good fisheries management, and those are excellent seafood choices. However, to maintain economically valuable fish populations, there must be a healthy base of forage species.

Forage fish in the California Current are hugely important in terms of predator production as compared to any other ecosystem in the world. Therefore, there is potentially huge commercial value to leaving forage in the water as food for bigger, more lucrative fish. With the growing worldwide demand to use forage fish for high-volume purposes, it is important that we act proactively to maintain the food web in the California Current. Most forage fish caught off our coasts are not used for human consumption and are exported overseas where West Coast fishery managers have no control over their end use.

Thank you for continuing to pursue ecosystem-based management measures. I encourage the Council to move forward in adopting management protections for currently unmanaged forage species as soon as possible.

Sincerely,

Lyf Gildersleeve
Owner, Flying Fish Co.

AMERICAN CETACEAN SOCIETY

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

Dear Council members:

Thank you for allowing the public to comment on the fishery ecosystem plan. The mission of the American Cetacean Society is to protect whales, dolphins, porpoises, and their habitats through public education, research grants, and conservation actions. Our Chapter's focus includes education about the diversity of Oregon's cetaceans and promotion of whale watching in Oregon. We organize volunteers to help spot gray whales and other cetaceans along the Oregon coast.

The ecotourism industry has added considerable socioeconomic value in Oregon coastal communities. There are about 200 gray whales that do not go as far north as Alaska to feed in the summer. They feed along coasts of Oregon, Washington and British Columbia. These whales are seen very close to shore while feeding and there are several communities on the Oregon coast that engage in whale watching tours. In many places, whale watching provides valuable, sometimes crucial income to a community, with the creation of new jobs and businesses. It helps foster an appreciation of the importance of marine conservation, and provides a ready platform for researchers wanting to study cetaceans or the marine environment. Whale watching offers communities a sense of identity and considerable pride. In a number of places, it does all of the above, literally transforming a community.

Whales, dolphins, and porpoises face more challenges today than at any other time in history. More than ever before, we must explore innovative, strategic ways to ensure the protection, safety, and welfare of cetaceans, and restore the health and biodiversity of wild marine and riverine habitats. From a predator perspective, it is important that we protect prey species. Forage fish in the California Current are hugely important in terms of predator production as compared to any other ecosystem in the world. Forage contributes about 52 tons per square kilometer annually to the production of their predators on the Pacific coast. Therefore, we urge the Council to adopt the final ecosystem plan and take the first step toward protecting the marine food web. Adopting this ecosystem plan constitutes a major step forward in the transition to an ecosystem-based approach to fisheries management.

In addition, we urge the Council to begin working on the first ecosystem initiative to prohibit new fisheries on currently unmanaged forage fish until we can assess any potential impacts to existing communities and predators, like cetaceans and sea birds. Thank you for your work to protect our marine environment by advancing ecosystem-based management. We look forward to engaging throughout this process.

Sincerely,

Joy Primrose
President
American Cetacean Society – Oregon Chapter

Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: Pacific Fishery Ecosystem Plan (FEP) And FEP Initiatives Document

March 31, 2013

Dear Chairman Wolford and Council Members,

On behalf of our 70,000 members, Audubon California and the Audubon Society in Oregon write to congratulate the Council on its Fishery Ecosystem Plan (FEP) and to provide suggestions for its implementation.

While the FEP lacks regulatory authority, it does provide concrete and needed mechanisms to implement the Council's intent to protect unmanaged forage species, as well as to achieve Optimal Yield for managed species through Fisheries Management Plans (FMPs), especially the Coastal Pelagic Species FMP (CPS FMP). At your April meeting, we urge you to adopt the FEP as well as make motions to implement specific commitments. Some of these motions are especially important in light of the lack of regulatory authority of the FEP. We recommend the Council consider the following areas for motions at its April meeting:

1. **An intent to begin implementing ecosystem-based initiative number 1, as described in Appendix A of the FEP.**

We strongly urge the Council to take immediate steps to implement the intent of its June 24, 2012 motion "to prohibit the development of new directed fisheries on forage species that are not currently managed by the Council, or the States, until the Council has had an adequate opportunity to assess the science relating to any proposed fishery and any potential impacts to our existing fisheries and communities." The Appendix states that:

The Council is considering assigning a new ad hoc committee to more fully develop FEP Initiative 1, so that the Council and the public may receive advice from a body composed of persons with expertise more focused on lower trophic level species and their interactions with fisheries, either directly as target species, or indirectly as bycatch.

We would like to see the Council move to assign parties to form and manage this ad-hoc committee, and direct this committee to quickly develop tasks and associated timelines.

2. **A commitment to Optimum Yield in Managed Fisheries.**

In our letter to the Council dated October 18, 2012, and included in the Supplemental Materials for the Council's November 2012 meeting, we commented that the FEP must include the objective of providing adequate forage for dependent predators, an objective currently found only in the CPS FMP. Providing adequate forage for predators is a key component of achieving Optimum Yield, defined as the Maximum Sustainable Yield, reduced by relevant social, economic and ecological factors. Chapter 6.1 mentions that the Council's Science and Statistical

Committee has been “considering a process to bring ecosystem considerations into stock assessments” in order to improve the flow of information into assessments of Optimum Yield. We urge the Council to prioritize this exercise which is a prerequisite to creating harvest quotas that achieve Optimum Yield. Section 3.2.1.1 of the FEP begins to describe biological components of the California including high trophic level non-fish species in the California Current Ecosystem that rely on forage stocks in this geography. Our October 18, 2012 letter to the Council provides examples of recent analyses of the energetic requirements of recovering stocks of humpback whales and California sea lions, and non-recovering (in the CCE) Steller’s sea lions. We urge the Council to make a high priority the engagement of marine ecologists in stock assessments – starting with the CPS FMP - and the development of harvest control rules and associated catch quotas.

3. **Support the development and continuation of the State of the Ecosystem Report.**

In particular, prioritize the development of an annual index of forage abundance and diversity as a benchmark for forage availability to predators.

4. **Improved Council stewardship of Pacific herring through Potential Future FEP Initiatives.**

Audubon is deeply concerned with the status of Pacific herring, a critical prey item for seabirds and other marine wildlife including salmonids and humpback whales. Appendix A of the FEP notes that Pacific herring is one of the most essential prey items for CCS predators and is also the only one managed by all three states. Currently, there is a lack of coordination among states in Pacific herring management. In Section A.2.3 of the Appendix, Potential Future FEP Initiatives for Council Consideration, the Cross-FMP Bycatch and Catch Monitoring Policy rightly notes that:

Moving beyond the fishery-by-fishery approach could allow the Council to better assess issues like: the cumulative effects of the bycatch of non-Council species taken in Council-managed fisheries …

Pacific herring is an ecosystem component species of the CPS FMP due to its foundational importance as forage. We urge the Council to take two actions, both of which correspond to larger goals in the Potential Future FEP Initiatives for Council Consideration within Appendix A. First, improve understanding of bycatch of Pacific herring in Council-managed fisheries (A.2.3), and second, conduct bio-geographic assessments of key spawning and coastal aggregation sites for Pacific herring (A.2.2). We would like to see the Council move to implement for Pacific herring the following concept in the FEP:

To implement this initiative, the Council could assemble an ad hoc advisory committee to assess: data availability and quality for identifying finer scale sub-regions nested within the large bio-geographic regions of the CCE, and whether any of those finer scale sub-regions are appropriate for smaller-scale ecosystem-based fishery science and management. Identifying finer scale sub-regions within the CCE could help scientists and managers better assess sub-populations, regional management issues, and how the effects of management decisions may vary between sub-regions. Identifying sub-regions could also help the larger natural resource science and management community to better assess and understand connections between terrestrial and marine ecosystems at a smaller than coastwide scale. An advisory committee to develop this initiative could include federal, state, and tribal ecologists and habitat *scientists, fishing community representatives, fishery participants from each of the Council's four FMPs, and others the Council deems appropriate to the task.*

Our members are deeply concerned that seabirds and other marine predators, including commercially and culturally important salmon and other large fish, are increasingly threatened by a growing global demand for forage fish. This FEP holds tremendous promise as a blueprint for Council activities to protect our marine food web. We look forward to strong Council action to robustly implement the FEP.

Meryl Redisch

Meryl Redisch, Executive Director
Audubon Society of Portland

Anna Weinstein, Marine Program Manager
Audubon California

William Hering, President
Rogue Valley Audubon Society

Ann Vileisis, President
Kalmiopsis Audubon Society

Eric Clough, President
Cape Arago Audubon Society

Debbie Schlenoff, Conservation Chair
Lane County Audubon Society

Diana Wales, President
Umpqua Valley Audubon Society

David Harrison, Conservation Chair
Salem Audubon Society

West Marine

March 28, 2013

Dear Chairman Wolford and Council Members,

We appreciate the Council's efforts to date to develop a Fishery Ecosystem Plan (FEP) that will improve the management of our fisheries by bringing ecosystem science and considerations into the decision making process. We urge the Council to take final action at this meeting to adopt the FEP and to begin implementation of the first ecosystem-based initiative to protect unmanaged forage fish.

The ocean off of our West Coast faces increasing pressure from large-scale changes in climate, ocean acidification, habitat degradation, pollution, invasive species, and of course a rising demand for marine protein to feed a growing world. It is the Council's responsibility to manage our fisheries in a way that considers the broader ecosystem in order to ensure long-term sustainability. Protecting the ocean food web through the conservation of prey fish is a pillar of ecosystem-based management, which is why we strongly support the FEP's first initiative.

Sustainably managed fisheries are also critical for our bottom line here at West Marine. Providing for the long-term health of our ecosystem ensures that people will be fishing off the West Coast for generations to come, and that means good business for the marine industry and all the derivative economic benefits that help drive coastal economies. Healthy populations of forage fish make this all possible.

The Council's top priority should be to ensure the sustainability of the marine ecosystem and existing fisheries here on the Pacific coast. Adequate conservation of forage fish may be the single most important action the Council can take to protect the Pacific marine ecosystem – and the fishermen and coastal communities that depend on it.

Thank you for your time and you stewardship of our oceans.

Randy Repass

Randy Repass
Chairman

RR/ls

500 Westridge Drive Watsonville CA 95076 **Tel: 831.728.2700** Fax: 831.728.2736 **westmarine.com**

David Bitts
President
Larry Collins
Vice-President
Duncan MacLean
Secretary
Mike Stiller
Treasurer

PACIFIC COAST FEDERATION of FISHERMEN'S ASSOCIATIONS

W.F. "Zeke" Grader, Jr.
Executive Director
Glen H. Spain
Northwest Regional Director
Vivian Helliwell
Watershed Conservation Director
In Memoriam:
Nathaniel S. Bingham
Harold C. Christensen

STEWARDS OF THE FISHERIES

Please Respond to:

☐ **California Office**
P.O. Box 29370
San Francisco, CA 94129-0370
Tel: (415) 561-5080
Fax: (415) 561-5464

www.pcffa.org

☐ **Northwest Office**
P.O. Box 11170
Eugene, OR 97440-3370
Tel: (541) 689-2000
Fax: (541) 689-2500

28 March 2013

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

RE: Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

The Pacific Coast Federation of Fishermen's Associations (PCFFA) represents working men and women whose livelihoods are directly tied to a well-functioning Pacific marine ecosystem. We support the Fishery Ecosystem Plan and accompanying list of Ecosystem Initiatives now before you. On behalf of the working men and women whose livelihoods depend on a productive Pacific marine environment, we encourage the Council to adopt the plan and then move quickly on to the first ecosystem initiative to protect forage, or prey, fish that aren't currently fished or managed.

This plan represents a milestone for fishery management and sustainable fisheries on the Pacific Coast. In fully describing human and ecological impacts on the ecosystem, the proposed Fishery Ecosystem Plan (FEP) provides a clearinghouse of data that will be useful in helping the Council to make decisions informed by the best available science.

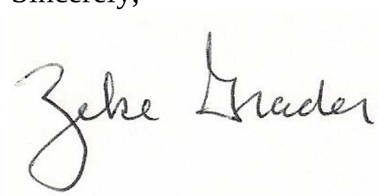
The Council is wise to include protection of unmanaged forage fish as its first Ecosystem Initiative. Low-trophic-level species such as sand lance, saury and smelts are among the category of plankton-consuming prey species that support economically important food fish targeted by small-boat commercial fishermen along the West Coast. Unfortunately, many species of prey fish are vulnerable to new fisheries starting at any time with no control and no assessment of the effect of a new forage fishery on predators like salmon, tuna, billfish, white bass, sablefish and halibut.

PCFFA has written or testified on the need to establish control over unmanaged forage species numerous times since November of 2011. The Council itself has also consistently expressed consensus over its desire not to allow new fisheries targeting forage species before it has had a chance to determine the effect on existing fisheries and coastal communities. We all agree that those questions should be answered before a new fishery begins, not after. That is why these fish should be included within appropriate Fishery Management Plans as soon as possible.

Once this initial Fishery Ecosystem Plan is adopted, we urge the Council to form an *ad hoc* committee to begin the process of implementing the initiative to protect unmanaged forage fish. This *ad hoc* committee should be prepared to present information needed by the Council to ensure progress is made on this initiative at the June meeting, when the issue of unmanaged forage fish comes before the Council again.

We urge the Council to adopt this plan and move expeditiously to the first initiative: Improving protection of forage fish as the key link in a healthy and resilient marine food web.

Sincerely,



W.F. “Zeke” Grader, Jr.
Executive Director

The Marine
Mammal Center

March 29, 2013

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

Re: Agenda Item H.1.c, Adoption of the Fishery Ecosystem Plan (FEP)

Dear Chairman Wolford,

On behalf of The Marine Mammal Center (TMMC), I write to support final action on the Fishery Ecosystem Plan (FEP).

The Marine Mammal Center is a nonprofit veterinary research hospital and educational center dedicated to the rescue and rehabilitation of ill and injured marine mammals - primarily elephant seals, harbor seals, and California sea lions. Since 1975, TMMC has been headquartered in Sausalito, CA in the Marin Headlands within the Golden Gate National Parks, and has rescued and treated more than 18,000 marine mammals.

The FEP is of great interest to TMMC as we endeavor to treat patients and study the causes of their illnesses, and seek to inspire greater stewardship of our coastal waters. As of this writing, TMMC is responding, with peer institutions along our coast, to an unusual morbidity event with California sea lions in southern California. Almost 1,000 sea lions have stranded, severely malnourished, since January of this year; in a more typical year, only 200 would have stranded. While it is not completely clear why this event is occurring, it is suspected that primary forage fish for this species are not at typical levels and may be a contributing factor.

Thank you for taking action in November to adopt the preliminary draft Pacific FEP and release it for public review. We applaud the inclusion of the draft list of California Current forage species into the section on FEP Initiative #1 and the creation of an initiative to develop a list of core ecosystem indicators to be tracked through the Annual Report. As the Council discussed in November, one core indicator should monitor the status of the forage base.

We urge the Council take final action on adopting the FEP at your meeting next month. Adopting a meaningful FEP is a major step forward in the national transition to an ecosystem-based approach to fisheries management. The top priority of the FEP should be to ensure a healthy ecosystem with the first key step protection of the marine food web. Following final adoption of the FEP, the Council

2000 Bunker Road · Fort Cronkhite · Sausalito, CA 94965 · Tel. 415.289.SEAL · Fax 415.289.7333 · MarineMammalCenter.org

Monterey Bay – PO Bo 778 – Moss Landing, CA 95039 – T 831.633.6298 – F 831.633.5927
San Luis Obispo – 1385 Main Street – Morro Bay, CA, 93442 – T 805.771.8300 – F 805.771.8304
Anchor Bay-Fort Bragg – T 415.289.SEAL

should proceed with its first ecosystem-based initiative by beginning the process of providing Fishery Management Plan (FMP)-level protections for unmanaged forage fish.

We strongly support the Council's decision to include the protection of unmanaged forage fish as its first Ecosystem Initiative. The objective of this initiative is to prohibit new fisheries on currently unmanaged forage fish until the Council can assess any potential impacts to existing fisheries and communities. We understand that the first phase of that initiative – to update the Pacific Fishery Management Council's List of Authorized Fisheries and Gear – is underway. In the FEP's discussion of this initiative, it is noted that the first phase alone is not enough to fully accomplish the objective. To do so, additional protections for unmanaged forage species must be implemented through a FMP amendment process as called for in the Council's June 2012 motion that establishes this initiative.

We urge the Council to adopt the Fishery Ecosystem Plan, and quickly move to achieve the goals of its first initiative by ensuring that forage fish are protected as the key link in a healthy and resilient marine food web.

Sincerely,

Dr. Jeff Boehm
Executive Director

2000 Bunker Road · Fort Cronkhite · Sausalito, CA 94965 · Tel. 415.289.SEAL · Fax 415.289.7333 · MarineMammalCenter.org

Monterey Bay – PO Bo 778 – Moss Landing, CA 95039 – T 831.633.6298 – F 831.633.5927
San Luis Obispo – 1385 Main Street – Morro Bay, CA, 93442 – T 805.771.8300 – F 805.771.8304
Anchor Bay-Fort Bragg – T 415.289.SEAL

From: **Lona Pierce** <alkpierce@colcenter.org>
Date: Sat, Mar 23, 2013 at 12:36 PM
Subject: Support the Fishery Ecosystem Plan and Ecosystem Initiatives
To: pfmc.comments@noaa.gov

Mar 23, 2013

Chairman Wolford and Council Members

I support the adoption of the Fishery Ecosystem Plan and the April list of Ecosystem Initiatives.

I am an Oregon resident who wants a sustainable marine ecosystem, and forage fish are a critical component. I request the Council to enact firm protections for forage fish that are vulnerable to unregulated fisheries.

I encourage you to take this precautionary measure as soon as possible. The Council's analysis, conducted in 2011, noted that industrial demand for forage fish is likely to grow more intense because of its value globally for feeding livestock, poultry and farmed fish. We cannot continue to increase consumption of fish stocks without eventual collapse of not only forage fish, but of all the species that depend on them. We could lose species like tuna, salmon, bass, rock fish, swordfish and other large fish, as well as marine mammals and seabirds.

Sincerely,

Lona Pierce
56498 Crest Dr
Warren, OR 97053-9616
(503) 397-5739

The following email is indicative of 92 that were received by the supplemental deadline.

From: **Spencer Miles** <spencermiles@gmail.com>
Date: Tue, Mar 26, 2013 at 5:31 PM
Subject: Protect forage fish - vital food for wild salmon and steelhead
To: danwolford@earthlink.net, pfmc.comments@noaa.gov

Dear Chairman Wolford,
I am very pleased to see that the Pacific Fishery Management Council is considering moving forward with their Fishery Ecosystem Plan (FEP). This plan if fully implemented will protect the marine food web as well as a vital food source for the wild salmon and steelhead that I cherish as a local in the Pacific Northwest.

Wild salmon and steelhead stocks are listed under the Endangered Species Act as a result of multiple factors including, water quality problems, past over-fishing, and decades of not protecting habitat conditions in our streams and estuaries. It is also clear to many of us that if we want to see our wild salmon recover we must also protect the marine food web on which salmon depend while at sea.

I understand there continues to be more and more information available about the economic benefits of protecting forage fish for seabirds, whales and other commercially valuable fish. I find this information compelling and instructive. I cannot support having unmanaged forage species directed to feed aquaculture, such as net-pen tuna, while jeopardizing the recovery and protection of our wild, native fish. This FEP would create a logical roadmap for Council activities that would play a significant role in protecting the marine ecosystem, for salmon, sea-birds and other marine predators. I urge you to adopt the FEP at your April meeting.

Sincerely,
Spencer Miles
Portland, OR
97202
9714003444

From: **Philip Jones** <philip.s.jones@comcast.net>
Date: Wed, Mar 27, 2013 at 9:27 AM
Subject: Please support the Fishery Ecosystem Plan
To: danwolford@earthlink.net, pfmc.comments@noaa.gov

Dear Chairman Wolford,
This is just a note to encourage your support in adopting this plan. "Forage" fish are an (up to this point) under-appreciated foundation of our aquatic ecosystem; and we need to protect them - fiercely. Your support in adopting this plan would be greatly appreciated.

Thank you for your consideration!
Sincerely,
Philip Jones
Seattle, WA
98133

From: **Aaron Longton** <aaron@oceanresourceteam.org>
Date: Fri, Mar 29, 2013 at 8:26 AM
Subject: FEP
To: pfmc.comments@noaa.gov

My name is Aaron Longton. I am a hook and line commercial fisherman in Port Orford. I think it is necessary to reduce harvest of forage species along the California current. It would also be good policy to restrict the catch to human consumption and bait for sustainable fishing practices where it is returned to the ecosystem.Wild species along the California current ecosystem depend entirely on what the natural system provides. To reduce the biomass of forage fish is to reduce the food fish biomass as well.

Restore the Food web, Aaron Longton

From: **Gerry Collins** <temcu@verizon.net>
Date: Thu, Mar 28, 2013 at 4:22 PM
Subject: Help Us Conserve the Pacific Ocean Ecosystem
To: pfmc.comments@noaa.gov

Mar 28, 2013

Chairman Wolford and Council Members

I am writing you today in support of the Pacific Fishery Management Council's efforts to develop an Ecosystem Fishery Management Plan. It is increasingly important to recognize the value of forage fish in regard to their contribution to a healthy ecosystem. With management and regulatory authority in place, you will be taking a step toward ensuring the long term vitality of our oceans.

Abundant forage stocks are imperative for maintaining healthy populations of commercially and recreationally important predator species like salmon, tuna and groundfish species as well as the many marine birds and mammals that rely on them for nourishment. That's why I believe forage fish species should be managed in a way that accounts for the food needs of other marine species. After all, if we have more food in the ocean, we will subsequently have healthier fish and other marine species.

Thank you for your continued commitment to make the California Current ecosystem a healthy and vibrant place--for the fish, birds and other mammals that live in and around it, and for the coastal communities that depend on a healthy ocean.

Sincerely,

Ms. Gerry Collins
25222 Madroe Dr.
Murrieta, CA 92563-5386

From: **Marshal Moser** <marshalmoser@gmail.com>
Date: Thu, Mar 28, 2013 at 9:51 AM
Subject: Please Protect Marine Ecosystem Health & Productivity via the Fishery Ecosystem Plan and Accompanying Ecosystem Initiatives
To: pfmc.comments@noaa.gov

Mar 28, 2013

Chairman Wolford and Council Members

Dear and Council Members,

Thank you for agreeing to develop a Fishery Ecosystem Plan. Please adopt the plan and accompanying list of Ecosystem Initiatives in April.

As a West Coast resident who benefits from a vibrant ocean, I believe a sustainable ecosystem depends on a well-functioning marine food web. The Council itself recognized forage fish as the cornerstone of a healthy ecosystem last June, when it set a goal of prohibiting new fisheries on forage species that aren't currently managed. Now, as its first official ecosystem initiative, it makes sense for the Council to follow through by enacting firm protections for forage fish that are vulnerable to unregulated fisheries emerging at any time. In doing so, the Council has a chance to establish itself as a leader in moving ecosystem-based management from theory into practice.

I encourage you to take this precautionary measure as soon as possible. The Council's own analysis, conducted in 2011, noted that industrial demand for forage fish is likely to grow more intense because of its value as a global commodity used in feeding livestock, poultry and farmed fish. The Council's top priority should be to make sure it protects forage fish as the linchpin of healthy existing fisheries and coastal communities here on the Pacific coast.

Thank you again for your foresight.

Sincerely,

Mr. Marshal Moser
32965 Hwy 97N
Lonesome Duck Ranch
Chiloquin, OR 97624

From: Nigel Strafford <generativity@hotmail.com>
Date: Wed, Mar 27, 2013 at 4:58 PM
Subject: Manage at the marine ecosystem and conserve all forage fish
To: danwolford@earthlink.net, pfmc.comments@noaa.gov

Dear Chairman Wolford,

Thank you for considering moving forward with their Fishery Ecosystem Plan (FEP). If fully implemented, this plan will protect the marine food web as well as a vital food source for the wild salmon and steelhead already challenged by pollution, net pen salmon diseases, and climate change.

Wild salmon and steelhead stocks are listed under the Endangered Species Act as a result of multiple factors including, water quality problems, past over-fishing, and decades of not protecting habitat conditions in our streams and estuaries. It is also clear to many of us that if we want to see our wild salmon recover we must also protect the marine food web on which salmon depend while at sea.

I understand there continues to be more and more information available about the economic benefits of protecting forage fish for seabirds, whales and other commercially valuable fish. I find this information compelling and instructive.

Menhadden overfishing impacted the health of the entire Chesapeake bay. With Herring size declining throughout the Puget Sound, I cannot support having unmanaged forage species directed to feed aquaculture, such as net-pen salmon and tuna, while jeopardizing the recovery and health of our wild, native fish and marine ecosystem.

This FEP would create a logical roadmap for Council activities that would play a significant role in protecting the marine ecosystem, for salmon, sea-birds and other marine predators. I urge you to adopt the FEP at your April meeting.

Sincerely,
Nigel Strafford
Seattle, WA
98102

From: Kevin Scribner <scribfish@gmail.com>
Date: Sun, Mar 31, 2013 at 10:38 AM
Subject: Fishery Ecosystem Plan comment
To: pfmc.comments@noaa.gov

March 31, 2013

Mr. Dan Wolford, Chair
Re: Agenda Item H.1, Adoption of the Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford:

Thank you for taking action in November to adopt the draft Fishery Ecosystem Plan and agreeing to release it for public review. I write today to support the adoption of the final Fishery Ecosystem Plan at the April meeting.

I spent 19 years fishing for salmon and herring in Alaska waters, giving me first hand experience with the abundance that comes from managing fisheries from a sustainable ecosystem planning approach. And I am now in the process of developing a direct-to-consumer seafood buying club that is predicated on scientific endorsement of sustainable practices. As well, this enterprise will provide seafood products with the highest value possible. Most often this points towards species higher on the food chain, but it also can lead towards maximizing the value of forage fish through targeting human consumption.

Through adoption of the Fishery Ecosystem Plan, the United States can provide a leading global model for valuing and adding-value to the management and harvesting of our forage fish. The top priority of the Fishery Ecosystem Plan should be to ensure a healthy ecosystem and that means protecting the marine food web upon which it depends. I join those who advocate that we treat our foundational systems and species as our trust fund, and that we live off its interest.

And, following the final adoption of the Ecosystem Plan, the Council should proceed immediately with its first ecosystem-based initiative by beginning the process of providing Fishery Management Plan protection for unmanaged forage fish.

Sincerely,

Kevin Scribner
Kooskooskie Fish
PO Box 40729
Portland, OR 97240

From: Jay Withgott <withgott@comcast.net>
Date: Sun, Mar 31, 2013 at 10:19 PM
Subject: urging attention to forage fish conservation
To: pfmc.comments@noaa.gov

Dear Pacific Fishery Management Council --

I'm writing prior to your April meeting in Portland to urge you to consider putting new emphasis on the conservation and management of so-called forage fish, the small fish such as herring, smelt, anchovies, and sardines that are so vital to the integrity of our marine and coastal food webs and ecosystems. Maintaining healthy populations of these fish is needed to ensure a reliable food supply for larger fish of commercial interest, for seabirds, and for marine mammals. As small forage fish come under increasing pressure for harvesting for aquaculture and other uses, we urgently need to have in place solid management programs that will place limits on harvests and ensure the conservation of these fish. I would urge you to take recent science into account in pursuing ecosystem-based strategies that truly protect the key players and processes that make for functioning marine ecosystems and sustainable fisheries. Thanks very much for your efforts.

Jay Withgott
Textbook author in environmental science
Portland, Oregon

From: Garth Murphy <garthmy@gmail.com>
Date: Fri, Mar 29, 2013 at 7:14 PM
Subject: FISHERY ECOSYSTEM PLAN ADOPTION
To: pfmc.comments@noaa.gov, Sean Watson <sean@24connect.net>

TO THE PFMC
RE: APRIL MEETING PORTLAND, AGENDA ITEM H.1.
FROM: GARTH MURPHY
INTEGRATED ECOSYSTEM MANAGEMENT
649 S VULCAN AVE, ENCINITAS CA 92024
PHONE 760 7538360

Thank you for taking action in November to adopt the preliminary draft Pacific FEP and release it for public review.
I am a second generation ecologist specializing in the integration of natural, business, social and technological ecosystems, with the aim of maintaining maximum stainable productivity over time for all elements and stakeholders.
My father, Garth I Murphy, received the first Phd in Marine Ecology from Scripps Institution of Oceanography UCSD. He was the founding coordinator of CALCOFI and instrumental in the 18 year California sardine fishing ban that brought that species back from the dead. He would be aghast to find that you still had not adopted a FEP for the entire California Current that protects/manages all species of the extended food web.
I urge you in his name and my own to adopt the PACIFIC FEP at your April meeting and move swiftly to strengthen and implement it. This is a giant step toward a national and worldwide transition to ecosystem-modeled fisheries management.
Every marine ecosystem element, physical, biological and social is connected; the whole is greater than the sum of its parts.
Humans, their activities and constructs are integral parts of marine ecosystems and any FEP.
Every disconnect you make, or, as a governing body, allow others to make, is a mistake; counterproductive; sometimes irreversibly.
Now is the hour to put such mistakes behind us. The FEP is the only possible path to maximum sustainable productivity. There is no other rational choice.
Ecosystem model management systems also work in other human endeavors and businesses less obviously connected to natural ecosystems. The top tech companies like Apple and Google employ them, grass-fed beef producers employ them. Eco-nomic efficiency is always the goal and result of comprehensive integrated ecosystem management.
I urge you to pick up your feet and take FISHERY ECOSYSTEM MANAGEMENT to its highest level, in a systematic and relentless manner. Every ecosystem element and function is an integral part of the whole. Forage species management is only the beginning of a successful FEP.

The value of an ecosystem is equal to the number of elemental connections squared. Every elemental disconnection, depletion or extinction is counter-productive. Value the connections as well as the interconnected elements.

We can look forward to a bright future for the oceans under FEP management. The results of any other system are grim.

At your service, Garth Murphy, for Integrated Ecosystem Management

Forage fish, as the staple food source for marine mammals, seabirds and predatory fish, are the centerpiece of a healthy California Current ecosystem. Our commercial and recreational fisheries all depend on a healthy prey base, so protecting forage fish simply makes good economic and environmental sense. It's a win for all of us.

To safeguard forage fish and the predators and economies that depend on them, we need to monitor the strength of the overall west coast forage base, conserve commercial prey species, like sardine, and prevent new fisheries for unmanaged species, like Pacific saury, before we fully understand the ecosystem impact.

I strongly support ecosystem-based management and urge the Pacific Fishery Management Council to approve the Pacific Coast Fishery Ecosystem Plan (FEP) and Ecosystem Initiatives Appendix when it convenes in April. I support the immediate implementation of FEP Initiative 1, protection of unmanaged forage species. The Council should begin by forming an ad-hoc advisory committee of forage species experts and charging this committee with developing recommendations for action at the June meeting.

Because an ecosystem approach requires the Council to consider the health of the entire forage base, both actively fished as well as un-fished species, the Council should ask ad-hoc advisory committee to lay the groundwork for an index of forage status. This would help the Council more fully understand how extracting more fish will impact the ecosystem and therefore, inform future decision-making.

Wayne Rechards — PO Box 1061 — Oma...

signature | name | address | city, state

SW FSA

email | affiliation | I'm a fisherman & I fish for:

The Council received cards identical to this from 58 individuals.

Agenda Item H.1

Adoption of the Pacific Coast Fishery Ecosystem Plan
9 April 2013

Chairman Wolford and Pacific Fishery Management Council:

Thank you for the opportunity to speak.

I would like to urge the Council to adopt the Fishery Ecosystem Plan as drafted, and in particular to adopt and implement the FEP's Initiative #1 for the protection of un-managed forage fish species.

Low-trophic-level fish such as herring, smelt, anchovies, and sardines are vital to the integrity of our marine and coastal food webs and ecosystems. Maintaining healthy populations of these fish will help ensure a reliable food supply for larger fish of commercial interest, for seabirds, and for marine mammals. I personally can best address seabirds. Research and monitoring clearly shows that forage fish populations have direct and substantial influence on seabird reproductive capacity and population levels. In turn, seabirds can be effective indicators of forage fish abundance. The Pacific Coast of North America has some of the richest seabird communities in the world, which testifies to the natural wealth of our fish populations and marine ecosystems. Yet many of our seabird species are declining, and this indicates a need for a precautionary approach to conservation and management of the fish they depend on.

As forage fish come under increasing harvesting pressure for aquaculture and other uses, we urgently need to have in place policies that will limit harvests and ensure the conservation of these fish. It would be unwise to open any new fishery without careful assessment based on strong scientific research. I would urge you to take recent science into account in pursuing ecosystem-based strategies that truly protect the key players and processes that make for functioning marine ecosystems and sustainable fisheries.

The FEP's Initiative #1 is an excellent step in the direction we need to go. Thank you very much for your efforts in drafting the plan, and I urge its adoption.

Jay Withgott
Textbook author in environmental science
Portland, Oregon

H.1.c.

2 April 2013

To the Pacific Fisheries Management Council

Concerning: the Fisheries Ecosystem Plan and forage fish initiative

I am writing in support of the Fish Ecosystem Plan Initiative to prohibit new fisheries on currently unmanaged forage fish. I believe that this is necessary until the Council can assess any potential impacts to existing fisheries, top predators and other forage fish consumers, including marine mammals. As I have missed the deadline for written submissions through the website, I have asked Tara Gallagher to present this on my behalf at the Council meeting.

I am a professor of Fisheries and Wildlife at Oregon State University, a member of the Biological Review Team for the status review of humpback whales under the US Endangered Species Act and a national delegate to the Scientific Committee of the International Whaling Commission. I have more than 30 years of experience with the study of humpback whales in the North Pacific. I am writing here in a personal capacity as a professional with an interest in the role of recovering populations of whales in the ecosystem. My views do not necessarily reflect the views of Oregon State University.

My reasons for supporting the Initiative relate to the need for a better understanding of the importance of forage fish to regional populations of humpback whales. Humpback whales are now recovering in abundance, following their protection from commercial hunting nearly 50 years ago. With this increase, humpback whales will be returning to their previous role as primary consumers of both krill and forage fish throughout the middle and upper latitudes of the North Pacific. Studies conducted over the last two decades have clearly shown the specialization of some humpback whales on forage fish, particularly Pacific herring, capelin and sandlance. Studies of stable isotope ratios from skin samples of living whales show that some of this foraging specialization or prey preference is regional, with whales showing greater consumption of forage fish off central California and in the northern Gulf of Alaska compared to northern British Colombia. Direct observation of foraging behavior shows that some prey preference is also individual or highly localized, as evidence by a small number of whales in southeastern Alaska showing specialization on herring feeding through group lunge-feeding. To my knowledge, this highly specialized, coordinated group foraging strategy has not been observed anywhere else in the world.

As humpback whales are likely to consume as much as 400 kg/day (approximately 880 lbs/day) during the summer feeding season (up to 6 months), a better understanding of their prey preferences and specialization is needed to develop accurate ecosystem models. For this reason, I further support the Pacific Fisheries Management Council in its efforts to adopt ecosystem-based approaches to fisheries management. I urge the council to include humpback whales and other top predators and primary consumers in this approach.

Sincerely

C Scott Baker

Professor, Department of Fisheries and Wildlife
Associate Director, Marine Mammal Institute
Hatfield Marine Science Center, Oregon State University
Email: scott.baker@oregonstate.edu

References

Barlow, J., J. Calambokidis, E.A. Falcone, C.S. Baker, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D.K. Mattila, T.J. Quinn, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R, P. Wade, D. Weller, B.H. Witteveen and M. Yamaguchi. 2011. Humpback whale abundance in the North Pacific estimated by photographic capture-recapture with bias correction from simulation studies. Marine Mammal Science 27:793-818.

Witteveen, B., K. Wynne and J. Roth. 2009. Population structure of North Pacific humpback whales on feeding grounds as shown by stable carbon and nitrogen isotope ratio. Marine Ecology Progress Series 379:299–310.

Witteveen, B.H., G.A.J. Worthy, K.M. Wynne, A.C. Hirons, A.G. Andrews_III and R.W. Markel. 2011. Trophic Levels of North Pacific Humpback Whales (*Megaptera novaeangliae*) Through Analysis of Stable Isotopes: Implications on Prey and Resource Quality. Aquatic Mammals 37:101-110.

Agenda Item: H1

Mid-Coast Watersheds Council
23 North Coast Highway
Newport, Oregon 97365

SALMON RIVER, SILETZ RIVER, YAQUINA RIVER, ALSEA RIVER, YACHATS RIVER, AND OCEAN TRIBUTARIES

April 4, 2013

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

Agenda item: H1
Re: support of FEP adoption

Dear Chairman Wolford and Council Members:

The MidCoast Watershed Council is a non-profit group located on the central Oregon coast. We have been working for 15 years to restore riverine and estuary habitat in the Siletz, Yaquina, Alsea, and Yachats basins.We have an economy based in good part on scientific research, commercial and recreational fishing activities, as well as on eco-tourism boasting many bird and whale watchers. Our Board of Directors, including recreational and commercial fishing interests, conservationists, agencies, and landowners, works to promote activities that protect and restore diverse habitats critical to the recovery of ESA listed Coho as well as watershed processes to support abundant levels of multiple species to support fishing and a healthy ecosystem. We write today in support of the Pacific Fishery Management Council's (Council) Fishery Ecosystem Plan(FEP) and urge the Council to adopt the plan at your April meeting. We also urge you to initiate the implementation of Ecosystem-based Initiative 1- the protection of unmanaged forage species.

We applauded the decision by the Council last June to conserve un-fished forage fish as an acknowledgement that they are a cornerstone of a productive marine ecosystem along the Pacific coast. Many people are just now understanding the role that forage fish play and how essential they are to a healthy ocean environment and how they critical to healthy fish, seabirds, shorebirds, and marine mammals populations. We ask that you fulfill your commitment to prohibit new fisheries targeting forage species that are not yet being fished.

Phone: 541-265-9195 Fax: 541-265-9351 mcwc@midcoastwatershedscouncil.org

We are aware that our marine environment is being affected by large-scale changes in climate, oceanic processes, coastal habitat degradation, and invasive species. Our coastal area, similar to others throughout your jurisdictional area, is under constant pressure to develop in sensitive areas and is still impacted by the legacy of past practices that continue to stress the environment. With these pressures and the reality that only a sustainable, resilient ocean ecosystem (including a balanced food web) will allow our region to help meet the need to feed a growing world, your FEP effort comes at the right time. We urge you to adopt the draft FEP, including the suggested schedule and amendment process for plan and Appendix A (Ecosystem Initiatives Appendix)

We hope that through the FEP, an index measuring forage abundance along the West Coast be developed and used. Such an index could help the Council maximize the benefits we derive from the ocean by weighing the tradeoffs between large-scale fisheries targeting prey fish versus leaving them in the water to feed high-value predators like salmon, tuna and halibut as well as other fish and wildlife.

Sincerely,

Wayne Hoffman

Wayne Hoffman
Coordinator

Agenda Item H.H.1

NATIVE FISH SOCIETY

Advancing the Recovery of Native, Wild Fish in Their Homewaters

April 9, 2013

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

Re: Agenda Item H.1, Adoption of the Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford and Council members:

I would like to take this opportunity as the River Steward Program Director for Native Fish Society to support of the Council's Fishery Ecosystem Plan and accompanying Ecosystem Initiatives.

Guided by the best available science, Native Fish Society advocates for the recovery of wild, native fish and promotes the stewardship of the habitats that sustain them. We do this for the benefits that healthy watersheds provide to present and future generations - and for the intrinsic virtues of rivers themselves. NFS uses a watershed approach to river and aquatic species conservation. Our priorities are to build lasting solutions for people and species that depend on healthy watersheds and actively promote watershed restoration.

The convergence of population growth and global climate change has thrust water-related issues to the forefront of many environmental debates. Every living creature depends on water, and water is impacted by, and connected to, virtually everything we do as humans. In the West, water resources are diminishing in quality and quantity. Land use practices continue to degrade water quality and watershed health. At the same time, scientific research clearly indicates that water resources will be further impacted by climate change. Thus, the threats to freshwater ecosystems have never been more abundant or more immense.

Each year, millions of ocean-bound juvenile salmon migrate through miles and miles of freshwater streams and tributaries. As they reach the Columbia River Basin and the near-shore ocean, their survival depends to a large degree on the presence of forage fish. It's no coincidence that salmon time the peak of their June run for the open ocean in May and June, when forage fish are most abundant. The extra calories provided by oil-rich forage fish enable salmon to grow larger, produce stronger eggs and improve reproductive success. Well-functioning food webs are fundamental for sustaining rivers as ecosystems and maintaining associated aquatic and terrestrial communities.

Biotic conservation is most successful where actions are aimed at protecting ecosystems rather than restoring them after the damage is done. We applaud the Council's proactive approach to ecosystem-based management. Incorporating food web considerations into management helps test assumptions and leads to discovery of species interactions that influence management success. Although the modeling of complete food webs may be difficult, there are approaches that can yield useful results relatively quickly. Therefore, Native Fish Society urges the Council to adopt their final Fishery Ecosystem

Plan at their April meeting in Portland and to begin work to implement protections for currently unmanaged forage species through a management plan amendment.

Thank you for considering our comments.

Sincerely,

Mark Sherwood
River Steward Program Director
Native Fish Society