COUNCIL FISHERY ECOSYSTEM PLAN (FEP) DEVELOPMENT

The Pacific Fishery Management Council (Council) is considering ecosystem-based approaches to fishery management and is in the process of developing a Fishery Ecosystem Plan (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 June of 2012 and provided guidance on further FEP development for the November 2012 Council meeting. In keeping with Council guidance in June, the Ecosystem Plan Development Team (EPDT) has provided a revised draft of the FEP, with an emphasis on drafts of Chapters 4 through 7 (Agenda Item K.1.a, Attachment 1). Chapter 4 considers the potential effects to the ecosystem from environmental processes and human activities and, when finalized, could recommend safeguards in fisheries management measures to buffer against uncertainties induced by those effects. Chapter 5 discusses Council ecosystem-based policy priorities across its FMPs, as they may apply to ocean resource management and policy processes external to the Council (e.g., West Coast Governors' Agreement on Ocean Health, National Ocean Council, international fishery and ocean resource management bodies). Chapter 6, which the Council has seen in earlier drafts, identifies and prioritizes research needs. With this draft FEP, the EPDT also introduces a draft Chapter 7, which would bring the Council's draft policy on forage fish species, as articulated in June 2012, into the FEP. Chapter 7 also introduces the concept of additional FEP initiatives to the Council process.

At this meeting, the Council is scheduled to review and refine the draft FEP and adopt a preliminary FEP for public review. Final FEP adoption is tentatively scheduled for March of 2013. 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 draft FEP at K.1.a., Attachment 1 proposes a six-year cycle for the FEP, so that descriptive passages within the FEP would remain in place until the next review period, suggested to begin in late 2016 or early 2017, with adoption of a revised FEP suggested for late 2018 or early 2019.

In a related matter, the Council took action in June to formally recognize the importance of forage fish to the marine ecosystem off our coast and to provide adequate protection for forage fish. The Council adopted the objective "to prohibit the development of new directed fisheries on forage species that are not currently managed by our Council, or the States, until we have an adequate opportunity to assess the science relating to the fishery and any potential impacts to our existing fisheries and communities." The Council plans to meet this objective through two primary approaches. The first consists of updating to the Federal List of Fisheries and Gear authorized off the West Coast while describing in the FEP the standards that the Council would use in assessing whether a proposed new fishery could compromise its conservation and management measures. The second is to enact protections through amendment to one or more of the Council's Fishery Management Plans. The Council scheduled the bulk of this effort to occur after the FEP is completed. Section 7.1 of the draft FEP outlines a process for implementing this initiative and includes proposed revisions to the Federal List of Fisheries and Gears. To expedite the process, the Council may consider requesting input from its advisory bodies, States, Tribes, and the public on the proposed revisions to the Federal List of Fisheries and Gears in advance of FEP completion.

<u>Council Action</u>:

1. **Provide feedback on the Draft FEP.**
2. **Consider adopting a preliminary FEP for public review.**
3. **Provide guidance on priority tasks for future work on FEP development.**
4. **Consider requesting input from its advisory bodies, States, Tribes, and the public on the proposed revisions to the Federal List of Fisheries and Gears in advance of FEP completion.**

<u>Reference Materials</u>:

1. Agenda Item K.1.a, Attachment 1: Draft Pacific Coast Fishery Ecosystem Plan.
2. Agenda Item K.1.d, Public Comment.

<u>Agenda Order</u>:

a. Agenda Item Overview — Mike Burner
b. Report of the Ecosystem Plan Development Team — Yvonne deReynier
c. Reports and Comments of Advisory Bodies and Management Entities
d. Public Comment
e. **Council Action**: Adopt Preliminary FEP for Public Review

PFMC
10/16/12

Agenda Item K.1.a
Attachment 1
November 2012

PACIFIC COAST FISHERY ECOSYSTEM PLAN

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

DRAFT

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NOVEMBER 2012

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
CDFG	California Department of Fish 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)
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
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

At its June 2011 meeting, the Pacific Fishery Management Council (Council or Pacific Council) adopted the following Purpose and Need Statement for a Fishery Ecosystem Plan (FEP):

The purpose of the 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.*

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' Agreement 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 identifies and prioritizes research needs and provides recommendations to address gaps in ecosystem knowledge and FMP policies. Chapter 7 proposes an ecosystem-based fishery management initiative process for the FEP's use into the future.

1.3 Schedule and Process for Developing the FEP

At its June 2011 meeting, the Council tasked its EPDT with drafting a schedule and process for developing the FEP. This FEP is a living document, which means that the Council anticipates periodically amending and updating the FEP. This November 2012 version of the FEP is a Council-review draft. At its November 2012 meeting, the Council will review this draft FEP and determine whether it is ready to be sent out as a public review draft and, if not, what revisions need to be made to the FEP before it may be considered a public review draft. The Council is tentatively scheduled to finalize this FEP at its March 2013 meeting. In Chapter 7, this FEP proposes that the Council consider this FEP as effective for at least 2013-2018, which may require a review-and-update process beginning in 2017.

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, possibly as brief as 15-20 pages in length;
- Not wait for the "perfect" science, 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.

In its report at that meeting, the Council's Scientific and Statistical Committee (SSC) noted that NMFS's West Coast fisheries science centers were working on an Integrated Ecosystem Assessment (IEA,) and recommended coordination between IEA scientists and the EPDT to ensure that they are "working from the same base data, avoid duplication of effort, and perhaps even consider producing a single joint report." The California Current IEA is an ongoing scientific effort that NMFS expects will produce and inform many reports. An annual state-of-the-ecosystem report in connection with this FEP would be informed by the IEA. The IEA process would not result in future annual state-of-the-ecosystem reports outside of the FEP-based annual ecosystem report.

As described in Section 6.1, the Council will receive its first draft annual state-of-the-ecosystem report at its November 2012 meeting, with the design and contents of that report based on guidance received from the Council and its advisory bodies, and on information and analyses from the California Current IEA and other sources.

2 Objectives

[The Council reviewed the FEP's draft objectives at its June 2012 meeting. The Council's recommended revisions are included in this November 2012 draft FEP.]

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. 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 may apply to ocean resource management and policy processes external to the Council. Thus, this section 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 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 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.

3 California Current Ecosystem Overview

3.1 Geography of the Ecosystem

The geographic range for this FEP is the entire U.S. West Coast Exclusive Economic Zone (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.

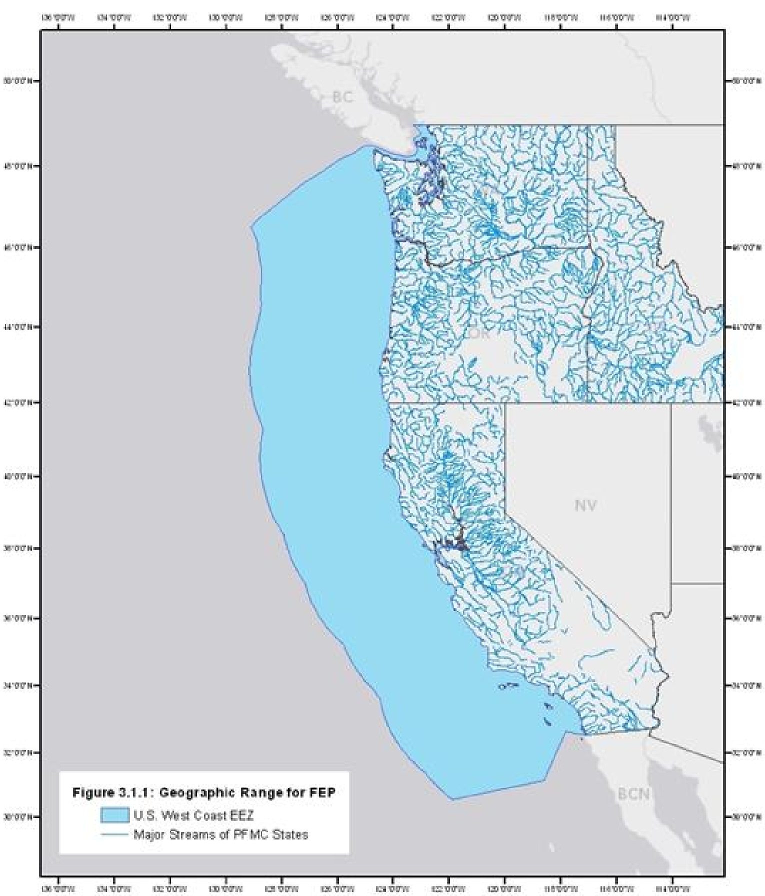


Figure 3.1.1: Geographic Range for FEP

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 develops 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).

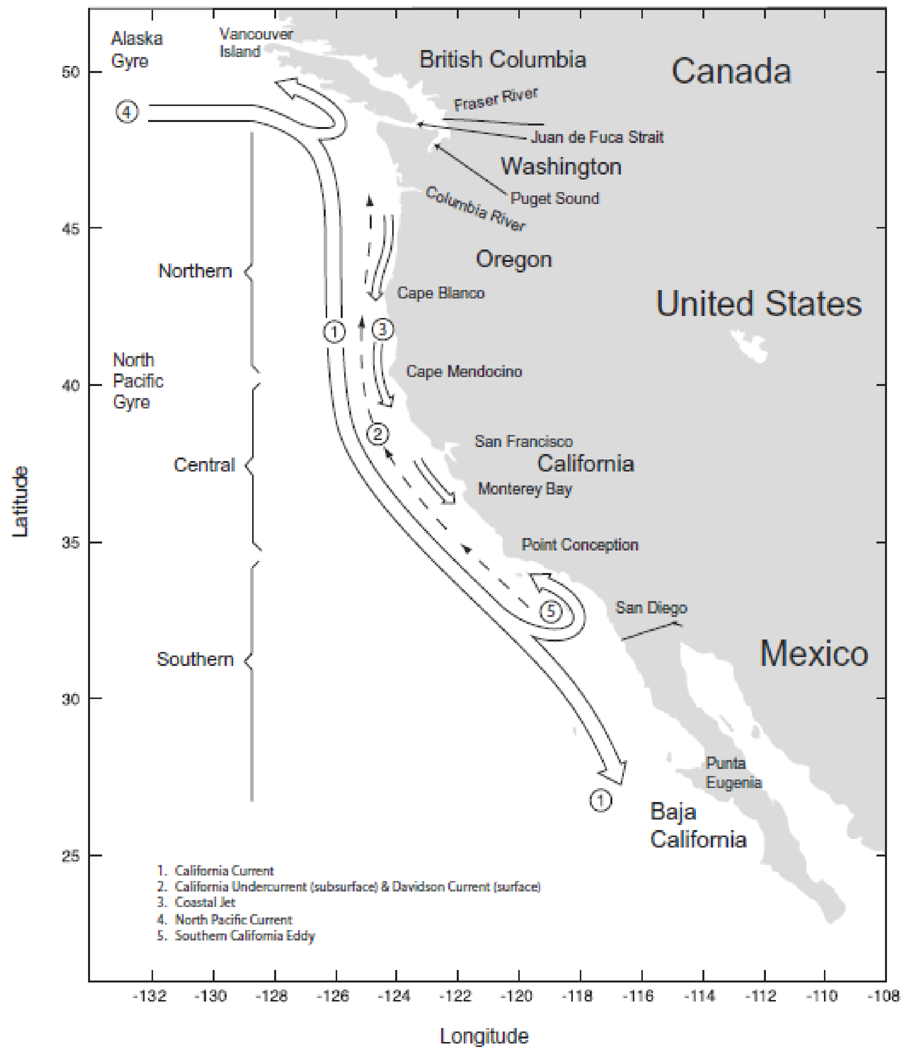


Figure 3.1.2: Dominant current systems off the U.S. West Coast

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 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.

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.

Maximum mixing of Columbia River water and ocean water occurs within the estuary and in the near field of the plume. Primary production has been shown to be higher in newly emerging plume water. Although most plume nitrate originates from coastally upwelled water, river-supplied nitrate can help maintain ecosystems during delayed upwelling. 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 feature of this region, a large fracture zone that forms a huge submarine ridge near Cape Mendocino and results in a significant narrowing of the shelf south of this feature. There are also a number of large submarine canyons in the sub-region between Monterey Bay and Point Sur. These features result in high diversity of 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.

3.1.2.1 Southern sub-region: Point Conception to Mexico border

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.

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 about management decisions with international implications; and the U.S. Coast Guard, which is concerned about enforcement and safety issues.

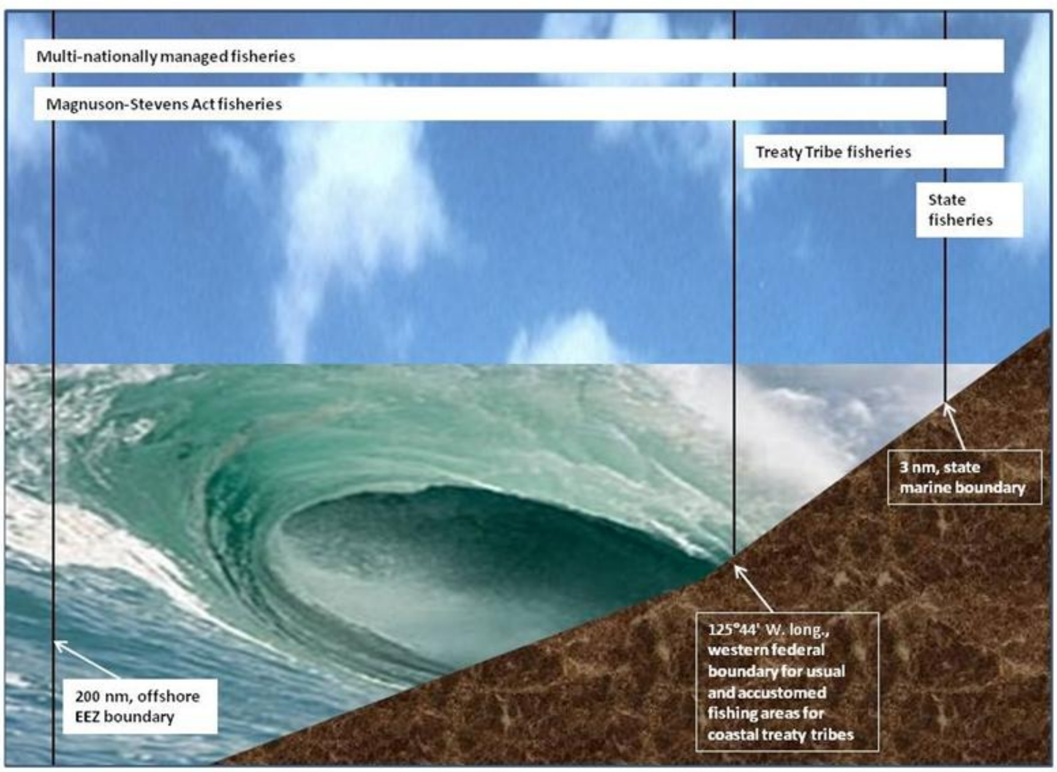


Figure 3.1.3: West Coast EEZ Fishery Management Authorities

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, 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.

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 Greys Harbor, although recreational fisheries are generally more active off California than off Washington

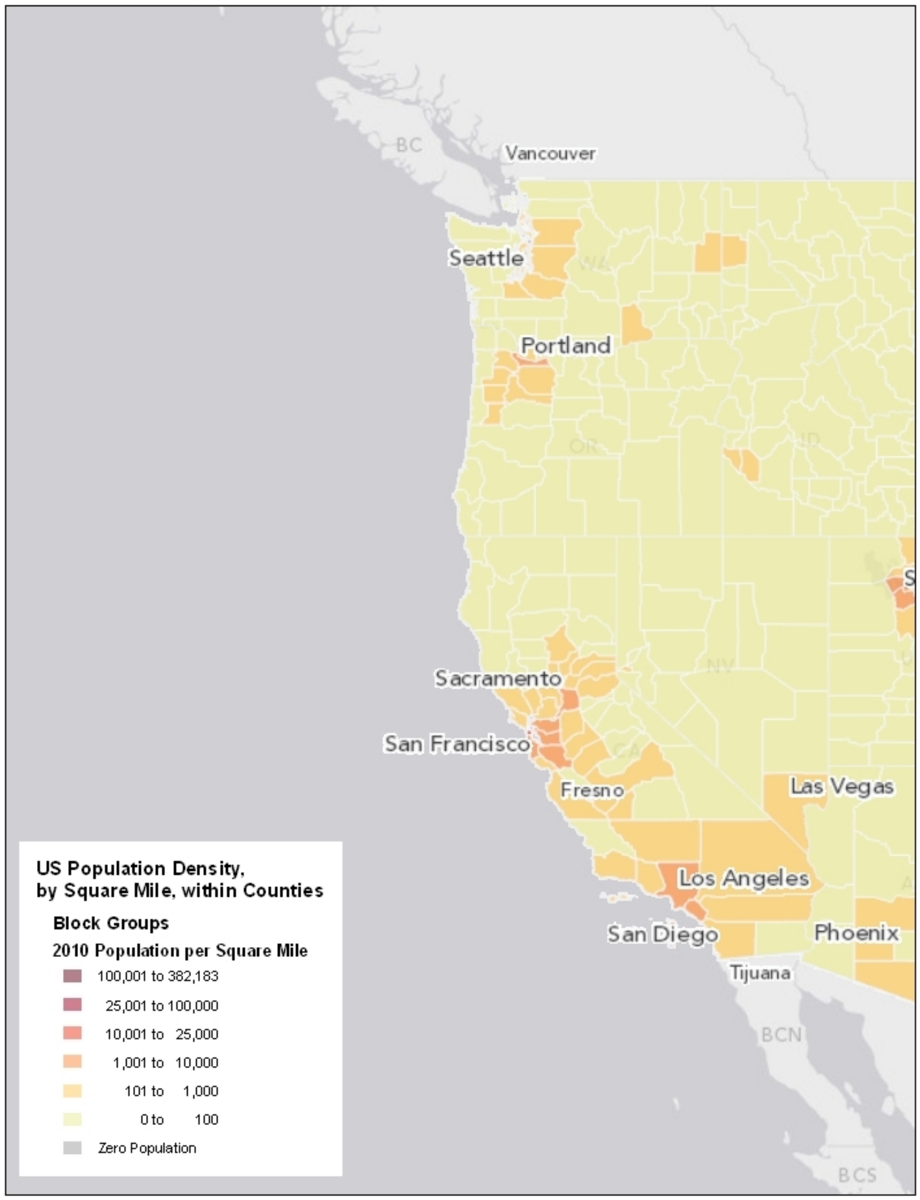


Figure 3.1.4: Human Population Density in the Western U.S.

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 Essential Fish Habitat (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).

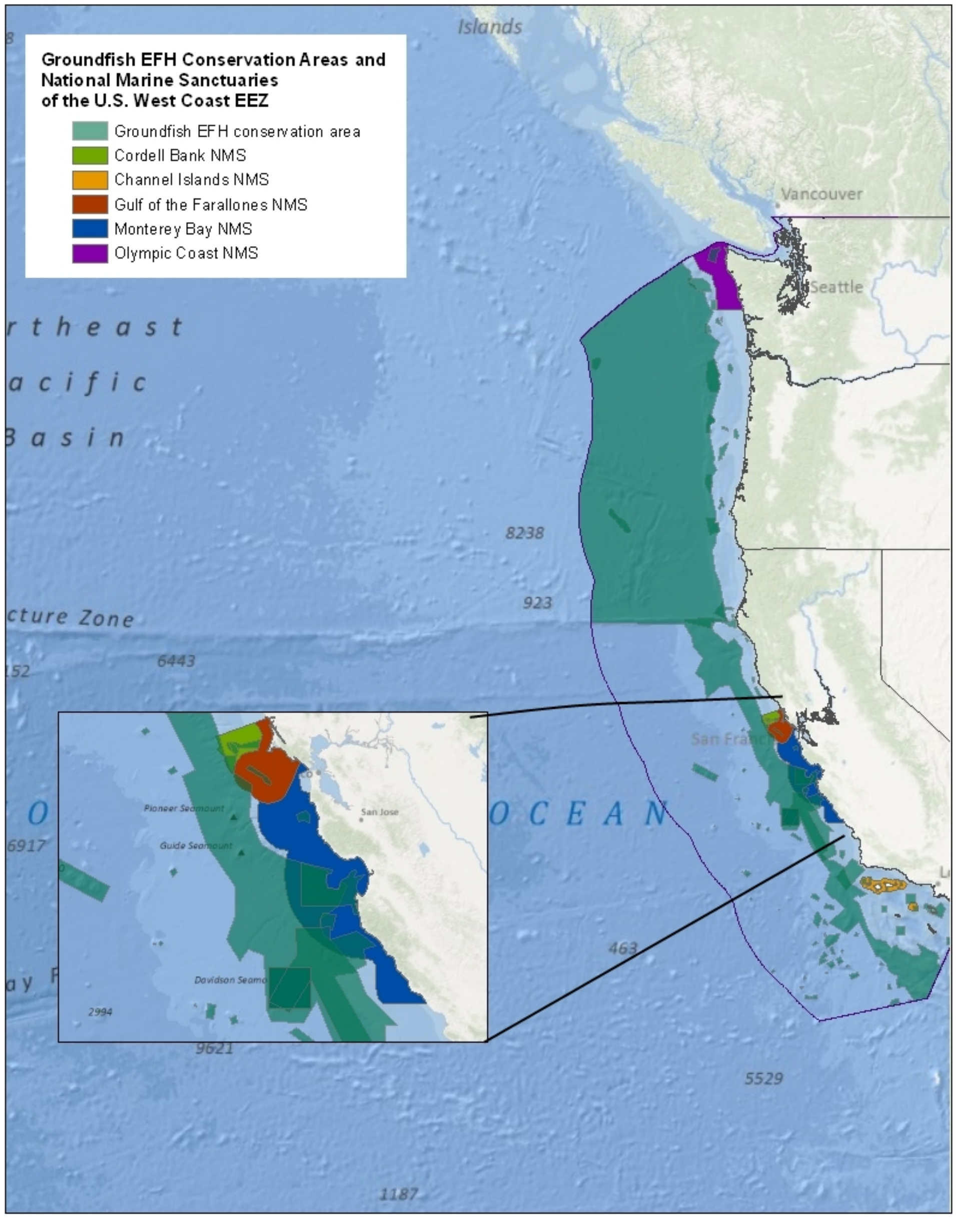


Figure 3.1.5: West Coast EFH Conservation Areas and National Marine Sanctuaries

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 level trophic level species are largely top predators such as marine mammals, birds, sharks and tunas.

As shown in Figure 3.2.1 from Field and Francis (2005,) 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.

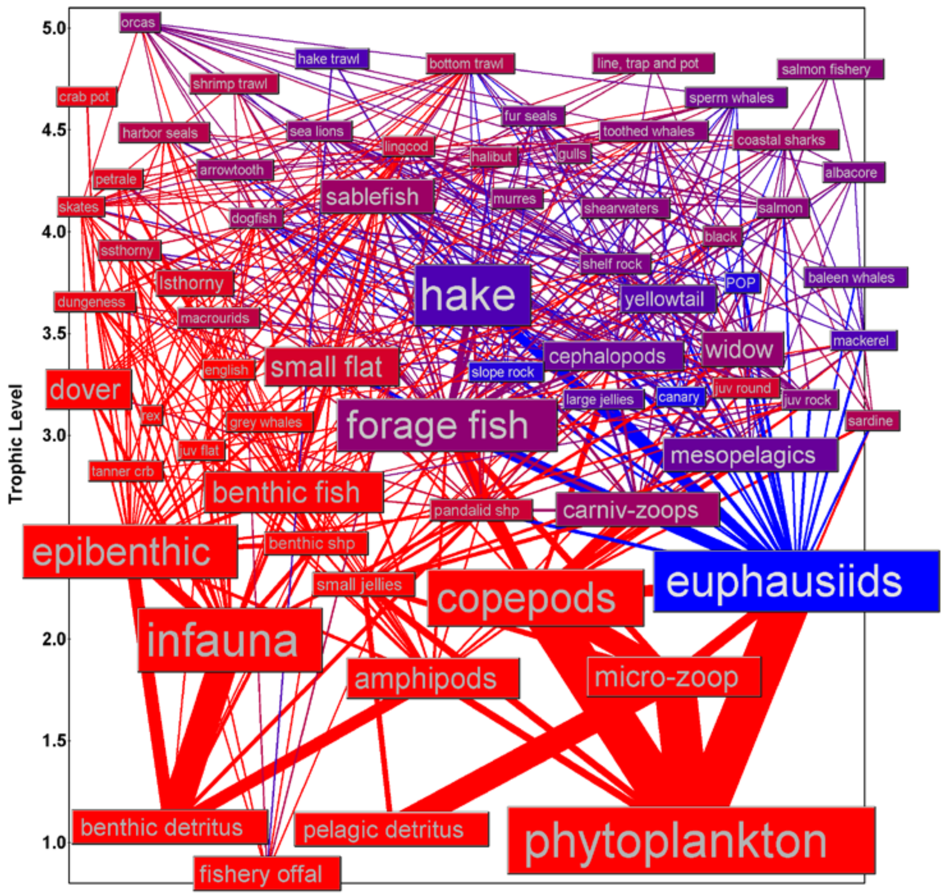


Figure 3.2.1: The significant food web of the Northern CCE: height of boxes is scaled to standing biomasses of species named; width of lines between species or species groups represents biomass flux of prey to predators; and benthic energy pathways are shown in red, while pelagic energy pathways are shown in blue. (Field and Francis, 2005)

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), leatherback turtles (breed in the western tropical Pacific) and bluefin tunas (breed in the western 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. 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 determine, although high sea lion pup mortalities have clearly been associated with El Niño events.

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 drift gill-net fisheries are an example of measures 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.

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 240,000, and short-beaked common dolphins over 400,000 animals (Carretta et al. 2010). Appreciation for the cumulative historical impacts of whaling and sealing, and the potential cascading impacts to marine ecosystems, has grown as marine mammal populations have recovered (NRC 1996, Estes et al. 2006). Currently, many populations appear to be approaching some level of carrying capacity, and there is no substantive evidence for indirect interactions with fisheries. Although most populations experience some incidental mortality as a consequence of fishing operations, and mortality sources generally do not exceed estimates of potential biological removals inferred by stock assessments, the mortality and serious injury rate in many instances cannot be considered to be insignificant, and overarching objectives are to approach a zero mortality and serious injury rate. In recent years there has been concern regarding high mortality rates for some cetaceans, particularly blue and humpback whales, caused by large ship strikes (Berman-Kowalewski et al. 2010).

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) and could be helpful in considering future refinements to such rules.

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, and can be considered in the context of strategic decision making.

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 conservation laws. A generalized breakdown would suggest three major communities of mid to high trophic level fish assemblages; highly migratory species, 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 specious communities (such as intertidal, kelp forest ecosystems, planktonic 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 CC have driven the recent poleward expansion of jumbo squid into the CC 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 Highly Migratory Species (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.

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, 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 (stock assessments are typically representative of the entire north Pacific, while some ecosystem models and data sources represent subsets of this region). 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, and the challenges associated with minimizing and managing 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.

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 found at relatively high levels of abundance 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, the concentration 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 such as 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 at larger sizes (Daly et al. 2009).

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 threatened 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 U.S. National Marine Fisheries Service 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.

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 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 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.

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 predominant 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, however, they 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.

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). 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)

Along with large multicellular plants (described in more detail in section 3.3.2)

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 unicellular 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.

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 and commensalism 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).

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. Miller and Brodeur's (2007) figure illustrating nekton diets is excerpted below as Figure 3.2.2. 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.

Diet analyses such as those of Miller and Brodeur (2007) and Dufault and colleagues (2009) can be used to provide strategic ecosystem advice, setting harvested species in the context of their prey and predators (Figure 3.2.1 below). These diet links between species also connect fishery management plans, and imply that 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).

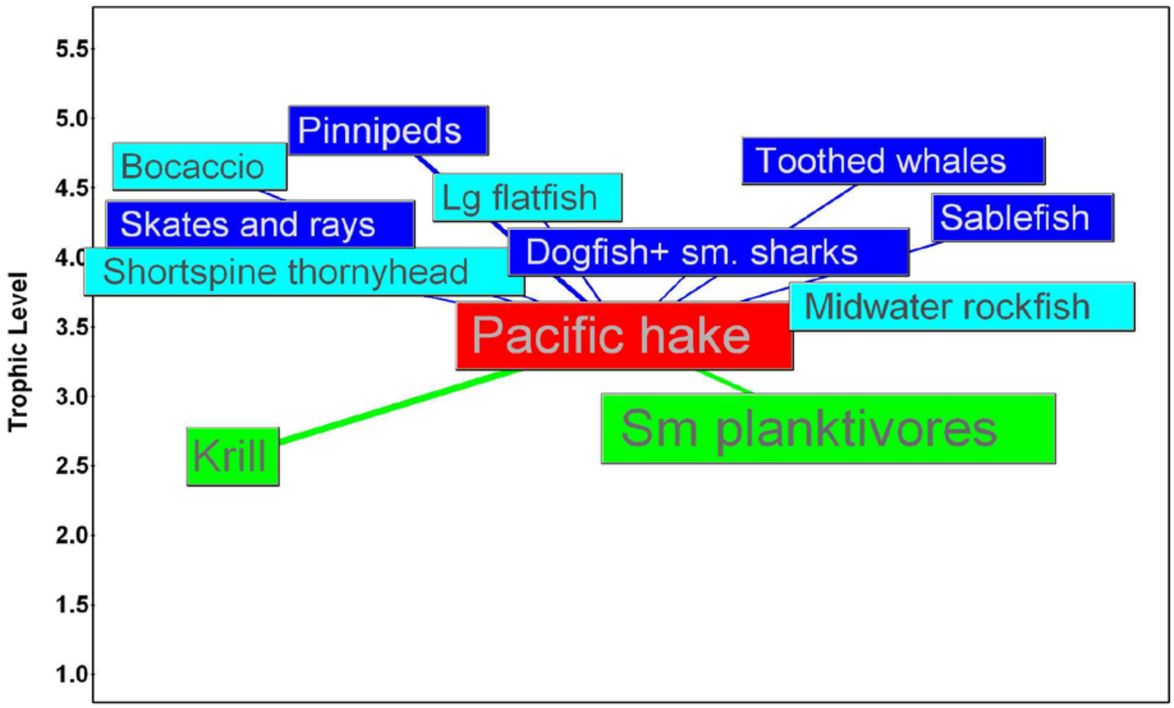
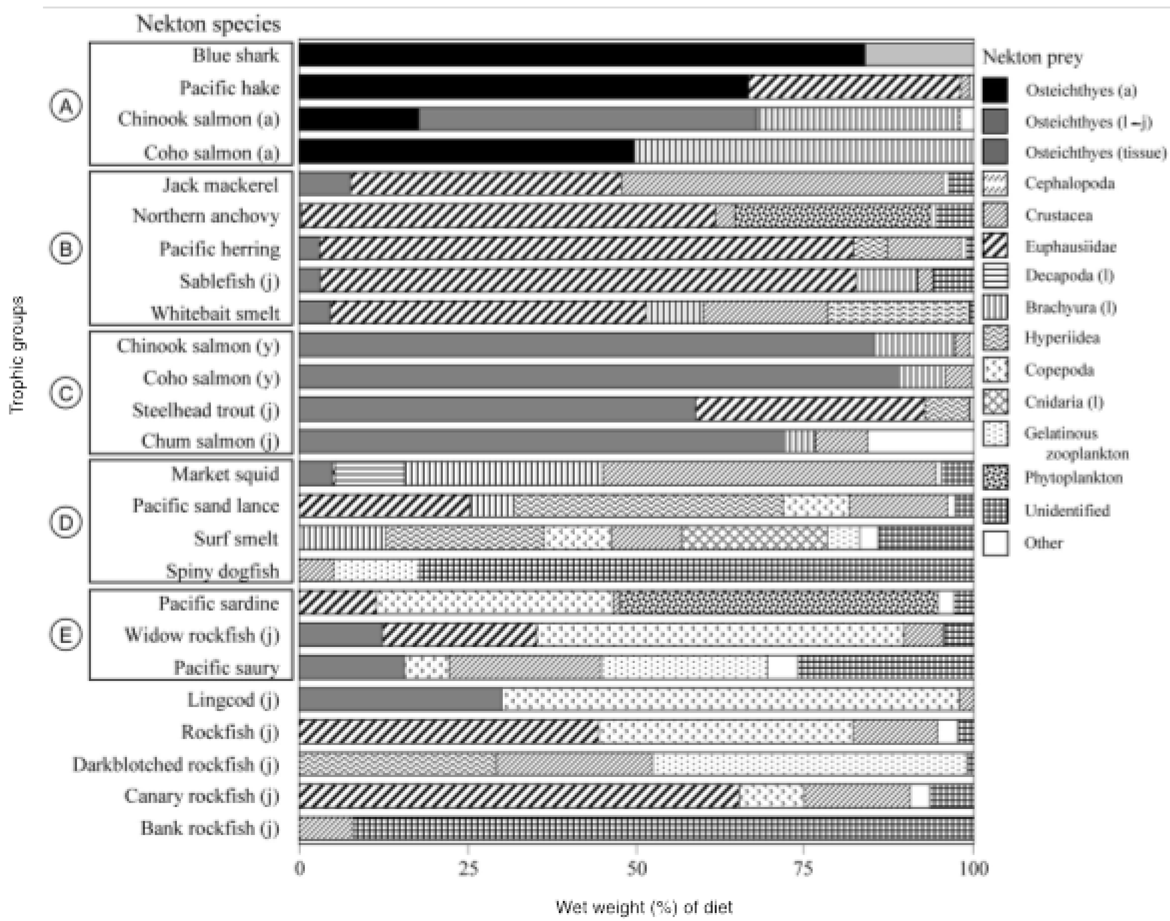


Figure 3.2.1: Primary food web of Pacific whiting. Pacific whiting are red, major prey items are green, and major predators are dark blue. Turquoise groups are both prey and predators of whiting at different life stages. Vertical position is approximately related to trophic level, with higher positions 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 whiting. (Levin and Wells, 2011, Ecoviz 2.3.6 software provided by Aydin, NOAA AFSC)

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.



Summary of nekton diets analyzed from June and August 2002 northern California Current GLOBEC (GLOBal ocean ECosystems dynamics) cruises. Trophic groups based on cluster analysis of diets (percent wet weight) are blocked and labeled (**A**) to (E). Species not blocked lacked sufficient numbers and frequency of occurrence for analysis. Scientific names of species in the order they appear in the figure are the following: blue shark (*Prionace glauca*), Pacific hake (*Merluccius productus*), chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), jack mackerel (*Trachurus symmetricus*), northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea pallasi*), sablefish (*Anoplopoma fimbria*), whitebait smelt (*Allosmerus elongatus*), steelhead trout (*O. mykiss*), chum salmon (*O. keta*), market squid (*Loligo opalescens*), Pacific sand lance (*Ammodytes hexapterus*), surf smelt (*Hypomesus pretiosus*), spiny dogfish (*Squalus acanthias*), Pacific sardine (*Sardinops sagax*), widow rockfish (*Sebastes entomelas*), Pacific saury (*Cololabis saira*), lingcod (*Ophiodon elongatus*), rockfish (*Sebastes* sp.), darkblotched rockfish (*S. crameri*), canary rockfish (*S. pinniger*), and bank rockfish (*S. rufus*). Life history stages of nekton are shown in parentheses: j = juvenile, y = yearling, and a = adult; nekton and prey with no indication of life history stage are adult.

Figure 3.2.2: Nekton diet summary, Miller & Brodeur 2007

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 in 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 predators. 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 year study, 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.

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, that shares a predator 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.

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 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 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.

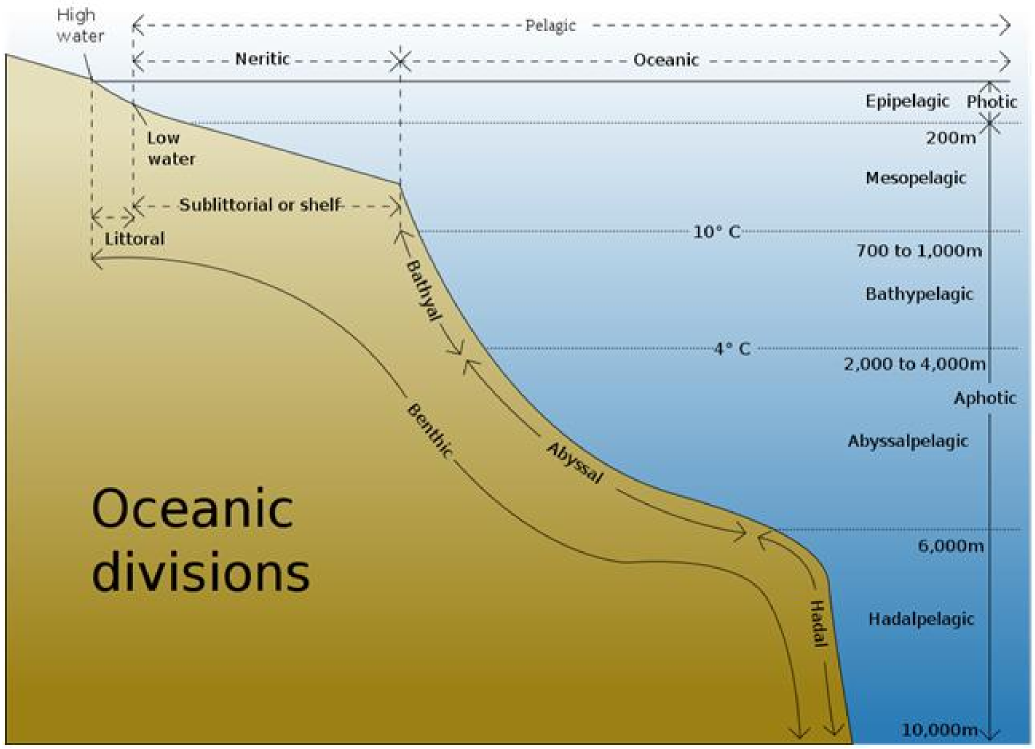


Figure 3.3.1: Divisions of coastal and oceanic zones, Wikimedia Commons

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.

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).

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.

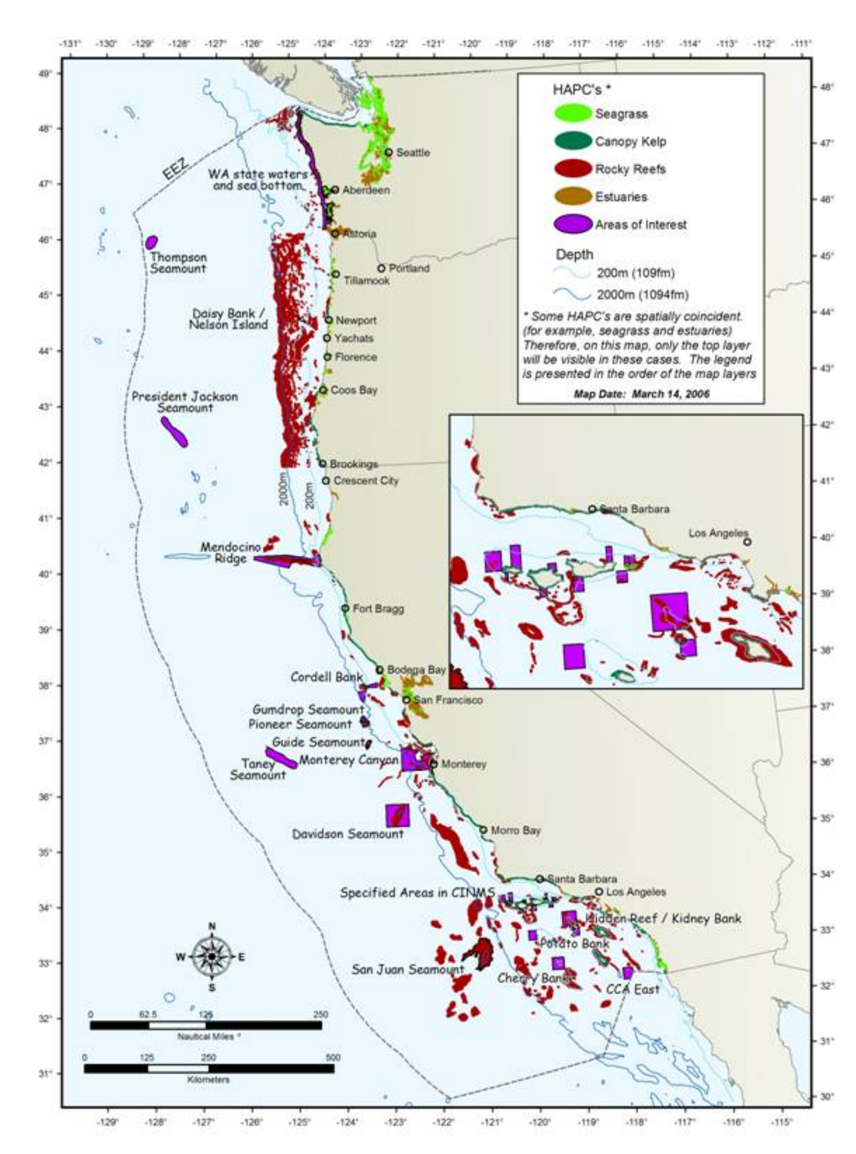


Figure 3.3.2: Groundfish HAPCs and Major Geological Structures [Figure 7-2 from Groundfish FMP]

- 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.

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 below 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.

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 into 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. 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.

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 which 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 is bounded by sills both seaward (Admiralty Inlet, 65 m depth) and landward (Narrows, 45 m depth (Navy 2006). 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 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 which are also weakly-tomoderately stratified down to the bottom. Such stratified waters may also be an important habitat, since they often occur after upwelling has decreased, and hence there may be significant residual production occurring in these waters, which often is focused and intensified near the depth of the pycnocline. Hence total water column productivity may be lower, but 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 (decreasing temperature), nitrate levels increase. When strongly stratified, such waters may be lower than saturation in oxygen content, depending on the orginal source of the water, and the balance between oxygen production by plants, and oxygen utilization for organism respiration and bacterial decomposition. Oxygen levels typically decrease with depth, to the "oxygen minimum zone" found typically just below to several hundred meters below the beginning of the main thermocline, below which oxygen levels may actually increase slightly.

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 Current (and hence the frontal zone and delineation between the other vertical water column types) 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.

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. 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, 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

Th 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, as 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 in the later winter or early spring, in a progression from south to north in the nearshore region. 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 which 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, and this FEP will be updated as the results of that discussion become available during late 2012 and beyond. 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 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). 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.] Laboratory studies can be used to examine habitat preferences in fishes under controlled conditions and provide the opportunity to introduce predation as a factor (e.g., Ryer et al. 2004).

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.

3.3.4 Human Effects on Council-Managed Species' Habitat

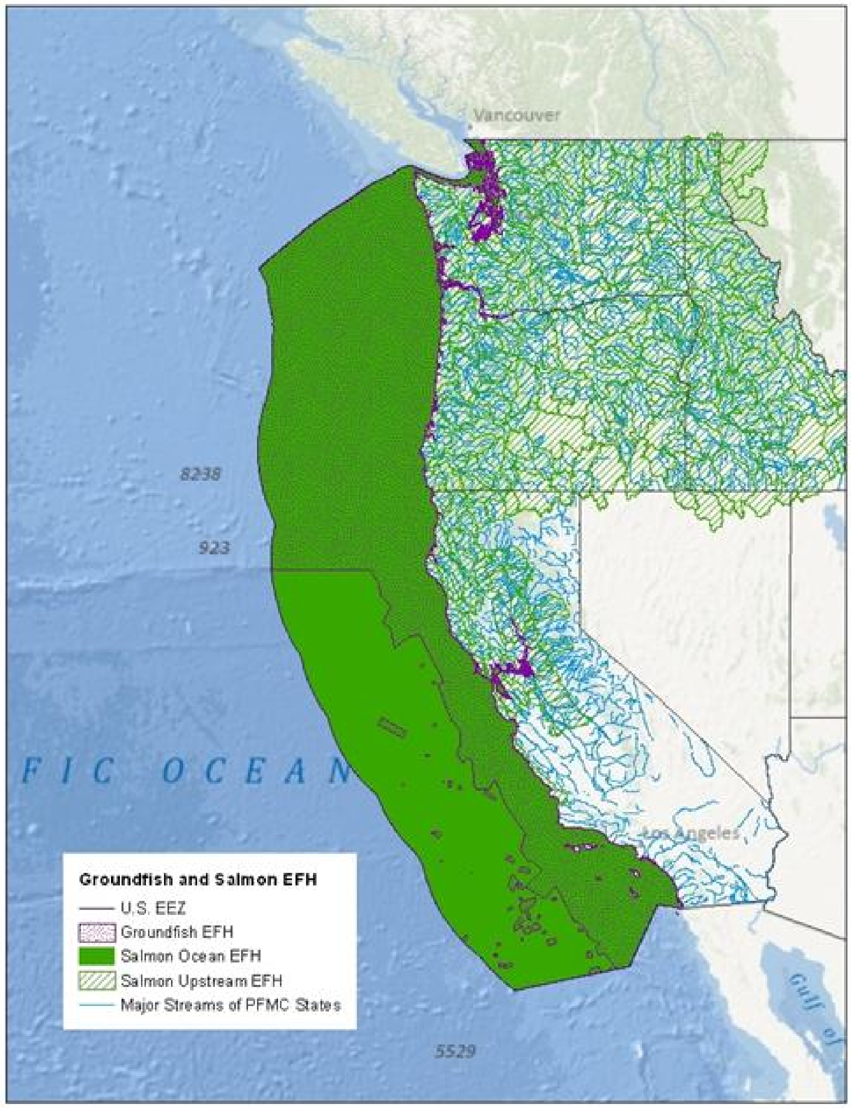


Figure 3.3.3: Groundfish and Salmon EFH of the West Coast

The MSA defines essential fish habitat (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 and, taken together, EFH of Council-managed species ranges from the salmon streams of Idaho to the international high seas habitats of highly migratory species. 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).

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.]

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 (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)

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 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 a 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.

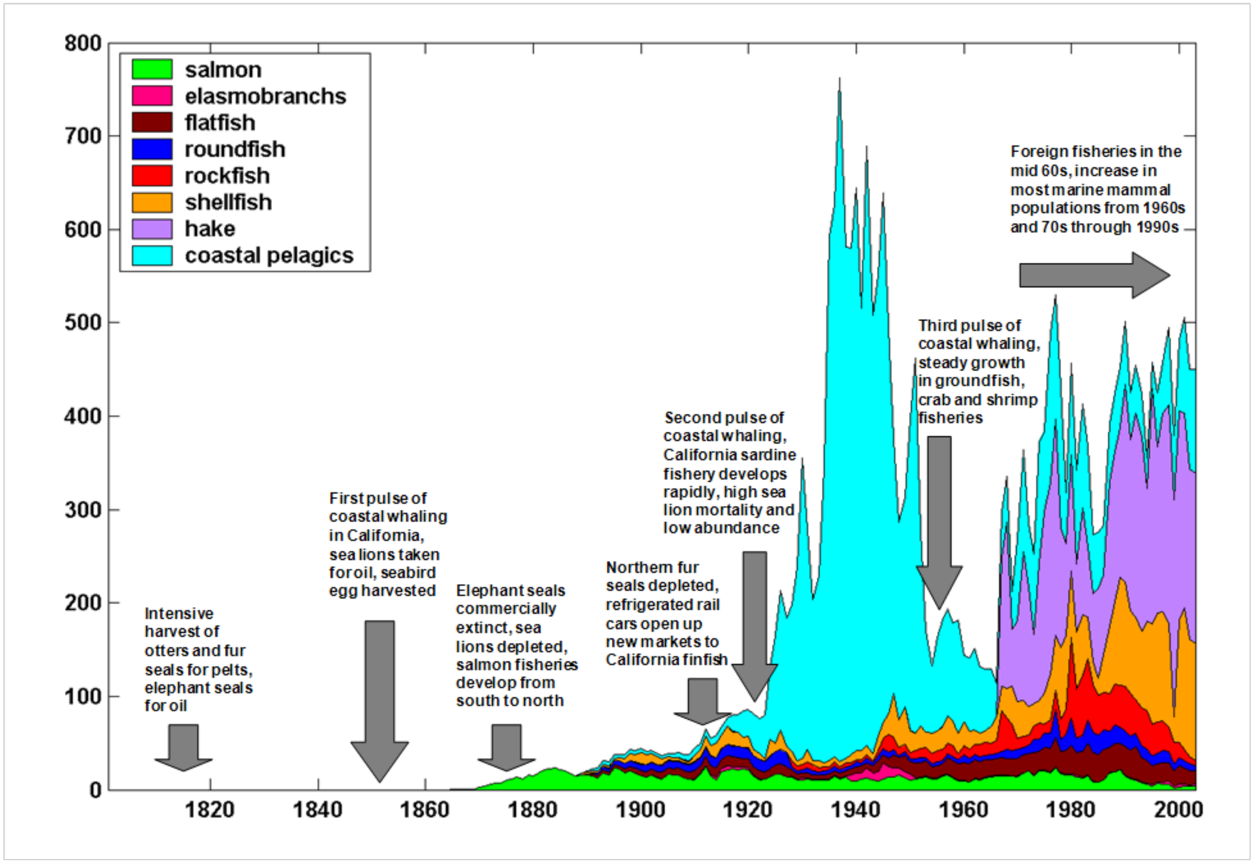


Figure 3.4.1: Major fisheries removals and developments within the U.S. portion of the CCE over the past two centuries

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 grey, 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-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.

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 19^{th} 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 notorious is the sardine fishery, immortalized by John Steinbeck in *Cannery Row*. Although sardines had been fished 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 decline (Clark and Marr 1955, Murphy 1966, Smith 1994). By the time the fishery was closed in 1968, the sardine population had declined by several orders of magnitude. However fisheries for northern anchovy, Pacific mackerel and jack mackerel continued. 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 (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.

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 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 (2005 $), 2000-2011.

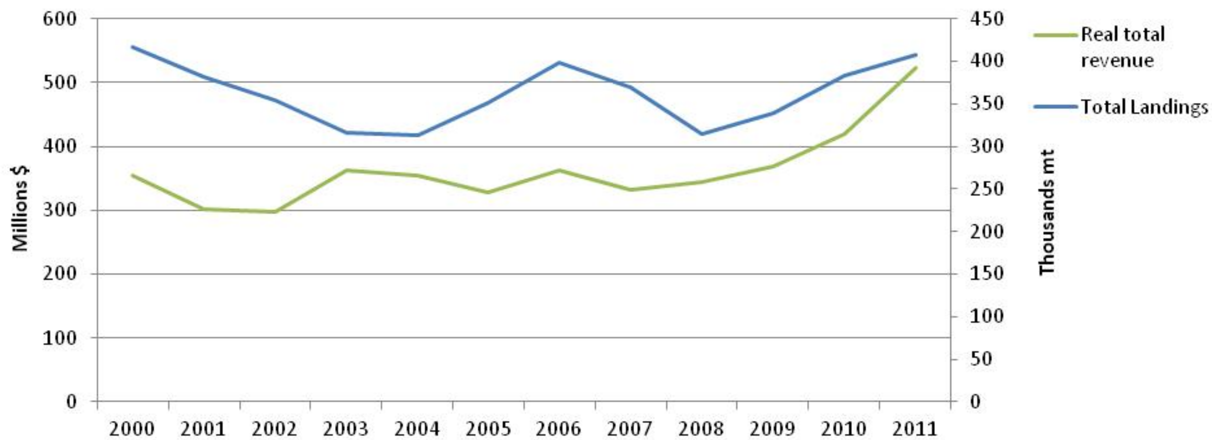
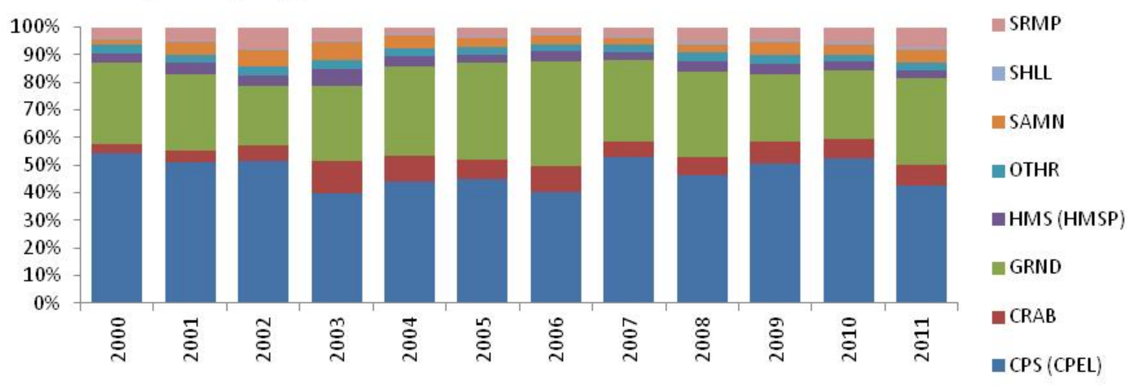


Figure 3.4.3: Percentage of total U.S. West Coast commercial landings by PacFIN management group, 2000-2011.



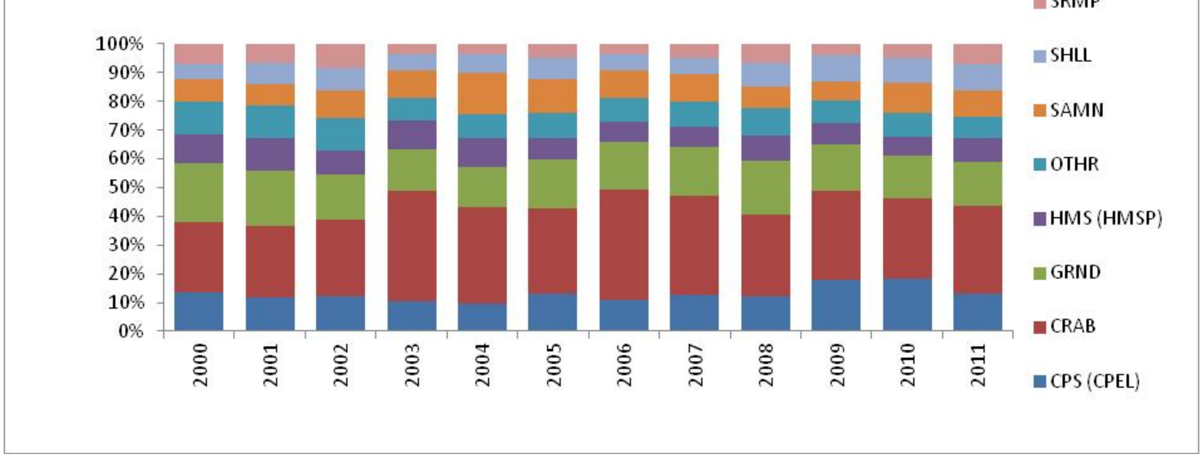


Figure 3.4.4: Percentage of total U.S. West Coast exvessel revenues by PacFIN management group, 2000-2011.

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.

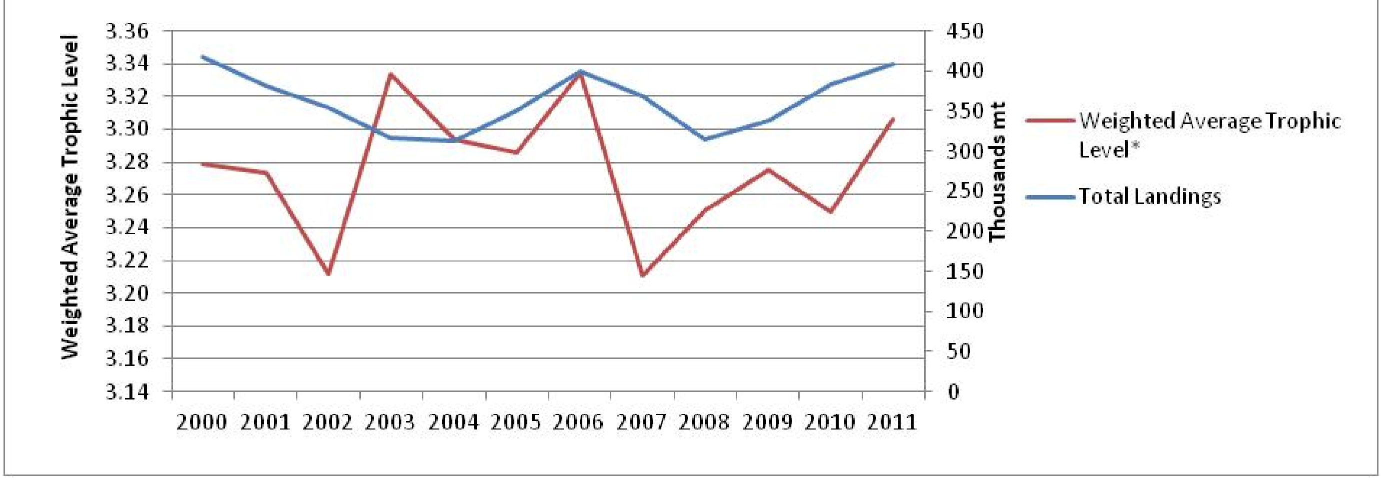
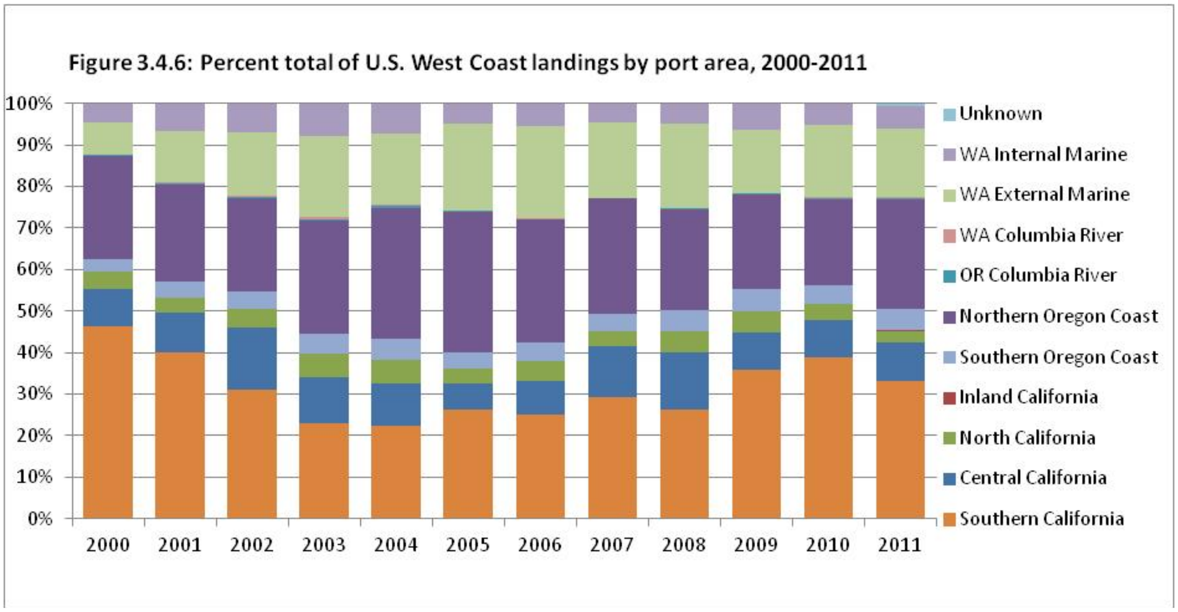
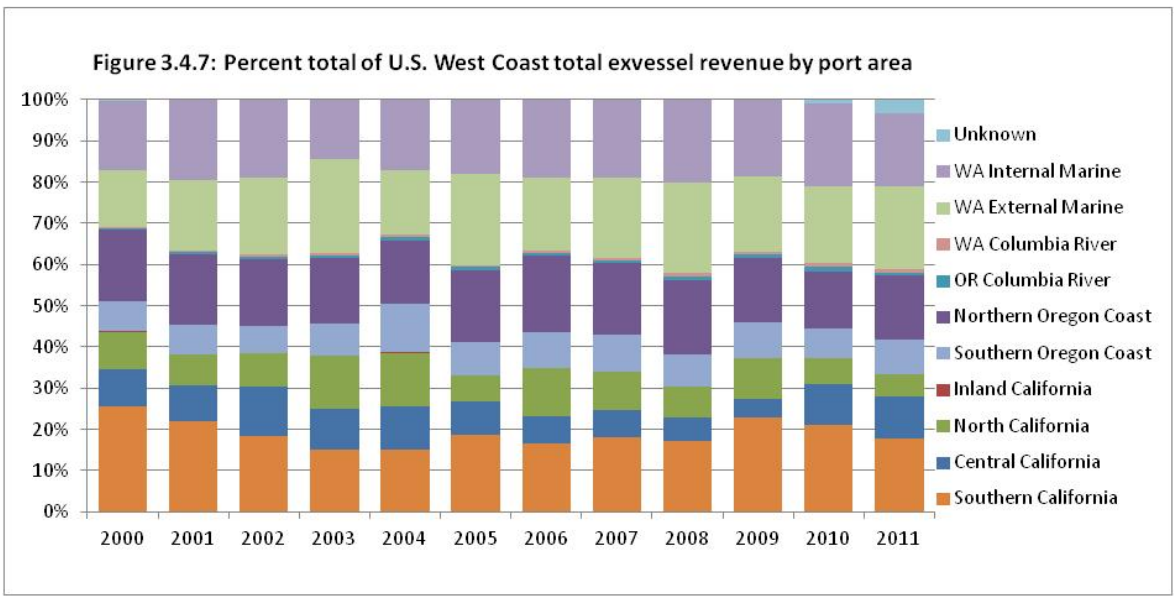


Figure 3.4.5: Total quantity (mt) and weighted average trophic level of U.S. West Coast landings, 2000-2011.

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).





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.

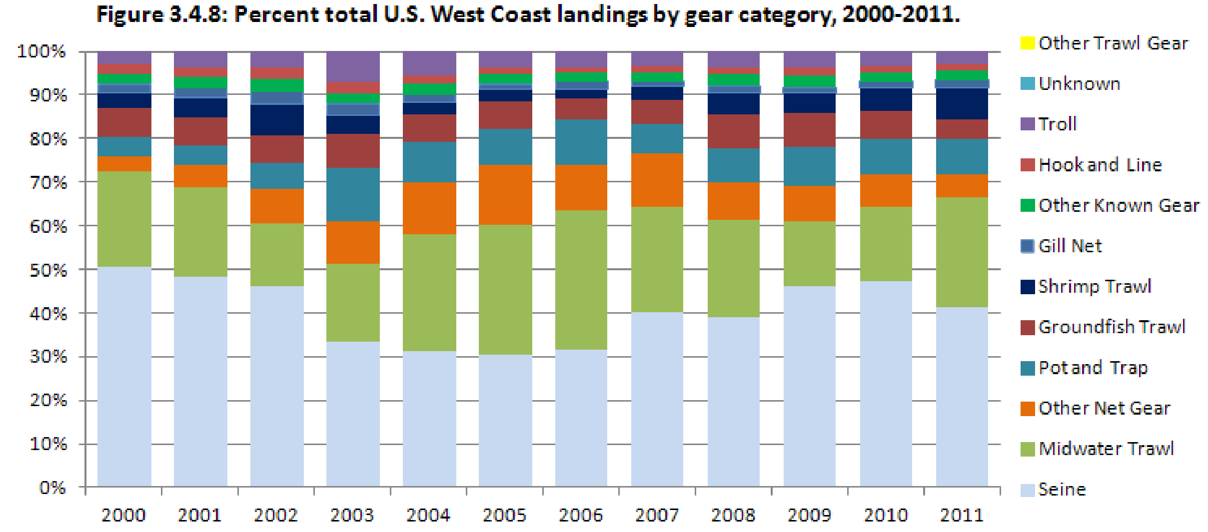
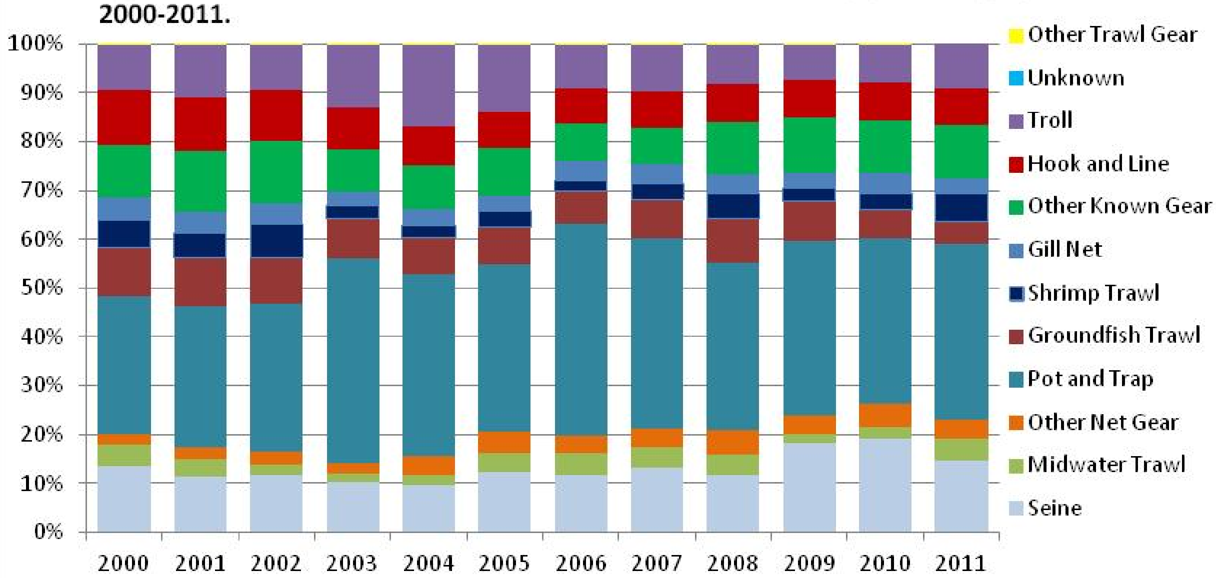
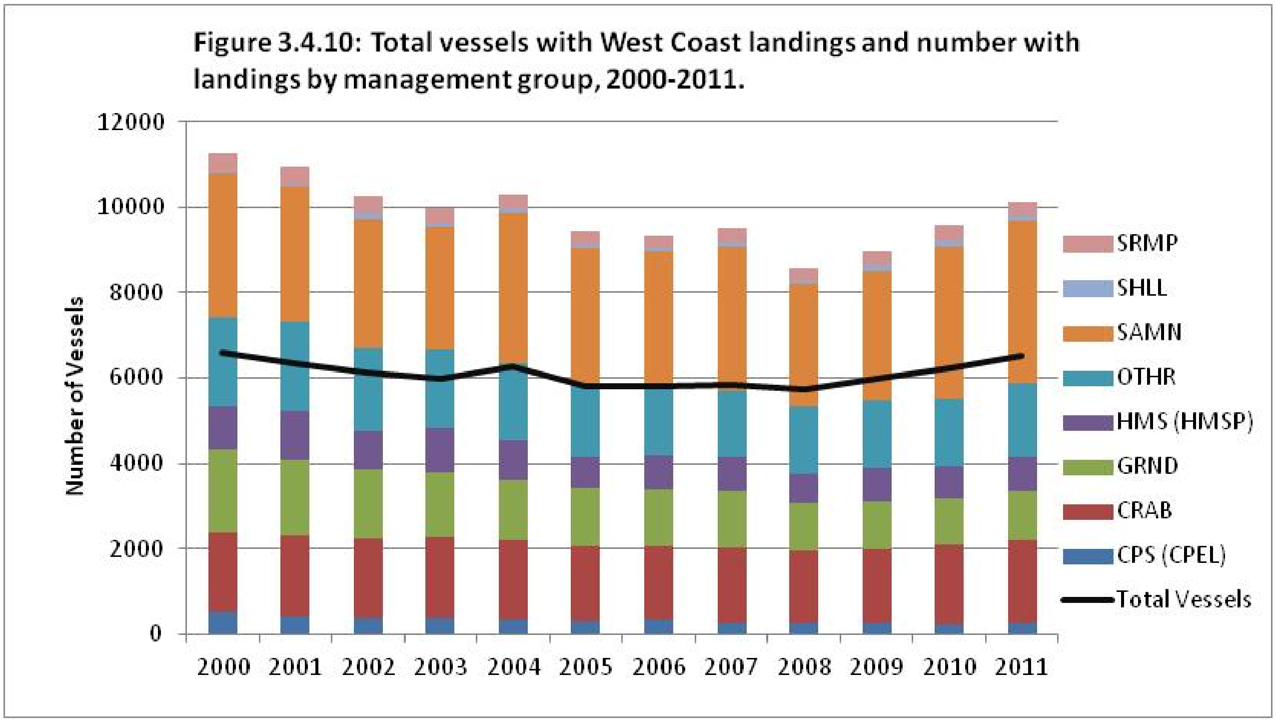


Figure 3.4.9. Percent total U.S. West Coast exvessel revenues by gear category, 2000-2011.

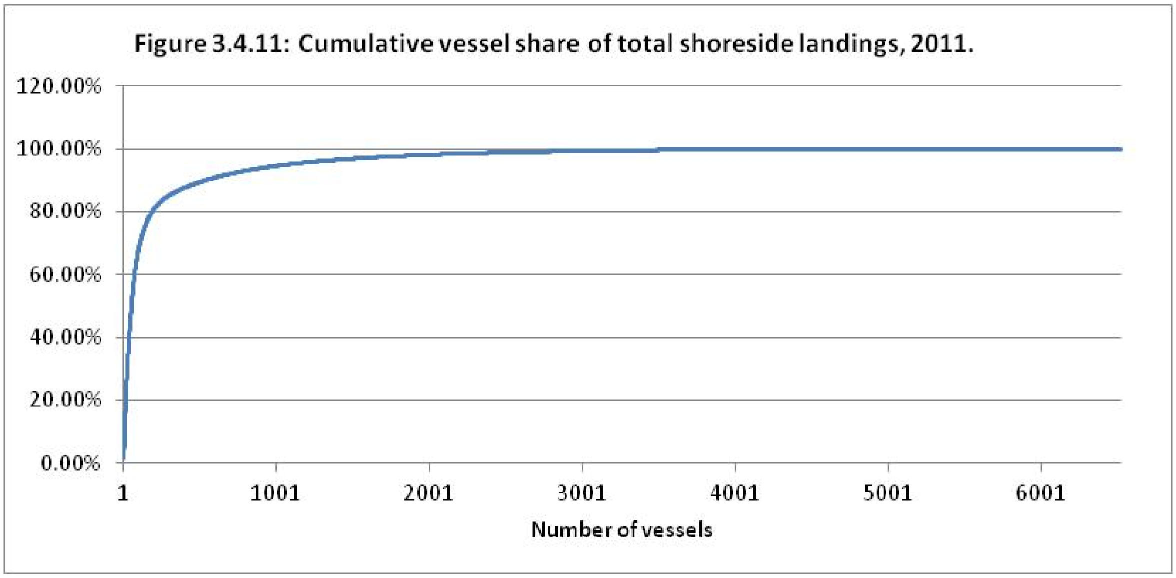


During the 2000-2011 period, the number of vessels that made landings in U.S. West Coast commercial fisheries remained fairly constant at around 6,000 annually (Fig. 3.4.10). Many of these vessels are capable of harvesting species in more than one management category, either using a single gear type (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.

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 suggests that in 2011 there were far more vessels than necessary to harvest the total landings. However, this finding for 2011 must be tempered by the temporal scale and scope of West Coast commercial fisheries, which are subject to the vagaries of ecosystems and economic systems alike.



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.

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 CDFG 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 means of enforcing fish landings and importing rules. Regulations on sales, processing, and transport of fish differ by state yet, again, 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 (HACCP) 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]

Figure 3.4.12 Example of FishTrax bar code card

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

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

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.

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.

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 3.4.1indicates, 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.

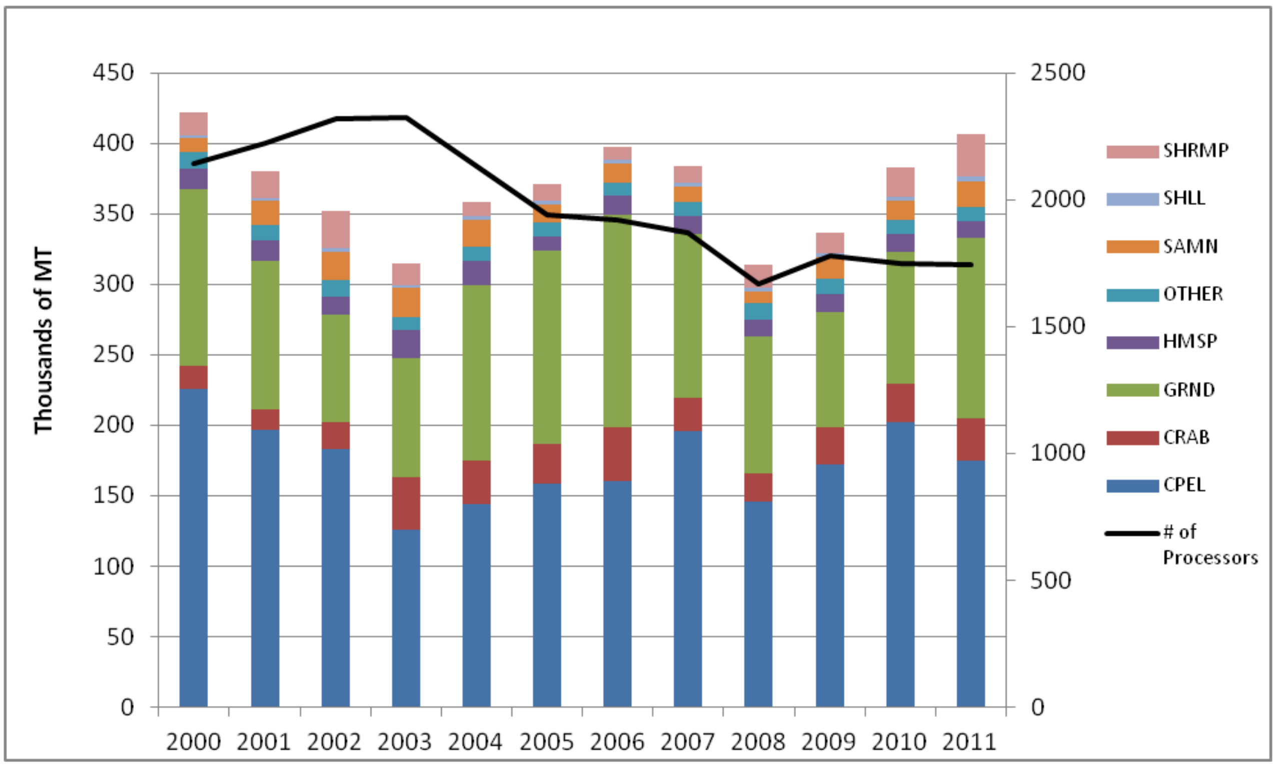


Figure 3.4.12 Coastwide processor count and major management species groups landings in mt. Unique primary processors only (secondary plants not counted), any processor that landed >100 lb in 2000-2011. Note: double-counting exists, since most processors land more than one type of species. Data source: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

Table 3.4.3. Number of seafood businesses by state for 2006-2008 (NMFS 2010).			
	Seafood product prep. & packaging		
Washington	2006	2007	2008
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		
Washington	2006	2007	2008
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		
Washington	2006	2007	2008
Employer firms	115	127	107
Oregon			
Employer firms	16	18	18
California			
Employer firms	252	300	278

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.

The model outputs reported in 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 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 3.4.1. 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

Table3.4.2. Direct Seafood Industry Impacts for Oregon, 2007-2009 (source: NMFS 2011#)

	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 3.4.3. Direct Seafood Industry Impacts for California, 2007-2009 (source: NMFS 2011)

	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

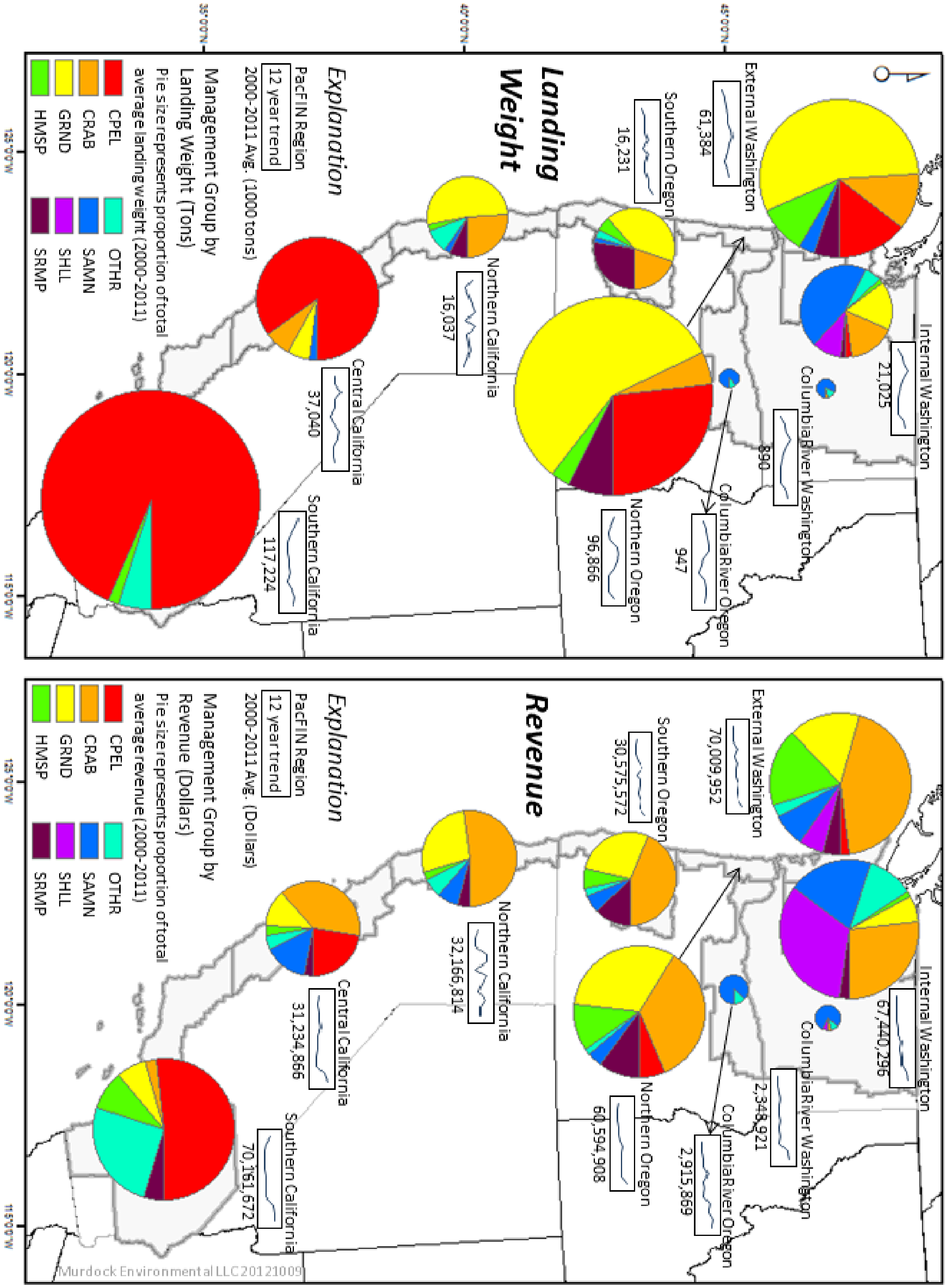


Figure 3.4.13. Regional landings by weight and value, with 12-year trends and average proportions for each major West Coast management group, 2000-2011. (Maps courtesy of Murdock Environmental, data source: PacFIN.

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 and the information is used to estimate total marine recreational catch and effort. It is a coordinated sampling survey designed to gather information for all finfish species, from anglers in all modes of recreational fishing [shore, party/charter and private/rental (or skiff)]. 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 has two survey programs, one to sample recreational catch from boats leaving coastal ports and then another to monitor recreational catch in Puget Sound.

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. In addition, information on discarded fish reported by anglers is recorded, as is the location of fishing activity by samplers onboard vessels or conducting interviews dockside. The Council relies on both state data gathering programs and on RecFIN to evaluate the effects of recreational fisheries on Council-managed species.

Recreational catch data includes numbers or weights of fish landed, by species or species group, numbers or weights of sampled discards, and angler-estimated numbers of discards. Recreational catch estimates are incorporated into stock assessments, particularly for salmon, Pacific halibut, and some groundfish and HMS species. In addition, estimates are used inseason, or during the year, 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. 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 can give us a broad-scale perspective on fluctuations in annual 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.

Cumulative recreational fisheries landings during the 2004-2011 period hit a low of about 3800 mt in 2008, with a recent high in 2010 of about 5500 mt. The ocean salmon fisheries in 2006 and 2008 were declared fishery disasters by the US 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. 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 fisheries' targets, although recreational fishing for coho is prohibited in California. Other popular recreational targets are albacore, several of the nearshore rockfish species, Pacific halibut, and Pacific mackerel. Many of the more popular recreational fisheries' 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

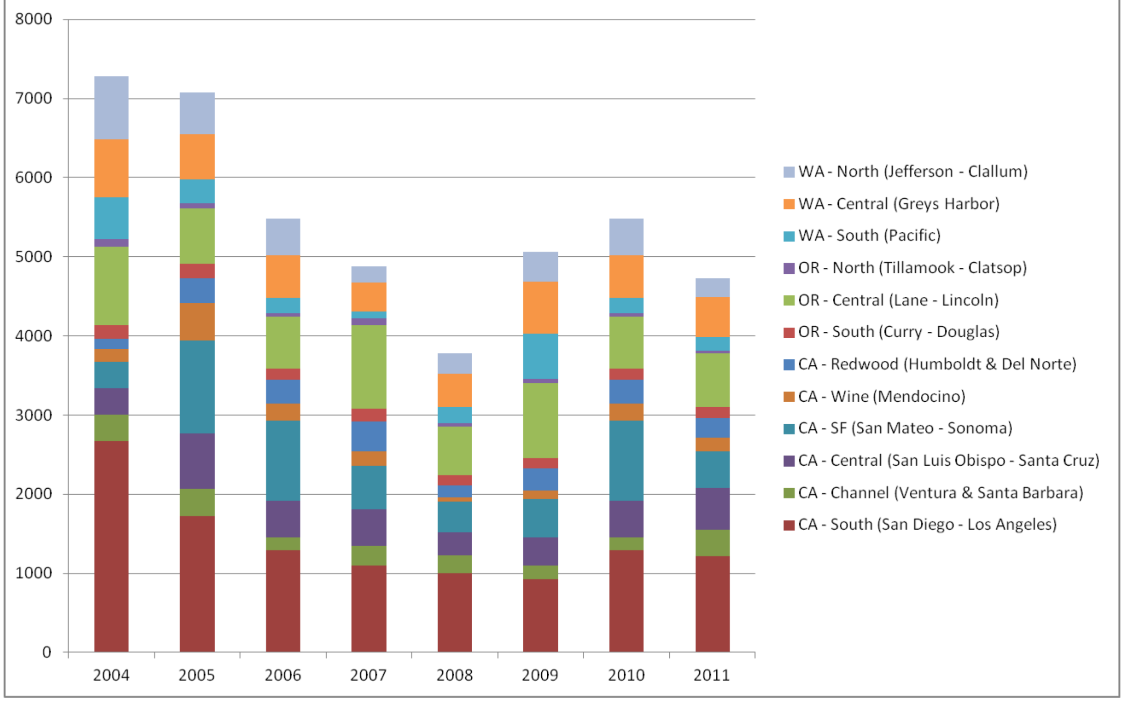


Figure 3.4.14. Annual cumulative West Coast recreational fisheries catch, in mt, separated by RecFIN sampling area

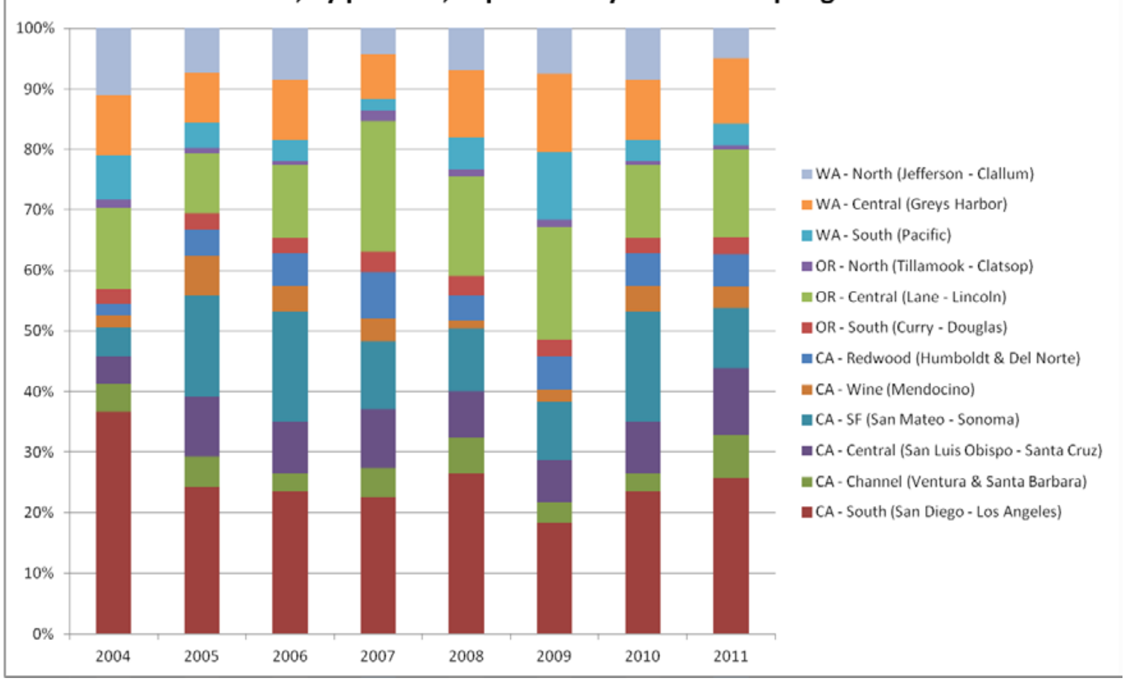


Figure 3.4.15. Annual cumulative West Coast recreational fisheries catch, by percent, separated by RecFIN sampling area

Table 3.4.7. 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%
	Chart is color-coded by FMP or CSP as follows:		CPS FMP	Groundfish FMP	HMS FMP	Salmon FMP	Pacific Halibut CSP	

*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

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 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 \$33.5M in 2007 and \$29.8M in 2008 (The Research Group, 2009). Recreational fishing is important to coastal residents, but also draws anglers from around the state as well as 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.

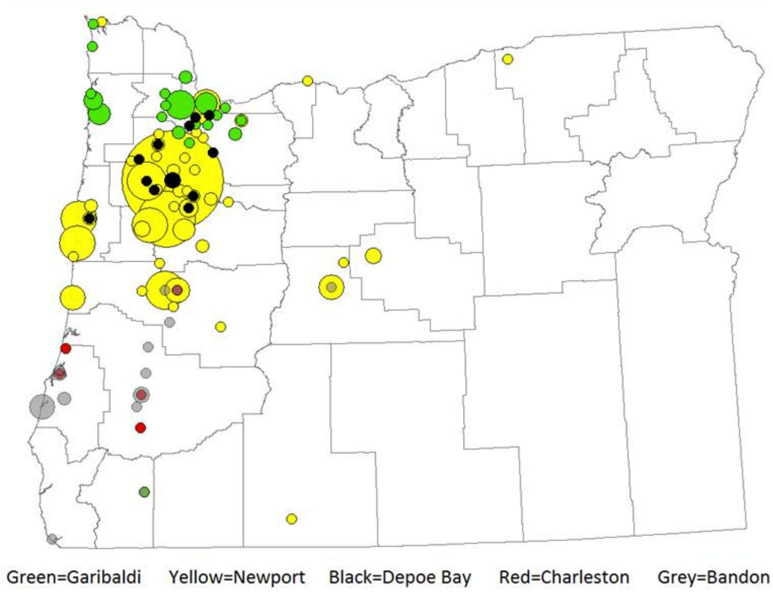


Figure 1 Hometowns of vessel owners and anglers who participated in the central Oregon coast halibut fishery. The colors and legend indicate the ports from which they launched. (Map courtesy Patrick Myrick, ODFW).

In addition, significant recreational fisheries for shellfish occur along the Oregon coast, contributing an estimated $36M 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 1.8M 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).

[Washington and California summaries to be added.]

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.

Under the 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.

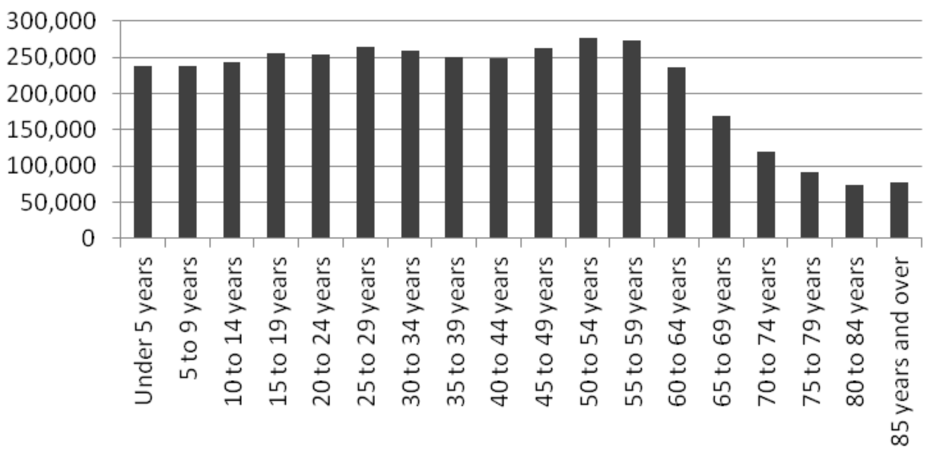


Figure 3.4.17. Age Distribution of Oregon's Human Population -- 2010 U.S. Census

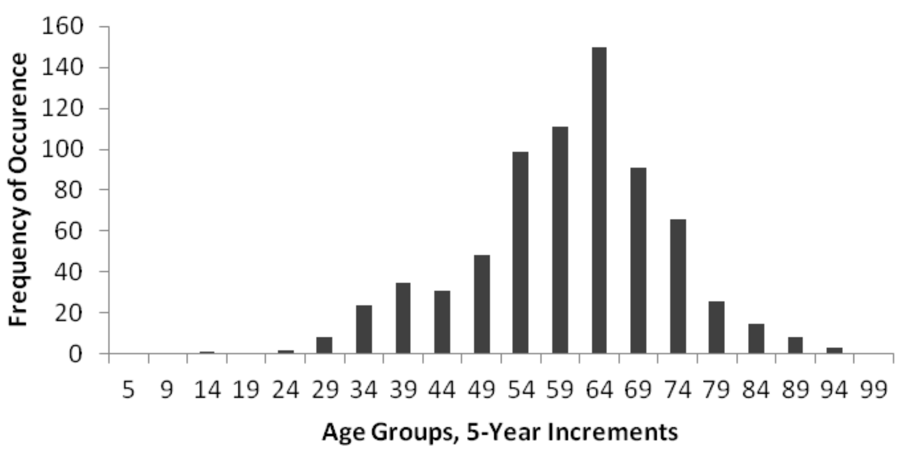
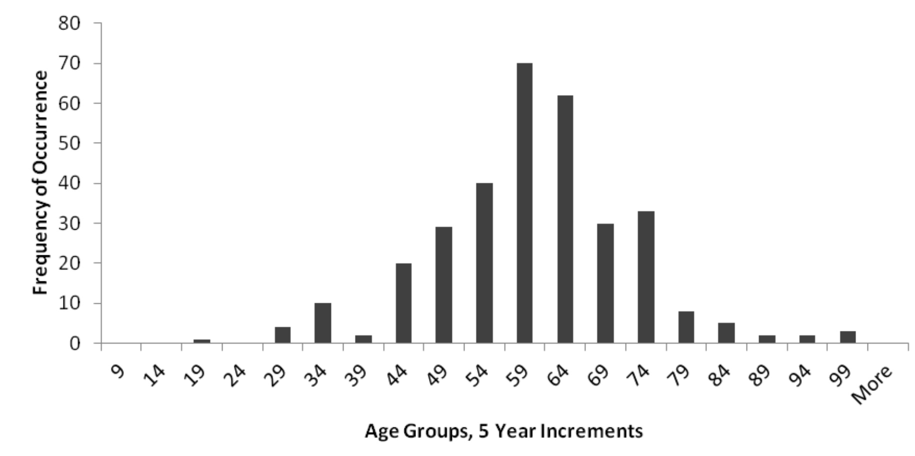


Figure 3.4.18. Age Distribution of Oregon's Salmon Troll Permit Owners

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

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



In Section 7.2.6, the FEP 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.

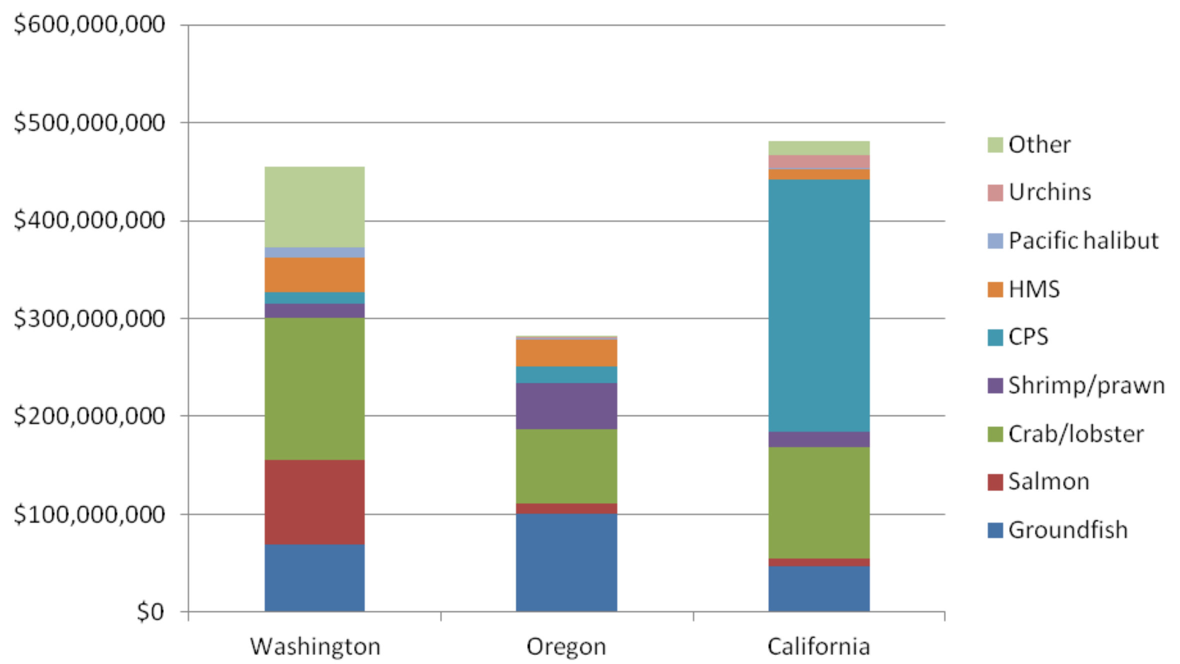
Within the Council process, economic analyses often separate fishing communities by geography or by sector (e.g., commercial or recreational, treaty or non-treaty, fishing or processing, trawl or fixed gear, purse seine or longline, etc.) Regional economic models are employed to assess the amount of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

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 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.

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 impacts were $1.68 and $1.91 respectively at the state level and $1.78 and $1.93 respectively coastwide.

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.

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

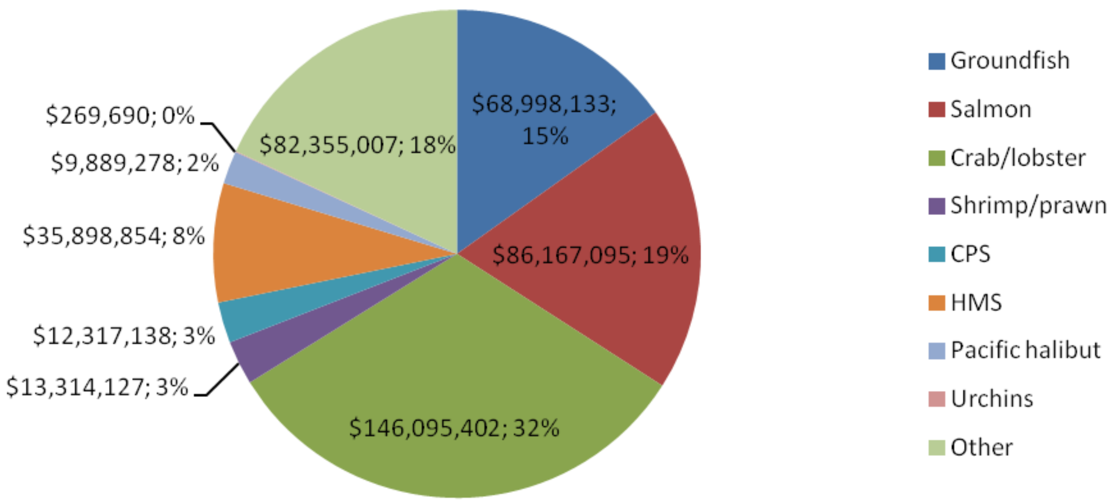
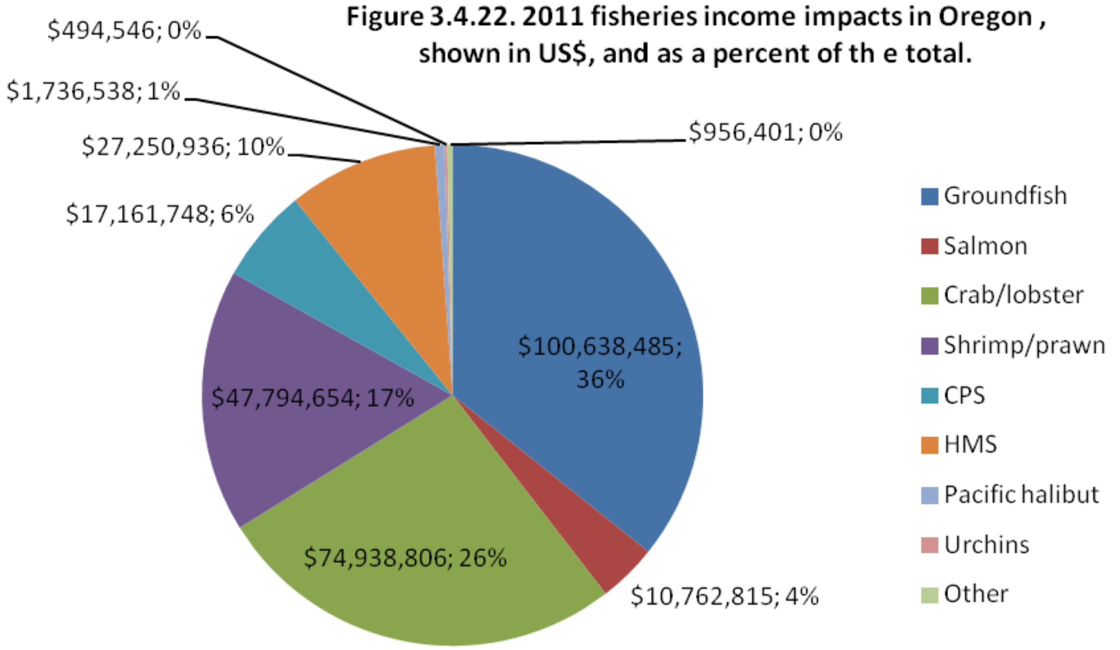


Figure 3.4.22. 2011 fisheries income impacts in Oregon , shown in US$, and as a percent of th e total.



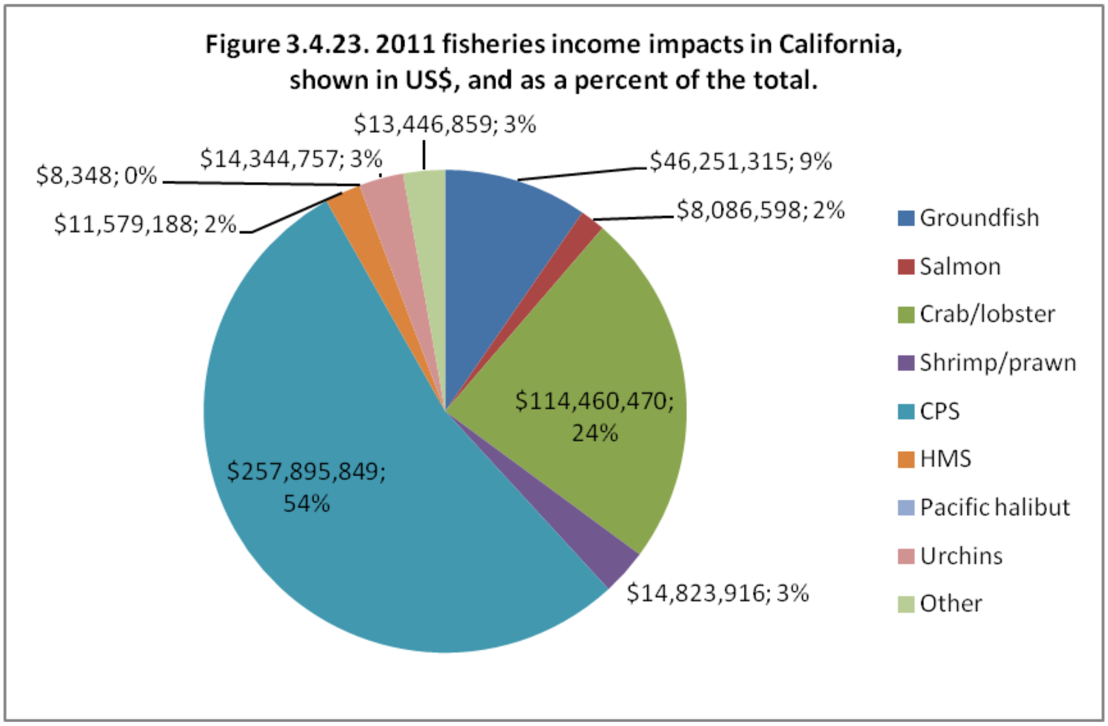
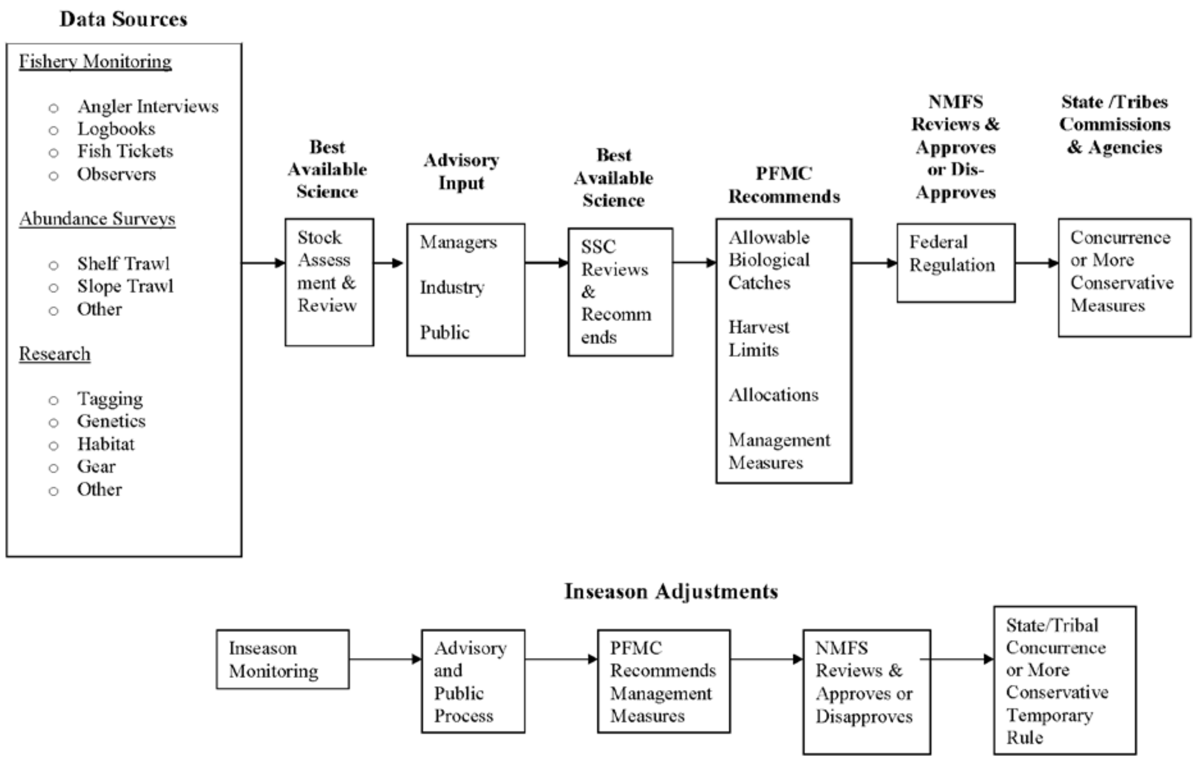


Figure 3.4.23. 2011 fisheries income impacts in California, shown in US$, and as a percent of the total.
$13,446,859; 3%
$14,344,757; 3%
$8,348; 0%
$11,579,188; 2%
$46,251,315; 9%
$8,086,598; 2%
$114,460,470; 24%
$257,895,849; 54%
$14,823,916; 3%
Groundfish
Salmon
Crab/lobster
Shrimp/prawn
CPS
HMS
Pacific halibut
Urchins
Other

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.

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	
	1977	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	
	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

Table 3.5.2: Major fishery management planning events in PFMC history		
Federal Fisheries Legislation-Related Events	Year	Major Council Events
		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)

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 West Coast 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 four common themes consistent with an ecosystem approach to fishery management: avoid overfishing, 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 this 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. 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 2011.

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 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 annual 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 a Current 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 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. Essential fish habitat (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 SAFE document.

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]
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]

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: swordfish longline fishery closure west of 150° W. long.; prohibition on light stick possession for longline vessels operating west of 150° W. long.; gear and operational modification requirements for HMS longline and drift gillnet vessels; seasonal area closures for longline and gillnet fisheries in times and areas where there have been prior fishery interactions with sea turtles, with additional closures during El Niño events; equipment and handling requirements for bringing incidentally caught turtles onboard, and resuscitating and releasing when possible. [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]
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]

3.5.1.3 CCE Species Managed Under the ESA or MMPA

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 of most marine and anadromous fish and mammal species of the U.S. CCE, although 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.

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, while Steller sea lions range across the entire North Pacific Ocean from coastal Japan and Korea to the U.S. West Coast, the portion off the U.S. West Coast is considered a DPS, known as the eastern DPS. While the Steller sea lion's U.S. western DPS remains listed as endangered under the ESA, NOAA has proposed removing the eastern DPS from ESA listing, based on its recovery from its prior status as threatened under the ESA (77 FR 23209, April 18, 2012).

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 uFnder 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. 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.

As shown in Table 3.5.5, ESA-listed marine or anadromous species that, in some 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
Northern Right whale (Eubalaena glacialis)		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
Bald eagle *(Haliaeetus leucocephalus)*		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)		
Canary Rockfish, Puget Sound/Georgia Basin DPS (Sebastes pinniger)		
Salmonids		
Chinook (*Oncorhynchus tshawytscha*)	Sacramento River winter ESU	Endangered

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

Marine mammals (cetaceans and pinnipeds) are protected under the Marine Mammal Protection Act (MMPA), regardless of whether their populations are depleted enough to warrant listing as threatened or endangered under the ESA. 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 2011, 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

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 northern resident 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*)	central North Pacific stock
North Pacific right whale (*Eubalaena glacialis*)	eastern North Pacific stock
Sei whale (*Balaenoptera borealis)*	eastern North Pacific stock
Minke whale (*Balaenoptera acutorostrata*)	CA/OR/WA stock
Pinnipeds	
California sea lion (*Zalophus californianus californianus*)	U.S. stock
Harbor seal (*Phoca vitulina richardsi*)	CA/OR/WA stock

Table 3.5.6: MMPA-protected species that may occur in U.S. West Coast EEZ	
Species	**Stocks**
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 United States stock

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.

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.

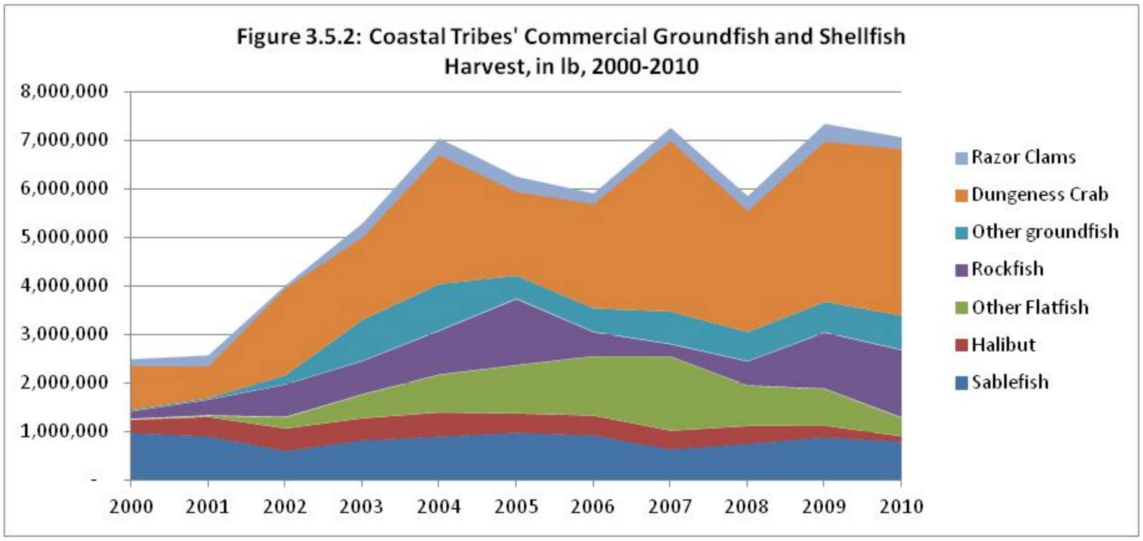
Each Tribe has established sets of laws and policies to achieve sustainable fisheries production through traditional and science-based management. Regulations to control conduct of each fishery (time, place, gear, etc.) are set through governmental procedures, and performance is monitored to ensure objectives 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



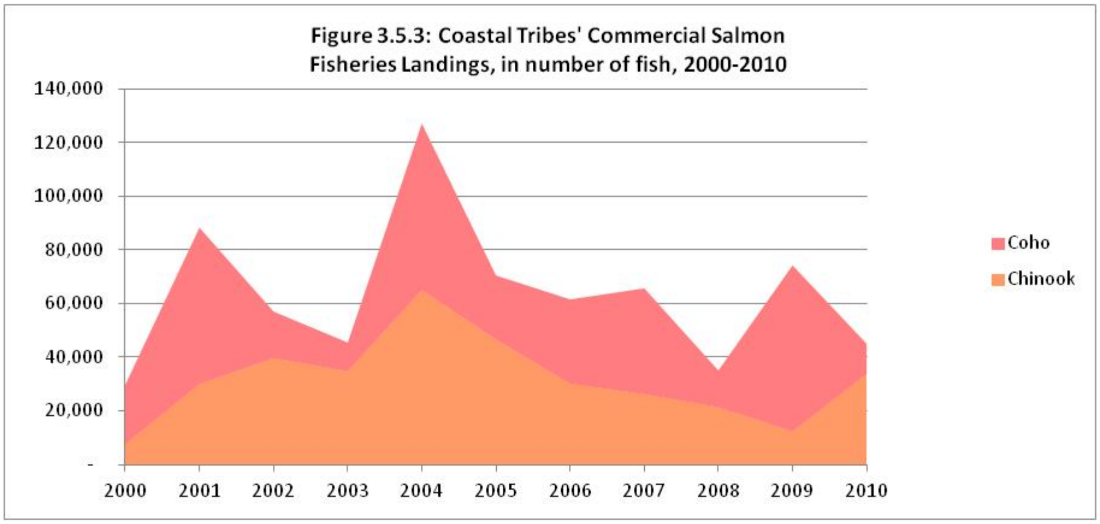


Figure 3.5.3: Coastal Tribes' Commercial Salmon Fisheries Landings, in number of fish, 2000-2010
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Coho
Chinook

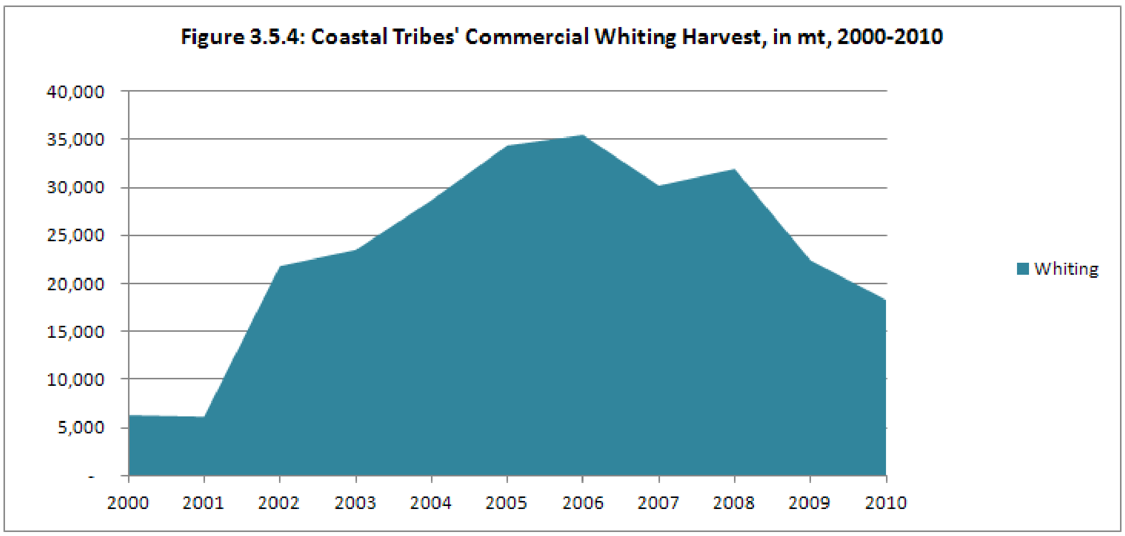


Figure 3.5.4: Coastal Tribes' Commercial Whiting Harvest, in mt, 2000-2010
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
Whiting

3.5.2.2 California Tribes in the Council Process

Tribal fisheries have been culturally important to California tribes since time immemorial. The primary stocks co-managed by the Council, California, and the Hoopa Valley and Yurok Tribes are the Chinook salmon stocks of the Klamath and Trinity River basins.

The Yurok Tribal fishery occurs within the lower 44 miles of the Klamath River. The Hoopa Tribal fishery occurs in the Trinity River from near the confluence with the Klamath River upstream to the 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 fall Chinook harvest is taken by dip nets and hook and line. Fall Chinook are typically harvested from early August through November, with peak harvest in the estuary occurring in late August through mid September and in the Trinity River from mid-August through mid-December, with peak harvest typically occurring in late-September to early-October.

In 1993, the Interior Department Solicitor issued a legal opinion that concluded the Yurok and Hoopa Valley Tribes of the Klamath Basin had 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 KRFC has been reserved for these tribal fisheries since 1994.

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. The Yurok and Hoopa Valley tribal authorities adopt annual tribal fishing regulations for their respective reservations.

The Yurok Tribal Council regulates the fall Chinook fishery via annual Fall 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 implemented. 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 KRFC 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 in the Yurok and Hoopa Valley Reservation Indian fall gillnet fisheries in the Klamath River 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. 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. Detailed Klamath River tribal fishery data can be found in the Council's annual Stock Assessment and Fishery Evaluation (SAFE) 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]).

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.

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.

[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.

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 the consumptive and non-consumptive interest groups;
- Support initiatives and existing programs which 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 which 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.

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 Exclusive Economic Zone. 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.

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

[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/

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.

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. 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 National Marine Fisheries Service regulations, including those recommended by the Pacific Fishery Management 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.

3.5.2.5 California Fisheries Management[6]

Within California's Natural Resources Agency there is the Fish and Game Commission (CFGC) and the Department of Fish and Game (CDFG) 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.

The Marine Life Management Act (MLMA) was enacted 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 CDFG. 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 fishery management plans (FMPs) as the framework for management—initially specifying development of FMPs for the nearshore fishery and white seabass.
- 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

[6] CDFG 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

fishery management plans are prepared by CDFG 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 NFA 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.

The Marine Life Protection Act (MLPA) was enacted in 1998 and directs the state to reevaluate and redesign California's system of marine protected areas (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. 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 Coastal Zone Management Act (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."

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 CPOA 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 program for California. The state program would be independent of the international Marine Stewardship Council's certification program. The directives of the state program include development of certification protocols for sustainable fisheries, a marketing and assistance program, a competitive grant and loan program for certification, an eco labeling component and an advisory committee. While the CDFG is not directly involved in the efforts to establish a California sustainable seafood certification 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.

3.5.2.5 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 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 four mainstem reservoirs and dams on the lower Snake River.

Only limited Snake River fall Chinook spawning occurred downriver from Snake River km 439, the site of Oxbow Dam. The construction of Brownlee Dam (1959; RKm 459 [construction completed in 1959, location at approximately 459 km from river's mouth]), Oxbow Dam (1961; RKm 439), and Hells Canyon Dam (1967; RKm 397) eliminated the primary production areas of Snake River fall Chinook salmon. Chinook had been prevented from accessing 58% of prime spawning habitat as early as 1901 with the construction of Swan Falls Dam at RKm 734 (Parkhurst 1950). Habitat was further reduced with the construction of four additional 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 to fall Chinook salmon 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 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 (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 Departments of Fish and Wildlife estimate that the 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

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

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, these fish are caught an average of 1.5 times, and about 50% of them are harvested (IDFG unpublished data).

3.5.3 Multi-State, Multi-Tribe and State-Tribal Fisheries Authorities

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 collects data and maintains databases on salmon, steelhead, and other marine fish for fishery managers and the fishing industry. For example, it 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.

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.

3.5.4 Internationally Managed Fisheries

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 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;
- 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.

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.

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 High 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:

- International Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries
- International Plan of Action for the Conservation and Management of Sharks
- International Plan of Action for the Management of Fishing Capacity
- International Plan of Action 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.

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 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 for the Western Hemisphere Convention (16 U.S.C. 1531-1543; 87 Stat. 884).

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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 develop 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.

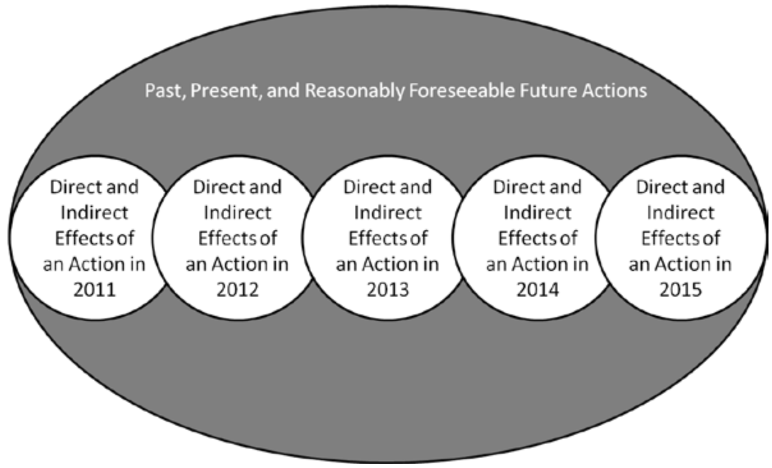


Figure 4.1: Cumulative Effects under NEPA

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.) 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. In Chapter 7, the FEP 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 obvious at the single species level, but less so at the community or ecosystem level. By both definition and design, fishing results 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 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 ecosystem prior to the advent of modern fisheries was simply recycled within ecosystem (EPAP 1999). The consequences of various level 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).

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 explicit 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 indicate 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.

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 (LTL) 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), Chapters 6 and 7 of this FEP include potential initiatives and research activities that could improve the scientific basis for addressing such issues in a management context.

Beyond the combined potential effects of managing suites of species to their estimated MSY levels, fishing truncates the age- and size (length)- structure of fish populations as older and larger individuals are typically selected by fisheries (Murawski et al. 2001). While the older age (and larger length) classes lost due to fishing mortality are not explicitly considered under current harvest control rules, there is evidence that loss of such individuals from a population can have deleterious impacts on the long term sustainability of that population (Berkeley et al. 2004a, Berkeley 2006). Current harvest control rules set a target level of female spawning biomass as an MSY proxy without consideration of the population age or length structure. The implicit assumption is that larvae produced by all females are equivalent in their probability of survival, although recent research suggests that larvae of older females are more likely to survive than those of younger females (Berkeley et al. 2004a, Berkeley 2006). However, research suggests that if older fish contribute disproportionately to recruitment, managing solely for a target spawning biomass will maximize neither yield nor population resilience (Murawski et al. 2001, Berkeley et al. 2004b, Berkeley 2006).

Specific age / length effects potentially include increased relative fecundity with age / length (Bobko and Berkeley, 2004), the storage effect of long-lived fish (Warner and Chesson, 1985), the effects of maternal age on birth date (Bobko and Berkeley, 2004; Wright and Gibb, 2005) and on larval resistance to starvation (Berkeley et al. 2004a), as well as migratory behavior that young fish 'learn' from older fish. In fish that exhibit age / length-related temporal patterns of spawning, elimination of older age classes through fishing will shorten the spawning season, potentially resulting in recruitment failure in years when successful recruitment is centered on a limited portion of the spawning season (Berkeley et al. 2004b). Age / length truncation is likely to be more problematic for the high recruitment variability species (Hollowed et al. 1987; Moser et al. 2000) managed by the Council since stock maintenance may be dependent on the relative stability of reproductive output when a population includes older age classes (Leaman and Beamish 1984). Longevity provides a storage effect that ensures the extended survival of adults until favorable recruitment conditions return (Warner and Chesson 1985), allowing such populations to persist during extended periods of adverse climatic conditions when recruitment fails. However, fishing induced truncation of a population's age length distribution may jeopardize population resilience to long term poor recruitment conditions (Berkeley et al. 2004b). Evidence also suggests that a broad age / length distribution can also reduce recruitment variability (Lambert 1990; Marteinsdottir and Thorarinsson 1998; Secor 2000a,b) by spreading larval production across a range of environmental conditions (Berkeley and Houde 1978; Lambert 1987; Hutchings and Myers 1993), and via increased larval survival from older / larger fish that may produce larger, healthier, or otherwise more fit larvae (Marteinsdottir and Steinarsson 1998). In Section 7.2.1, this FEP proposes a potential initiative to investigate the long-term effects of Council harvest policies on age-and size- distribution in managed stocks.

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

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, 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 includes 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 salmonids and other protected 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 be consuming millions of salmonid smolts 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-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., El Nino/Southern Oscillation) and interdecadal (e.g., Pacific Decadal Oscillation) 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 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 are 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 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 Nino 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.

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.

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

In general, West Coast groundfish fisheries may affect non-target species in a variety of ways, although bycatch is often considered the most serious (Dayton et al. 1995). Other fishing effects may 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).

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 at the water's surface (FAD – floating aggregation devices; Aliani and Molcard 2003)) and on the bottom (artificial reefs; Stolk et al. 2007). Specific examples of fishing impacts to nontarget species are described in further detail below.

[The groundfish and CPS commercial fisheries are emphasized in this November 2012 draft. To be updated with discussions of salmon and HMS fisheries.]

4.2.1.1 Groundfish Fisheries

Marine mammals

From 2002–2009, there was only a single fishery interaction with a large whale reported by the groundfish observer programs (collision between a fishing boat and a sperm whale (Jannot et al. 2011a)). The lack of observed interactions with those components of the fishery that have moderate to high observer coverage (at-sea hake catcher/processor and most parts of the bottom trawl fisheries) indicates that direct interactions between these components of the groundfish fishery and large whales are rare (Northwest Fisheries Science Center 2011). However, most components of the open access fixed gear portion of the groundfish fisheries have very low observer coverage, so the lack of reported interactions with fixed gear such as traps or pots does not indicate that such interactions do not occur. Indeed, the observation of stranded or dead whales with trailing gear or evidence of gear-related scaring indicates that some unobserved fishing mortality does occur, although few of these deaths can be directly linked to a specific fishery (Northwest Fisheries Science Center 2011).

Despite all of the potential risks imposed on cetaceans by groundfish fisheries in marine ecosystems outside the CCE, direct cetacean interaction with the US West Coast commercial groundfish fishery are rarely observed (Jannot et al. 2011a). The Northwest Fisheries Science Center (2011) summarized the potential impact of the California Current groundfish fisheries on the following species/guilds: striped dolphin (Stenella coeruleoalba); short-beaked common dolphin (Delphinus delphis); Risso's dolphin (Grampus griseus); Pacific white-sided dolphin (Lagenorhynchus obliquidens); northern right whale dolphin (Lissodelphis borealis); Dall's porpoise (Phocoenoides dalli); sperm whale (Physeter macrocephalus); fin whale (Balaenoptera physalus); blue whale (B. musculus); humpback whale (Megaptera novaeangliae); Baird's beaked whale (Berardius bairdii); and, a small beaked whale guild (including Cuvier's beaked whale, Ziphius cavirostris, and beaked whales of the genus Mesoplodon). They concluded that the annual take from groundfish fisheries never approaches the potential biological removal level for any of the aforementioned species of cetaceans covered in the Stock Assessment (Carretta et al. 2011). However, given the low observer coverage of most fixed gear fleets, and the potential for indirect or unobserved effects (Bearzi et al. 1999, DeMaster et al. 2001, DeMaster et al. 2006, Robbins et al. 2007) there is considerable uncertainty in characterizing population level impacts from this gear type.

Groundfish fisheries in the CCE are likely to have, at most, a negligible effect on the population growth rate of the Southern Resident killer whales (Northwest Fisheries Science Center 2011). Southern Resident killer whales are a slow growing population, and although the species is capable of maintaining a 2.3% growth rate (Olesiuk et al. 1990), this population has achieved a growth rate of only 0.4% since the mid-1970s. Previous work has demonstrated links between prey availability (Chinook abundance), and killer whale fecundity and survival (Ford et al. 2009, Ward et al. 2009). The linear relationship between Chinook abundance and probability of calving can be used to evaluate a reduction of 0.25%; under this scenario, the probability of a female calving would be reduced by 0.06%. Given that births occur infrequently, and the population is subject to both demographic and environmental stochasticity, such a change would be undetectable (Northwest Fisheries Science Center 2011).

The total U.S. fishery mortality and serious injury for Guadelupe fur seal stock is less than 10% of the calculated potential biological removal and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate (Northwest Fisheries Science Center 2011). There are no reports of Guadalupe fur seal bycatch from the groundfish fisheries in the CCE, and habitat and trophic effects are likely small. Thus, impacts on population growth rate are likely to be negligible (Northwest Fisheries Science Center 2011).

The West Coast Groundfish fisheries are imposing some minor additional (non-natural) mortality on Steller sea lions (Northwest Fisheries Science Center 2011). However, the population has been increasing steadily, and the current estimated serious injuries and mortalities from the fishery are far below the PBR level. Based on this information, recent impacts from fishing are not substantially impacting the eastern DPS abundance as a whole (Northwest Fisheries Science Center 2011). It should be kept in mind, however, that the southernmost portion of the eastern DPS has contracted, and the southernmost active rookery, at Año Nuevo Island, although apparently stable, is at a historically low population size. Population growth in the eastern DPS is due to population growth in the northern regions of the DPS (Allen and Angliss 2011).

Indirect trophic effects of groundfish fisheries on marine mammals in the CCE appear to be negligible (Kaplan et al. 2012).

Seabirds

Potential biological removal data are not calculated for various bird species as they are for marine mammals. The best metric of impact of the groundfish fisheries in the CCE on birds is expressed as the take relative to the total population size or the population growth rate. As with the above section on marine mammals, this section focuses on those seabirds protected under the ESA, particularly short-tailed albatross and marbled murrelet. West Coast groundfish fisheries are not imposing additional (non-natural) mortality on California least tern. (Northwest Fisheries Science Center 2011)

West Coast groundfish fisheries are imposing some additional (non-natural) mortality on short-tailed albatross (Northwest Fisheries Science Center 2011). The number of takes per year is very likely to be higher than the number of takes observed (one lethal take over the period of 2002–2011), and based on the black-footed albatross mortality rate, is probably ~1/year and unlikely to be >2/year. On its own, this level of mortality is very small compared to the annual growth rate of the population (~6.5%; currently >200 birds/year). Even when combined with known mortality from other fisheries, mortality from fishing is not a significant impediment to the growth and recovery of the species (U.S. Fish and Wildlife Service 2008). Analyses of the impacts of Alaskan trawl mortality on the Torishima short-tailed albatross population suggest that trawl-related bycatch exceeding the current expected incidental take in that fishery (two takes in any 5-year period) by even a factor of 10 would have little impact on when the species' proposed recovery goals are achieved (Zador et al. 2008). At present, the level of estimated fishing mortality is small compared to the annual growth rate of the population (Northwest Fisheries Science Center 2011). Use of mitigation measures, such as streamer lines or integrated weighted lines like those employed in Alaskan fisheries, would be expected to reduce take even further (U.S. Fish and Wildlife Service 2008, Washington Sea Grant 2011).

West Coast groundfish fisheries do not appear to be imposing additional (non-natural) mortality on marbled murrelets (Northwest Fisheries Science Center 2011). However, some components of the fishery occur in the nearshore areas frequented by murrelets, and a much more common species with similar foraging behavior and diet— the common murre—has been occasionally reported as bycatch in these fisheries. However, the West Coast population of the common murre is approximately 62 times as abundant as the marbled murrelet—population size was estimated at 1.1 million in 1988 – 89 (Carter et al. 2001) — and likely forages over a broader marine area (Manuwal et al. 2001). The relatively low rate of bycatch of common murres (average of 3.4 per year; (Jannot et al. 2011a)) in groundfish fisheries in the CCE suggests that bycatch of marbled murrelets in these fisheries, although not impossible, is expected to be very rare (Northwest Fisheries Science Center 2011).

ESA-listed Fish Species

Eulachon have been documented as bycatch in the groundfish trawl, pink shrimp, and at-sea hake fisheries from 2002-2010, with the largest amounts (>99%) generally coming from the pink shrimp trawl fishery (Al-Humaidhi et al. 2012a). Estimated annual mean bycatch of eulachon exceeded 670,000 fish from 2007-2010, although these estimates do not include catches during 2007-2009 from WA, where catches were not observed.

On average, 359 green sturgeon are estimated to have been caught as bycatch per year from 2002-2010 (Al-Humaidhi et al. 2012a). The largest green sturgeon bycatch estimates occurred in 2006, when 793 individuals were estimated from the fishery; in comparison, an estimated 109 fish were caught in 2007. Most (95%, annual average from 2002-2010) of the green sturgeon bycatch occurs in the limited entry sector of the California halibut commercial trawl fishery, which primarily takes place at depths of <60 m in fishing grounds adjacent to San Francisco Bay, California .

Salmon bycatch in the groundfish fisheries in the CCE is predominantly represented by Chinook salmon incidentally landed in the Pacific whiting fishery. Estimated mean annual bycatch (no. of fish) of Chinook from 2002-2010 has been just under 10,000 fish yr-1, and bycatch from non-hake sectors have declined substantially since 2005 (Al-Humaidhi et al. 2012b). For all other salmon species, the mean annual bycatch estimate ranges from <1.0 fish yr-1 (sockeye) to 554 fish yr-1 (coho).

Invertebrates

Dungeness crab and Tanner crab are among the few invertebrates for which bycatch mortality has been estimated in the groundfish fisheries in the CCE, primarily due to their economic value. Limited entry bottom trawls represented the largest share of estimated discard mortality (mt) for Dungeness and Tanner crab in 2010, at 266 mt and 455 mt, respectively (Bellman et al. 2011). The pink shrimp fishery in Oregon and California also quantifies discards of squid, octopus, unidentified shrimp, urchins, and sea cucumbers (NMFS 2008).

Benthic invertebrate communities are also 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). Research in and around fishing areas in Monterey Bay National Marine Sanctuary has shown high levels of bottom trawling not only can decrease bottom habitat complexity and biodiversity of invertebrate epifauna, but may also enhance the abundance of opportunistic invertebrate species (Engel and Kvitek 1998).

Macroalgae

Kelp beds and other macroalgae are generally protected from the direct effects of fishing because they are considered essential fish habitat (http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-

Management/Groundfish-EFH/Index.cfm). However, these resources are still susceptible to indirect effects associated with the harvest of kelp consumers and some of their predators (Tegner and Dayton 2000, Steneck et al. 2002). By far the most important consumers of kelps are sea urchins, which are capable of consuming nearly all algae in many communities. Two urchin predators, spiny lobsters (Panulirus interruptus) and the sheephead (Semicossyphus pulcher), play an important role in the control of sea-urchin populations, and intense fishing has affected the abundance and size distribution of these predators on time scales consistent with the increase in urchin grazing(Steneck et al. 2002).

4.2.1.1 CPS Fisheries

CPS that are currently managed, and thus have been or could be subject to fishing pressure include: jack mackerel, Pacific mackerel, Pacific sardine, northern anchovy, and, although not fish, market squid and krill. All of these species 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). 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. For example, removal of sardines could allow an increase in other small bait fish, herring, etc. that would also feed planktivorously, and therefore plankton would likely not increase in numbers. At the same time, many of the predators on sardine are likely not obligate "sardinovores" and thus would be able to switch to other prey items; e.g. salmon have been shown to have fairly variable diets (Brodeur et al., 2007). On the whole, sardine, anchovy, and mackerel only make up a small portion of the total forage base, and thus the impacts of their direct removal through fishing is likely not to have a large impact on the entire ecosystem.

Another potential impact, other than the direct removal of these species through fishing, is the bycatch caused by the methods for catching these relatively small species. To catch most of the CPS species requires using small mesh nets that also occasionally catch other non-target species, although this is relatively rare, as it is usually possible to target large schools of CPS species, rather than rely on indiscriminate trawling, and several management directives, such as area and time closures, are in effect which also serve to minimize bycatch (CPS FMP). Since these are pelagic fish, the nets used and areas fished rarely leads to disturbance of the seafloor. Thus, as currently managed, fishing on CPS have only small impacts on non-fish organisms in the CCS. Only through a drastic increase in the allowable harvest of these species could there be significant impacts on non-fish species, and most likely the impact would be greater on the predators of these species, particularly if any predator species specializes or prefers a particular CPS species, although such specialization is typically not the case.

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. 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.

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., El Nino/Southern Oscillation) and interdecadal (e.g., Pacific Decadal Oscillation) 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.

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. The 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, 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 (CCSIEA 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. Although currently, the system off of Oregon appears to oscillate between these two communities, it is possible that under long-term change, there might be a more permanent switch to one community over the other. Additionally, it is 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.

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 the 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.

4.3 Direct and Indirect Effects of Fishing on Biophysical Habitat

Any fishing gear affects the flora and fauna of a given location to some degree, but the magnitude and duration of the effect depends on several factors, including gear configuration, towing speed for mobile gear, water depth, and the substrate over which the fishing activity occurs. Variations in substrate include differences in sediment type, bed form (sand waves and ripples, flat mud), and biologic structure (shell, macroalgae, vascular plants, sponges, corals, burrows). The effects depend on the susceptibility of the habitat, type of fishing gear, as well as the spatial distribution and intensity of fishing effort (Natural Resource Council 2002). It is also important to evaluate whether the disturbances are slight changes within the scale of natural disturbance or whether the effects are meaningful to ecosystem resources and services, and thus indirectly to fisheries. 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 the same state.

Under the MSA, each fishery management plan must contain an assessment of the potential adverse effects of fishing on Essential Fish Habitat for management unit species. For coastal pelagic species, fishing 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 for highly migratory species, fishing gears are pelagic and fishing effects on biophysical habitat were 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 Groundfish FMP, Appendix 2C (2006), limited empirical data from the west coast coupled with information from literature reviews showed that bottom trawl gear is known to have 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. [Have deferred incorporating a more detailed summary in this draft. Plan to update this section with new groundfish EFH results and analyses, if they become available prior to final FEP adoption].

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 & line methods have the least impact (PFMC 2006).

Given the paucity of information on all the factors that are necessary to assess the effects of fishing gear on biophysical habitat, fisheries and their general impacts are described below for some fisheries with potentially the greatest impacts on habitat.

4.3.1 Commercial Fisheries with Mobile Fishing Gears

4.3.1.1 Groundfish Trawl Fishery

Trawling can reduce habitat complexity. The direct effects of trawling include loss of erect and sessile epifauna, smoothing of sedimentary bedforms and reduction of bottom roughness, and removal of taxa that produce structure. Direct effects can also increase food availability as dead benthic organisms become food for scavenging species. Mobile gear, such as trawls, also can change surficial sediments and sediment organic matter, thereby affecting the availability of organic matter for microbial food webs (National Research Council, 2002).

Trawl gear can crush, bury, or expose marine flora and fauna and reduce structural diversity. Emergent epifauna, such as sponges, hydroids, and bryozoans, provide habitat for invertebrates and fishes. Disturbance of emergent epifauna can increase the predation risk for juvenile fish. Decreased prey abundance increases the foraging time for juvenile fish, thus exposing them to higher predation risk (National Research Council, 2002.)

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 (Figure 4.2), 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 (see draft IEA).

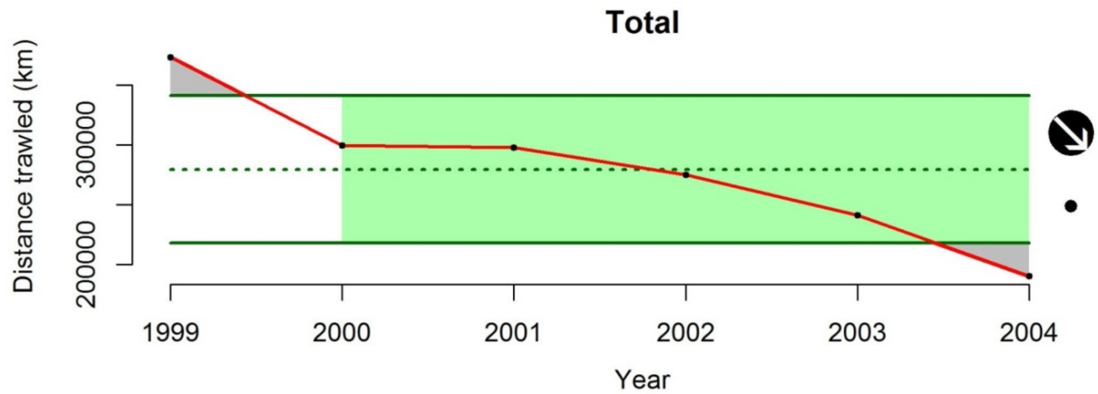


Figure 4.2. The time series of total distance trawled (km) along the coast of Washington, Oregon and California made by limited entry groundfish trawl fishery, with two relative statistics on the right hand side: the arrow at the top right indicates whether the trend of the last five-years is positive (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.e 4.2.

4.3.1.1 Pink Shrimp Trawl Fishery

The trawl fishery for pink shrimp off the coasts of Oregon and Washington operates in much the same way and has similar types of impacts to biophysical habitat as the trawl fishery for groundfish. 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.

4.3.1.1 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 fisheries not managed the Council, 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. CDFG; 2. ODFW; 3. CDFG 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.

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 does overlap it 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 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.

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.

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.

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 strongly linked to their prices on the worldwide market, and for most species, West Coast fisheries tend to be 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 where and when landings of managed species groups occur. 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 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 but low volume. In Oregon the 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 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.

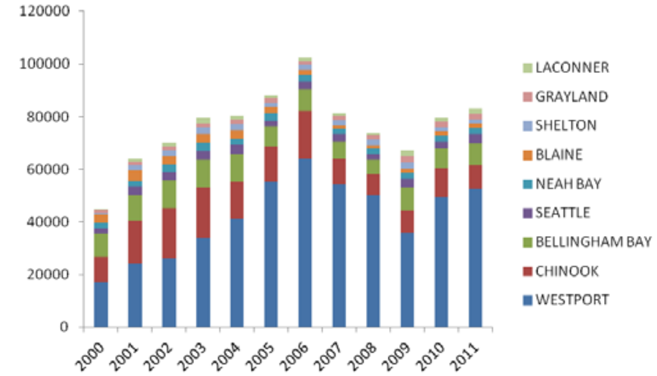


Figure 4.4. Revenue per pound for total landings in Washington ports that accounted for 90% of the average annual commercial landings, 2000-2011.

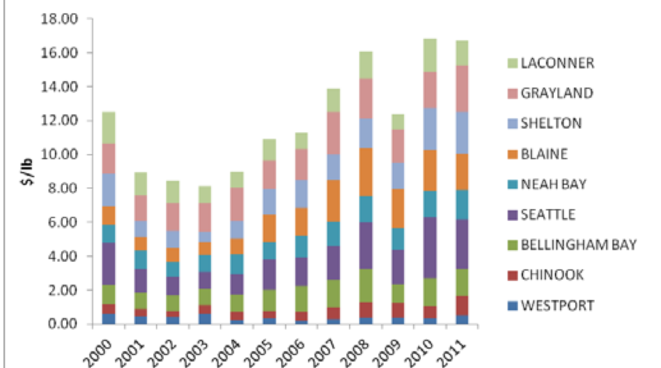


Figure 4.5. Annual total landings for the Oregon ports accounting for 99% of the average annual commercial landings, 2000-2011.

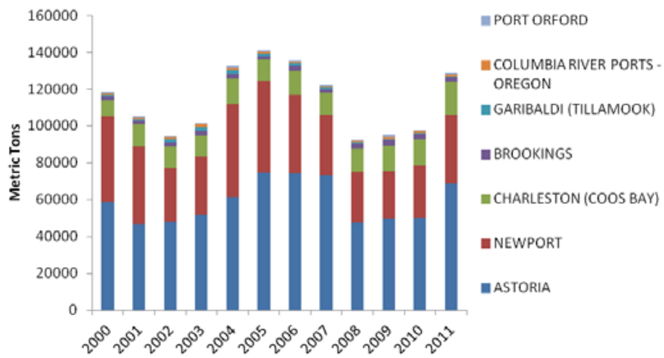


Figure 4.6. Revenue per pound for total landings in Oregon ports that accounted for 99% of the average annual commercial landings, 2000-2011.

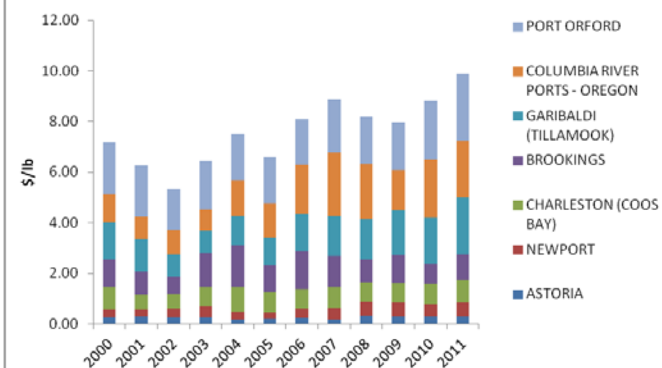


Figure 4.7. Annual total landings for the California ports accounting for 90% of the average annual commercial landings, 2000-2011.

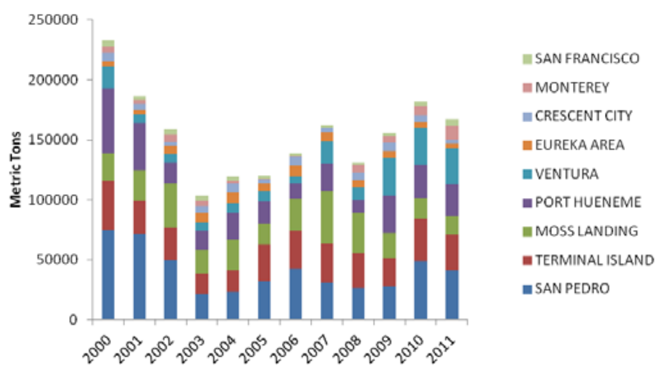
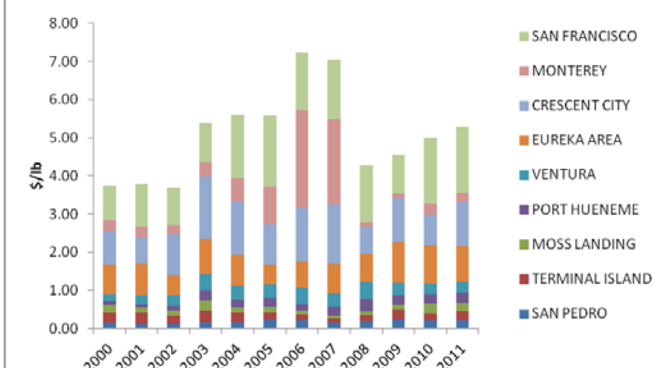


Figure 4.8. Revenue per pound for total landings in California ports that accounted for 90% of the average annual commercial landings, 2000-2011.



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 and possible connections to degradations of terrestrial habitat that 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).

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.

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), 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.

[Needs additions to complete, particularly known climate change impacts. Changing variability in storm surges, violence of winter weather, drought conditions that may affect salmon abundance.]

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. 2001, 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. 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 that are being observed 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 (CCSIEA 2012, and references therein).

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). Additionally, substantial changes in weather and precipitation patterns will 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. In Section 7.2.8, 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.

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.

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).

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 CCS (Schwing and Mendelssohn, 1997). Within the CCS, 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 Nino 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 CCS 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 CCS (Di Lorenzo et al., 2008). Since 1975, the NPGO has seen more extreme and/or longer duration events than previously (CCSIEA 2012). Thus chl-a and salinity within the CCS may also be experiencing heightened extremes and durations of those extremes. The Pacific Decadal Oscillation (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 (CCSIEA 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 CCS. Within the CCS, 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 (CCSIEA 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.

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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 March 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, inshore of the EEZ to encompass salmon rivers as far east as Idaho, and offshore of the EEZ to include migratory waters for highly migratory species. 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 Concern

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, 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 Salmon

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:

- 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;
- 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 salmon 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;

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;
- 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.

5.1.4 Species and locations with tribal treaty rights to fishing

As discussed 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.

5.1.5 Internationally-managed species

As discussed 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 concern 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. 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, such as activities that:

- 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.

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.

5.3.2 Tribal Fishing Communities

As discussed in 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 affect 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).

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 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.

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.

5.5 Sources for Chapter 5

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

6.1 Bringing 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.

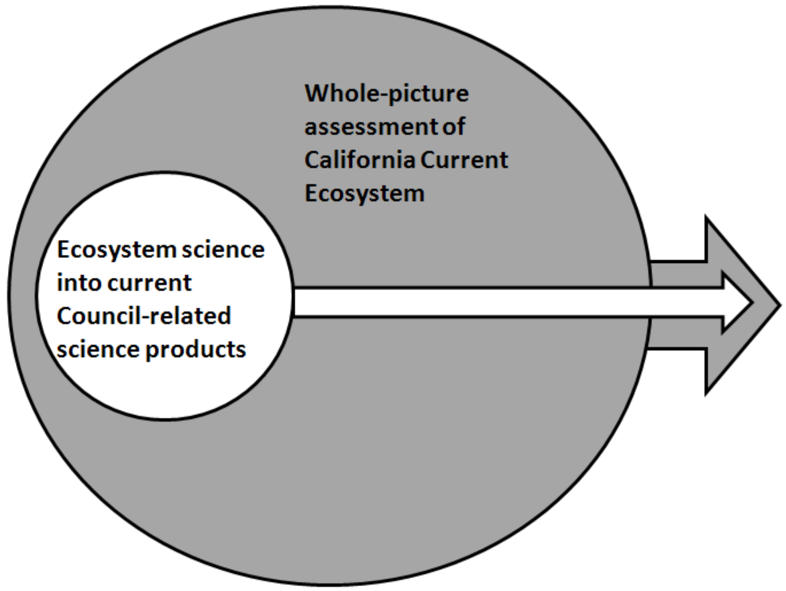

Figure 6.1: Two-part process to bring ecosystem science to the Council

6.1.1 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.

6.1.1 Bringing Ecosystem Information and Science into the Larger Council Process

At its September 2010 meeting, the SSC also provided advice on approaches to bring ecosystem information more broadly into the Council decision-making process by increasing and improving the ecosystem science information used within the Council process:

> *""…The Council should request NMFS to initiate development of an annual report on conditions in the California Current ecosystem…"* (H.1.c., Supplemental SSC Report)

In November of 2011, the Council requested that the EPDT provide a draft outline for an Annual State of the California Current Report, focusing on those biophysical trends known or likely to affect shifts in abundance of Council-managed species. The EPDT drafted an outline in June of 2012, based on guidance provided by the Council, for which the primary objective would be to provide a short summary and synthesis of environmental, biological and socio-economic conditions that may be indicative of environmental or socio-economic trends with real or potential effects on the productivity, distribution or socioeconomic conditions of managed fish populations and their associated fisheries. The Council recommended a length of no more than 15-20 pages for the initial annual report, recognizing that several scientific processes and institutions working within the CCE already produce detailed technical reports on the state of the CCE (including the CalCOFI State of the California Current report, PaCOOS quarterly summaries, and ongoing IEA, efforts by both science centers along the West Coast). The Council further asked that this report focus on clear, straightforward explanations of the trends and indicators most relevant to Council managed fisheries, summarize how and why such indicators should be relevant to Council consideration to the extent practicable, and point to additional details or documentation for additional information where warranted.

The first draft of this annual report will be included in the Council's November 2012 briefing book, based largely on material compiled for the California Current IEA effort. The report reflects a combined effort between the EPDT and the IEA team to synthesize and distill a summary of the wide range of information provided in the full California Current IEA, in keeping the Council's guidance and overarching objectives in mind. This initial effort to compile an IEA executive summary tailored for the Council and Council community is the first step of an iterative process wherein the EPDT and IEA teams provides the Council with the draft ecosystem considerations report, for review and comment by the Council and its advisory bodies. Council feedback on the initial report would then lead to modifications to the topics or species considered, presentation, or other concerns, ultimately improving IEA products and reports over time. The larger forthcoming iteration of the California Current IEA is under review in autumn 2012 and includes information on the status and trends of ocean/climate drivers, human pressures on the CCE, coastal communities, ecological integrity of the CCE, forage fish, marine mammals, seabirds, groundfish, and salmon. NOAA anticipates an early 2013 internet release for the larger California Current IEA.

6.2 Science Questions for Future Consideration

Ecosystem science can be useful both in its application to FMP species-group management, and to aid in long-term Council planning on ecosystem-wide concerns. In this section, we review the science questions common across all four FMPs, follow with FMP-specific research issues, and conclude with a discussion of some broad-scale and long-term issues that could affect fisheries management, such as climate shifts and ocean acidification. Francis et al. (2007) recommend making scientific progress towards ecosystem based fisheries management with these principles: 1. Keep a perspective that is holistic, risk-averse, and adaptive. 2. Question key assumptions, no matter how basic. 3. Maintain old-growth age structure in fish populations. 4. Characterize and maintain the natural spatial structure of fish stocks. 5. Characterize and maintain viable fish habitats. 6. Characterize and maintain ecosystem resilience. 7. Identify and maintain critical food web connections. 8. Account for ecosystem change through time. 9. Account for evolutionary change caused by fishing. 10. Implement an approach that is integrated, interdisciplinary, and inclusive (Francis et al. 2007). Given those recommendations, here are areas where ecosystem science might better inform Council decisions:

6.2.1 Cross-FMP – Needed Future Ecosystem Considerations

1. Evaluate the influence of climatic/oceanographic conditions on the population dynamics of FMP species. Develop IEA indicators to track that influence, such as for upwelling, sea surface temperatures, Pacific Decadal Oscillation, chl-a, and zooplankton index. Evaluate the efficacy of incorporating environmental factors within the current stock assessment modeling framework (Stock Synthesis 3). Model effects of climate forcing and other ecosystem interactions (e.g., trophic interactions) on productivity and assess utility of simulated estimates of the unexploited biomass over time (a "dynamic B0") rather than the static estimate of long-term, mean, unfished abundance (Sibert et al. 2006). This is now done for many assessments in order to represent relative depletion from both a static and dynamic perspective (Maunder and Aires-da-Silva 2010) and could incorporate insights from ecosystem models (e.g. Brand et al. 2007).
2. Assess high and low frequency changes in the availability of target stocks, and the vulnerability of bycatch species, in response to dynamic changes in climate and oceanographic conditions (such as seasonal changes in water masses, changes in temperature fronts or other boundary conditions, and changes in prey abundance). Link with socio-economic data and modeling to assess effects of changes in availability on West Coast fisheries. For example, during periods of low HMS availability, recreational fishermen who might prefer to harvest HMS species may increase harvest rates and activity for alternative species, such as rockfish and other groundfish.
3. Examine ecological interactions for influence on managed and non-managed species, including predator-prey relationships, competition, and disease. Investigate the role of FMP species in the food web, including analysis of behavioral interactions (e.g. functional response) between predators and prey.
4. Evaluate effectiveness of standardized bycatch reporting methodologies in all FMP fisheries and develop quantitative information on the extent of the cumulative bycatch of all FMP fisheries.
5. Spatially-explicit management: What is the effect of marine spatial planning on FMP species and fisheries? To address this question, a review of marine spatial planning would include both fisheries and non-fisheries closures, traditional fishing grounds, the effects of potential future non-fishing ocean areas uses, and asking about the types of activities tend to generate EFH/ESA consultations.

This should also include questions about the effects of spatially explicit management on fisheries research and monitoring and modeling (e.g. stock assessments).

6. Investigate how viability and resilience of coastal communities are affected by changes in ecosystem structure and function, including short- and long-term climate shifts.
7. Investigate 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).
8. Identify key indicators for recruitment, growth, spatial availability, and overall CCE productivity.
9. Investigate how different habitat types contribute to species productivity rates (habitat-specific demographic rates). Determine whether Habitat Assessment Improvement Plan (NMFS 2010) can be used to incorporate habitat data into stock assessment models.
10. Better understand spatial structure and geographic range (meta-population structure) of managed stocks and investigate what are the most appropriate spatial scales for management.
11. Assess the effects of different types of fishing gear on ecosystem structure and function, and investigate the effects of the ecosystem structure and function on gear performance.
12. Assess near-shore distribution of FMP species for habitat needs and fishery vulnerability during nursery and pre-reproductive life stages. Characterize the influence of nearshore marine, estuarine and freshwater water quality on survival, growth, and productivity.
13. Assess the evolutionary impacts of fishery management measures and fishing practices, and investigate whether those impacts affect yield or sustainability.
14. Non-market valuation techniques need to be developed in order to estimate existence or other non-use values that are applicable to FMP target species, as well as the non-target species that interact with FMP target species.
15. Develop an analytical framework to compile the information and evaluate the tradeoffs society is willing to make across the alternative ecological benefits fishery resources provide.

6.2.2 CPS FMP – Needed Future Ecosystem Considerations

1. Research related to the role of CPS in the ecosystem, the influence of climactic/oceanographic conditions on CPS, and defining predator-prey relationships.
2. Climate or ecosystem indicators are not included in the annual stock assessments for Pacific sardine and Pacific mackerel, the FMP's actively managed species. If significant climate-productivity relationships could be developed for Pacific sardine and Pacific mackerel, as well as for other CPS, assessments would benefit since CPS are known to be quite sensitive to long and short-term climate change in the CCLME.
3. Review and revise the climate-based factor in the harvest control rule for Pacific sardine. While not included directly in the assessment process, a climate-based factor is included in the process for determining the annual harvest level for Pacific sardine. For sardine, the FRACTION term in the harvest control rule formula is a function of a three-year average of sea surface temperatures (SST) taken at the Scripps Institute of Oceanography pier located in La Jolla, California. Including this term reflects the positive relationship between sardine reproductive success and water temperature; at higher SSTs a greater fraction of the available biomass can be harvested. Recent work by McClatchie et al. (2010) has shown that the strength of the correlation between Scripps Pier sea surface temperature and the prediction of sardine productivity is not as strong or as defined as previously thought. The Council has long identified the review of harvest control rules as a high priority research need and has tasked the CPSMT and the SSC with reviewing these findings. It is anticipated that the Council, the SWFSC, and the States will work toward the development of improved environmental indicators.
4. A management concern of the Council under EBFM will be the evaluating trade-offs between increasing/decreasing the yield of CPS and the potential yield loss/gain of a predator that may be in another Council FMP or be of concern in terms of its ecological importance. In order to evaluate

optimum yield in this situation, ecological and economic considerations come to the fore, since its resolution depends crucially on the relative net benefits provided society through these interactions (Hannesson et al. 2009; Hannesson and Herrick 2010).

6.2.3 Groundfish FMP – Needed Future Ecosystem Considerations for the Assessment of Stock Abundance, Distribution, and Productivity

1. West Coast groundfish species show low frequency variability in recruitment (i.e. prolonged periods of high and low recruitment) due to lower biomass and/or a low productivity environmental regime. This variability can increase the level of uncertainty in assessment results. For example, the biomass of widow rockfish has decreased steadily since the early 1980s, and recruitment during the early 1990s is estimated to have been considerably smaller than before the mid-1970s (He et al. 2007). However, there is evidence that recruitment of many rockfish species since 1999 has been higher than the average of the 1990s (He et al. 2007). Additionally, several data sources in the cabezon assessment indicate that there was potentially good recruitment after 1999 and before 1977, whereas these same sources indicate that recruitment was poor prior to 1999 in the Southern California stock (Cope and Punt, 2006). The cabezon recruitment patterns of the California sub-stocks suggest a possible link between environmental forcing and population dynamics (Cope and Key 2009). Specifically, strong ENSO conditions (especially in Southern California) may be a pre-cursor to significant recruitment events and should be explored further to help increase the understanding of spatially-explicit recruitment responses and inform future recruitment events (Cope and Key 2009). For example, declines in kelp habitat caused by increasing ocean temperatures in Southern California since the 1990s led assessors to suspect that the decline of blue rockfish in this area was in part due to environmental factors affecting habitat, rather than being entirely a function of fishing (Key et al. 2008). For sablefish, correlations between spring sea surface height (Schirripa 2005), zooplankton indices (Schirripa 2007), and sablefish age-0 survival suggest environmental forcing of recruitment. Historical reports of large year classes (e.g., the 1947 year class of canary rockfish reported by sport fishermen in central California) could be investigated to better inform recruitment drivers (Stewart et al. 2011b). Finally, while Dover sole recruitment variability is low compared to other West Coast groundfish, periods of low and high recruitment may correlate with the environmental conditions that could help predict future biomass levels (Hicks and Wetzel 2011). Hamel et al. (2009) recommend investigating effects of PDO, ENSO and other climatic variables on recruitment. A better understanding of the relationship between the population dynamics and climate for such species using tools such as meta-analysis (Wallace and Cope 2011) could reduce the uncertainty of future assessments (Cope and Punt, 2006; He et al. 2007).

2. Research is needed on relative density of rockfish in trawlable and untrawlable areas and differences in age and length compositions between these areas (e.g. shortspine thornyhead (Hamel 2005); darkblocked rockfish (Hamel 2008, Hamel and Ono 2011), canary rockfish (Wallace and Cope 2011)). Understanding groundfish distribution and habitat features can provide more precise estimates of abundance from the surveys, and can guide survey augmentations that could better track changes in stock size through targeted application of newly developed survey technologies (e.g. for untrawlable habitats) (Wallace and Cope 2011). Such studies could also assist in determining selectivity and in aiding the evaluation of spatial structure and the use of fleets to capture geographically-based patterns in stock characteristics, such as different exploitation histories, growth, or fecundity in different areas (Wallace and Cope 2011).

3. Investigate predation impacts likely to affect abundance of assessed species, e.g. lingcod on gopher rockfish (Key et al. 2005); sablefish and shortspine thornyhead on longspine thornyhead (Fay 2005, Field et al. 2006); Humboldt squid on Pacific hake (Field et al. 2007, Homes et al. 2008).

4. Time-varying catchability and availability of fish to the surveys may affect our fishery independent index of abundance for some groundfish species. For example, recommendations for investigating hake spatial distributions across all years and between bottom trawl and acoustic surveys are driven by concerns regarding the estimation of changes in catchability/availability across years (Helser et al. 2006; Helser et al. 2008). Two primary issues are related to the changing spatial distribution of the survey as well as the environmental factors that may be responsible for changes in the spatial distribution of hake and their influences on survey catchability and selectivity (Agostini et al. 2006, Helser et al. 2006; Helser et al. 2008). A review of the acoustic hake data to assess whether there are spatial trends in the acoustic survey indices that are not being captured by the model is also a priority (Helser et al. 2006; Helser et al. 2008). Analysis should include investigation of hake stock migration (expansion/contraction) in relation to variation in environmental factors (Helser et al. 2006; Helser et al. 2008). Hamel et al. (2009) also recommend investigating time-varying availability inshore for lingcod. Spiny dogfish also exhibit large scale seasonal changes in spatial distribution, warranting further research into these movements so that the stock unit can be better defined, and to aid in addressing transboundary stock issues (Cieri et al. 2011). Seasonal spiny dogfish movement suggests that the summertime surveys (AFSC, NWFSC, and IPHC) may not be representative of the population size and distribution available to the fishery in other seasons (Gertseva and Taylor 2011). If the movements are very regular, the surveys may still provide a reliable relative index of abundance, but any differences in movement patterns due to climate or prey availability could impact these indices (Gertseva and Taylor 2011). Acoustic or satellite tagging of spiny dogfish in coastal waters could provide valuable insight into movement patterns along the coast and benefit future assessments (Gertseva and Taylor 2011).

5. Investigate how growth rates, maturity schedules, and fecundity have varied over time and between areas, as influenced by environmental factors and changes in population density because of apparent low frequency variability in environmental conditions and/or population density, e.g., Pacific hake (Hamel and Stewart 2009, Stewart et al. 2011a); bocaccio (MacCall 2008); chillipepper rockfish (Field 2007); english sole (Stewart 2008); lingcod (Hamel et al. 2009); splitnose rockfish (Gertseva et al. 2009); chilipepper (Harvey et al., 2011); spiny dogfish (Cieri et al. 2011); sablefish (Wespestad et al. 2011a); petrale sole (Chen et al. 2011a, Haltuch et al. 2011); pacific ocean perch (Hamel and Ono 2011); greenspotted rockfish (Gertseva et al. 2011, Dick et al. 2011); Dover sole (Wespestad et al. 2011b). Regional differences in exploitation history and biological traits can result in demographic independence of local stocks, even in the absence of clear genetic differentiation, with important implications for management (Waples et al., 2008).

6. Standard modeling approaches that take into account changes in target fisheries to estimate historical discards (bycatch) should be developed that can be used across stock assessments (Dorn et al. 2011). For example, discard sampling of yelloweye bycatch in the directed Pacific halibut fishery (Taylor and Wetzel 2011) and the calculation of total catch for data poor species (Dorn et al. 2011).

7. There are high densities of many groundfish stocks near the U.S.-Canada or U.S.-Mexico borders. Given the high likelihood that many groundfish stocks are transboundary (e.g. spiny dogfish (Cieri et al. 2011, (Gertseva and Taylor 2011)); sablefish (Stewart et al. 2011b); petrale sole (Chen et al. 2011a); Pacific Ocean perch (Chen et al. 2011b; (Hamel and Ono 2011); greenspotted rockfish (Gertseva et al. 2011a, Dick et al. 2011); canary rockfish (Wallace and Cope 2011); blackgill rockfish (Gertseva et al. 2011b)), combined with potential seasonal or directed movement patterns for some species, suggests that U.S. and Canada/Mexico should explore the possibility of joint groundfish stock assessments. At a minimum transboundary stock effects—in particular the consequences of having spawning contributions from external stock components, catches in transboundary waters, and common life history traits—should be evaluated. While resolution of conducting bi-national

assessments is beyond the scope of what can be reasonably expected from the U.S. stock assessment teams alone, a formal framework for completing such assessments should be established.

6.2.4 HMS FMP – Needed Future Ecosystem Considerations

1. Assess nearshore distribution of juvenile sharks for habitat needs and fishery vulnerability during nursery and pre-reproductive life stages (Hanan 1993, Cartamil 2010).
2. Research and modeling needed on the links between climate and the migration patterns of protected bycatch species to allow us to refine our closed area management programs, such as for leatherback and loggerhead sea turtles. For turtles in particular, fisheries-independent research is needed to better understand turtle distribution and habitat use, and to assess and model linkages to oceanographic and biological trends within the CCE.
3. Evaluate utility of Pacific pelagic ecosystem models for informing Council or other management body decisions. Both models (e.g., Watters et al. 2003, Hinke et al. 2004, Lehodey et al. 2008) and empirical evidence (Sibert et al. 2006, Polovina et al. 2009) suggest that with increasing fishing pressure, decline in top predators has or should contributed to increasing catch rates of mid-trophic level species such as mahimahi, pomfret and escolar. An improved understanding of the impacts of fishing on pelagic food webs and the productivity on different trophic guilds in this ecosystem should be beneficial to both modeling and management efforts.
4. More comprehensive data and modeling of real or potential interactions with protected and prohibited species are needed for most HMS fisheries. This is particularly the case with HMS stocks that are shared with Mexico, where there is inadequate understanding and data exchange for HMS fisheries that are likely affecting both protected species distribution patterns and migration routes of prohibited species of fish. Improved habitat data for target and prohibited species north of Point Conception, where there has similarly been very little research on habitat associations, could also reveal insights about the potential differences in both geographic and vertical distribution of target and prohibited species.
5. The long-term consequences of climate change are expected to drive large scale changes in species-specific habitat availability as well as ecosystem-wide patterns of biodiversity, with up to 35% change in the core habitat for some species (Hazen et al. 2012). An improved understanding of which species (including both target species and protected species that interact with fisheries) might benefit and which might become more vulnerable to fishing impacts would benefit long-term management efforts.

6.2.5 Salmon FMP – Needed Future Ecosystem Considerations

1. Develop tools that describe the environmental state and potential habitat utilization for near-shore anadromous fish, including coastwide sampling of juvenile distributions, monitoring and characterization of the forage based for juvenile and adult salmon, and fine-scale mapping of stock-specific ocean habitat and catch distributions.
2. Examine temporal trends in regional salmon harvest rates and measure their covariation with temporal and spatial patterns of environmental variability. Characterize temporal changes in size, age and migration timing of heavily exploited salmon stocks to evaluate correlations with harvest and environmental patterns. Assess the evolutionary effects of fishing season timing and location.
3. Characterize the influence of nearshore marine, estuarine and freshwater water quality on survival, growth, and reproduction of salmon.
4. Determine influence of sea surface temperature anomalies to smolt-to-adult return predictions.
5. Evaluate apparent increasing percentage of one-ocean jacks in salmon returns to fresh water.
6. Develop targets and metrics for monitoring regional ecosystem and/or population-level effects of climate change on the distribution and survival of salmon.

7. Acquire data and develop management tools to support regional, total-mortality management of salmon harvests.
8. Evaluate the positive and negative effects of hatchery production, on a regional basis, on population dynamics of wild salmon stocks, in maintaining the role of salmon in the CCE, mitigating for loss of historic production, serving objectives of salmon restoration and recovery, sustaining local components of the fishing industry, sustaining treaty fisheries and meeting international agreements.
9. Document the effects of ecological interactions such as disease, predation and competition on the population dynamics of adult and juvenile salmon.
10. Develop cumulative risk assessment models and other tools to evaluate the cumulative effects of human activities (habitat reduction, hydropower generation, hatchery production, harvest) and ocean conditions (seasonal variations, interannual and inter-decadal climate shifts, long-term climate change) on West Coast salmon productivity, population status, and predator-prey relationships.

6.2.6 Broad-Scale and Long-Term Oceanographic Conditions

As identified in Section 4.5, changes in temperature, oxygen saturation, and ocean pH are key oceanographic features that help to define both habitability and productivity for much of the CCE, have both direct and indirect impacts on fisheries species, and are expected to change with future climate variability. Future research considerations that would improve the Council's ability to incorporate oceangraphic conditions into ecosystem-based fishery management are:

1. Direct physiological effects of temperature, pH, and O changes on managed and non-FMP forage species, including, but not limited to: tolerance limits, growth rate, reproductive rate
2. Current spatial and depth boundaries of all FMP, and non-FMP forage species in regards to temperature, pH, and O.
3. Spatially-specific trend analysis of temperature, pH, and O changes specific to the EFH of all FMP and non-FMP forage species
4. Spatially-specific forecasts of temperature, pH, and O changes specific to the EFH of all FMP and non-FMP forage species
5. Spatially-specific trend and forecast of temperature, pH, and O effects on food chain base (1° and 2° production) for all FMP and non-FMP forage species

6.3 Sources for Chapter 6

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7 Cross-FMP Ecosystem-Based Fisheries Management Initiatives

The Council has discussed the FEP as a living document that, under its *Purpose and Need Statement,* is to provide "management policies that coordinate Council management across its FMPs and the CCE." With regard to 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 Chapter is intended to build on the Council's June 2012 decision on potential future fisheries for currently unfished and unmanaged forage fish species, illustrating how that decision might serve as the Council's first cross-FMP ecosystem-based fishery management initiative. [In keeping with this FEP's status as a living document, the EPDT is proposing with this November 2012 draft that the Council consider identifying cross-FMP policy priorities for evaluation by the Council and its advisory bodies over the next six years, from 2013 through 2018. Efforts to revise and update the FEP would likely need to begin in late 2016 – early 2017.]

In this Chapter 7, the EPDT has proposed several draft examples of cross-FMP fisheries management initiatives. The EPDT, as it is currently composed, may or may not be the most appropriate advisory body to develop background analyses for these initiatives. Chapter 7 envisions that, as the Council decides to address each new cross-FMP initiative, it will consider anew the most appropriate analysts for the initiative development process. Cross-FMP initiatives analyzed and discussed through the Council process would ultimately 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 several other fishery management councils nationwide. Some 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 EFH, retention limits for octocorals, sea turtle bycatch measures, and other issues.

In June 2012, the Council recommended using the FEP to assess the protections that may be needed to prevent the future development of fisheries for unfished, umanaged forage fish species of the U.S. West Coast EEZ. If the Council adopts the cross-FMP initiative model proposed in this section, the initiative to prevent the future development of fisheries for currently unfished forage fish species would be the first FEP initiative developed through the FEP, yet implemented by authorities of the FMPs.

7.1 FEP Initiative 1, Protection for Unfished Forage Fish

It is the Council's intent 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.

7.1.1 Council Policy on the Development of New Fisheries for Unfished Species

Pursuant to Title II of the MSA, there is no allowable level of foreign fishing for species currently unfished within the U.S. West Coast EEZ. Fishing vessels and fish processors of the U.S. have the capacity to harvest and process up to and beyond the level 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 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 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 or FMP 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 PFMC 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 species or stock listed as threatened or endangered under the Endangered Species Act;
- 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.

7.1.2 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, developing any additional necessary protections for unfished and unmanaged forage fish through recommendations to amend one or more of the Council's FMPs.

In the first stage, the Council will 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 7.1 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 7.1 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*.

Table 7.1: 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 is broad enough to include the array of horizontal and vertical, and stationary and mobile hook and line gear used in West Coast commercial and recreational fisheries: "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):	

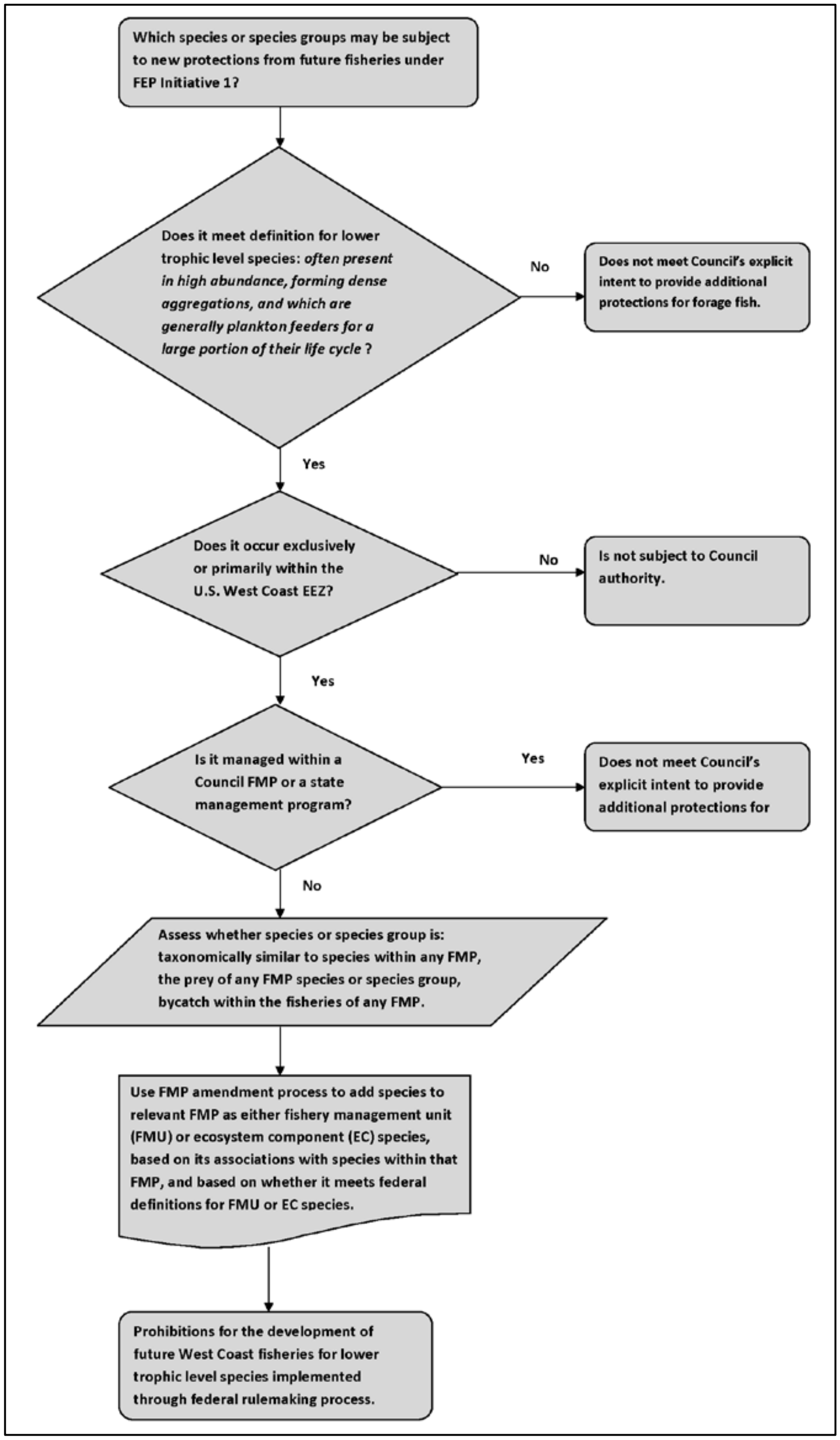
Table 7.1: Authorized West Coast EEZ Fisheries and Gear	
Fishery	**Authorized gear types**
A. ~~Longline and setline fishery~~ *Commercial*	Longline, troll (when taken as allowable incidental catch in the salmon troll fishery)
B. ~~Hook-and-line fishery~~ *Recreational*	Hook and line
9. California Halibut (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 Handline Fishery (Non-FMP)	Trap, handline, hook and line
~~**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~~

The Council's draft policy on the development of new fisheries for unfished species, at Section 7.1.1, 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).

Figure 7.2 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."

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 regulations provide further guidance, stating “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 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 to one or more of its FMPs, and has transmitted those amendments and their accompanying analyses to NMFS, the agency would finalize 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, in the style of the South Atlantic and other fishery management councils. A comprehensive amendment process would allow the Council 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.

7.2 Potential Future FEP Initiatives for Council Consideration

During its development process for this 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 EPDT drafted the following potential future FEP initiatives for the Council’s consideration based on the FEP’s Purpose and Need Statement, the FEP’s Objectives, and the national standards and other requirements of the Magnuson-Stevens Act. In looking at the major themes of the Magnuson-Stevens Act, the EPDT went back to its March 2011 Discussion Document (Agenda Item

J.1.c., Attachment 1) to consider cross-FMP themes addressing: harvest level policies and overfished/overfishing, bycatch, EFH, and community effects of fisheries management. Depending on how the Council wants to use this FEP in 2013 and beyond, the Council could use its review process for this draft FEP to prioritize the next FEP initiatives to follow FEP Initiative 1, Protection for Unfished Forage Fish (7.1). The following draft initiatives are intended as suggestions to help the Council develop an ecosystem initiative process if it so desires. The Council may choose to develop different initiatives, or may not adopt an ecosystem initiative process at all.

7.2.1 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, HMS, and CPS, has two goals that could help the Council better address the larger-scale harvest issue of maintaining 'old growth' age- and size-distributions in managed fish stocks:

- 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 (HCRs); and
- Conduct a management strategy evaluation (MSE) that considers the performance of current HCRs as well as alternative HCRs that incorporate age- and length-structure into Council management reference points.

This initiative would help the Council to consider how current HCRs behave with respect to the truncation of age- and size-distribution of managed stocks, and to alternative HCRs that incorporate age- and length-structure into Council management reference points. Background work for this initiative should include an evaluation of the trade-off in catches between managing for the highest proportion of old fish for a given spawning biomass, which is biologically desirable given the influence of older fish on larval survival and could require reductions in fishing mortality, and current management strategies that do not explicitly consider age composition. As discussed in Section 4.1.1, 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).

While ideally, age data would be available for all fish stocks, often only length data are available for use as a proxy for age. For long lived species and species that reach their asymptotic size rapidly relative to their life span, length data will be less informative that age. Nonetheless, there are methods meant to capture catch length composition characteristics indicative of sustainable catches (Froese 2004, Cope and Punt 2009) due to the wide availability and low cost of data collection. These methods are based on the ideas that catch length compositions should reflect take of primarily mature individuals (Leaman 1991; Myers and Mertz 1998), consist of fish lengths at which the highest yield from a cohort occurs, and conserve large mature individuals (Berkeley et al. 2004b).

Froese (2004) provides simple guidance for interpreting fishery length composition data and Cope and Punt (2009) provide a set of catch length composition metrics useful for the conservation of large, mature individuals that can also be used to monitor population status relative to exploitation. However, translating the broad suggestions of Froese (2004) into practical management advice can be problematic (Rochet and Trenkel 2003; Link 2005), especially given the strong interaction between selectivity and stock status (Cope and Punt 2009). Punt et al. (2001) formally evaluated size-based indicators and their potential use as reference points, but simulation testing via a formal management strategy evaluation approach of the Councils current HCRs and potential age (length) based reference points is needed.

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 HCRs, and an approach for conducting a management strategy evaluation of HCRs. 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.

7.2.2 Bio-Geographic Region Identification and Assessment Initiative

Section 3.1.2 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

Within each finer scale sub-region, the Council may wish to undertake assessments of fishery removals, 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 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, and 3) changes in species distributions and migration patterns.

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 three 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.

7.2.3 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 or 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 Council SAFE documents and in NMFS reports, particularly the National Bycatch Report (NMFS 2011). If NMFS and Council 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
- 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, and whether science and management programs used under one FMP could be usefully translated for use 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.

7.2.4 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 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 NMFS and Council 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 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. 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, and others the Council deems appropriate to the task.

7.2.5 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' 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 7.2:

Table 7.2: 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 vessel 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 contines 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 regularly rates 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.

7.2.6 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 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 the 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 NMFS and Council 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.

7.2.7 Cross-FMP Socio-Economic Effects of Fisheries Management Initiative

Like 7.2.6, 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.

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), and fisheries management agencies within the U.S. and elsewhere are developing social impact assessment methodologies intended to specifically look at the effects of fisheries management programs on fishing communities (cite). 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 initially 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 also 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.

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.

7.2.8 Cross-FMP Effects of Climate Shift Initiative

As discussed in Section 3.1.1 and Chapter 4, 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 ENSO and the PDO). 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 single 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 CE, 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.

7.3 Sources for Chapter 7

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Agenda Item G.1.d
Supplemental REVISED Final Council Action
June 2012

It is 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. We declare that our objective is to prohibit the development of new directed fisheries on forage species that are not currently managed by our Council, or the States, until we have an adequate opportunity to assess the science relating to the fishery and any potential impacts to our existing fisheries and communities.

The Council directs the Ecosystem Plan Development Team (EPDT) to proceed with Option 2 as detailed in Agenda Item G.1.b, EPDT Report, and schedule a progress report on its work to update and revise the List of Fisheries (LOF), to be made to the Council as soon as possible after completion of the fishery ecosystem plan (FEP). The Council further directs that:

A. Regarding the LOF, all Council advisory bodies shall be tasked with identifying 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. This exercise shall be completed by the advisory bodies and provided to the EPDT as soon as possible after completion of the FEP.
B. For state-managed fisheries, the states shall be responsible, through their EPDT representatives, for preparing the list of state-managed fisheries which have a nexus with Federal waters, for inclusion in the updated List.
C. The EPDT's progress report shall include any analysis on the possible effectiveness of the LOF application process in meeting the goal of preventing development of non-existent fisheries.
D. The report shall also include, to the extent possible, any new information or analysis regarding the application of Section 600.747 of the Federal rules, including whether there is a possibility of amending these regulations for the West Coast such that additional requirements and specifications regarding the Council's review of applications could be formally incorporated into Federal regulations.
E. Regarding the Council's standards which would be used in assessing whether a proposed new fishery could compromise conservation and management measures within the West Coast EEZ, the EPDT progress report shall provide full detail of the proposed standards and process, in order to make the procedural and content requirements clear and transparent to both applicants and the public, consistent with the recommendations outlined in Option 2 of the EPDT Report.
F. As soon as possible after completion of the FEP upon receipt of the Progress Report, the Council shall review and provide guidance so that the content can be finalized for incorporation into the draft FEP, consistent with the FEP development schedule identified on page 2 of the draft FEP (H.1.a, Attachment 1, June 2012).

After completion of the FEP, the Council will proceed to incorporate any needed protections into our current suite of fishery management plans through an amendment process.

PFMC
11/05/12

Agenda Item K.1.b
Supplemental EPDT Presentation
November 2012

Ecosystem Plan Development Team Draft Fishery Ecosystem Plan

EPDT Presentation for K.1.

November 6, 2012


CALIFORNIA BIOREGIONS
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
Klamath
Modoc
Sacramento Valley
Bay-Delta
Sierra
San Joaquin Valley
Central Coast
Mojave
South Coast
Colorado Desert
Crecent City
Eureka
Redding
Susanville
Fort Bragg
South Lake Tahoe
Sacramento
Santa Rosa
Stockton
Oakland
San Jose
Monterey
Fresno
Ridgecrest
Bakersfield
San Luis Obispo
Needles
Oxnard
Los Angeles
San Bernadino
Palm Springs
Blythe
El Centro
San Diego
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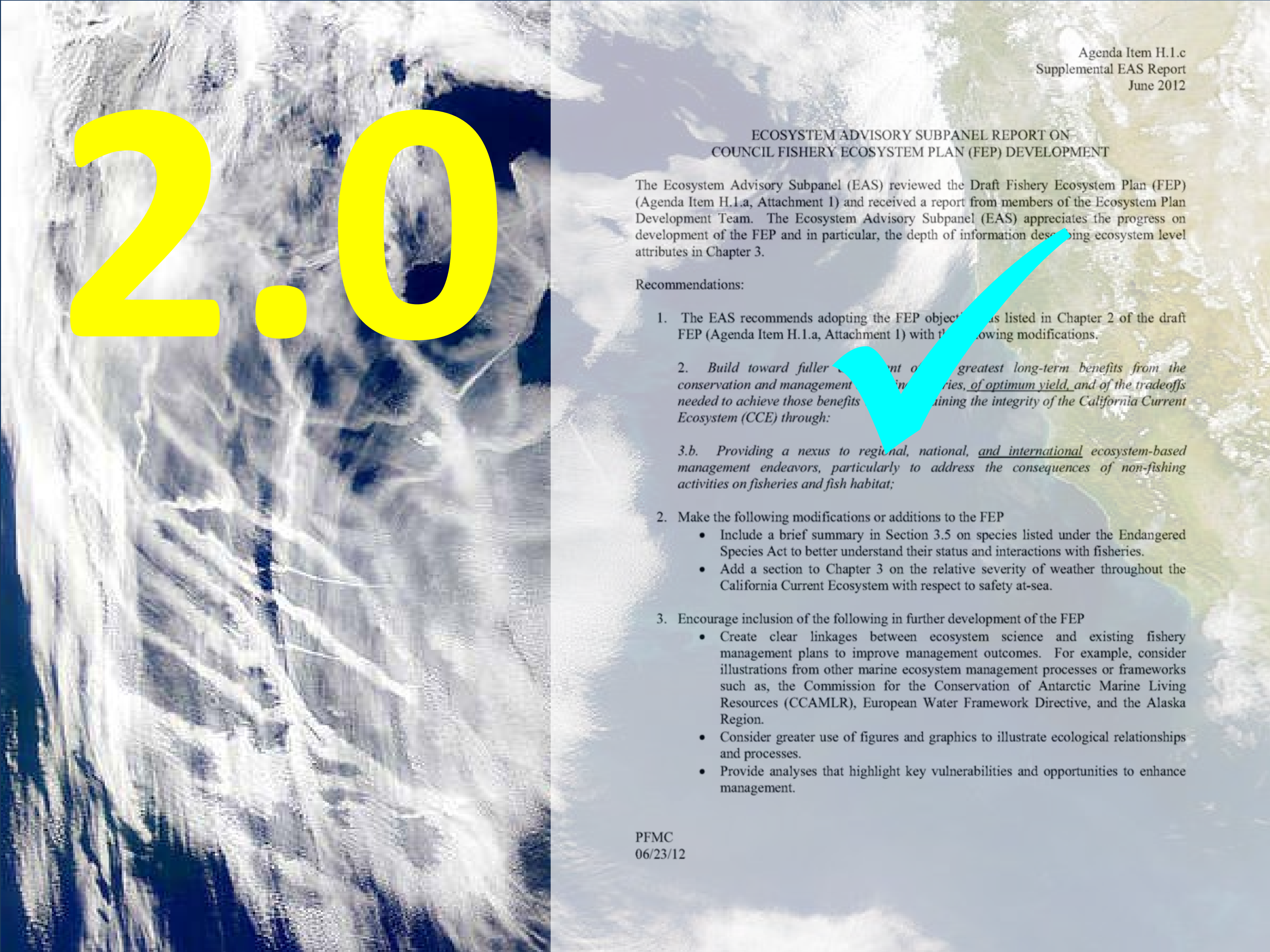
1.1 Adopted (by you, June 2011) ✓

1.2 Updated (November 2012) ✓

1.3 Updated (November 2012) ✓
FEP

1.4 Updated (November 2012) ✓



Agenda Item H.1.c
Supplemental EAS Report
June 2012

ECOSYSTEM ADVISORY SUBPANEL REPORT ON
COUNCIL FISHERY ECOSYSTEM PLAN (FEP) DEVELOPMENT

The Ecosystem Advisory Subpanel (EAS) reviewed the Draft Fishery Ecosystem Plan (FEP) (Agenda Item H.1.a, Attachment 1) and received a report from members of the Ecosystem Plan Development Team. The Ecosystem Advisory Subpanel (EAS) appreciates the progress on development of the FEP and in particular, the depth of information des[illegible]ing ecosystem level attributes in Chapter 3.

Recommendations:

1. The EAS recommends adopting the FEP objec[illegible]s listed in Chapter 2 of the draft FEP (Agenda Item H.1.a, Attachment 1) with t[illegible]owing modifications.

   2. *Build toward fuller [illegible]nt o[illegible] greatest long-term benefits from the conservation and management [illegible]ries, of optimum yield, and of the tradeoffs needed to achieve those benefits [illegible]ining the integrity of the California Current Ecosystem (CCE) through:*

   3.b. Providing a nexus to regi[illegible]al, national, and international ecosystem-based management endeavors, particularly to address the consequences of non-fishing activities on fisheries and fish habitat;

2. Make the following modifications or additions to the FEP
   - Include a brief summary in Section 3.5 on species listed under the Endangered Species Act to better understand their status and interactions with fisheries.
   - Add a section to Chapter 3 on the relative severity of weather throughout the California Current Ecosystem with respect to safety at-sea.

3. Encourage inclusion of the following in further development of the FEP
   - Create clear linkages between ecosystem science and existing fishery management plans to improve management outcomes. For example, consider illustrations from other marine ecosystem management processes or frameworks such as, the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), European Water Framework Directive, and the Alaska Region.
   - Consider greater use of figures and graphics to illustrate ecological relationships and processes.
   - Provide analyses that highlight key vulnerabilities and opportunities to enhance management.

PFMC
06/23/12

40 CFR §1502.15 Affected environment.

3.0

The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues. Verbose descriptions of the affected environment are themselves no measure of the adequacy of an environmental impact statement.

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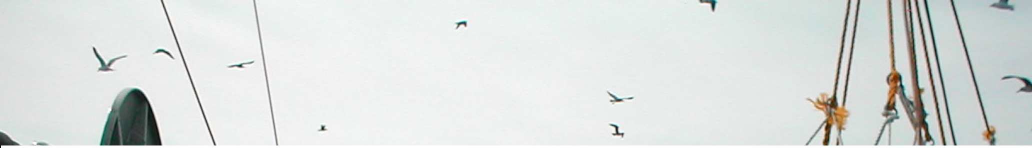
3.5.1.3

June 2012, 1.2: "Chapter 4 discusses the cumulative effects and uncertainties of environmental shifts and human activities on the marine environment and potential cross-FMP fishery management measures that could be used to buffer against those effects and uncertainties."

November 2012, 1.2: "Chapter 4 discusses the cumulative effects and uncertainties of environmental shifts and human activities on the marine environment. . . . Chapter 7 proposes an ecosystem-based fishery management initiative process" for the FEP's use into the future."



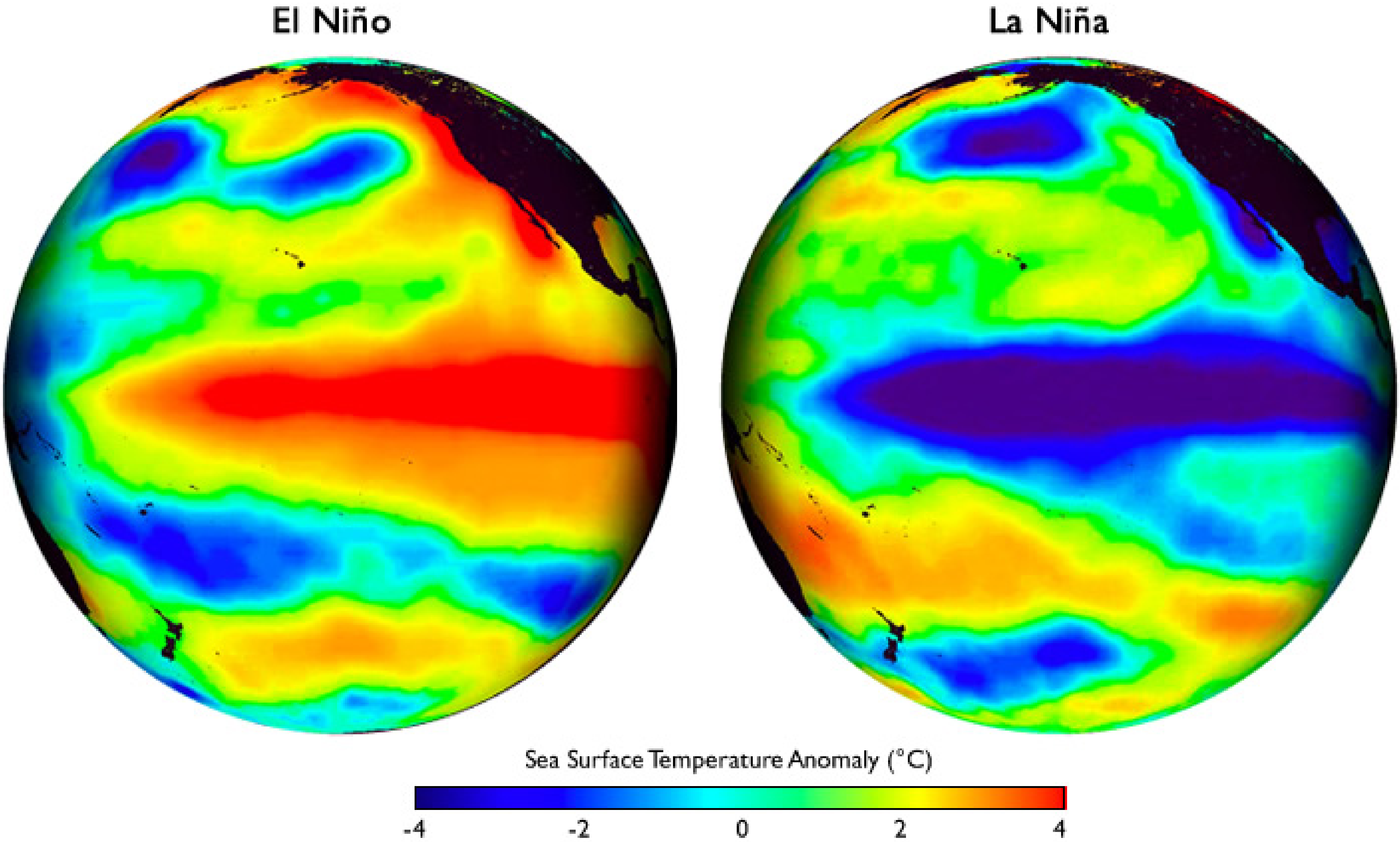

El Niño
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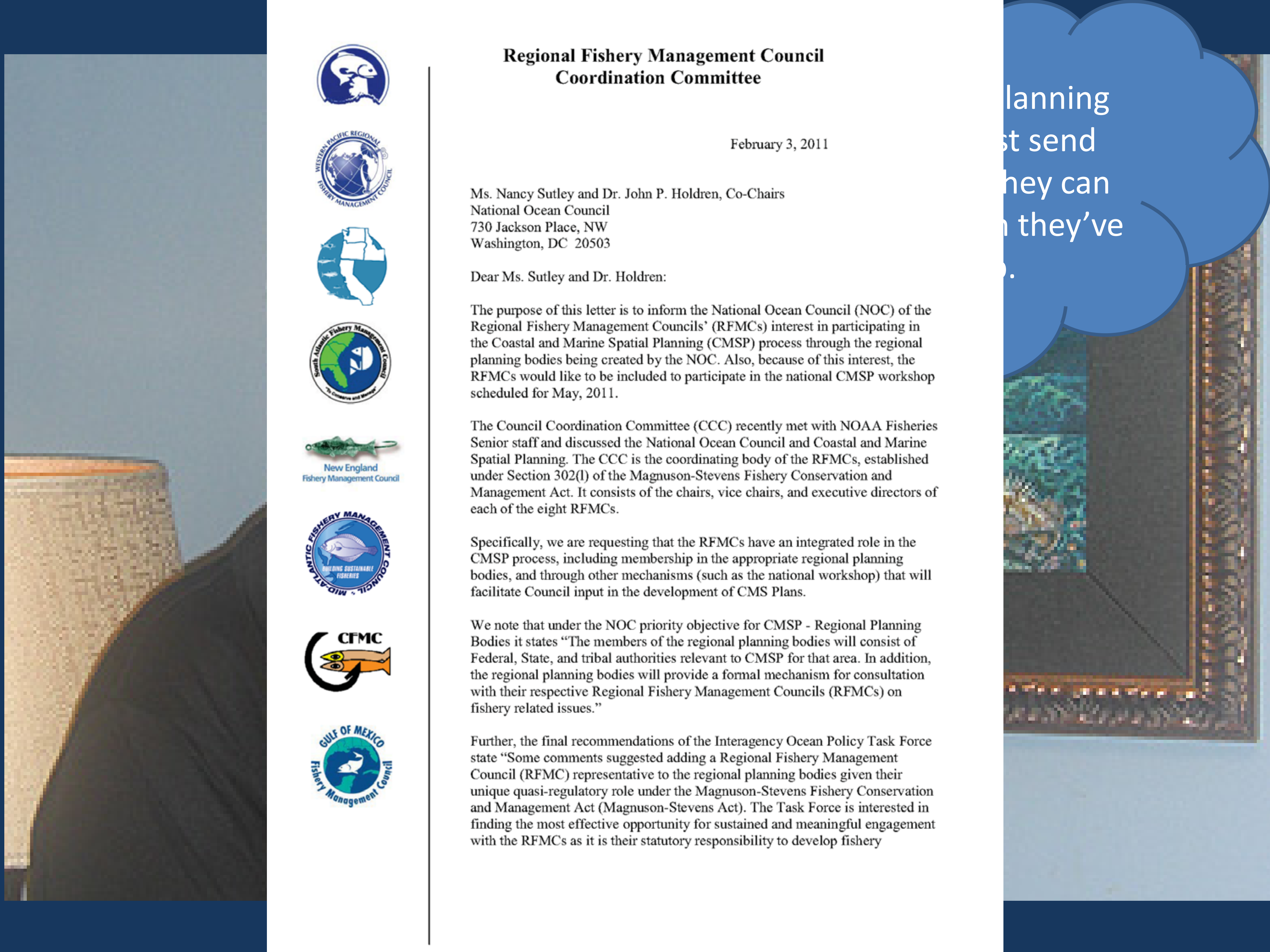
Table 3.3.1 Non-Fishing Human Activities that May Negatively Affect EFH for One or More Council-Managed Species

Coastal or Marine Habitat Activities	Freshwater or Land-Based Habitat Activities
Alternative Offshore Energy Development	Agriculture
Artificial Propagation of Fish and Shellfish	Artificial Propagation of Fish and Shellfish
Climate Change and Ocean Acidification	Bank Stabilization
Desalination	Beaver removal and Habitat Alteration
Dredging and Dredged Spoil Disposal	Climate Change and Ocean Acidification
Estuarine Alteration	Construction/Urbanization
Habitat Restoration Projects	Culvert Construction
Introduction/Spread of Nonnative Species	Desalination
Military Exercises	Dam Construction/Operation
Offshore Mineral Mining	Dredging and Dredged Spoil Disposal
Offshore Oil and Gas Drilling and Liquefied Natural Gas Projects	Estuarine Alteration
Over-Water Structures	Flood Control Maintenance
Pile Driving	Forestry
Power Plant Intakes	Grazing
Sand and Gravel Mining	Habitat Restoration Projects
Shipping Traffic and Ocean-based Pollution	Irrigation/Water Management
Vessel Operation	Military Exercises
Wastewater/Pollutant Discharge	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



New England Fishery Management Council

CFMC

Regional Fishery Management Council Coordination Committee

February 3, 2011

Ms. Nancy Sutley and Dr. John P. Holdren, Co-Chairs
National Ocean Council
730 Jackson Place, NW
Washington, DC 20503

Dear Ms. Sutley and Dr. Holdren:

The purpose of this letter is to inform the National Ocean Council (NOC) of the Regional Fishery Management Councils' (RFMCs) interest in participating in the Coastal and Marine Spatial Planning (CMSP) process through the regional planning bodies being created by the NOC. Also, because of this interest, the RFMCs would like to be included to participate in the national CMSP workshop scheduled for May, 2011.

The Council Coordination Committee (CCC) recently met with NOAA Fisheries Senior staff and discussed the National Ocean Council and Coastal and Marine Spatial Planning. The CCC is the coordinating body of the RFMCs, established under Section 302(l) of the Magnuson-Stevens Fishery Conservation and Management Act. It consists of the chairs, vice chairs, and executive directors of each of the eight RFMCs.

Specifically, we are requesting that the RFMCs have an integrated role in the CMSP process, including membership in the appropriate regional planning bodies, and through other mechanisms (such as the national workshop) that will facilitate Council input in the development of CMS Plans.

We note that under the NOC priority objective for CMSP - Regional Planning Bodies it states "The members of the regional planning bodies will consist of Federal, State, and tribal authorities relevant to CMSP for that area. In addition, the regional planning bodies will provide a formal mechanism for consultation with their respective Regional Fishery Management Councils (RFMCs) on fishery related issues."

Further, the final recommendations of the Interagency Ocean Policy Task Force state "Some comments suggested adding a Regional Fishery Management Council (RFMC) representative to the regional planning bodies given their unique quasi-regulatory role under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The Task Force is interested in finding the most effective opportunity for sustained and meaningful engagement with the RFMCs as it is their statutory responsibility to develop fishery

7.0

Agenda Item K.1.a
Attachment 1
November 2012

PACIFIC COAST FISHERY ECOSYSTEM PLAN

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

DRAFT

PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 101
PORTLAND, OR 97220
(503) 820-2280
(866) 806-7204
WWW.PCOUNCIL.ORG
NOVEMBER 2012

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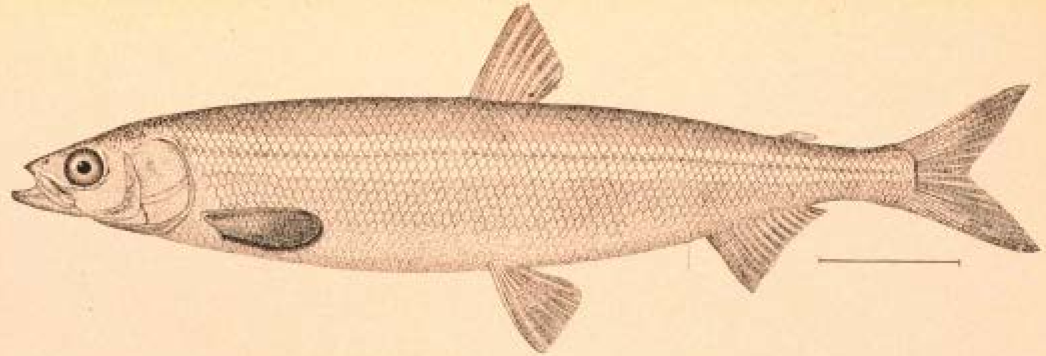
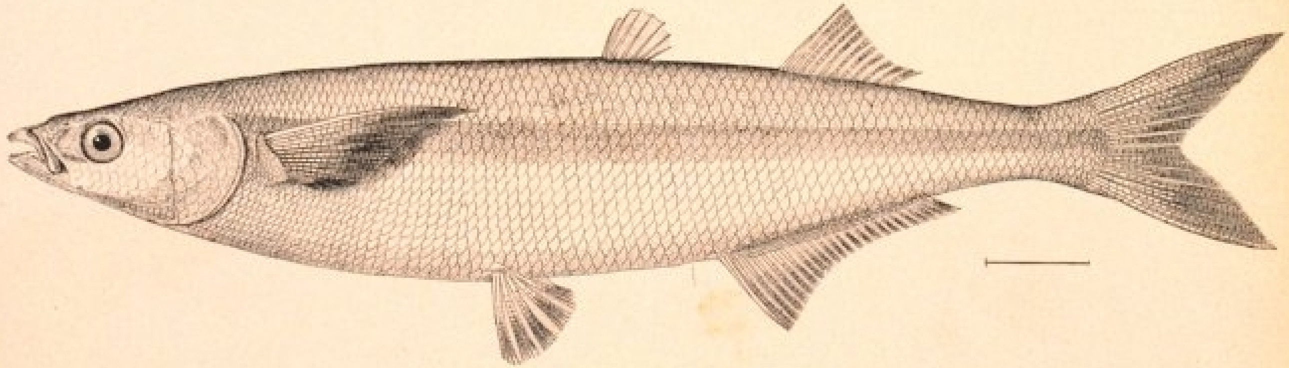


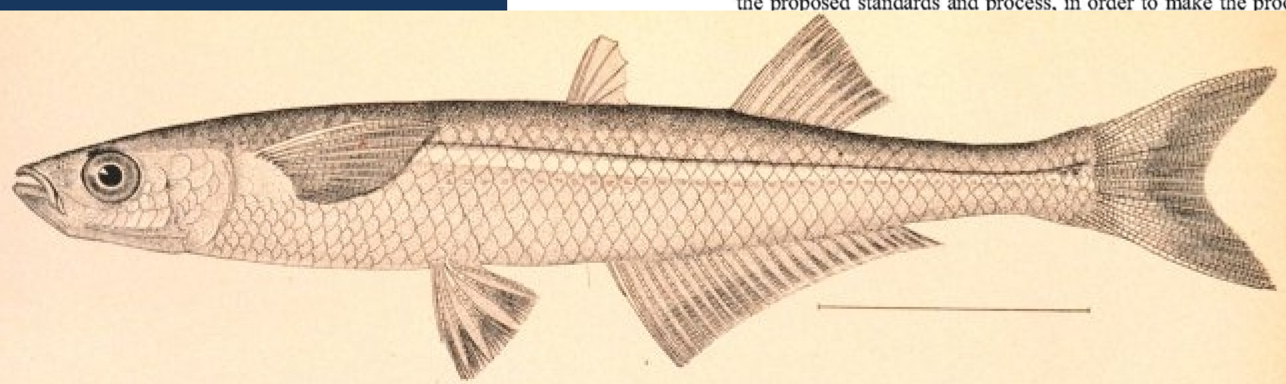
THE CALIFORNIA SURF SMELT.

Hypomesus pretiosus (Grd.), Gill. (p. 544.)

Drawing by H. L. Todd, from No. 27966, U. S. National Museum, collected at Yakutat Bay, 1886, by Dr. T. H. Bean.



THE CALIFORNIA "SMELT" OR PESCADILLO.



THE SAND SMELT OR SILVER SIDES.

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review of applications could be formally incorporated into Federal regulations.

E. Regarding the Council's standards which would be used in assessing whether a proposed new fishery could compromise conservation and management measures within the West Coast EEZ, the EPDT progress report shall provide full detail of the proposed standards and process, in order to make the procedural and content
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7.2

TITLE III—NATIONAL FISHERY MANAGEMENT PROGRAM

SEC. 301. NATIONAL STANDARDS FOR FISHERY CONSERVATION AND MANAGEMENT 16 U.S.C. 1851

(a) IN GENERAL.—Any fishery management plan prepared, and any regulation promulgated to implement any such plan, pursuant to this title shall be consistent with the following national standards for fishery conservation and management:

98-623

(1) Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

(2) Conservation and management measures shall be based upon the best scientific information available.

(3) To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

(4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

104-297

(5) Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

(6) Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

(7) Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

104-297, 109-479

(8) 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 meet the requirements of paragraph (2), 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.

104-297

(9) 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.

104-297

(10) Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

97-453

(b) GUIDELINES.—The Secretary shall establish advisory guidelines (which shall not have the force and effect of law), based on the national standards, to assist in the development of fishery management plans.

SEC. 302. REGIONAL FISHERY MANAGEMENT COUNCILS 16 U.S.C. 1852

97-453, 101-627, 104-297

(a) ESTABLISHMENT.—

(1) There shall be established, within 120 days after the date of the enactment of this Act, eight Regional Fishery Management Councils, as follows:

(A) NEW ENGLAND COUNCIL.—The New England Fishery Management Council shall consist of the States of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut and shall have authority over the fisheries in the Atlantic Ocean seaward of such States (except as provided in paragraph (3)). The New England Council shall have 17 voting members, including 11 appointed by the Secretary in accordance with subsection (b)(2) (at least one of whom shall be appointed from each such State).

(B) MID-ATLANTIC COUNCIL.—The Mid-Atlantic Fishery Management Council shall consist of the States of New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia, and North Carolina and shall have authority over the fisheries in the Atlantic Ocean seaward of such States (except North Carolina, and as provided in paragraph (3)). The Mid-Atlantic Council shall have 21 voting members, including 13 appointed by the Secretary in accordance with subsection (b)(2) (at least one of whom shall be appointed from each such State).

(C) SOUTH ATLANTIC COUNCIL.—The South Atlantic Fishery Management Council shall consist of the States of North Carolina, South Carolina, Georgia, and Florida and shall have authority over the fisheries in the Atlantic Ocean seaward of such States (except as provided in paragraph (3)). The South Atlantic Council shall have 13 voting members, including 8 appointed by the Secretary in accordance with subsection (b)(2) (at least one of whom shall be appointed from each such State).

For those images where sources are not shown directly on image, all were either created for the November 2012 Draft FEP, or courtesy of the U.S. National Oceanic and Atmospheric Administration, except:

Slide 2: California bioregions; California Natural Resources Agency
Slide 4: Northeast Pacific Ocean; NASA/Goddard Space Flight Center.
Slide 6: Briefing book table, Pacific Fishery Management Council . (Repeated at Slide 16)
Slide 7: Maps from FEP courtesy of Murdock Environmental, LLC. Trinity River View, Hoopa Valley Tribe.
Slide 10: Northwest Training Ground Complex map; U.S. Navy. Ship discharge diagram; U.S. Environmental Protection Agency. Outer Continental Oil and Gas Strategy map; U.S. Department of Interior. West Coast Governors' Agreement on Ocean Health Action Plan, WCGA.
Slide 11: Donald McIsaac, Pacific Fishery Management Council.
Slide 12: *Alice C. Evans, working in her laboratory*, 1928, Library of Congress
Slide 16: *The Declaration Committee*, 1876, Currier & Ives, Library of Congress

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON FISHERY ECOSYSTEM PLAN

The Coastal Pelagic Species Advisory Subpanel (CPSAS) reviewed the draft Fishery Ecosystem Plan (FEP) and commends the Ecosystem Plan Development Team (EPDT) for the significant body of work that this draft represents. The CPSAS supports Council action to adopt this draft for public review, and would like to provide feedback on how the document may be improved between now and the March 2013 meeting. Below is a summary of the broader, conceptual issues the CPSAS suggests could be clarified in the FEP.

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. Chapter 7 of the FEP proposes that the Council consider the FEP as effective for at least five years, i.e. 2013-2018, with an update process beginning in 2017. A more comprehensive explanation of the interaction amongst these documents could help 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.

Our understanding is that ecosystem models such as IEA and Atlantis may be able to suggest ecosystem-fishery trade-offs, but are not intended to determine explicit harvest quotas. In that regard, the CPSAS recommends that the EPDT provide a more detailed explanation of how the FEP document, as well as the IEA and CC Annual Report may be used by the management teams, advisory subpanels and Council.

In the discussion of low trophic level forage species, section 3.2.1.3 (page 18) the FEP could acknowledge findings from the Lenfest Forage Fish Task Force Report appendices (Figures E.5.1 and E.5.5) and other studies showing that CPS fisheries in the CC Ecosystem remove approximately two percent of the productivity of small and large planktivorous fishes. This information is important to consider in the context of future management of CPS and other 'forage' fisheries.

Chapter 6 of the FEP section 6.2.2 outlines science questions for future consideration related to the CPS Fishery Management Plan. The CPSAS notes that of the four issues listed for consideration, number 3 ("review and revise the climate-based factor in the harvest control rule for Pacific sardine") has been recommended by the CPSAS, Coastal Pelagic Species Management Team (CPSMT) and Scientific and Statistical Committee to be the initial focus of a harvest parameters workshop to be convened in early 2013. The outcomes from this workshop may help to complete item 2 ("developing climate-productivity relationships for Pacific sardine and other Coastal Pelagic Species"). Thus, number 3 under 6.2.2 may help inform number 2.

We recommend that bullet three under section 5.2 (Fish Habitat) include mention of ocean acidification. Also, under Section 6.2.2 (Future Ecosystem Considerations), number 1 should

include the potential effects of ocean acidification when considering the influence of climactic/oceanographic conditions on CPS.
Pacific sardine is currently mentioned in Chapter 5 under section 5.1.5 (Internationally- Managed Species), giving the impression that there is international management of Pacific sardines. However, the CPSAS points out that there is no treaty governing the international management of sardines in the CC Ecosystem. Nevertheless, we encourage the Council to promote international cooperation in the management of CPS with Mexico and Canada, in addition to any non-fishing related activities this section of the FEP may cover in the future.

We look forward to working with the EPDT in further developing this document.

PFMC
11/06/12

ECOSYSTEM ADVISORY SUBPANEL REPORT ON FISHERY ECOSYSTEM PLAN (FEP)

The Ecosystem Advisory Subpanel (EAS) reviewed the draft Fishery Ecosystem Plan (FEP) (Agenda Item K.1.a, Attachment 1) including the structure of the complete document and revisions since prior drafts.

Chapter 3

The EAS found this chapter to be a useful and comprehensive overview of fishery information and ecosystem-based measures across the Council's Fishery Management Plans (FMPs) and recommends these specific revisions:

- In Section 3.1.2 on page 7, expand on statement "*A different set of sub-regions may be more appropriate in the context of other issues and analyses*," by adding the phrase "such as population structures of various fish species." and include a reference to Section 7.2.2 regarding bio-geographic region identification.
- Update Figure 3.2.1 regarding food web interactions to reflect improvements in fishing gear and fishing practices.
- Add text and graphics on State-water protected areas to the description of geographic features of the California Current Ecosystem (CCE) in Section 3.1.3.

Chapter 4

The EAS was supportive of the FEP's documentation of natural influences that can create substantial variations in fish populations in the absence of fishing pressure. The EAS felt that this is a phenomenon that is not always adequately considered in fishery management and public perceptions. The EAS recommends the following revisions to Chapter 5:

- Update Section 4.2.1.1 regarding coastal pelagic fisheries (p. 116) to note that some species are not known to switch prey (or switching prey is not energetically efficient), but rather rely on a narrow range of forage species.
- Update the text and figures in Section 4.4.1 to include information on locally-important fishing communities: e.g., Morro Bay, Half Moon Bay, Ilwaco. Currently, the information presented only includes the larger ports in terms of revenue and tonnage.

Chapter 5

The EAS found this chapter and its treatment of Council priorities for ocean resource management to have great value. Many members have participated in processes outside of the Council process where other ocean users have sought to assess how to avoid adverse impacts to fisheries (e.g., wave energy projects). Chapter 5 is a useful tool for focusing attention on key issues to consider when evaluating non-fishery impacts on the ecosystem and their effects on fisheries. Although this chapter does not afford the Council the authority to address non-fishery impacts directly, this information has value, particularly if used as an outreach tool.

Specifically, the EAS recommends the following revisions to Chapter 5:

- Add to Section 5.1 discussions of activities (i.e., aquaculture) that concentrate wild stock parasites or diseases, activities that can injure fish acoustically (e.g., seismic testing, active sonar), and text to call attention to juvenile life stages where appropriate.

- Add to Section 5.2 a discussion of the importance of estuarine and nearshore habitats and the effects of surrounding land use.

Chapter 6

The EAS reviewed the cross-FMP recommendations in Section 6.2.1 and developed a proposed prioritization of the list of future ecosystem considerations. Priorities are captured in a 2x2 cost/benefit matrix in Figure 1 at the end of this report. The numbers in Figure 1 refer to the numbering of the items in Section 6.2.1, not to their priority ranking. Their priority is reflected in their position in the figure. Item 9, 11, and 13 from Section 6.2.1 were not prioritized in this exercise because the EAS felt they would be better prioritized within the future ecosystem considerations of specific FMPs.

Chapter 7

The initiative process presented in Chapter 7 represents a practical approach for bringing ecosystem-based management concepts into the Council's deliberations and decision-making.

- The EAS believes that FEP Initiative 1 as presented in the draft FEP has merit on its own and represents a good example of a process that would allow the Council to provide ecosystem-based direction across FMPs.
- In developing FEP Initiative 1 further, the EAS recommends additional consideration of incidental catches as they relate to Table 7.1 so that species that are currently legal to land do not become illegal.
- The EAS recommends including Table A1 "Preliminary Summary of Select LTL Species in the CCE" from the November 2011 draft of the FEP (Agenda Item H.2.a) as an appendix to the public review draft. An appropriate way to incorporate it would be on page 159 within the discussion on developing a list of unfished forage species with a sentence such as "A preliminary table of species with these characteristics was presented in the November 2011 draft of the FEP (Agenda Item H.2.A) and is attached as Appendix 1."
- The EAS did not review the Potential Future Initiatives section 7.2 in detail or discuss their relative priorities, but we would be pleased to do that during the public review process if requested by the Council.

Figure 1. Prioritizing Section 6.2.1 Cross-FMP Future Ecosystem Considerations

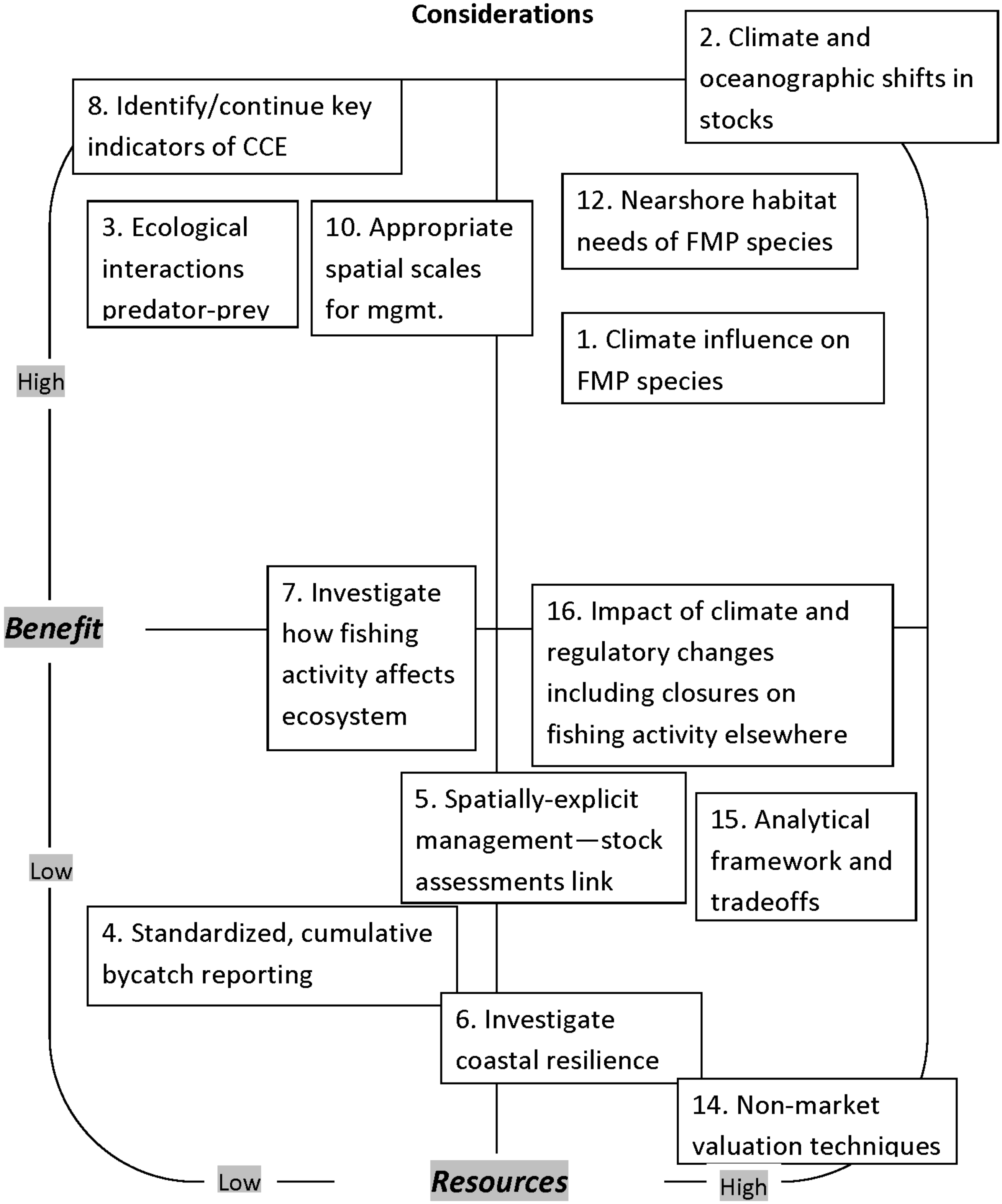


Figure 1 Footnotes, rationale for the prioritization of each item.

1. *Climate impact on FMP species. Important to understanding future management options. Fairly high cost because science is still developing.*
2. *Shifts in stocks, split social interactions out and added to new 16. This is at the heart of ecosystem-based management and takes advantage of ecological and climate research, leveraged through IEA.*
3. *Predator/prey interactions. High importance to ecosystem-based decisions and an important attribute of IEA. Models exist but need to be updated and ground-truthed.*
4. *Bycatch reporting. More value in situations where there is cumulative pressure on species caught in multiple fisheries, and these situations could be the focus of effort, rather than across-the-board standardization.*
5. *Effects of spatially explicit management. Good monitoring focus where reserves are in place; being done in California. May not be generalizable outside of specific situations, so it may be difficult to apply at an ecosystem scale.*
6. *Climate impacts on coastal communities. Climate is important, but this line of research is tangential to Council interests. They should be able to take advantage of research done by others.*
7. *Cumulative fishing impacts on the ecosystem. "Investigate how fishing activity affects ecosystem structure and function." To some, seemingly one of the key components necessary for ecosystem-based management. To others, it seemed a difficult task with low value, and the potential to single out fishing impacts among many. The task needs to be explained in more specific terms to be prioritized and acted on. We ranked it mid-level in benefit and relatively low cost.*
8. *Identify key indicators. Recognized this is being done in the context of the state of the ecosystem report, and supportive of its value. High benefit/low cost so long as new monitoring is not needed.*
9. *Habitat contributions to productivity. Not prioritized, high priority item, but should be considered within the priorities for each FMP.*
10. *Spatial structure of stocks. Probably a high value to better scale and focus management measures, but we aren't sure of the costs. Some can be done by models. Also value to considering unmanaged stocks in the same way.*
11. *Effects of gear on ecosystem structure and function. Not prioritized, should be evaluated in terms of individual FMPs.*
12. *Vulnerability in early life stages. Agreement that this has high value, because the impacts on fisheries are serious. We have some doubt about how much effect the Council can have on shoreline and nearshore impacts, but Council recognizing it as a priority may help get it done. Recognize there is a high cost because field studies are needed.*
13. *Evolutionary impacts. Not prioritized, should be evaluated in terms of individual FMPs.*
14. *Non-market valuation. Low benefit to Council's work, and costs are likely to be relatively high.*
15. *Analytical framework. Difficult to prioritize because the scope is unclear, so utility and costs are hard to assess. If it referred more directly to IEA and specific work to be done, it may have been easier to comment on.*
16. *New ecosystem consideration on developing social science and economic approaches to understanding potential displacement effects and shifts in fishing activity in response to ecosystem conditions as well as regulations (separated from number 2).*

PFMC
11/06/12

6.2.1 Cross-FMP – Needed Future Ecosystem Considerations

1. Evaluate the influence of climatic/oceanographic conditions on the population dynamics of FMP species. Develop IEA indicators to track that influence, such as for upwelling, sea surface temperatures, Pacific Decadal Oscillation, chl-a, and zooplankton index. Evaluate the efficacy of incorporating environmental factors within the current stock assessment modeling framework (Stock Synthesis 3). Model effects of climate forcing and other ecosystem interactions (e.g., trophic interactions) on productivity and assess utility of simulated estimates of the unexploited biomass over time (a "dynamic B0") rather than the static estimate of long-term, mean, unfished abundance (Sibert et al. 2006). This is now done for many assessments in order to represent relative depletion from both a static and dynamic perspective (Maunder and Aires-da-Silva 2010) and could incorporate insights from ecosystem models (e.g. Brand et al. 2007).
2. Assess high and low frequency changes in the availability of target stocks, and the vulnerability of bycatch species, in response to dynamic changes in climate and oceanographic conditions (such as seasonal changes in water masses, changes in temperature fronts or other boundary conditions, and changes in prey abundance). Link with socio-economic data and modeling to assess effects of changes in availability on West Coast fisheries. For example, during periods of low HMS availability, recreational fishermen who might prefer to harvest HMS species may increase harvest rates and activity for alternative species, such as rockfish and other groundfish.
3. Examine ecological interactions for influence on managed and non-managed species, including predator-prey relationships, competition, and disease. Investigate the role of FMP species in the food web, including analysis of behavioral interactions (e.g. functional response) between predators and prey.
4. Evaluate effectiveness of standardized bycatch reporting methodologies in all FMP fisheries and develop quantitative information on the extent of the cumulative bycatch of all FMP fisheries.
5. Spatially-explicit management: What is the effect of marine spatial planning on FMP species and fisheries? To address this question, a review of marine spatial planning would include both fisheries and non-fisheries closures, traditional fishing grounds, the effects of potential future non-fishing ocean areas uses, and asking about the types of activities tend to generate EFH/ESA consultations.

This should also include questions about the effects of spatially explicit management on fisheries research and monitoring and modeling (e.g. stock assessments).

6. Investigate how viability and resilience of coastal communities are affected by changes in ecosystem structure and function, including short- and long-term climate shifts.
7. Investigate 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).
8. Identify key indicators for recruitment, growth, spatial availability, and overall CCE productivity.
9. Investigate how different habitat types contribute to species productivity rates (habitat-specific demographic rates). Determine whether Habitat Assessment Improvement Plan (NMFS 2010) can be used to incorporate habitat data into stock assessment models.
10. Better understand spatial structure and geographic range (meta-population structure) of managed stocks and investigate what are the most appropriate spatial scales for management.
11. Assess the effects of different types of fishing gear on ecosystem structure and function, and investigate the effects of the ecosystem structure and function on gear performance.
12. Assess near-shore distribution of FMP species for habitat needs and fishery vulnerability during nursery and pre-reproductive life stages. Characterize the influence of nearshore marine, estuarine and freshwater water quality on survival, growth, and productivity.
13. Assess the evolutionary impacts of fishery management measures and fishing practices, and investigate whether those impacts affect yield or sustainability.
14. Non-market valuation techniques need to be developed in order to estimate existence or other non-use values that are applicable to FMP target species, as well as the non-target species that interact with FMP target species.
15. Develop an analytical framework to compile the information and evaluate the tradeoffs society is willing to make across the alternative ecological benefits fishery resources provide.

Prioritizing Future Considerations

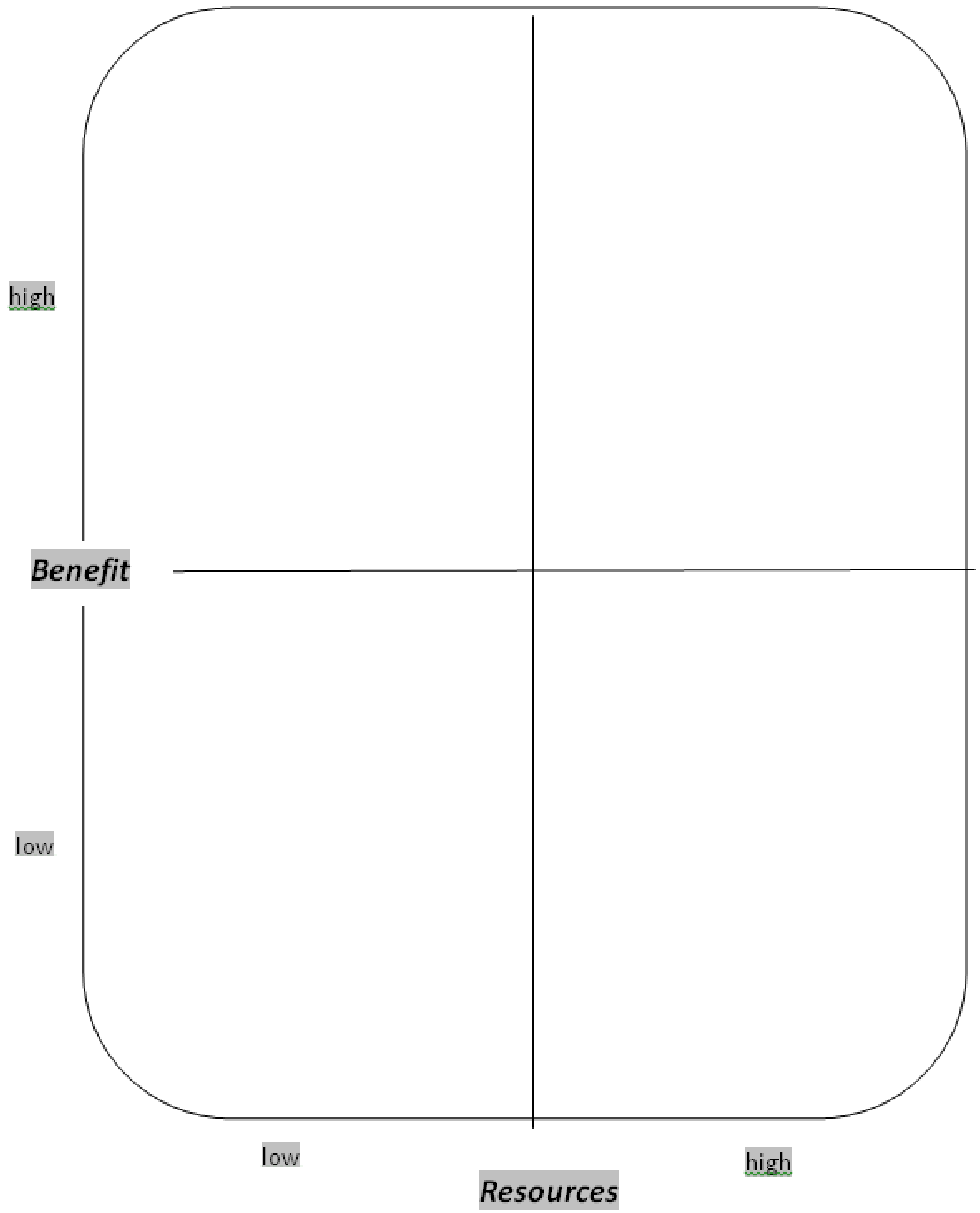
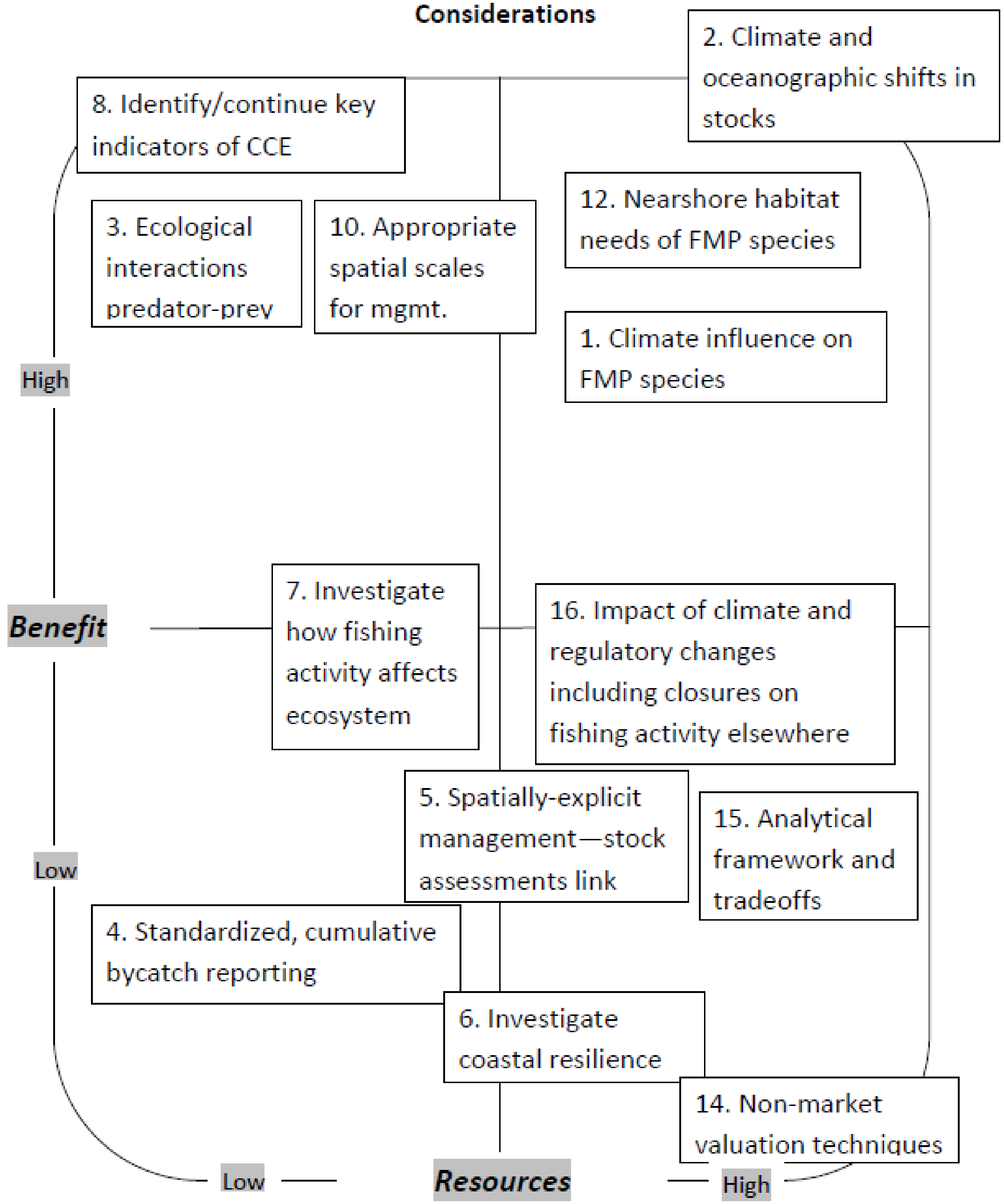


Figure 1. Prioritizing Section 6.2.1 Cross-FMP Future Ecosystem Considerations



GROUNDFISH ADVISORY SUBPANEL REPORT ON FISHERY ECOSYSTEM PLAN (FEP)

The Groundfish Advisory Subpanel (GAP) received a presentation from Dr. John Field about the documents and issues under Pacific Fishery Management Council (Council) consideration. It appears the Ecosystem Plan Development Team is on the right track in developing an informational Fishery Ecosystem Plan (FEP), as directed by the Council. The GAP reiterates our previous recommendation that the FEP should be an informational document that provides a basis to broaden the scope of Council decisions. The FEP should not create new regulatory authorities at this time.

In addition to information currently provided in the draft FEP, the GAP recommends adding information on natural events that could disturb ecosystem components. For example, the draft FEP speaks to potential disturbance to bottom habitat caused by fishing activities. The GAP strongly notes that there are many natural occurrences that disturb or alter bottom habitat. Those natural events should be identified and accounted for in the FEP.

Relative to the question of the readiness of the draft FEP for adoption as a public review document, the GAP understands that the Scientific and Statistical Committee (SSC) might have several specific recommendations for changes to the current draft before the FEP is ready for prime time. The GAP supports further SSC review of the FEP prior to release for public review, if deemed necessary by the SSC. At this time, and taking into account any additional SSC review, the GAP thinks the FEP is on track for final adoption at the March 2013 Council meeting.

PFMC
11/05/2012

GROUNDFISH MANAGEMENT TEAM REPORT ON THE DRAFT PACIFIC COAST ECOSYSTEM PLAN

The Groundfish Management Team (GMT) reviewed the Draft Pacific Coast Fishery Ecosystem Plan (FEP) Report (Agenda Item K.1.a, Attachment 1) and has the following comments and suggestions. We would like to thank the Ecosystem Plan Development Team (EPDT) for their work on crafting the Draft FEP. It provides an impressive overview of the California Current Ecosystem (CCE), Chapter 3 being particularly intensive, and the present understanding of many of the processes therein. The GMT suggests additional information for consideration in the final draft.

One area that perhaps needs further attention in the final draft is the interplay between ocean acidification and upwelling. Both of these are addressed in the report; however, potential increases in shoaling of acidic water, whether in depth of the shoaling or frequency of the events are not discussed in detail. This is likely to have considerable biological effects given the prominence of upwelling in the ecology of the CCE. The GMT would also like to note that the final draft may benefit from prioritization among the initiatives mentioned in Chapter 7, as well as a better indication of how Chapters 6 and 7 relate. Currently, those two chapters overlap heavily and seem redundant.

Longer-term goals for better understanding the ecosystem might focus on region-based fishing effort compared to stock distribution by sector/fishery and for individual species or assemblages. For example, section 7.2.2 could be expanded to include broader information on where fisheries are occurring (e.g. with vessel monitoring system, logbook, and observer data.) versus our understanding of biomass distribution of species (e.g. from surveys) to differentiate regional impacts by fishery and stock. Future efforts could also try to better account for unobserved fishing mortalities. The fate of fish that escape from trawl nets at fishing depth or long-term mortality of released fish from recreational fisheries are not currently included in our estimates of mortality. Another index that may be informative is a temporal description of area fished. For example the proportion of the Exclusive Economic Zone (EEZ) restricted to bottom contact gear illustrated annually may provide additional context on the geographic range and distribution of fishing impacts to habitat.

Finally, the Council may want to consider how ongoing improvements to our understanding of the ecosystem (spatially and temporally where appropriate) might be incorporated into Council processes. Whether these need to be done in regular updates to the FEP or through other avenues such as the information/products that might be developed as part of a Workshop with the integrated Ecosystem Assessment (IEA) Team or in future State of the California Current Ecosystem Reports is a question that we provide additional consideration on under Agenda Items K.2 and K.3. In short it is the GMT's understanding that funding to do ecosystem work directly within the Council process (i.e. through regular updates to the FEP) may not be available over the long term. As such 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). In light of this, the

Council may wish to consider adding cumulative impacts analysis to the FEP initiatives in Chapter 7.

PFMC
11/05/12

HABITAT COMMITTEE REPORT ON FISHERY ECOSYSTEM PLAN (FEP)

General Comments

The majority of the Fishery Ecosystem Plan (FEP) is informational in nature, summarizing the current range of information and issues in an ecosystem context. The information is constructive, bringing relevant ecosystem and habitat issues into one document. It also includes very specific information on how to move forward in an ecosystem management context. This is a major step forward in providing the type of information that the Habitat Committee (HC) has advocated for years.

In addition to these comments, we have the following general suggestions for further improvement.

- In discussion of all species, the models need to be better explained, including the uncertainties and tradeoffs involved with each.
- Information on the ecological value of forage fish to fishery management plan (FMP) species and quantifications of predator-prey relationships, if possible, would be a useful addition to this section.
- Discussion of socioeconomics should reflect the fact that as Federal financial resources become scarce, dredging in many communities may be suspended, which will have detrimental impacts on their fishing industries.
- The document would benefit from reorganization to make some topics easier to find and others less redundant. For example, a discussion of fishing impacts on essential fish habitat (EFH) occurs in Sections 3.3.4.1 and in 4.3, and a similar discussion occurs in Section 4.1.1 but doesn't address prey as a component of EFH.

Chapter 3: California Current Ecosystem Overview

Chapter 3 is a detailed, up to date, and thorough presentation of ecological, economic, social and fishery management information for the California Current Ecosystem. Having this information in one place helps readers understand the complexity, richness, diversity, and vulnerability of the environment and the resources it supports.

The summarized descriptions and comparisons of each FMP's objectives and ecosystem-based management (EBM) measures are helpful.

In **Section 3.3.4 (Human Effects on Council-Managed Species' Habitat)**, the FEP inaccurately states that EFH extends into the international high seas habitats of highly migratory species. In fact, EFH can only extend to the boundary of the Exclusive Economic Zone. Similar statements are made in other sections of the document.

The title of **Section 3.5.3 (Multi-State, Multi-Tribe and State-Tribal Fisheries Authorities)** is misleading, as it implies entities such as the Pacific State Marine Fisheries Commission and West Coast Governors Alliance on Ocean Health have fishery management authority or otherwise directly affect fisheries management. Their roles need to be clarified.

Section 3.5.3.4 (West Coast Governors' Alliance on Ocean Health): It should be made clear that in regard to the second bullet on protecting and restoring ocean and coastal habitats, the Alliance is depending on the Pacific Marine Estuarine Fish Habitat Partnership (formally recognized by the National Fish Habitat Partnership in 2012) to serve that role.

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

Chapter 4 does an excellent job of describing habitat interactions that affect managed stocks. It also accurately spells out the complex challenges that arise when human actions create conditions conducive to enhanced predation on listed stocks.

This chapter failed to address the implications of sea level rise.

Section 4.1.1 (Direct and Indirect Effects of Fishing on Fish Abundance)

We recommend changing the second sentence (first paragraph) to "By both definition and design, fishing results in reductions in standing biomass of targeted populations and may result in moderate to severe shifts…"

Section 4.2 (Direct and Indirect Effects of Fishing on Non-Fish Abundance)

According to its title and introduction, this section is intended to discuss impacts of fishing on non-fish abundance (i.e., invertebrates, mammals, seabirds). However, it includes discussion of impacts to fish, specifically Endangered Species Act- (ESA) listed fish species and forage fish (see Subsection *4.2*.1.1 Groundfish Fisheries). For consistency, these discussions should be placed under "Direct and Indirect Effects of Fishing on Fish Abundance."

Section 4.2.1.1 (CPS Fisheries)

This section speculates that impacts of forage fish fishing on predator species (fish, birds, mammals) are minimal, and concludes that "On the whole, sardine, anchovy, and mackerel only make up a small portion of the total forage base, and thus the impacts of their direct removal through fishing is likely not to have a large impact on the entire ecosystem." However, this statement is not well-supported by the discussion provided, and there is some disagreement in the literature on this point. Therefore, this chapter would benefit from an expanded discussion, including the role of forage fish species in the ecosystem, and supported by a more in-depth literature review.

Section 4.3.1.1 (Groundfish Trawl Fishery and Pink Shrimp Fishery)

It would be useful to include time series maps of the trawl footprint. As noted in the report, although distance trawled is less over time, the current trawl footprint provides a more meaningful measurement of the total habitat affected. Additionally, while the total trawl footprint has decreased since 2003 due to Rockfish Conservation Areas, EFH closures, and gear restrictions, trawl activity is likely more spatially concentrated, possibly with greater impact on benthic habitat in those places. A map depicting the spatial intensity of fishing (fishing effort) would be useful.

Chapter 5

Section 5.1 (Species of Concern)

The name of this section, "species of concern," has a specific meaning under the ESA and should be changed.

5.1.1 (PFMC Policy Priorities for Ocean Resource Management) and Section 5.1.2 (Species Protected Through and Overfished Species Rebuilding Program)

The titles of these subsections should be consistent, either based on fish species or issues.

The focus of this chapter should be broadened to cover other protections provided under ESA and EFH instead of focusing only on recovery plans.

Both sections should reference existing EFH documents and their appendices regarding non-fishing threats. In addition, remove references to activities the Council is "particularly concerned with" as this is only a partial list of those fishing threats and concerns.

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

This chapter suggests a number of analyses and products for informing EBM in the future. This section would benefit from a framework with analysis-specific objectives, timelines, and actions, to expedite and guide the integration of ecosystem science into fisheries management. At this juncture, even a draft framework would be helpful.

6.2 (Science Questions for Future Consideration)

This section should reference the Research and Data Needs Document regarding ecosystem research priorities, and the Research and Data Needs document should include items from this section in its ecosystem section. In addition, this section should include the Information and Research Needs identified in the EFH review documents.

Chapter 7: Cross-FMP Initiatives

Chapter 7 provides practical guidance to the Council on how to move forward with EBM, and the HC urges the Council to consider a timeframe for moving forward on these initiatives.

7.2.4 (Cross-FMP EFH Initiative)

Although there are efficiencies to be gained with a cross-FMP EFH initiative (for example threats to EFH across FMPs), due to staffing and funding limitations it would be difficult, if not impossible, to complete these reviews in a timely manner. In addition, because these reviews have different processes and levels of complexity, they would be difficult to consolidate. However, as a starting point, existing EFH tools could be better integrated to make data more easily accessible.

Add New Section: Framework for FEP Integration

The FEP should include a framework that describes how to apply ecosystem science information from the FEP and Integrated Ecosystem Assessment to each FMP.

PFMC
11/03/12

Agenda Item K.1.c
Supplemental HMSAS Report
November 2012

HIGHLY MIGRATORY SPECIES ADVISORY SUBPANEL REPORT ON THE FISHERY ECOSYSTEM PLAN (FEP)

The Highly Migratory Species Advisory Subpanel (HMSAS) has the following comments:

- Even though the FEP is termed a "Plan," we think it would be better termed an "Assessment" of how the various factors may affect the optimum yield of the Fishery Management Plan (FMP) stocks.
- The HMSAS is concerned that this FEP will negatively influence harvest allowance regulations in the FMPs, and could do irreparable harm to the fishing industry and to the communities that depend on the fisheries.
- We are concerned that conclusions made in the FEP Draft based on the descriptions of a particular fishery may be misleading and lead to stereotypes. For example, on page 46 there is a statement that "… in 2011 there were far more vessels than necessary to harvest the total landings." The HMSAS thinks this is a misleading statement.
- Another example is on page 54. There is a section for importers and brokers. However, the portion of economics and removals from imports by processors and dealers has not been segregated from the domestic portion.
- The HMSAS is concerned that the State-of-Ecosystem Reporting on page 2 indicates that FMPs may be modified without definitive answers and numbers.
- There needs to be a comprehensive analysis in the FEP on the effects of the biomass removals by marine mammals and sea birds.
- It seems strange to the HMSAS that this draft Plan of the California Current would apply to HMSAS stocks that range outside of the California Current for most of their life cycle.
- A minor comment is that the graphs need to be presented in a way that color is not necessary to understand the meaning, or all copies need to be in color.

In conclusion, the members of the HMSAS received this document less than two weeks ago and received a briefing at 4:00 p.m. on the only day that we were meeting. We think there are many more problems to be identified in the FEP. We recommend that this Draft FEP needs more revision and will not be ready to go to public review by the March Council meeting.

PFMC
11/05/12

SALMON ADVISORY SUBPANEL REPORT ON COUNCIL FISHERY ECOSYSTEM PLAN (FEP) DEVELOPMENT

The Salmon Advisory Subpanel (SAS) met via teleconference on October 29, 2012 to review materials for the November Council meeting including the draft Fishery Ecosystem Plan (FEP) (Agenda Item K.1.a, Attachment 1). The SAS developed the following recommendations for Council consideration.

Although the SAS had limited time before the teleconference to complete a detailed review of the FEP, the SAS appreciates the considerable time invested in the plan's development and encourages continued work and review towards completion of the FEP. The SAS remains interested in the critical role of forage to healthy salmon stocks and urges the Council to continue to consider forage issues throughout the completion and implementation of the FEP.

PFMC
11/02/12

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON COUNCIL FISHERY ECOSYSTEM PLAN (FEP)

The Scientific and Statistical Committee (SSC) reviewed the draft Fishery Ecosystem Plan (FEP), which is scheduled for adoption at the March 2013 Council meeting. Mr. Mike Burner and Dr. John Field were available to answer questions. The SSC has reviewed most of this document at past meetings, and spent most of the discussion time at this meeting on new and revised sections of the FEP.

The Council has recommended the FEP serve as an advisory document. Many of the recent revisions to the FEP follow recommendations from Council advisory bodies, and the document continues to improve. The FEP provides the Council with the means to look at issues that are pertinent to fisheries management, but outside of traditional single-species management. It also provides a useful summary of system level information potentially pertinent to fisheries management. The SSC commends the efforts of the Ecosystem Plan Development Team (EPDT) and Ecosystem Advisory Subpanel (EAS) to make this document a valuable contribution to ecosystem-based management planning, and offers the following observations and suggestions:

1. Final editing should further emphasize how ecosystem-based information and cross-fishery management plan (FMP) issues should affect Council decision-making and process.

2. Section 7 would benefit from re-organization to emphasize the status of the different initiatives listed, which range from well-formulated plans to general proposals for future research. Prioritization of the initiatives would benefit upcoming efforts to review and utilize the tools that are provided by the California Current Integrated Ecosystem Assessment (Agenda Item K.2.c, Supplemental SSC Report).

3. Much of the basis for ecosystem-based management is an integration of ecosystem and fishery effects on species, habitats, and human communities, including cumulative effects. The connection that is relevant to Council operations is population resiliency and response to change. Many of the issues raised in the FEP can be framed in this way, which may help the Council and advisory bodies prioritize ecosystem-related initiatives.

4. Cross-FMP initiatives can integrate data from biological and socio-economic systems.

5. Many of the initiatives in Chapter 7 overlap with the Research and Data Needs document. The ecosystem section of the Research and Data Needs document should be modified to reflect the initiatives in chapter 7 of the FEP.

The SSC will forward detailed comments and recommendations for revisions to the FEP to the EPDT.

PFMC 11/05/12

THE PEW ENVIRONMENT GROUP
PACIFIC FISH CONSERVATION CAMPAIGN
4189 S.E. Division St., Portland, Oregon 97202

October 11, 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: Agenda Item K.1.d, Development of a Pacific Fishery Ecosystem Plan

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), to encourage the Council to stay on track with adopting a finalized FEP in March of 2013, and to ensure that the FEP prioritizes protection of the marine food web.

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.[1] While the progress it has made is promising, in order for the FEP to best fulfill its stated purpose and need it should:

- Include in its objectives an explicit reference to the assessment of Optimum Yield (OY), as defined in the Magnuson-Stevens Fishery Conservation and Management Act (MSA).[2]
- Call for monitoring the status and trends of the forage base in the Exclusive Economic Zone off the West Coast as an indicator of ecosystem health.
- Provide a framework to ensure that information from the FEP is incorporated and utilized in the decision making process.

A description and the justification for these items are described in further detail below. We ask that the Council consider these suggestions as it reviews the forthcoming final draft of the FEP and incorporate them into the guidance it gives to the Ecosystem Plan Development Team (EPDT) as it prepares the FEP to be released for public comment.

[1] PFMC. June, 2012. Draft Pacific Coast Fishery Ecosystem Plan. Agenda Item H.1.a. Page 2
[2] 16 U.S.C. 1802 § 3(33)(B).

FEP Goals & Objectives

We agree with the approach taken by the EPDT to establish objectives for the FEP in accordance with those found throughout the Council's fishery management plans (FMPs); including first-order ecosystem-based goals of avoiding overfishing and minimizing bycatch and impacts to habitat. We also support the EPDT's inclusion of an additional objective found only in the Coastal Pelagic Species (CPS) FMP: that of providing adequate forage for dependent species.[3] This objective in particular is the focus of our comments below.

The National Standard 1 (NS1) Guidelines echo this objective from the CPS FMP by stating that the benefits of ecosystem protection result from among other things, "maintaining adequate forage for all components of the ecosystem."[4] 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."[5] In short, forage conservation is a primary component of ecosystem-based fishery management[6] 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 second objective listed in the FEP addresses the assessment of the greatest long-term benefits derived from the conservation and management of marine fisheries and the tradeoffs necessary to achieve those benefits. We concur with the recommendation made by the Ecosystem Advisory Subpanel to modify this objective by including a specific reference to OY as follows:[7]

> *"2. Build toward fuller assessment of the greatest long-term benefits from the conservation and management of marine fisheries, <u>of optimum yield</u>, and of the tradeoffs needed to achieve those benefits while maintaining the integrity of the CCE…"*

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.[8] Under the MSA, OY is defined as Maximum Sustainable Yield (MSY) reduced by relevant social, economic and ecological factors.[9] The incorporation of

[3] PFMC. 1998. Coastal Pelagic Species FMP. Page1-4.
[4] 50 C.F.R. § 600.310(e)(3)(iii)(C).
[5] 50 C.F.R. § 600.310(e)(3)(iv)(C).
[6] 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.
[7] PFMC. June, 2012. Ecosystem Advisory Subpanel Report on Council Fishery Ecosystem Plan Development. Agenda Item H.1.c.
[8] 16 U.S.C. 1851 § 301(a)(1)
[9] 16 U.S.C. 1802 § 3(33)(B).

these factors into the determination of catch levels is thus a requirement of FMPs.[10] It should be clear that a major objective of the FEP will be to assist the Council to identify, assess and explicitly incorporate these factors into its existing FMPs as an adjustment from MSY to OY.

In regards to economic OY considerations, 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.[11] Economic and social OY adjustments must be carefully designed so that they do not overlook the possible negative impacts of forage fish depletion on commercial and recreational fisheries for marine predators in higher-trophic levels (e.g., salmon and tuna), and must incorporate long-term impact assessments on all stakeholders for fisheries which are dependent on forage species as opposed to just short-term perspectives on catch reduction impacts to forage fisheries. 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. Additionally, the FEP should analyze alternative forage management strategies to identify and minimize any potential negative impacts to existing fisheries and the ecosystem.

FEP Ecosystem Indicators & Implications for Management

According to the draft outline for an annual state of the California Current ecosystem report provided to the Council by the EPDT in June 2012, one of the planned components of the FEP will be to identify a suite of ecosystem indicators for the Council to monitor and utilize in its decision making process.[12] The Council has heard public testimony pointing out that overall abundance and composition of the forage base is a critical indicator of ecosystem status and also that we have the scientific expertise to begin developing that indicator from both a qualitative and quantitative perspective.[13] As this process unfolds and as ecosystem science expands, we encourage the council to establish benchmarks or thresholds of forage abundance against which the forage indicator may be measured and which are consistent with the Council's ecosystem goals and objectives. Additionally, the FEP should identify important forage species and evaluate the ecological services they provide. This information should be used, in conjunction, to help inform the development of conservation and management measures that

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[10] 50 C.F.R. § 600.310(e)(3)(iv)(C).

[11] Hannesson, R., & Herrick JR, S. 2010. The value of Pacific sardine as forage fish. *Marine Policy*, *34*(5), 935-942.

[12] PFMC. June, 2012. Draft Outline for an Annual State of the California Current Ecosystem Report. Agenda Item H.1.a, Attachment 2.

[13] See Public Comment at November 2011 PFMC Meeting. Agenda Item H.2.c. Page 7.

"protect and conserve the flow of trophic energy within the ecosystem;"[14] as stated in the Objectives section of the FEP.

The use of indicators is a well-recognized approach in the practice of ecosystem-based fisheries management. For example, in 2006 the North Pacific Fishery Management Council's (NPFMC) Groundfish Plan Team noted low levels of forage biomass (sandlance, capelin, eulachon, herring, etc) in the Bering Sea and Aleutian Islands management area. This indicator of forage abundance was viewed as a qualitative reason for acting with extra precaution when setting that season's catch levels for walleye pollock.[15] Additionally, the NPFMC's Aleutian Islands Ecosystem Team monitors the reproductive success of various seabirds in the management area and uses that information as an indicator of forage availability and system level productivity.[16]

A report released by Livingston *et al.* in 2005 describes ecosystem indicators as valuable tools for assessing ecosystem status and the impacts of fishing on the ecosystem. The authors also highlight how the indicator approach is being expanded to utilize models to predict possible future trends and changes in ecosystem status.[17] Specifically, in order to detect changes outside of the natural range of prey availability relative to predator demands, this report describes the assessment of trends in forage biomass as a quantitative indicator that is measured against thresholds established in accordance with existing ecosystem goals and objectives. As the Council refines its use of indicators and develops thresholds, the FEP must also provide a framework for the Council to consider and respond to information on the short-term and long-term status, trends and forecasts relative to the forage base.

In October of 2011, the National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) held a national Scientific and Statistical Committee workshop on ecosystem and social science considerations in federal fishery management. Much of the discussion focused on forage issues and bringing ecosystem considerations into the fishery management process. In regards to monitoring and assessing forage abundance within a system, the workshop report found that:

> *"[I]t may be more important to identify an overall forage base cutoff or biomass threshold rather than a species-specific goal. Oceanographic or ecological conditions that result in poor survival across species can have broader and greater impacts on the system than fluctuations in a single species' population*

[14] PFMC. June, 2012. Draft Pacific Coast Fishery Ecosystem Plan. Agenda Item H.1.a. Page 4.
[15] Aydin, K. 2008. *The evolution of ecosystem approaches: notes from the front lines.* Alaska Fisheries Science Center. NMFS.
[16] NPFMC. September 2011. Summary Report of Aleutian Island Ecosystem Assessment Workshop. September 28-29, 2011.
[17] Livingston, P. A. et al. 2005. A framework for ecosystem impacts assessment using an indicator approach. ICES Journal of Marine Science, 62: 592e597.

> *level and this aggregated treatment of forage would better mitigate such fluctuations."*[18]

We'd also like to remind the Council of comments made by the CPS Management Team (CPSMT) regarding the monitoring of the forage base in the Council's ecosystem plan (at that time referred to as the E-FMP, before the decision to make the plan a strictly advisory FEP):

> *"The identification and monitoring of indicator species and the role species play in the food web are likely to be important issues for the E-FMP….It may become more practical to monitor species for their ecological role and associated ecosystem functions under the E-FMP rather than in the EC (Ecosystem Component) categories of the Council's four FMPs…..There are many small pelagic nekton species (primarily fish and squid) that are not presently a target of commercial fisheries…These forage species, together with presently managed coastal pelagic species, comprise the forage base for the California Current ecosystem. As the Council moves to developing an E-FMP, it is important that key populations of forage species are monitored, their role in the food web identified, as well as identifying how fluctuations in forage species abundances affect CPS abundance."*[19]

We wholeheartedly concur with the CPSMT that an FEP is the proper place to address ecosystem-wide forage base issues. Similar to utilization of forage status and trends, as the FEP begins to identify ecological and economic tradeoffs and alternative management scenarios are evaluated, there must be a framework 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.

Conclusion

We'd like to commend the Council for its development of the Pacific FEP. The sections of the FEP that describe its Purpose and Need as well as its Objectives reflect a sincere effort on the Council's part to manage our fisheries with an ecosystem-based approach. We fully understand that this process is evolutionary rather than revolutionary and that 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.

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[18] Seagraves, R. and K. Collins (editors). 2012 Fourth National Meeting of the Regional Fishery Management Council's Scientific and Statistical Committees. Report of a National SSC Workshop on Scientific Advice on Ecosystem and Social Science Considerations in U.S. Federal Fishery Management. MAFMC, Williamsburg, VA.

[19] PFMC. March, 2010. Amendment 13 to the Coastal Pelagic Species Fishery Management Plan. Please refer to March 2010 PFMC Meeting Agenda Item H.2.a.

Forage species populations fluctuate dramatically in response to ocean conditions and they 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.[20] While the Council can't stop global warming or regulate non-fisheries uses of 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
Pacific Fish Conservation Program
Pew Environment Group

[20] Hsieh et al. 2006. Fishing elevates variability in the abundance of exploited species. Nature 443:859-862. Doi:10.1038/nature05232

west
marin
environmental
action
committee

ESTABLISHED 1971

October 10, 2012

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

Dear Chairman Wolford and Council Members,

The Environmental Action Committee of West Marin (EAC) is a 41-year environmental advocacy group based in Point Reyes Station, California. We understand and highly regard the role that forage fish play in our marine ecosystem, and we are dedicated to ensuring that they are responsibly managed for current and future generations.

EAC appreciates the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. Forage fish are the lifeblood of a healthy ocean. ***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 timely adoption of a strong Fishery Ecosystem Plan.***

Our coastal ecosystem is under increasing pressure. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

It is important that the Council adopt a plan that is useful in improving fishery management. A meaningful Fishery Ecosystem Plan should include an index measuring forage abundance along the West Coast. The Council's top priority should be to ensure the stability 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 consideration of our concerns and comments.

Sincerely yours,

Amy Trainer

Amy Trainer, Executive Director

Wild Oceans
For the future of fishing

NATIONAL COALITION FOR MARINE CONSERVATION

A PROJECT OF THE NATIONAL COALITION FOR MARINE CONSERVATION (NCMC)

October 11, 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

RE: **Agenda Item K.1 – Ecosystem Based Management: Fishery Ecosystem Plan (FEP)**

Dear Dan,

The National Coalition for Marine Conservation (NCMC) is pleased by the progress the Pacific Council is making toward adoption of a Fishery Ecosystem Plan (FEP) next March and we appreciate the opportunity now to provide comments and recommendations during this final phase of development.

As you know, NCMC has consistently advocated for inclusion of an ecosystem status indicator for west coast forage species in the council's developing Fishery Ecosystem Plan (FEP). A means to monitor and assess the status of the overall forage base in the California Current, with the ultimate objective of maintaining an adequate supply of forage for all components of the ecosystem[1], has been the overarching goal of our parallel requests for the council to re-evaluate its harvest guidelines for Pacific sardine and mackerel in an ecosystems context, and to prohibit new fisheries for unmanaged forage species until a mechanism for protecting the available forage base is in place and operable.

In ecosystem-based fishery management, everything is linked. To be functional, the FEP needs to "provide a metric against which all fishery-specific FMPs are measured in order to determine whether or not management effectively incorporates and achieves the Council's ecosystem goals."[2] That means, in the case of forage fish, a measurable indicator of desirable

[1] National Standard 1 Guidelines. 50 CFR Part 600.310(e)(3)(iv)(C)
[2] NMFS. 1999. *Ecosystem-Based Fishery Management*. A Report to Congress by the National Marine Fisheries Service Ecosystem Principles Advisory Panel.

4 Royal Street, SE, Leesburg, VA 20175 (703) 777-0037

and undesirable states that can be used to inform management decisions, i.e., allowable fishing levels, under the Coastal Pelagic Species (CPS) FMP.

Future CPS conservation and management, as discussed by the CPS Management Team at its meeting October 9, 2012, will benefit from moving toward an assemblage approach, wherein harvest control rules are developed that can be more generally applied to multiple small pelagic species. Within these control rules or harvest guidelines, the concept of CUTOFF is a critical element since, if set at the appropriate level, establishes a threshold of forage to be set-aside for the ecosystem. The council's FEP, should it feature an ecosystem status indicator for the small pelagic or forage fish trophic level, would inform both stock assessments and management decisions, enabling the council to determine set-asides for forage species relative to the status of the forage base overall.

As we've pointed out in written comments and oral statements to the Ecosystem Plan Development Team and the Council, the literature and emerging practice demonstrate that ecosystem status indicators are necessary to an effective ecosystems approach to fisheries management and, most importantly, that they are viable. Below we summarize the statements, with sources, that we've previously cited supporting the value of an indicator of overall available forage as either a qualitative or a quantitative measure of ecosystem health[3]:

- *It was generally agreed by participants at the 4th National SSC Workshop that it may be more important to identify an overall forage base cutoff or biomass threshold rather than a species-specific goal. As the workshop's report advises, ecological conditions that result in poor survival across species can have broader and greater impacts on the system than fluctuations in a single species' population level and this aggregated treatment of forage would better mitigate such fluctuations.*

  Source: Seagraves, R. and K. Collins (editors). 2012. Fourth National Meeting of the Regional Fishery Management Council's Scientific and Statistical Committees. *Report of a National SSC Workshop on Scientific Advice on Ecosystem and Social Science Considerations in U.S. Federal Fishery Management*. Mid-Atlantic Fishery Management Council, Williamsburg, VA.

- *The low level of overall available forage in the Bering Sea and Aleutian Islands ecosystem (sand lance, eulachon, capelin, herring, shrimp, jellyfish and other forage fish) was viewed by the North Pacific Council's Plan Team as a **qualitative** reason for being cautious in setting allowable harvests of pollock.*

  Source: Aydin, K. 2008. *The evolution of ecosystem approaches: notes from the front lines.* Alaska Fisheries Science Center. NOAA Fisheries Service.

- *It was also noted by the North Pacific Council's scientific advisors that low numbers of forage fish are considered a negative indicator, while high numbers are an indication of favorable conditions for predators.*

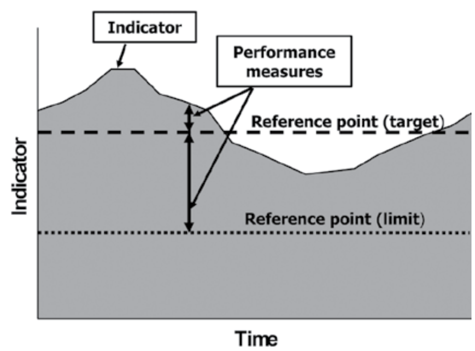
[3] *For original citations, see* National Coalition for Marine Conservation letters to the council dated October 13, 2011 and May 28, 2012.

Source: Northwest Fisheries Science Center. 2011. *Indicators Under Development: Forage Fish and Pacific Hake Abundance.* NOAA Fisheries Service.

- *Livingston et al cited the need to develop indicators to assess the ecosystem-level impacts of fishing and predict possible future trends in these indicators. Considering the ecosystem goal of maintaining predator-prey relationships, energy flow and balance within the system and species diversity, the authors recommended a **quantitative** index of forage biomass, with a threshold for action, is recommended as an indicator for maintaining pelagic forage availability.*

  Source: Livingston, P.A., Aydin, K., Boldt, J., Ianelli, J., and Jurado-Molina, J. 2005. *A framework for ecosystem impacts assessment using an indicator approach.* ICES Journal of Marine Science, 62: 592-597.

As in the FAO (2003) diagram below, a forage abundance indicator could be modeled after the reference points currently used in single-species management. For example, this familiar way of measuring status over time could be used to implement the National SSC Workshop's recommendation of a system- or trophic-level OY. (Seagraves 2012).



Fishery ecologists studying conservation of important prey fish for their ecosystem services in other regions are investigating alternative indicators which might be used to inform single species management decisions. Among these are:

- <u>*Biomass Size Spectra*</u> *(BBS), which depict the abundance and distribution of organisms at each level of the food chain. BSS models potentially can serve as ecological indicators, as constituents of a trophic level respond to natural or human-induced stresses.*

  Source: Jung, S. and E.D. Houde. 2005. Fish biomass size spectra in Chesapeake Bay. *Estuaries* 28(2): 226-240.

- <u>*Prey-predator ratios*</u>*, to index availability and probable vulnerability of prey to predators and serve as an indicator of expected prey mortality and predator abundance.*

  Source: Uphoff, J. and C. Jones and R.M. Johnson. 2006. *Predation on Menhaden*. Menhaden Species Team Background and Issue Briefs. Ecosystem Based Management for Chesapeake Bay.

Because the Fishery Ecosystem Plan is a living document and is to be advisory in nature, at least for the foreseeable future, the council's responsibility at this juncture is to endorse the use of ecosystem indicators and to task the Ecosystem Plan Development Team with initiating development of a forage base (and predator base, too, if desirable) indicator. That is the critical first step. From there, the challenge to the council, the EPDT and interested stakeholders will be translating these ecosystem indicators into decision criteria, an absolutely critical next step to ensure that all council actions achieve the goal of optimum yield, which includes maintaining adequate forage to sustain predator populations, including commercially and recreationally valuable fish and fisheries.

Thank you for your consideration.

Sincerely,

Ken Hinman
President

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

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Oct. 9, 2012

To: PMFC
Attn: Dan Wolford
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384
Fr: Russell Bassett, executive director, and Norm Ritchie, government affairs director
Re: Donation thank you

Chairman Dan Wolford and members of the Council,

The Association of Northwest Steelheaders represents 1,400 members in Oregon and Washington, and has more than 50 years of history working on behalf of fish and fisheries in the Pacific Northwest. Our members are pretty much all salmon and steelhead anglers, and we are writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of forage fish in the water for the high value predator species we all cherish.

A resilient ocean ecosystem depends first and foremost on a healthy food web, which is why we consider conservation of the prey species as the cornerstone of ecosystem-based fishery management. In June, the council itself highlighted the importance of forage fish in the Pacific when it set a goal of prohibiting new fisheries on currently unmanaged forage species until proving it wouldn't harm the ecosystem.

Forage fish are a critical measure of a healthy Pacific Ocean. Unlike other factors affecting ecosystem health—a changing climate, pollution, a growing population—the council can control how fishing affects the prey base along our Coast. As you finalize the ecosystem plan, we urge you to establish measures to track forage fish abundance as an indicator of ecosystem status and to track it over time. Knowing how much food is available for the fish we like to catch and eat can guide the council as it makes important decisions about our fisheries.

A strong ecosystem plan also can help the council evaluate trade-offs between fishing for forage fish and leaving them in the water as food for everything else in the ocean—including high-value predators such as salmon, tuna and halibut as well as seabirds and marine mammals. This will help maximize the environmental and economic benefits we receive from our ocean while ensuring that we are managing it sustainably over the long term.

We in the Northwest consider our prey-species fisheries as part of our heritage and birthright. We invest heavily in protecting and enhancing inshore fish habitats, but realize ocean conditions play a major role and "good ocean conditions" ultimately means good forage abundance for salmon and steelhead. These fish enter the ocean in one of the most dynamic ecosystems in the world. As a steward of this incredible natural asset, the Council should adopt an ecosystem plan that includes firm measures to protect it.

Thank you,

Russell Bassett
Executive Director

Norm Ritchie
Government Affairs Director

Anglers dedicated to enhancing and protecting fisheries and their habitats for today and the future.

South Coast Tours LLC
27436 Hunter Creek Rd.
Gold Beach, OR 97444
www.southcoasttours.net
(541) 373-0487

Dear Chair Wolford and Council Members:

The last time I was out fishing on the Siletz reef near Lincoln City, Oregon, I hooked a bunch of Blacks and after the bite died down I had time to examine the fish. What I noticed was a handful of small baitfish poking out of one of their mouths. This guy hadn't even had the time to digest and he was hitting my jig!

It reminded me of the letter I sent a while back urging the council to use ecosystem-based management and the precautionary principle when addressing potential new forage fish fisheries. I still believe that we need to protect the lower end of the food chain so our targeted recreational and commercial near shore fishing can rebuild and thrive into the future.

My kayak tour business has slowed now that fall has set in and the tourists have mostly stopped coming to the south coast. I now have time to reflect on the summer and what most of the tourists this year wanted to do while kayaking in the estuaries and the ocean in southern Oregon.

Seeing baitfish in the mouth of that Black rockfish on the deck also made me think of another day on the water from this last summer. On most of my tours the clients were interested in wildlife viewing and enjoying the natural beauty of this amazing area. Some folks wanted to fish, but most were more interested in watching the birds, seeing whales and enjoying the thrill of paddling around the headlands in places few folks get to see. One tour in particular stands out as an example of the interconnection of birds and the forage fish they so depend. On this tour the Brown Pelicans were all around us. They were diving and catching hundreds of little fish that were balling up around our kayaks. I wasn't sure exactly which type of forage fish they were, but the amazing scene playing out around us was in one clients words "the most amazing thing I've ever seen."

I worry that more exploitation of these important baitfish might have serious impacts on larger, more iconic animals like salmon and brown pelicans. We should not be catching these forage fish for ridiculous uses such as feeding livestock and farmed fish. Salmon and other highly sought after prey fish as well as the myriad of seabirds that depend on abundant forage need to have protections in place for the little, but so important fish. My business is very dependent on seeing wildlife and catching fish that rely on healthy forage stocks so I 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 timely adoption of a strong Fishery Ecosystem Plan.

Thank you for your efforts,

Dave Lacey
Owner: South Coast Tours, LLC

The Northwest Guides and Anglers Association

To protect, enhance, and promote healthy sportfisheries and the ecosystems they depend on in the Pacific Northwest.

October 22, 2012

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Re: Agenda Item K.1.d, Public Comment on Draft Pacific Coast Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

NWGA's mission is to protect, enhance, and promote healthy sportfisheries and the ecosystems they depend on in the Pacific Northwest. We appreciate the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. Forage fish are the lifeblood of a healthy ocean and are the key to healthy fisheries. The Oregon Department of Fish and Wildlife Commission chose not to advance an experimental fishery to pursue krill as a forage fish species. This was a good first step in securing the future of a sound ecosystem that supports an array of commercially important species that many NW sport and commercial fishers rely on. 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 timely adoption of a strong Fishery Ecosystem Plan.

The Pacific Northwest is still a relatively untapped resource as a sportfishing destination, but our coastal ecosystem is under increasing pressure. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

It's important that the Council adopt a Fishery Ecosytem Plan that's actually useful in improving fishery management, including an index measuring forage abundance along the West Coast. Additionally, it should 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 ocean wildlife and high-value predators like salmon, tuna and halibut.

The Council's top priority should be to ensure the stability 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.

In Gratitude,

Bob Rees, president
NW Guides and Anglers Association

Port Orford Ocean Resource Team
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oceanresourceteam.org

October 18, 2012

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

Dear Chairman Wolford and Council Members:

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.

We appreciate the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. Forage fish are the lifeblood of a healthy ocean. 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 timely adoption of a strong Fishery Ecosystem Plan. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management. A meaningful Fishery Ecosystem Plan should include an index measuring forage abundance along the West Coast.

The Council's top priority should be to ensure the stability 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 attention to this important issue.

Sincerely,

Leesa Cobb

Leesa Cobb
Executive Director

Heal the Bay

1444 9th Street
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October 22, 2012

Mr. Dan Wolford, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384
Submitted via email: pfmc.comments@noaa.gov

Re: Comments on Pacific Coast 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 the Santa Monica Bay and Southern California coastal waters and watersheds safe and healthy for people and local ecosystems, we welcome the opportunity to submit these comments on the Pacific Coast Fishery Ecosystem Plan ("FEP").

We appreciate the Council's decision in June recognizing the importance of forage fish to a productive marine ecosystem along the Pacific coast. There is a growing body of scientific literature detailing the importance of forage fish to overall ecosystem health. Forage species provide critical prey for many commercially and recreationally significant fisheries and for seabird and marine mammals that support eco-tourism and wildlife viewing recreation. Several West Coast forage fisheries are also commercially important in their own right. Due to their unique ecological role, forage species are thus of great environmental, recreational and economic importance to the people of California. We ask that you keep on track to fulfill your commitment to move forward with the adoption of a strong Fishery Ecosystem Plan and to protect forage species that are not yet being fished from new fisheries.

It is important that the Council adopt a plan that is useful in improving fishery management. A meaningful FEP should include an index measuring forage abundance along the West Coast. Additionally, it should help the Council maximize the benefits derived from the ocean by looking at the costs and benefits between large-scale fisheries targeting forage fish, versus leaving prey fish in the water to feed ocean wildlife and high-value predators like salmon, tuna, and halibut.

There are increasing pressures to our coastal ecosystem - including large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management. We recommend that the Council's top priority be to ensure the stability of the marine ecosystem and existing fisheries here on the Pacific coast. Adequate conservation of forage fish is a vital element in protecting the Pacific marine ecosystem – and the fishermen and coastal communities that depend on it. Thank you for the opportunity to comment. Please contact us if you have any questions.

Sincerely,

Dana Roeber Murray, MESM
Marine & Coastal Scientist

Sarah Abramson Sikich, MESM
Coastal Resources Director

October 22, 2012

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

Re: Agenda Item K.1.d, Development of a Pacific Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

We write today in support of forage fish conservation. 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. That is why we write today in support of ecosystem-based management including forage fish conservation.

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.

We must be proactive and take a precautionary approach in the management of the ocean food web. Forage species are vital to a healthy ocean ecosystem and are particularly vulnerable to overfishing due to their natural schooling behavior and the wide fluctuations in their numbers. The collapse of the California sardine fishery is illustrative of what overexploitation of a forage species during a population downcycle can do to the ecosystem and the industries that depend on sustainable fish populations.

The National Wildlife Federation views global warming as the single biggest threat to wildlife. The listing of Pacific euchalon as a threatened species is one example of the effects changing ocean conditions can have on forage populations. With the threat of global warming and ocean acidification, it is imperative that we safeguard 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. In turn offering our children and our children's children the same outdoor and recreation opportunities we enjoy today.

We appreciate the Council's decision in June 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 timely adoption of a strong Fishery Ecosystem Plan.

Thank you for allowing the public to weigh in on you on this ecosystem-based management plan. We look forward to participating throughout this process.

Sincerely,

Nic Callero
National Wildlife Federation
Regional Outreach Coordinator
Pacific Region

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

Dear Chairman Wolford and Council Members,

We appreciate the Council's decision in June 2012 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 timely adoption of a strong Fishery Ecosystem Plan. A resilient ecosystem depends on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

It's important that the Council adopt a plan that's actually useful in improving fishery management, rather than a weighty document that sits on a shelf.

A meaningful Fishery Ecosystem Plan should include an index measuring forage abundance along the West Coast. Additionally, it should 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 ocean wildlife and high-value predators like salmon, tuna and halibut.

The Council's top priority should be to ensure the stability 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.

We urge the PFMC to stay on track by approving a strong draft FEP in November and releasing it for public comment.

Thank you.

Lance Morgan, PhD, President
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Dear Chairman Wolford and Council Members,

Thank you and the Council for recognizing that forage fish are the cornerstone of a productive marine ecosystem and base of sustaining fisheries along the Pacific coastline at your June meeting.
Forage fish like Herring, Sardines, are the lifeblood of a healthy ocean and support important wildlife and fisheries in the California Coastal Upwelling Zone. We ask that you keep on track to fulfill your commitment to prohibit new fisheries targeting forage species that aren't yet being fished without proper understanding of their biology, their natural history and the cyclical fluctuations these fish populations are known to incur.
Therefore, we urge you to adopt a strong and comprehensive analysis and strong Fishery Ecosystem Plan.

Our coastal ecosystem is under increasing pressure not only from fishing but pollution and other direct and indirect impacts. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

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Thank You

Nick

NICK COBURN PHILLIPS
Explorer ~ Marine Scientist & Cameraman
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Thank You.

David McGuire, MPH
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October 18, 2012

Mr. Dan Wolford, Chairman, Pacific Fishery Management Council
7700 NE Ambassador Place, #101
Portland, OR 97220

Re: Agenda item k.1.d, Development of a Pacific Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

On behalf of our 60,000 members, we applaud the progress the Council has made on the development of a Fishery Ecosystem Plan (FEP), which we see as a crucial tool that will help the Council unify and simplify complicated yet critical ecosystem considerations across its activities and FMPs.

The purpose of the 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."

In order to best fulfill that stated purpose, the FEP must include the objective of providing adequate forage for dependent species, an objective found only in the Coastal Pelagic Species Plan. Further, the appropriate tool for achieving that objective is Optimum Yield, defined as the Maximum Sustainable Yield, reduced by relevant social, economic, and ecological factors. The overarching objective of the FEP will be to assist the Council to achieve Optimum Yield, by way of explicitly incorporating these factors.

One example of the need to incorporate these factors is how Chinook salmon, a species with profound social, economic and ecological value, responds to natural- and fisheries- induced changes in its prey base. Herring is one of the most important prey items of Chinook salmon in central California, along with anchovies, sardines and jack mackerel.[1]There was a dramatic decline of herring in Chinook salmon diet in central California over the last half century: In 1955, herring comprised the majority of California Chinook salmon diet in the late winter and spring (February, March and April) with significant pulses also in summer. In 1980-1986, herring was a minority of Chinook salmon diet in late winter/spring, although summer pulses were still evident at similar levels. Winter/spring was not sampled in 2005-2007 but herring was undetectable during the summer period when herring had previously comprised 10% of salmon diet.[2] Concurrently, stocks of anchovies in southern California, and stocks of sardines coast-wide, have declined.[3] This overall reduction in prey availability and diversity has "likely contributed to reduced and more variable Chinook salmon abundance and return rates."[4]

Second, we would like to expand upon the draft Plan's reference to the many pinniped and whale populations that have increased dramatically over recent decades, following an era of exploitation. Recent studies have quantified the often surprisingly large volume of prey required to sustain these recovering populations:

Humpback whale (Megaptera novaeangliae) The humpback whale population in the northeast Pacific has increased by approximately 5% per year for the last 20 years, requiring a larger share of forage species than in previous years. The California and Oregon population quadrupled from 1990 to 2008 and is now estimated at 2,043 individuals.[5,6] The population of 2,043 humpback whales in California and Oregon requires approximately 817 tons of food per day (0.4 tons/day/whale/2043 whales).[7,8] "Whales foraged in large numbers (81-147 individuals) over much of the fall and winter in Prince William Sound resulting in significant predation intensity. In absolute terms, whales potentially consumed between 2,639 and 7,443 tons of herring in 2007-2008. This represented a predation intensity of 27% to 77%. In 2008-2009 whales potentially consumed between 2,362 and 12,989 tons and predation intensities ranged between 11% and 63% of the total biomass present in spring 2008. For comparison, the last harvest of herring from Prince William Sound was 3,904 tons in 1998- approximately 20% of the spawning biomass."[9]

Steller sea lion (Eumetopias jubatus): Steller sea lions are recovering in Washington and Alaska, but failing to recover in central and southern California, where the population declined between 1982 and 2002 and is now estimated at 4,000 individuals.[10] In southeast Alaska herring is the most common prey item.[11] In southeast Alaska, Steller sea lions make high energetic investments to locate herring schools. One study notes that "abundant quantity and presence of some high quality prey (salmon, herring and eulachon) likely sustains the increasing population in southeast Alaska."[12] The population of 4,000 Steller sea lion in central and northern California requires 78 tons of food each day (calculated using calorie content of herring and hake).[13,14,15,16]

California sea lion (Zalophus californianus): The U.S. population of California sea lions increased 6.5% per year from 1983-2003, and may now be stabilized at about 238,000 individuals.[17] California sea lions in central California (Hurricane Point to Ano Nuevo Island) in 1999, numbering about 18,000 individuals, consumed about 8-10% of the sardine stock.[18]

Other energetics information is available for seabirds and other taxa. Collectively, this type of energetics information underscores the urgency of the Ecosystem FMP including the explicit objective of using Optimum Yield as defined by the Magnuson-Stevens Fishery Conservation and Management Act.

In conclusion, we appreciate the progress the Council has made on an FMP thusfar, and look forward to the Council's adoption of a final FEP in March 2013 that will serve as an effective tool for transitioning to robust ecosystem-based management.

Thank you for the opportunity to comment.

Sincerely,

Anna Weinstein
Seabird and Marine Program
Audubon California
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[1] Brodeur, R.D. 1990. A synthesis of the food habits and feeding ecology of salmonids in marine waters of the North Pacific. (INPFC Doc.) FRI-UW-9016. Fish. Res. Inst., Univ. Washington, Seattle. 38 pp.

[2] Thayer, J. J. Field and W. Sydeman. 2012. Changes in California Chinook salmon diet over the past 50 years: relevance to the population crash. In review for: Can J Fish Aquat Sci.

[3] Zwolinski, J. and D. Demer. 2012. A cold oceanographic regime with high exploitation rates in the northeast Pacific forecasts a collapse of the sardine stock. PNAS 11138606109

[4] Thayer, J. J. Field and W. Sydeman. 2012. Changes in California Chinook salmon diet over the past 50 years: relevance to the population crash. In review for: Can J Fish Aquat Sci.

[5] Calambokidis J. et al. 2008. Splash: Structure of populations, levels of abundance and status of humpback whales in the North Pacific. Cascadia Research, Final report for Contract AB133F-03-RP-00078.

[6] Rice, S. , John R. Moran, Janice M. Straley, Kevin M. Boswell, and Ron A. Heintz. 2010. Significance of Whale Predation on Natural Mortality Rate of Pacific Herring in Prince William Sound. Restoration Project: 100804.
Final Report

[7] Witteveen, B.H. 2003. Abundance and feeding ecology of humpback whales (*Megaptera Novaengliae*) in Kodiak, Alaska. Masters thesis, University of Alaska. 109p.

[8] Audubon California, unpublished analysis

[9] Rice et al 2010. Ibid.

[10] NOAA Fisheries, Office of Protected Resources, website. http://www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/

[11] Womble et al. 2005. Distribution of Steller Sea Lions in relation to spring-spawning fish in SE Alaska. Mar Ecol Prog Ser (294) 271-282.

[12] Sigler, M. et al. 2009. Steller sea lion foraging response to seasonal change in prey availability. Marine Ecology Progress Series **Vol. 388: 243–261, 2009**

[13] Sigler MF and Csepp DJ (2007) Seasonal abundance of two important forage species in the North Pacific Ocean, Pacific herring and walleye pollock. Fish. Res. 83:319-331

[14] WombleJN, SiglerMF(2006) Seasonal availability of abundant, energy-rich prey influences the abundance and diet of a marine predator, the Steller sea lion *Eumetopias jubatus* . Mar Ecol Prog Ser325:281–293

[15] Roth. J. et al. 2008. Annual prey consumption of a dominant seabird, the common murre, in the Caifornia Current system. International Council for the Exploration of the Sea. Published by Oxford Journals.

[16] A. Weinstein. Unpublished analysis. Audubon California.

[17] NOAA Fisheries, Office of Protected Resources, website. http://www.nmfs.noaa.gov/pr/species/mammals/pinnipeds/

[18] Weise, M and J. Harvey. 2008. Temporal variability in ocean climate and California sea lion diet and biomass consumption: implications for fisheries management. Mar Ecol Prog Ser 373 (157-172)

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Ocean Conservancy
Start a Sea Change

831.854.4630 Telephone
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Delivered by electronic mail to: pfmc.comments@noaa.gov

October 23, 2012

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

RE: Agenda Item K.1.d, Development of a Pacific Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members:

Please accept the following comments with respect to the Pacific Fishery Management Council's (Council) consideration of development of a Pacific Fishery Ecosystem Plan (FEP) at your upcoming November meeting.

1. **Ocean Conservancy supports the FEP development process**

Ocean Conservancy[1] supports the development of an FEP for the U.S. California Current Large Marine Ecosystem (CCE). The Council's FEP will serve as an important vehicle for collecting and synthesizing existing information on the CCE and will provide a platform for incorporating ecosystem considerations into existing fisheries governance to improve management of CCE fisheries. In addition, this FEP process has the potential to act as a national model for an ecosystem based approach to fisheries management. We commend the Council for the progress that has been made on the FEP to date and urge that adoption of the FEP remain on track for March 2013, recognizing that the FEP will be a 'living document' and subject to revision as new information becomes available.

We recommend that the purpose statement of the FEP be broadened, adding that the purpose of the FEP is to assist the Council in setting management goals and objectives that are consistent with an ecosystem-based approach to management. Recognizing that the Council has determined, for now, that the FEP will not have regulatory authority, we urge that the information contained in the FEP nonetheless be fully utilized in the full range of Council decision making processes, in particular with respect to the determination of Optimum Yield as defined in the Magnuson Stevens Fishery Management and Conservation Act.[2] We also urge that the Council develop the tools and mechanisms necessary for giving the FEP regulatory authority in the future.

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[1] Ocean Conservancy, a non-profit organization with over 120,000 members, 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.

[2] 16 U.S.C. 1851 Section 301 (a)(1).

2. The FEP should contain key components for protection of forage fish populations

As we noted in our letter to the Council dated August 31, 2012, Ocean Conservancy views the Council's adoption of an explicit objective to prohibit new, directed fisheries on forage species until the Council can review the science and assess potential impacts to other fisheries and communities as a significant step towards ecosystem based management. We commend you for this important action.

Well-managed, abundant stocks of forage fish are critical for maintaining ecosystem health and for seabirds, marine mammals and countless species of commercially and recreationally important fish populations within the CCE. Forage fish populations are of particular concern, especially in light of increasing ocean variability due to a more volatile ocean climate. These small marine fishes are key species in the transfer of energy from the bottom of the food web to higher levels.

As the Council moves forward with developing the Fisheries Ecosystem Plan between now and March 2013, we urge that protection and management of forage fisheries be explicitly addressed in the FEP. Specifically, we urge that the FEP contain the following key components:

- Establishment of a specific objective of providing adequate forage for dependent species.
- Identification of overall abundance and composition of the forage base as a critical indicator in the suite of ecosystem indicators that the Council will monitor under the FEP and utilize in its decision making process.

Ocean Conservancy appreciates the broad concensus that exists with respect to the importance of ensuring a healthy ecosystem and abundant forage base to sustain viable, resilient CCE fisheries. The Council has heard from a diverse range of interests about this issue over the past several months—from fishermen to tourism operators to bird watchers. Similar to the Council, the State of California has also been focused on improving management of forage fisheries in recently. The California Fish and Game Commission (Commission) is expected to vote on an official state policy with respect to protection and management of forage fisheries at their November 2012 meeting in Los Angeles. The policy language before the Commission was the product of collaboration between the conservation community and fishing industry representatives, again demonstrating the broad range of interests affected by, and supportive of, sound management of forage species.

The Council's new FEP provides an opportunity to improve protection of the forage base consistent with the direction adopted by the Council at your June 2012 meeting. Ocean Conservancy urges you to take full advantage of this opportunity.

We appreciate the Council's interest in and commitment to this issue and your consideration of our comments.

Sincerely,

Greg Helms
Pacific Program Manager

George H. Leonard, Ph. D.
Director of Strategic Initiatives

Border Grill®

October 23, 2012

Pacific Fishery Management Council
Dan Wolford, Chairman
7700 N.E. Ambassador Pl., Ste. 101
Portland, OR 97220-1384

Dear Chairman Wolford and Council Members,

We appreciate the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. We know you understand forage fish are the lifeblood of a healthy ocean and a balanced food web, the same way we know that a healthy Pacific Ocean means better food for our customers at Border Grill restaurants and Truck.

We are thankful for the work the Council performs, especially its ongoing efforts to develop ecosystem-based approaches to fishery management. That is why we are asking you to keep on track to fulfill your commitment to prohibit new fisheries targeting forage species that aren't yet being fished, starting with timely adoption of a strong Fishery Ecosystem Plan.

It's important that the Council adopt a meaningful Fishery Ecosystem Plan useful in improving fishery management, including an index measuring forage fish abundance along the West Coast. Additionally, it should 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 ocean wildlife and high-value predators like salmon, tuna, and halibut.

Adequate conservation of forage fish may be the single most important action the Council can take to protect the Pacific marine ecosystem--and the restaurants, fishermen, and coastal communities that depend on it.

We appreciate the opportunity to offer our support for forage species fishery management, and are always happy to keep an open dialogue about important environmental issues. If you are in the Los Angeles or Las Vegas areas, we'd love to see you at Border Grill and perhaps continue the discussion.

Sincerely,

Mary Sue Milliken
Chef/Owner, Border Grill Restaurants & Truck
"Top Chef Masters" & "Too Hot Tamales"

Susan Feniger
Chef/Owner, Border Grill Restaurants & Truck
"Top Chef Masters" & "Too Hot Tamales"

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

Dear Chairman Wolford and Council Members,

I am writing on behalf of Harbor Breeze Cruises, a southern California cruise company run out of Long Beach, that has been offering seasonal whale watching cruises for nearly twenty years. I am writing to urge you to prevent new fisheries on currently unmanaged forage fish until the important role they play in the marine ecosystem is studied.

Throughout the year, our guests are treated to sightings of Gray and Blue Whales, Fin Whales, Humpback Whales, Minke Whales and Killer Whales. Other wildlife frequently spotted are a variety of dolphins including Common, Bottlenose, Risso's, and Pacific White Sided, as well as sea lions. These marine mammals are drawn to the California Current along the coast due to the abundance of nourishment that a healthy population of forage fish provides.

We appreciate the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. Forage fish are the lifeblood of a healthy ocean. 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 timely adoption of a strong Fishery Ecosystem Plan.

Our coastal ecosystem is under increasing pressure. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

It's important that the Council adopt a plan that's actually useful in improving fishery management, rather than a weighty document that sits on a shelf.

A meaningful Fishery Ecosystem Plan should include an index measuring forage abundance along the West Coast. Additionally, it should 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 ocean wildlife and high-value predators like salmon, tuna and halibut.

At Harbor Breeze Cruises, our livelihoods depend on a thriving marine ecosystem that supports the diets of marine mammals, and we are lucky enough to bring the experience of sighting these animals to thousands of people every year.

We hope to continue our work for many years to come, which is why we are urging the Council to express the responsible foresight by preventing new fisheries on unmanaged forage species until a management plan is in place that takes into account their important role in the marine food web.

We appreciate the opportunity to offer our support for this issue and would be happy to provide additional comments to the Council, if needed.

Thank you.

Best regards,

Amber Boyle
Vice President
Harbor Breeze Corp.
Yacht Charters and Cruises
tel: (562) 983-6880, fax: (562) 983-6883, website: www.longbeachcruises.com

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

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The Council's top priority should be to ensure the stability 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.

My father, Garth I Murphy was the founding coordinator of CALCOFI and I have followed in his weighty footprints - to further the adoption of ecosystem analysis and management as a conservation tool in the ocean and all walks of life on earth. I worked for two years on the MLPAI as a stakeholder. Garth I would be thrilled to hear you are actually adopting an FEP. Its about time, he would growl from his grave. Please do the right thing for the California Current ecosystem and our world economy. Remember that the meaning of the word economy is ecosystem management!

Thank You.

Garth Murphy,
649 South Vulcan Ave
Encinitas, CA 92034

CENTER for BIOLOGICAL DIVERSITY — Because life is good.

Submitted via email

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

October 23, 2012

Dear Chairman Wolford and Council Members:

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The Center for Biological Diversity focuses on securing a future for all animals, great and small, hovering on the brink of extinction. To recover healthy populations requires protecting not only those animals, but also their habitat. Recent science has indicated that out of many anthropogenic impacts to the marine environment, managers should prioritize the problem of inadequate prey for species like killer whales[1] and sea birds.[2] A resilient ecosystem depends first and foremost on a balanced food web.

Therefore a meaningful Fishery Ecosystem Plan should include an index measuring forage fish abundance along the West Coast. Additionally, it should help the Council maximize the benefits we derive from the ocean by properly valuing forage fish's role to feed ocean wildlife and high-value predators like salmon, tuna and halibut.

The Council's top priority should be to ensure the stability of the marine ecosystem and existing fisheries here on the Pacific coast. Adequate and timely 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.

Sincerely,

Catherine Kilduff

Catherine W. Kilduff, M.S., J.D.

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[1] Ayres, K.L., R.K. Booth, J.A. Hemplemann, K.L. Koski, C.K. Emmons, R.W. Baird, K. Balcomb-Bartok, M.B. Hanson, M.J. Ford, S.K. Wasser. 2012. Distinguishing the impacts of inadequate prey and vessel traffic on an endangered killer whale (*Orcinus orca*) population. PLoSONE 7(6): e36842.
[2] Cury, P.M., I.L. Boyd, S. Bonhommeau, T. Anker-Nilssen, R.J.M. Crawford, R.W. Furness, J.A. Mills, E.J. Murphy, H. Osterblom, M. Paleczny, J.F. Piatt, J.-P. Roux, L. Shannon, W.J. Sydeman. 2011. Global seabird response to forage fish depletion—One-third for the birds. Science 334:1703-1706.

PACIFIC COAST FEDERATION of FISHERMEN'S ASSOCIATIONS

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

22 October 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite101
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 are encouraged that the Council is working to adopt a Fishery Ecosystem Plan (FEP). We ask that you adopt the plan by your March 2013 meeting, and that you act now to ensure that it prioritizes the protection of the marine food web upon which our fisheries depend.

Prey, or forage, fish are a key measure of a productive ocean, which, in turn, supports economically valuable fisheries on food fish such as salmon, tuna, billfish, white bass, sablefish and halibut. As such, one critical activity for the FEP will be to monitor the status and trends of the forage base off of our coast. Monitoring forage fish abundance for use in the decision-making process is currently being done in the North Pacific through the Aleutian Island FEP and through the Ecosystem Considerations chapter in their annual groundfish stock assessments. Simply put, knowing how much food is in the ocean for our commercially valuable predator species will help ensure the Pacific Council is making decisions based on the best available science.

Many of our members are small-boat commercial salmon fishermen who directly depend on having plenty of bait in the water to support robust and healthy populations of harvestable fish in the ocean. Forage fish also serve as alternative prey for predatory seabirds, marine mammals and bigger fish like hake that would otherwise devour outmigrating salmon and steelhead smolts around estuaries and plumes such as the Columbia River. For example, government scientists are already using forage abundance as an indicator of future salmon returns in both the Columbia River and Sacramento River systems. This is the kind of information than can greatly help improve our ability to sustainably manage our fisheries resources.

We spend a lot of time and effort along the West Coast debating how to improve freshwater habitat. Hydroelectric dams, poor water management, toxic pollutants and development have all taken their toll on historic salmon runs. For all the time and resources expended to improve freshwater habitat, the Pacific Fishery Management Council has an equal responsibility to ensure it is doing all it can to track and protect the prey fish that nourish and sustain salmon for the majority of their life cycle in the ocean.

PCFFA supports the development of a strong ecosystem plan, and we note that the council decided in 2011 that it would be advisory rather than regulatory. As such, the council has a special obligation to make sure the plan includes a framework for actually using the data it tracks to help make decisions.

Sincerely,

W.F. "Zeke" Grader, Jr.

W.F. "Zeke" Grader, Jr.
Executive Director

West Marine

October 23, 2012

Mr. Dan Wolford, Chair

Pacific Fishery Management Council

7700 NE Ambassador Place, Suite 101

Portland, OR 97220-1384

Dear Chairman Wolford and Council Members,

We appreciate the Council's decision in June recognizing forage fish as the cornerstone of a productive marine ecosystem along the Pacific coast. Forage fish are the lifeblood of a healthy ocean. 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 timely adoption of a strong Fishery Ecosystem Plan.

Our coastal ecosystem is under increasing pressure. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management.

It's important that the Council adopt a plan that's actually useful in improving fishery management, rather than a weighty document that sits on a shelf.

A meaningful Fishery Ecosystem Plan should include an index measuring forage abundance along the West Coast. Additionally, it should 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 ocean wildlife and high-value predators like salmon, tuna and halibut.

The Council's top priority should be to ensure the stability 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.

Randy Repass

Randy Repass

Founder and Chairman

THE PEW ENVIRONMENT GROUP

PACIFIC FISH CONSERVATION CAMPAIGN
4189 S.E. Division St., Portland, Oregon 97202

Oct. 22, 2012

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

Dear Chairman Wolford,

The Pew Environment Group has collected 3,450 comments from residents of California, Oregon, Washington and Idaho encouraging timely adoption of a Fishery Ecosystem Plan and to make sure the plan includes an index of forage abundance as an important measure of a productive ocean food web.

The petition is included here with the name, city and state of each individual who sent a comment. Please note that some of the letters have been personalized or include additional comments.

Thank you,

Erik Robinson
Pew Environment Group

Oct. 22, 2012

Chairman Dan Wolford
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

Subject: Please Adopt a Fishery Ecosystem Plan

Dear Chairman Wolford and Council Members,

I am writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.

A resilient ocean ecosystem depends first and foremost on a healthy food web, which is why conservation of forage fish is widely recognized as a pillar of ecosystem-based fishery management. In June, the council itself highlighted the importance of forage fish in the Pacific when it set a goal of prohibiting new fisheries on currently unmanaged forage species until proving it wouldn't harm the ecosystem.

Forage fish are a critical measure of a healthy Pacific Ocean. Unlike other factors affecting ecosystem health – a changing climate, pollution, a growing population – the council can control how fishing affects the prey base along our coast. As you finalize the ecosystem plan, I urge you to establish measures to track forage fish abundance as an indicator of ecosystem status and to track it over time. Knowing how much food is available for the fish we like to catch and eat can guide the council as it makes important decisions about our fisheries.

A strong ecosystem plan also can help the council evaluate trade-offs between fishing for forage fish and leaving them in the water as food for everything else in the ocean--including seabirds, marine mammals, and high-value predators such as salmon, tuna and halibut. This will help maximize the environmental and economic benefits we receive from our ocean while ensuring that we are managing it sustainably over the long term.

West Coast residents benefit from one of the most dynamic ecosystems in the world. As a steward of this incredible natural asset, the council should adopt an ecosystem plan that includes firm measures to protect it.

Sincerely,

Suzanne A'Becket	Cupertino	CA
Basil Allen Jr.	Rialto	CA
Martin Ansell	West Hollywood	CA
V Abel	Oakland	CA
June Abner	San Diego	CA
Elizabeth Abrantes	Cambridge	CA
Maria Diaz Acillona	San Francisco	CA
Megan Adams	Placerville	CA
Cheryl Adamski	Monterey	CA
Elizabeth Adan	Carmichael	CA
Willy Aenlle	Altadena	CA
Victor Afanasiev	La Grange	CA
Jane Affonso	Redondo Beach	CA
Christie Agovino	Beverly Hills	CA
Christie Agovino	Los Angeles	CA
Marco Aguilera	Carlsbad	CA
Edwin Aiken	Sunnyvale	CA
Cheryl Albert	Freedom	CA
Gary Alderette	Santa Rosa	CA
Masha Aleskovski	El Cerrito	CA
Matthew Alexander	San Jose	CA
Janis Alldis	Scotts Valley	CA
Dennis Allen	Santa Barbara	CA
Vinit Allen	San Rafael	CA
Donna Alleyne-Chin	Montara	CA
Bobbi Allison	Bay Point	CA
Charles Almack	Calexico	CA
Susan Alpern	Murrieta	CA
Judith Alter	Los Angeles	CA
Cherie Altevers	Lincoln	CA
Mariah Altrocchi	Sonoma	CA
Sonia Alvarez	Laguna Niguel	CA
Gloriamarie Amalfitano	San Diego	CA
Nicole Amato	Vacaville	CA
Isabella Amoroso	floridia	CA
Kristine Andarmani	Saratoga	CA
Jon Anderholm	Cazadero	CA
T Andersom	Irvine	CA
Dave Anderson	Berkeley	CA
Donna Anderson	Westchester	CA
John Anderson	San Diego	CA
Patricia Anderson	Roseville	CA
Roger Anderson	Pleasanton	CA
Joan Andersson	Topanga	CA
Christine Angeles	Burlingame	CA
J Angell	Rescue	CA
Robert Anger	Santa Monica	CA
Tanya Anguita	Berkeley	CA
Raul Anorve	Los Angeles	CA

Karol Kim Anthes	Irvine	CA	
Georgia Antonopoulos	Pleasant Hill	CA	
Luisa Aogstini	San Mateo	CA	
Susan Apgar	Tujunga	CA	
Chet Arachy	El Dorado Hills	CA	
Susaan Aram	Laguna Beach	CA	
Anthony Arcure	Fresno	CA	
Johanna Arias-Bhatia	Los Angeles	CA	
Behnoosh Armani	Fullerton	CA	
Brian Armer	Bakersfield	CA	
Maris Arnold	Berkeley	CA	
Tina Arnold	Laguna Beach	CA	
David Arnson	Los Angeles	CA	*This is very important to me*
Dolly Arond	Northridge	CA	
Sergio Arroyo	Anaheim	CA	
Luke Asbury	Ventura	CA	
Lynne Asdel	Ventura	CA	
Chris Ashton	San Diego	CA	
Barbara Askew	Santa Barbara	CA	
Neda Aslanpour	Cupertino	CA	
John Asprey	Moraga	CA	
Debra Atlas	Redding	CA	
Suzanne Attig	West Hills	CA	
Bob Atwood	Redding	CA	
Bettie Auble	Citrus Heights	CA	
Heidi Aubrey	San Diego	CA	
Natalie Audage	Davis	CA	
Candi Ausman	Fremont	CA	
Emma Ausman	North Hollywood	CA	
Janice Austin	Temecula	CA	
L Austin	Orange	CA	
Steve Avila	Los Angeles	CA	
Diana Aylward	Woodland Hills	CA	
Lois B.	Freedom	CA	
MELISSA BECKOFF	Hesperia	CA	
reva BIERS	Tarzana	CA	
Christa Babst	W Hollywood	CA	
Christina Babst	W Hollywood	CA	
Verna Bacon	Capitola	CA	
Sacha Badame	Oakland	CA	
Rosa Baeza	Reseda	CA	
J Bagby	Boulder Creek	CA	
Jennifer Bailey	Visalia	CA	
Marc Bailey	San Pedro	CA	
Mark Bailey	El Cerrito	CA	
Donetta Bair	Rancho Santa Margarita	CA	
Kelsey Baker	Novato	CA	
Kristy Baker	Idyllwild	CA	
Patricia Baker	Laguna Hills	CA	

Paula Baker	Gilroy	CA
Deesa Balasingam	Salinas	CA
Anne Balderston	Corona Del Mar	CA
Barbara Baldock	Monterey	CA
Brice Baldwin	Long Beach	CA
Jeff Ball	Sacramento	CA
Jonathan Ballak	Los Angeles	CA
Alex Ballar	Reseda	CA
Nickola Ballas	San Francisco	CA
Michael Ballot	Stockton	CA
Ranko Balog	Irvine	CA
Marie Balounova	Grass Valley	CA
Brian Baltin	Long Beach	CA
Carol Banever	Los Angeles	CA
Stan Banos	San Francisco	CA
Stan Banos	San Francisco	CA
Clayton Barbeau, M.A., MFT	San Jose	CA
Christopher Barhoum	Hermosa Beach	CA
Nick Bariloni	San Jose	CA
Rebecca Barker	Glendora	CA
Leonie Barnes	Larkfield	CA
Pamela Barnes	Los Altos	CA
Candice Barnett	Santa Monica	CA
Gary Barnett	Phelan	CA
Maureen Barron	Novato	CA
Alfredo Barroso	San Diego	CA
Bruce Barrow	Benicia	CA
Dwight Barry	Antioch	CA
Joan Basore	San Anselmo	CA
Abigail Bates	Los Angeles	CA
Robyn Bates	Fresno	CA
Candace Batten	Los Angeles	CA
Hannah Beadman	Los Angeles	CA
Bryce Beal	San Francisco	CA
Jerry Beale	Pasadena	CA
Carol Beam	San Diego	CA
Ian Beardsley	Claremont	CA
Paul Bechtel	Redlands	CA
Connie Beck	El Cajon	CA
Jeff Beck	Los Angeles	CA
Carol Becker	Sherman Oaks	CA
Jeffrey Beckers	Oakland	CA
Mark Beckwith	Berkeley	CA
Adam Beebe	San Francisco	CA
Kevin Begin	San Diego	CA
Maureen Belle	Poway	CA
Anna Bellin	Beverly Hills	CA
Sally Benardo	Huntington Beach	CA
Mercedes Benet	Carlsbad	CA

Richard Benson	Lawndale	CA	
Abot Bensussen	San Diego	CA	
Marcia Bentley	Coronado	CA	
Debi Bergsma	Fontana	CA	
Bryan Bergstrand	Fortuna	CA	
Madeleine Berke	Monte Rio	CA	
Helene Bernbaum	Los Angeles	CA	
Anna Bernhard	Atherton	CA	
Benjamin Bernhardt	Santa Ana	CA	
Katherine Bernhardt	Santa Ana	CA	
Shauna Bernie	Agua Dulce	CA	
Carla Berra	Aromas	CA	
Maureen Besancon	Woodland Hills	CA	
Jolino Beserra	Los Angeles	CA	
Elizabeth Bettenhausen	Cambria	CA	
Daniel Better	Los Angeles	CA	
Blaze Bhence	Cypress	CA	
Sally Bianco	Chico	CA	*As a biologist and a resident of the Pacific Coastal area, I know that the ocean is a vast and complex ecosystem, and also that it is much more heavily impacted by human activities than is reported in the news. Yes, the 'big names' of the ocean - e.g., dolphins, whales, otters - are given attention. The 'big names' of ocean degradation get some attention, such as the Great Plastic Atoll and the deaths of sea birds and other animals who ingest some of this wandering debris. But the small members of the ecosystem like forage fish, krill, aquatic plants do not receive the care they deserve. Their contribution to a healthy ocean is huge but their individual forms are small, they aren't cute and rarely interact in dramatic ways with humans. So they are forgotten, taken for granted. But unless we reverse our human activities and put justifiable emphasis on these small members with big impact, we will see the consequences too late. Reversing these consequences is uncharted territory, while conserving them is possible right now.*
Kendra Bickler	Ramona	CA	
Helen Bierlich	Los Angeles	CA	
Nicole Bilotti	San Francisco	CA	
Diane Binder	Moreno Valley	CA	
Alexander Birrer	Santa Ana	CA	
Jill Bittner	San Francisco	CA	
Dwain Bivens	Glendale	CA	
Julie Bixler	Tulare	CA	
Timarie Bixler	Escondido	CA	
Robert Blackmoore	Kelseyville	CA	
Robert Blackmore	Santa Monica	CA	
Pat Blackwell-Marchant	Castro Valley	CA	
Jill Blaisdell	La Canada	CA	
Richard Blakemore	Mariposa	CA	
Russell Blalack	Cupertino	CA	
Denishia Blanco	Imperial	CA	
Jon Bleyer	San Diego	CA	
Michael Blodgett	Oakland	CA	
Robert Blomberg	Berkeley	CA	
Daniel Blum	Gilroy	CA	*Now is the time to ACT on a plan for rstoring a healthy ecosystem on*

our Pacific Coast. We owe it to the indigenous species that inhabit these waters that there is a plentiful food supply for their sustenance. Controlling the exploitation of forage fish is the first step in maintaining a healty food web for all.

Casey Boden	Citrus Heights	CA
Sondra Boes	Campbell	CA
Ronald Bogin	El Cerrito	CA
Stephen Bohac	Twain Harte	CA
Julie Bohnet	Willits	CA
Donna Boland	San Francisco	CA
Diane Bolman	Novato	CA
Jose Ricardo Bondoc	San Francisco	CA
Ricco Bonelli	Redondo Beach	CA
Andrea Bonnett	Altadena	CA
A Bonvouloir	Sunnyvale	CA
David Boone	El Cajon	CA
Joseph Boone	San Luis Obispo	CA
Carolyn Boor	Rancho Cucamonga	CA
Martha Booz	El Sobrante	CA
Annette Bork	Irvine	CA
Barbara Boros	Solvang	CA
Vic Bostock	Altadena	CA
David Bott	Sacramento	CA
Cyril Bouteille	Mountain View	CA
Joyce Bower	Citrus Heights	CA
Louise J Bowles	Long Beach	CA
Jason Bowman	Sacramento	CA
Nancy Boyce	San Rafael	CA
Ernest Boyd	Sunnyvale	CA
Jon Boyden	Los Angeles	CA
Lea Boyle	Danville	CA
Kyle Bracken	Santa Monica	CA
John Brady	Rosemead	CA
Amy Brain	Walnut Creek	CA
Laurie Bramlage	Sunnyvale	CA
Victoria Brandon	Van Nuys	CA
Harry Brass	Berkeley	CA
Joyce Braun	Calabasas	CA
Angie Bray	Venice	CA
Christine Brazis	San Francisco	CA
Joseph Breazeale	Concord	CA
Bonnie Breckenridge	San Diego	CA
Joan Breiding	San Francisco	CA
Paul Brelin	Sebastopol	CA
John Brennan	Oakdale	CA
Ryan Brennan	San Rafael	CA
Maria Breuninger	Oakland	CA
Georgia Brewer	Sherman Oaks	CA
Sheryl Brezina	San Dimas	CA
Barbara Britton	Pleasant Hill	CA

Julia Broad	Anaheim	CA	
Jason Brock	Los Angeles	CA	
David Brooks	Lompoc	CA	
Deborah Brooks	San Francisco	CA	*Thank you for considering my comments.*
Linda Brosh	Novato	CA	
Robert Brosius Jr	Tarzana	CA	
Cecilia Brown	Oakland	CA	
Damon Brown	Los Angeles	CA	
Elaine Brown	Sunland	CA	*I am writing as a 75-year-old with a BS in Zoology to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.*
Gregory Brown	San Francisco	CA	
Jeanne Brown	San Diego	CA	
Patricia Brown	San Carlos	CA	
Stephanie Brown	Oakland	CA	
Steven Brown	Yreka	CA	
Vera Brown	Redwood City	CA	
Susan Browne	Portola Valley	CA	
Leonard Bruckman	Granite Bay	CA	
Rose Bruno	Hollister	CA	
Lauren Bryant	La Crescenta	CA	
Margaret Buck	San Clemente	CA	
Trent Buckman	Carlsbad	CA	
Joseph Buhowsky	San Ramon	CA	
Kay Buie	Carmichael	CA	
Peter Burchard	Fairfax	CA	
Jayna Burdue	Cypress	CA	
Dayna Burgeson	Newcastle	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	
Judy Burris	Calabasas	CA	
Stacy Burt	Beaumont	CA	
Karen Burtness Prak	Menlo Park	CA	
James Burtnett	Santa Cruz	CA	
Hari Busby	Hemet	CA	
Joan Bush	Spring Valley	CA	
Travis Bushard	San Diego	CA	
Dylan Busse	CALABASAS	CA	
Maria Bustamante	El Cerrito	CA	
Ray Bustos	Fullerton	CA	
Diane Butler	Glendora	CA	
Greg Buttner	Del Mar	CA	
John Buttny	Santa Ynez	CA	
Nancy Byers	Berkeley	CA	
MIKE CLIPKA	Lathrop	CA	
DEIRDRA CUTHBERTSON	Santa Rosa	CA	

Patricia Cachopo	Santa Clara	CA
Randy Caffejian	Fresno	CA
Antoinette Calavas	Mendocino	CA
Andrew Calderella	Valencia	CA
Sabina Caliguri	San Diego	CA
Ron Calvisi	Toluca Lake	CA
Patrick Cameron	El Cajon	CA
Chris Camp	San Francisco	CA
David Camp	Burbank	CA
Amy Campbell	Wildomar	CA
Dionna Campbell	Carmichael	CA
Dudley and Candace Campbell	Valley Glen	CA
Elaine Campbell	Rancho Mirage	CA
Lauren Campbell	Mill Valley	CA
Nancy Campbell	Santa Rosa	CA
Norma Campbell	Campbell	CA
Ernest Canning	Thousand Oaks	CA
Diane Cantwell	Los Angeles	CA
Mark Cappetta	San Mateo	CA
Geraldine Card-Derr	Exeter	CA
Richard Cardella	Hydesville	CA
Sylvia Cardella	Hydesville	CA
Jered Cargman	Los Angeles	CA
Rick Carlos	Martinez	CA
Eric Carlson	Los Osos	CA
Alan Carlton	Alameda	CA
Paul Carlton	San Clemente	CA
Victor Carmichael	Pacifica	CA
Summer Carnahan	San Marcos	CA
Ingrid Carp	San Francisco	CA
Annie Carpenter	Venice	CA
Gary Carpenter	Pacifica	CA
Gaile Carr	Mount Shasta	CA
Laurie Carr	Mira Loma	CA
Donna Carr, M.D.	Encinitas	CA
Martha Carrington	Oakland	CA
Mark Carroll	San Diego	CA
Reidun Carstens	LA	CA
Charlene Carter	Fort Bragg	CA
Jennifer Cartwright	Costa Mesa	CA
Brian Cassidy	Capitola	CA
Pam Cassidy	Rohnert Park	CA
Pam Cassidy	Rohnert Park	CA
Robert Cassinelli	Sacramento	CA
Lillian Castaneda	Culver City	CA
Alan Castner	Emeryville	CA
Dan Castori	Clayton	CA
Gail Caswell	San Francisco	CA
Creed Cate	Sacramento	CA

Heather Cauldwell	Monterey	CA
Sharon Cavallo	Auburn	CA
Lilllyan Cendejas	Brea	CA
Daniel Chan	Sherman Oaks	CA
Leonard Chandler	San Jose	CA
Donald Chapman	Victorville	CA
Felicia Chase	Encino	CA
Linda Chase	Anaheim	CA
Juanita Chavez	San Diego	CA
Morris Chay	Santa Rosa	CA
Pamela Check	Chico	CA
Gail Cheeseman	Saratoga	CA
Ted Cheeseman	Saratoga	CA
Allan Chen	Alameda	CA
Mich Chen	Fremont	CA
Cari Chenkin	Citrus Heights	CA
Suzy Chersky	Fountain Valley	CA
Antonia & Andrew Chianis	Blue Jay	CA
Andrew Chiaramonte	Marina Del Rey	CA
Chaz Chilcote	San Diego	CA
Nat Childs	Miranda	CA
Robert Chirpin	Northridge	CA
Diana Cho	Santa Barbara	CA
Carolyn Chris	San Francisco	CA
Joanna Chu	Lafayette	CA
Gay Chung	San Francisco	CA
Terry Church	Petaluma	CA
Susan Ciaramella	Sylmar	CA
Lois Cirner	San Diego	CA
Leanne Civiletti	Frazier Park	CA
Barri Clark	Los Angeles	CA
Irina Clark	San Diego	CA
Jane Clark	Fresno	CA
Annalisa Clearihue	Culver City	CA
Cynthia Cleese	Los Angeles	CA
Heather Clough	Ventura	CA
Josephine Coatsworth	Berkeley	CA
Megan Coffey	Rohnert Park	CA
Cameron Coffman	North Hollywood	CA
Benita Cohen	Desert Hot Springs	CA
Danielle Cohen	Marina Del Rey	CA
Mitch Cohen	Berkeley	CA
Barbara Cohn	Carlsbad	CA
Nancy Cohn	Atascadero	CA
Aaron Cole	Aliso Viejo	CA
Alex and Anne Cole	Santa Barbara	CA
Elizabeth Cole	Burlingame	CA
Ruth Cole	Imperial Beach	CA
Mary Coleman	Orangevale	CA

Amy Colla	Los Angeles	CA	
Gerry Collins	Murrieta	CA	
Sandy Commons	Sacramento	CA	
Kathy Compagno	Napa	CA	
Karen Connell	Van Nuys	CA	
Robert Conner	Big Bear City	CA	
Cherie Connick	Crescent City	CA	
Cecelia Conover	San Diego	CA	
Lori Conrad	Davis	CA	
Harald Conradi	Los Angeles	CA	
Thomas Conroy	Manhattan Beach	CA	
Barbara Consbruck	Sylmar	CA	
Heather Constable	Oakland	CA	
Craig Cook	Santa Rosa	CA	
Liz Cook	Davis	CA	*Very little is more imporant than the health of our food systems, particularly the oceans.*
Mitzi Coons	Hollywood	CA	
Arlene Cooper	San Francisco	CA	
Charlene Cooper	Gardena	CA	
Carlos Cordova	San Diego	CA	
Norma Corey	Redwood City	CA	
Pete Corkey	San Francisco	CA	
Christopher Cornish	San Francisco	CA	
sarah Cornish	Sun Valley	CA	
Stephanie Corona	Downey	CA	
Pamela Corradini	Simi Valley	CA	
Jim Corriere	Brawley	CA	
Maria Corvalan	Brea	CA	
Catherine Corwin	Santa Monica	CA	
Edward Costello	Santa Monica	CA	
Leslee Cotlow	San Francisco	CA	
Robert Cotner	Grover Beach	CA	
Anne Cotta	San Anselmo	CA	
Anna Cottle	Valencia	CA	
Paul Couillard	San Diego	CA	
Jennifer Counter	Colton	CA	
Sandi Covell	San Francisco	CA	
Leticia Cowan	San Jose	CA	
Lorena Cox	Rsm	CA	
Ben Crabb	Fremont	CA	
Frances Craig	Paso Robles	CA	
Joanne Crandall-Bear	Sacramento	CA	
Donna Crane	Anderson	CA	
Phillip Cripps	Cathedral City	CA	
Linda Crook	Desert Hot Springs	CA	
Carolyn Crow	Burlingame	CA	
Kurt Cruger	Long Beach	CA	
Cathy Crum	Agoura Hills	CA	
Christine Cuccia	San Francisco	CA	
Eleanor Cuevas	Sonoma	CA	

Kermit Cuff Jr.	Mountain View	CA
Philip Culp	Los Angeles	CA
Sherrell Cuneo	Los Angeles	CA
Debra Cunningham	Encinitas	CA
Eithne Cunningham	Grass Valley	CA
william Cuppoletti	Penngrove	CA
Jim Curland	Moss Landing	CA
Kevin L Curtis	Fullerton	CA
Joe Cuviello	Solana Beach	CA
Pat Cuviello	Redwood City	CA
Elizabeth Czyzewski	Los Angeles	CA
John D	Brentwood	CA
CARLA DAVIS	Corte Madera	CA
Susan Dailey	Pleasanton	CA
Cathleen Daley	Richmond	CA
Mitch Dalition	San Francisco	CA
Rhea Damon	Calabasas	CA
Nicole Danesh	Agoura Hills	CA
Thomas Dannecker	Los Angeles	CA
Lisa Dare	Tujunga	CA
Kathleen Darland	Santee	CA
Michael Darling	Frazier Park	CA
Elizabeth Darovic	Lake Elsinore	CA
Robert Davenport	Lakewood	CA
Dorothy L Davies	San Francisco	CA
Sue Davies	Philo	CA
Matthew Davila	Modesto	CA
Jill Davine	Culver City	CA
Clark Davis	Los Osos	CA
J Davis	San Francisco	CA
Melissa Davis	Santa Cruz	CA
Michelle Davis	Vacaville	CA
Robert Davis	San Diego	CA
Suzy Davis Mantee	Malibu	CA
Jessica Davis-Stein	Sherman Oaks	CA
Denine Dawson	Monrovia	CA
Wayne Day	San Francisco	CA
Victoria De Goff and family	Berkeley	CA
Elisse De Sio	Redwood City	CA
Vic DeAngelo	San Francisco	CA
Mary DeLongfield	Newhall	CA
Deborah DeMaddalena	Tustin	CA
Carolyn DeMirjian	Van Nuys	CA
Margaret DeMott	Sacramento	CA
Richard DeSantis	Palm Desert	CA
Rayline Dean	Ridgecrest	CA
Brian Debasitis	San Jose	CA
Michael Decker	Los Angeles	CA
Diana Dee	North Hollywood	CA

John Delaney	Ventura	CA
M. Delatte	Long Beach	CA
Arthur Delgadillo	Lakewood	CA
Heather Della Ripa	South Lake Tahoe	CA
Gail Demirtas	Thousand Oaks	CA
Diana Denisoff	Forestville	CA
Lou Anna Denison	Long Beach	CA
Michael Denton	San Leandro	CA
Wendy Derbort	Yucaipa	CA
Pam Dewitt	Clovis	CA
Siladitya Dey	Santa Barbara	CA
Joseph DiFrancesco	La Quinta	CA
Denise DiPasquale	Hermosa Beach	CA
Renee Diamond	Agoura Hills	CA
Francisco Diaz	Richmond	CA
Helen Dickey	El Cerrito	CA
Agnes Dickson	Irvine	CA
Cathe Dietrich	Albany	CA
Catherine Dishion	Montecito	CA
Nancy Dix	La Jolla	CA
Carol Doehne	Roseville	CA
James Doeppers	Mill Valley	CA
James Domenico	San Francisco	CA
Michael Dominguez	Torrance	CA
Valeska Donoso	Santa Monica	CA
Barbara Dorame	Long Beach	CA
Jesse Doty	Eureka	CA
Yvette Doublet-Weislak	Morgan Hill	CA
Von Douglas	Highland	CA
Kristine Dove	Indian Wells	CA
Tiffany Downey	Hercules	CA
Amy Dowsett	Palo Alto	CA
Ramona Draeger	San Francisco	CA
Ivan Dryer	Northridge	CA
Anish Dube	Simi Valley	CA
Carol Dubovick	Pleasant Hill	CA
Justin Dunscombe	Mountain View	CA
Rikki Dunsmore	Santa Cruz	CA
Richard Duran	Chino	CA
Sheri Duren	Anaheim	CA
Samuel Durkin	Fairfield	CA
Teresa Durling	San Francisco	CA
Miller Duvall	Los Angeles	CA
Kathleen Dwyer	Monrovia	CA
Julia Earl	Larkspur	CA
Linda Eberle	Venice	CA
Patrick Echelbarger	Santa Cruz	CA
Carlos Echevarria	Inglewood	CA
Jay Edgerton	Rancho Palos Verdes	CA

John Edman	Sunnyvale	CA
Pandora Edmonston	Mariposa	CA
Bita Edwards	Woodacre	CA
Carole Ehrhardt	Pebble Beach	CA
Howard Eisenberg	San Mateo	CA
karen Eisenlord	Studio City	CA
Laurie Eisler	Cotati	CA
Steve Eklund	Salinas	CA
denice Eldridge	Vacaville	CA
Bernard Elias Elias	Redondo Beach	CA
Edward Elkins	Salinas	CA
Susan Eller	Elk Grove	CA
Denis Elliott	Arcadia	CA
Jim Elliott	Encinitas	CA
Robert Ellis	Oakland	CA
Wilma Ellis	Oroville	CA
Lora Elstad	Los Angeles	CA
Giselle Embry	Escondido	CA
David Enevoldsen	San Jose	CA
Christine Engel	Santa Rosa	CA
Ken Ennis	Bakersfield	CA
Barbara Epstein	Rolling Hills Estates	CA
Taia Ergueta	Redwood City	CA
Suzanne Erickson	Sonora	CA
Deb Escoto	Riverside	CA
Dan Esposito	Manhattan Beach	CA
Sandy Esque	San Clemente	CA
Malka Essig	Oakley	CA
John Essman	Healdsburg	CA
Douglas Estes	San Francisco	CA
Chad Evans	Glendale	CA
Michael W Evans	Los Angeles	CA
Miranda Everett	Lake Isabella	CA
Shanna Everett	Stockton	CA
Tracy Ewing	Artesia	CA
Janet Eyre	San Francisco	CA
Jean FLEMING	Studio City	CA
Rita Fahrner	San Francisco	CA
Don Faia	Aptos	CA
Edward Fairchild	Sunnyvale	CA
Jamie Falgoust	Shingle Springs	CA
Dominick Falzone	Los Angeles	CA
Lorna Farnum	Rossmoor	CA
Beverly Farr	Goleta	CA
Marilynn Fasick	Adelanto	CA
Melanie Faulkner	Fallbrook	CA
Cassandra Fazio	Cotati	CA
Lori Fedele	Sun City	CA
Emily Feingold	Concord	CA

Ruth Feldman	Alamo	CA	
Rene Feliciano	San Leandro	CA	
Helga and James Fellay	Carmel Valley	CA	
Haydee Felsovanyi	Pescadero	CA	
Christine Fenlon	Sacramento	CA	
Laura Ferejohn	Laguna Hills	CA	
James Ferguson	Fallbrook	CA	
Linda Ferland	Ventura	CA	
Cynthia Fernandez	Point Richmond	CA	
Kait Ferrall	Mountain View	CA	
Mauro Ferrero	Los Angeles	CA	*A Fishery Ecosystem Plan is very important! Please adopt it.Thanks*
Kathleen Fidaleo	La Jolla	CA	
Elisabeth Fiekowsky	Sebastopol	CA	
Robert Field	Los Gatos	CA	
Aixa Fielder	Los Angeles	CA	
Gayle Fieldgrove	Bakersfield	CA	
Deborah Filipelli, Ph. D.	the sea ranch	CA	*The following represents my position in strong support of a Fishery Ecosystem Plan and for action that would conserve forage fish.*
VERONIKA Fimbres	San Francisco	CA	
Jeff Findeis	long beach	CA	
Christine Fink	Stockton	CA	
Cary Fischer	San Francisco	CA	
Jason Fish	Victorville	CA	
Margaret Fish	Boonville	CA	
Ted Fishman	San Jose	CA	
Todd Fisk	San Diego	CA	
Austin Fite	Pacific Palisades	CA	
Stan Fitzgerald	San Jose	CA	
Mary Flavan	Morro Bay	CA	
Allison Fleming	Los Angeles	CA	
Jude Fletcher	Oakland	CA	
Claire Flewitt	San Lorenzo	CA	
Barry Flicker	Woodacre	CA	
Chris Flook	Nevada City	CA	
Ron Flores	Escondido	CA	
Flo Flowing	Eureka	CA	*You do know that FISH ARE DYING now in the KLAMATH River don't you do to lack of water? Our ecosystem needs help now not 10 years from now. You do know we aren't honoring our word to the Native American Tribes. How sad we have no integrity.*
Christine Fluor	Corona Del Mar	CA	
Grant Foerster	Albany	CA	
James Foley	Simi Valley	CA	
Doug Ford	Fremont	CA	
Lauren Ford	Venice	CA	
Kim Forrest	Los Banos	CA	
Janice Foss	Pinole	CA	
Sharie Foster	Tujunga	CA	
Liz Fowler	Richmond	CA	
Billy Fox	Wilton	CA	
Gene Fox	Del Mar	CA	

Louis Fox	Berkeley	CA	
Mark Foy	Berkeley	CA	
Lynne Francovich	Oxnard	CA	
Zachary Frank	Los Angeles	CA	
Megan Franklin	Brea	CA	
Forest Frasieur	Benicia	CA	
Cary Frazee	Eureka	CA	
Lorena Frcek	Los Angeles	CA	
Robert Frcek	Los Angeles	CA	
Jodi Frediani	Santa Cruz	CA	
Nancy Freedland	Big Bear City	CA	
Rea Freedom	Los Gatos	CA	
Dale Freeman	Auburn	CA	
Helena Freeman	Los Angeles	CA	
Kyri Freeman	Barstow	CA	
Mark Freeman	San Diego	CA	
Richard Freeman	Kensington	CA	
Julene Freitas	Oakland	CA	
Dean Frick	San Francisco	CA	
Dean Frick	San Francisco	CA	
Dean Frick	San Francisco	CA	
Michael Friedman	El Sobrante	CA	
Christine Frisco, RN	Palo Alto	CA	
Jackie Fritz	Irvine	CA	
J. Froiland	Rohnert Park	CA	
Robert Fromer-Bonilla	Palmdale	CA	
Tina Frugoli	Thousand Oaks	CA	
Jeniffer Fuentes-Mishica	Long Beach	CA	
John Fuhrer	Newport Beach	CA	
Jed Fuhrman	Topanga	CA	*As a professor of marine biology for over 30 years (and current holder of an endowed chair at USC on that topic), I am writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.*
Kristina Fukuda-Schmid	Culver City	CA	
Ann Fuller	Petaluma	CA	
Laura Fung	Nevada City	CA	
Robert Furst	Joshua Tree	CA	
Carol Anne Fusco	Berkeley	CA	
Joe Futterer	Topanga	CA	
Nelvin Gaba	Long Beach	CA	
Ellen Gachesa	Napa	CA	*As uncontrolled population growth continues to increase degradation of our environment, it is essential that we protect food sources in the ocean.*
Betty Gaines	Antioch	CA	
Glenn Gallagher	Simi Valley	CA	
Gloria Gallagher	Yorba Linda	CA	*Once the circle of life is broken...it cannot be restored...keep it intact...*
Thomas Gallagher	Burlingame	CA	
Roxanna Galvan	Oakland	CA	
Stefanie Gandolfi	Oakland	CA	

Kim Ganz	San Jose	CA	
Armando A. Garcia	Paramount	CA	
Deisha Garcia	San Jose	CA	
Hector Garcia	Los Angeles	CA	
Michael J. Garcia	Santa Ana	CA	
Toni Garcia	Aliso Viejo	CA	
Boyd Gardiner	Rancho Santa Fe	CA	
David Gardner	Santa Monica	CA	
Michelle Gardner	Paso Robles	CA	
Jamila Garrecht	Petaluma	CA	
Carole Garrett	Folsom	CA	
Megan Garrett	Sacramento	CA	
Tudy Garrett	Glen Ellen	CA	
John Gaspar	Lancaster	CA	
John Gasperoni	Berkeley	CA	
Nicole Gaston-Fowler	Tulare	CA	
Kay Gata	Burbank	CA	
Arnold Gatti	Livermore	CA	
Gina Gatto	Castro Valley	CA	
Joy Gault	Los Osos	CA	
Tomas Gayton	San Diego	CA	
Lionel Gazeau	Monte Rio	CA	
Lisa Gee	La Crescenta	CA	
Gemma Geluz	Fairfield	CA	
Mija Gentes	Saratoga	CA	
Diane Gentile	Nicasio	CA	
Balfour Gerber	San Francisco	CA	
Gordon Gerbitz	Santa Barbara	CA	
Richard Gibbons	Cupertino	CA	*My Grand Godchild Annika and I thank you for doing the right thing.*
Brigitte Gibbs	San Diego	CA	
Gustavo Gil	Rancho Cucamonga	CA	
Karyn Gil	Sacramento	CA	
David Gilbertson	Santa Barbara	CA	
Barrie Gile	Lomita	CA	
Ayesha Gill	Oakland	CA	
Chris Gillespie	Napa	CA	
Thomas Gillespie	La Mirada	CA	
Larry Gilman	Los Angeles	CA	
Nancy Gingrich	Sebastopol	CA	
Dana Ginn	Temecula	CA	
Barbara Ginsberg	Santa Cruz	CA	
Celeste Gionet-Hawker	San Jose	CA	
Jean Gladstone	Eureka	CA	
Joseph Glaston	Desert Hot Springs	CA	
Sheryl Glausch	Union City	CA	
Debra Gley	Trabuco Canyon	CA	
Janice Gloe	Oakland	CA	
Courtney Glondeniz	El Cajon	CA	
Peggy Goddard	La Jolla	CA	

Claire Godwin	Sebastopol	CA	
Hester Goedhart	Redwood City	CA	
Darlene Goguen	Tujunga	CA	
Warren Gold	Mill Valley	CA	
Sarah Goldbaum	San Francisco	CA	
Nancy Goldberg	Los Angeles	CA	
Susan Goldberg	Glendale	CA	
Jane Goldman	Half Moon Bay	CA	
Carol Goldstein	San Dieho	CA	
Roz Goldstein	Greenbrae	CA	
Joseph Golinveaux	Berkeley	CA	
Bernie Gonzales	Caruthers	CA	
Carol Gonzales	Ventura	CA	
Greg Goodman	Concord	CA	
Sue Goodrich	San Diego	CA	
Kevin Goodwin	San Diego	CA	
Edward Goral	Montrose	CA	
Barry Gordon	Santa Rosa	CA	
Mildred Gordon	Oceanside	CA	
Dara Gorelick	Van Nuys	CA	
Ela Gotkowska	LODZ	CA	
Martin Gottlieb	Woodland Hills	CA	
Mark Gotvald	Pleasant Hill	CA	
Nancy Gowani	Winnetka	CA	
Jess Graffell	Yucaipa	CA	
S. Scott Graham	Santa Cruz	CA	
Seana Graham	Santa Cruz	CA	
Steven Graham	San Diego	CA	
Rosemary Graham-Gardner	Manhattan Beach	CA	
Martin Grantham	Emeryville	CA	
Caryn Graves	Berkeley	CA	
Joel Graves	Santa Monica	CA	
Sharon Graves	Westwood	CA	
Horace Gray	Hayward	CA	*THE OCEANS ARE DYING.*
Denise Greaves	San Jose	CA	
Bill Green	Westlake Village	CA	
Jo Green	El Cerrito	CA	
June Green	Belmont	CA	
Marilyn Green	Manhattan Beach	CA	
Bert Greenberg	San Jose	CA	
S. Greene	Cazadero	CA	*This ecosystem is just one of many on the verge of collapse. When our ecosystem collapses, we will not be able to feed ourselves. The ocean covers the earth. It would be responsible, reasonable, and intelligent to understand what we preserve of our little corner adds to the preservation of the whole. And the preservation of the whole biosphere is at stake, because we WILL experience more disasters worldwide as a result of our practices that led to climate change, to nuclear toxins proliferated everywhere, and to a tipping-point devastation of the integrity of the biosphere we rely on for air, water, food, and life. This is already happening. It would behoove any member of your voting group to recognize the urgent necessity to preserve what is left, and prevent further destruction by purely financial and greedy*

			interests who have no conscience of the results of the destruction they are implementing, and to begin to see and work to integrate any policies of preservation by collaborating with the entire plan. You may be looking at implementing one little guideline to preserve school fish in our West Coast oceans. Please see this as one small NECESSARY act that needs to be dovetailed into all other government and corporate acts to preserve, because our ecosystem cannot sustain itself with the types of assaults visited upon it. We need an integrated plan to preserve what we haven't ruined of our ecosystem, including our air, water, food, and soil. Implementing a plan to protect small ocean fish is a start. But don't let oil and gas companies, or nuclear companies, blast the ocean in order to "find out" about the earthquake faultlines to see if the Diablo Canyon power plant is "safe" because no nuclear power is safe when climate change is present, and it is. Such blasting would kill and maim the same fish, as well as ocean mammals and every other ocean creature, which would make any protections you enact moot. We need an integrated plan to preserve what is left from corporate rapaciousness, including our staple foods and the oceans that supply staple foods to many human cultures around the world. To protect small ocean fish is a start, but this plan needs to be integrated in order to preserve what little compromised biosphere is left for our descendants. Please do preserve the little fish. And the big fish. And the whales. And the humans, and begin by protecting school fish in our oceans.
Brigette Greener	San Jose	CA	
Ken Greenwald	Santa Monica	CA	
Ramsey Gregory	Elk Grove	CA	
Mercy Grieco	Fresno	CA	
Ian Griffith	Los Angeles	CA	
Russell Grindle	Fairfield	CA	
Jackie Guardado	Alameda	CA	
Raquel Guillen	San Francisco	CA	
Valerie Guinan	Cupertino	CA	
Elizabeth Guise	Los Angeles	CA	
Tim Guisinger	Camarillo	CA	
Jere Guldin	Los Angeles	CA	
Elizabeth Gulick	North Hollywood	CA	*PLRASE DON'T ALLOW OUR OCEANS TO DIE FROM INACTION ON YOUR PART*
Jenny Gumpertz	Palm Desert	CA	
J. Barry Gurdin	San Francisco	CA	
Brian Gustafson	Eureka	CA	
Cathy Guthrie	Novato	CA	
Nancy Gutierrez	Palm Desert	CA	
Nichole Gutierrez	El Cajon	CA	
CAREY HAUSER	N Hollywood	CA	
C HENDRICKSON	Los Angeles	CA	
Lani HInk	Vineburg	CA	
Inna Habelski	San Leandro	CA	
Todd Hack	San Diego	CA	
Sarah Hafer	Sacramento	CA	
Alan Haggard	San Diego	CA	
George Hague	Moreno Valley	CA	*YOU KNOW THIS IS THE RIGHT THING TO DO!!! SO PLEASE DO IT.*
Brenda Haig	Long Beach	CA	
James Haig	San Rafael	CA	
Trevolyn Haines	Chino Hills	CA	

Cathy Hale	La Mesa	CA	
Jay Hales	San Diego	CA	
Gregory Hall	San Marcos	CA	
Linda Hall	Fontana	CA	
Natalie Hall	Encino	CA	
Jacqueline Haller	Belmont	CA	
Teresa Haller	Orangevale	CA	
Candace Hallmark	Belmont	CA	
Graham Hamilton	Santa Monica	CA	
Shari Hamilton	Morro Bay	CA	
Tracey Hamilton	San Jose	CA	
Jill Hammer	Grass Valley	CA	
Marcella Hammond	San Diego	CA	
Sharon Hamolsky	Solana Beach	CA	
James Hampson	San Francisco	CA	
Shota Hanai	Torrance	CA	
Mark Hanisee	Riverside	CA	
Charlotte Hansen	Los Angeles	CA	
Mary Lynn Hansen	Piedmont	CA	
Phillip Hansen	Markleeville	CA	
Joseph Hardin	Santa Monica	CA	
Jana Harker	Woodland Hills	CA	
Joanne Harkins	Venice	CA	
Heidi Harmon	San Luis Obispo	CA	
Zac Harmon	Long Beach	CA	
Barbara Jane Harpe	Lomita	CA	
Rebecca Harper	Los Angeles	CA	
Vince Harper	Orange	CA	
Roger H. Harrell	Hermosa Beach	CA	
John Harris	Pittsburg	CA	
Lois Harris	Claremont	CA	
Zoe Harris	San Anselmo	CA	
Randall Hartman	Torrance	CA	
Anne Harvey	San Diego	CA	*My family and I, some of whom run a large popular seafood restaurant, urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.*
Fred Harvey		CA	
Joe Harvey	Twain Harte	CA	
Richard Harvey	Paso Robles	CA	
Carolina Hasenau	Oakland	CA	
Jeffrey Hasenau	Oakland	CA	
Nancy Hasenpusch	San Andreas	CA	
Gerald Haslam	Penngrove	CA	
Susan Hathaway	Pico Rivera	CA	
Brenda Hattisburg	Oakland	CA	
Murray Hawkins	Cedarpines Park	CA	
Paula Hawkins	San Diego	CA	
Claire Hawley	Santa Clara	CA	
Kiyo Hayasaka	Oakland	CA	

Christine B. Hayes	Upland	CA
Jennifer Hayes	Modesto	CA
Tim Hayes	El Cajon	CA
Walter Hays	Palo Alto	CA
Sharon Haywood	Laguna Beach	CA
Yuriko Hazlett	Port Hueneme	CA
Kris Head	Garden Grove	CA
Christine Headworth	RAMONA	CA
Diane Healy	Vacaville	CA
Bob Hearns	Beverly Hills	CA
Zack Heart	La Jolla	CA
Julie Heath Elliott	Los Angeles	CA
Nancy Heck	Santa Maria	CA
Wayne Heckman	Ukiah	CA
Lin Heidt	San Diego	CA
Robert Heilman	Placerville	CA
Mark Hein	Woodland Hills	CA
Bridgett Heinly	Encino	CA
Dennis Heinzig	Nicasio	CA
Roberta Heist	Fort Bragg	CA
Kathleen Helmer	Woodland Hills	CA
Jo Ann Henderson	Aptos	CA
Nancy Henderson	Orinda	CA
Steven Henderson	Cathedral City	CA
Charlene Henley	San Jose	CA
Dakota Hennessey	Santa Monica	CA
Karen Henriksen	Lakeside	CA
John Henry	Tracy	CA
Christina Heon	Arroyo Grande	CA
Sam Hergenrather	Sebastopol	CA
Bill Herman	Oceanside	CA
Scott Herman	Sacramento	CA
Birgit Hermann	San Francisco	CA
CYNTHIA Hernandez	Ukiah	CA
Dena Hernandez-Kosche	Glendale	CA
Ana Herold	Pacifica	CA
Jo Ann Herr	Oakland	CA
Veronica Herrera	Culver City	CA
Andria Herron	Cloverdale	CA
Faith Herschler	Stanton	CA
William Hewes	Simi Valley	CA
Steve Hibshman	Foster City	CA
Lacey Hicks	Fresno	CA
Nancy Hiestand	Davis	CA
Matthias Hildebrandt	Los Angeles	CA
Kevin Hile	Palm Springs	CA
Frank Hill	North Hollywood	CA
Susan Himes-Powers	San Francisco	CA
Hannah Hinchman	Chico	CA

First rule in intelligent tinkering is keep all the parts. A sea ecosystem needs the small but numerous denizens, including forage fish. To mix metaphors, they're the geese that lay the golden tuna!

Frances Hinckley	Corte Madera	CA

A healthy ecosystem is like a pyramid; everything rests on the strength of the incredible breadth of its base: in this case the little forage fish, krill and everything else at the "bottom" of the food web

Lanier Hines	San Francisco	CA
Jeremy Hinkson	Sacramento	CA
Will Hirsch	Arcata	CA
Charles Hochberg	Philo	CA
Suzanne Hodges	Sacramento	CA
Rebecca Hoeschler	El Segundo	CA
Marla Hoff	Modesto	CA
Carleton Hoffman	San Francisco	CA
Sabrina Hogan	Monrovia	CA
Dale Hoglund	La Quinta	CA
Jennifer Holbrook	Berkeley	CA
Cathy Holden	Sacramento	CA
Jennifer Holien	Millville	CA
David Hollier	Crestline	CA
Candace Hollis-Franklyn	Tiburon	CA
Kyva Holman	Oakland	CA
Magnus Holmen	Los Angeles	CA
Carla Holmes	Los Altos	CA
Christine Holmes	San Francisco	CA
Virginia Holmes	Menlo Park	CA
Roberta Holt	Stockton	CA
William Holt	Pleasanton	CA
Norbert Holter	San Francisco	CA
Windy Holzbach	San Francisco	CA
Betsy Holzhauer	Saint Helena	CA
Celeste Hong	Los Angeles	CA
Val Hongo-whiting	Laguna Niguel	CA
Marianne Hooper	Pasadena	CA
Clare Hooson	Belmont	CA
Joy Hoover	Lompoc	CA
Michael Hoover	Los Angeles	CA
Milda Hoover	La Verne	CA
Kathleen Hopkins	Oakland	CA
Elissa Horne	North Hollywood	CA
Michael Horton	South San Francisco	CA
Lucy Horwitz	Los Angeles	CA
Martin Horwitz	San Francisco	CA
Jane Houle'	Pasadena	CA
Jerry Howard	Carlsbad	CA
Mari Howland	Los Angeles	CA
Fred Vance Hubbell	Bakersfield	CA
Robert Huber	Oakland	CA
Lesley Hudak	Orinda	CA
Molly Huddleston	Santa Rosa	CA
Richard Hudgins	Fallbrook	CA
Mary Hughan Rojeski	Santa Monica	CA
Joe Hughes	Willits	CA

Kathryn Hughes	malmesbury	CA	
Siavash Human	Santa Monica	CA	
Richard Hundley	North Fork	CA	
Paul Hunrichs	Santee	CA	
Rochelle Hunter	Santa Ana	CA	
Shannon Hunter	Santa Clara	CA	
Stan Hunter	Sierra Madre	CA	
Ann Hunter-Welborn	Encinitas	CA	
Bev Huntsberger	Altadena	CA	
Janine Hurd Glenn	La Mesa	CA	
Kristin Hurley	Poway	CA	
Linda Hurley	Anaheim	CA	
Dr. Terrance A. Hutchinson	California City	CA	
Kelly Hutchinson	Los Angeles	CA	
Terry Hutmacher	Santa Cruz	CA	
Frank Huttinger	Pasadena	CA	
Jinx Hydeman	Trabuco Canyon	CA	
Keith Ignatowicz	Cupertino	CA	
Miriam Iosupovici	Imperial Beach	CA	
Zia Islam	Winnetka	CA	
Vanja Ivanova-Hathcock	Sacramento	CA	
Steve Iverson	Newport Beach	CA	*CONSERVE, NOT COMSUME*
Mary Izett	Lafayette	CA	
Mark J. J. Fiore	San Francisco	CA	
Ernest J. Scholz	San Francisco	CA	
CAMACHO JOSE	Los Angeles	CA	
Kathleen Jacecko	Redondo Beach	CA	
Alicia Jackson	Vallejo	CA	
Elizabeth Jackson	Elk Grove	CA	
Lael Jackson	Del Mar	CA	
Robbyn Jackson	San Francisco	CA	
Kelly Jacobs	Oakland	CA	
Brenda Jaime	San Jose	CA	
Tina Jaime	San Jose	CA	
Katherine Jain	San Rafael	CA	
Janet Jamerson	San Leandro	CA	
Damian James	Oakland	CA	
Lorie James	Petaluma	CA	
Quinton James	Los Angeles	CA	
Peggy Jamieson	Placentia	CA	
Kimberly Jannarone	San Francisco	CA	
Theresa Jaquess	Huntington Beach	CA	
Andres Jaramillo	North Hollywood	CA	
Marsha Jarvis	Pinole	CA	
Louisa Jaskulski	Hayward	CA	
Vance Jason	Livermore	CA	
Lynne Jeffries	Laguna Niguel	CA	
Lisa Jensen	Santa Cruz	CA	
Virginia Jensen	Los Osos	CA	

Tania Jesus	Newport Beach	CA
Kenneth Jimenez	Mount Shasta	CA
Claire Joaquin	Pollock Pines	CA
Juliet Johns Pearson	Grass Valley	CA
Asali Johnson	Cupertino	CA
Bev Johnson	San Juan Capistrano	CA
Elsa Johnson	Pacific Grove	CA
Joyce Johnson	Burbank	CA
Lisa Johnson	San Diego	CA
Liz Johnson	Albany	CA
Randi Johnson	Topanga	CA
Stephen Johnson	San Diego	CA
Valerie Johnson	Mission Hills	CA
Wayne Johnson	San Francisco	CA
stephen Johnson	West Hollywood	CA
Philip Johnston	Scotts Valley	CA
Allison Jones	San Francisco	CA
Gary Jones	San Marino	CA
Penelope Jones	Novato	CA
Laura Jones-Bedel	San Diego	CA
Hadi Jorabchi	Woodland Hills	CA
Mark Jordan	Santa Cruz	CA
Lil Judd	Sylmar	CA
TJ KENNY	San Jose	CA
Cyndi Kahn	Venice	CA
Laura Kaiser	Los Angeles	CA
Robin Kallman	San Francisco	CA
Patty Kamysz	San Jose	CA
Irene Kane	Oakland	CA
Mike Kappus	San Francisco	CA
Nowell Karten	Santa Monica	CA
Joanna Katz	Berkeley	CA
Dawn Kauffman	Walnut Creek	CA
Andrea Kaufman	Guerneville	CA
Helmut Kayan	San Francisco	CA
Andrea Kean	Berkeley	CA
Curtis Keedy	Riverside	CA
John M. Keefe	South Pasadena	CA
Larry Keller	Santa Cruz	CA
Marcia Keller	San Diego	CA
Shelly Keller	Sacramento	CA
Rachel Kelley	Santa Monica	CA
Frances Kelly	Simi Valley	CA
Gerald Kelly	Santa Monica	CA
James Kelly	Huntington Beach	CA
Nancy Kelly	Fresno	CA
Rev. J. Patrick Kelly	Sacramento	CA
Jane Kelsberg	Antioch	CA
Juliette Kelsey	Spring Valley	CA

Arthur Kennedy	Isla Vista	CA	
Mark Kennedy	Mount Shasta	CA	
Richard Kennedy	Cerritos	CA	
Gretchen J. Kenney	Redwood City	CA	
Janet Kennington	Los Angeles	CA	
Schuyler Kent	Los Angeles	CA	
Charlene Kerchevall	Oceanside	CA	
Julie Kersey	Aptos	CA	
Jenni Kerteston	Santa Barbara	CA	
Amrit Khalsa	Redondo Beach	CA	
Mha Atma Khalsa	Los Angeles	CA	*As a concerned American citizen and taxpayer I strongly urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.*
Donna Khoury	Camarillo	CA	
Meaghen Kidd	Palo Alto	CA	
Henry Kielarowski	San Francisco	CA	
Laura Kielman	Sacramento	CA	
Guadalupe Killion	San Anselmo	CA	
Norman Kindig	Yorba Linda	CA	
Kim King	Nevada City	CA	
Sara King	San Mateo	CA	
Terry King	Oakland	CA	
Francis Kintz	San Francisco	CA	
Bettina Kirby	Sebastopol	CA	
Judith Kirk	Redwood City	CA	
James Kirks	Chico	CA	
Kaye Kirkwoodf	Santa Clarita	CA	
Saran Kirschbaum	Los Angeles	CA	*You know that everything in the ocean is connected one way or another and that's why I am writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.*
Karen Kirschling	San Francisco	CA	
Craig Kleber	Los Angeles	CA	
Tracey Kleber	Los Angeles	CA	
Howard Klein	San Bruno	CA	
Philip Klein	Los Angeles	CA	
V. Joseph Klein	Benicia	CA	
Walter Kleine	Oakland	CA	
Diana Kliche	Lawndale	CA	
George Klipfel II, CLS, MT(	Cathedral City	CA	
Pete Klosterman	San Mateo	CA	
Cafrmen Klucsor	Sunnyvale	CA	
Thomas Knecht	Pasadena	CA	
Deanna Knickerbocker	Mountain View	CA	
Diane Knight	West Hills	CA	
Karl Koessel	Blue Lake	CA	
John Kohler	Agoura Hills	CA	
Laura Kohn	San Francisco	CA	
Ellen Koivisto	San Francisco	CA	
Tatiana Korotkova	Palo Alto	CA	

Sheila Kothari	Palo Alto	CA	
Lynn Kouzel	San Pedro	CA	
Natalie Kovacs	San Clemente	CA	
Donna Kowzan	Moorpark	CA	
Gail Koza	San Francisco	CA	
Joan Kramer	Los Angeles	CA	
Julie Kramer	San Francisco	CA	
Joshua Krasnoff	Oak View	CA	
Irene Kraus	Mission Viejo	CA	
Natalie Kraus-Darden	Folsom	CA	
Lisa Krausz	Tiburon	CA	
Fred & Sara Krauthamer	Monterey Park	CA	
Paula Kren	Martinez	CA	
Elizabeth Krohn	Sebastopol	CA	
kathy Lou Kronenberger	Novato	CA	
Carol Kruger	San Jose	CA	
K Krupinski	Altadena	CA	
Pat Kruse	La Mesa	CA	
Eli Kuala	San Diego	CA	
Dan Kuklo	Berkeley	CA	
Richard Kuntze	Monterey	CA	
Susan Kurcz-Easom	Pittsburg	CA	
Rebecca Kurtz	Mountain View	CA	
Celia Kutcher	Capistrano Beach	CA	
Sheri Kuticka	Concord	CA	
James L. Hench	Napa	CA	
Dana L. L. Stewart	Lakeside	CA	*We offer solutions to organic fish farming in both fresh and salt water, our Oceans Harvest Eco-Seafood (c). www,abccgreentechs.com. We can help. Our family has been stewards of our lands and waters in California for 5, going on 6, generations! We look forward to your response. Thank you for your every effort in this regard.*
ILEANA LIEL	Riverside	CA	
GEORGE LOVEDAY	Grass Valley	CA	
Isabella La Rocca	Berkeley	CA	
Isabella La Rocca	Berkeley	CA	
Jason LaBerge	Malibu	CA	
Roberta LaFrance	San Leandro	CA	
Maryann LaNew	San Clemente	CA	
Sharon Laabs	La Jolla	CA	
Elizabeth Ladiana	Ventura	CA	
Barbara Lafaver	Concord	CA	
Isabelle Lafrance	San Mateo	CA	
Carol Lake	Solvang	CA	
Kelley Lamke	Santa Rosa	CA	
Cathy Lampshire	Anaheim	CA	
Ezmeralda Landeros	Lincoln Heights	CA	
Marisa Landsberg	Manhattan Beach	CA	
Jana Lane	Oakland	CA	
Julie Lane	Sebastopol	CA	
Jeri Langham	Sacramento	CA	*AS AN EMERITUS PROFESSOR OF BIOLOGICAL SCIENCES AFTER 38*

YEARS OF TEACHING ECOLOGY AT CALIFORNIA STATE UNIVERSITY, I am writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water.

Jim Lansing	San Francisco	CA
Catherine Lanzl	Encinitas	CA
I-Ching Lao	Los Angeles	CA
Linda Lapetino	Los Angeles	CA
Gary Lapid	Mountain View	CA
Larry Lapuyade	San Anselmo	CA
Ruby Lara-Leon	Ventura	CA
Thora Lares	Cotati	CA
Lucy Larom	San Diego	CA
Areil Larsen	San Luis Obispo	CA
Karen Larson	Chino	CA
Tracey Larvenz	San Diego	CA
Peggy Larvey	Santa Clara	CA
Kathleen Lassiter	Jenner	CA
Gabriel Lautaro	Oakland	CA
Jeannie Lawrence	Santa Monica	CA
William Lawson	Calimesa	CA
Jason Lawson-St.Hill	Bay Point	CA
Ometh Layton	L.A.	CA
Josie Lazo	San Francisco	CA
Leslie LeClere	Valley Village	CA
Evelyn Ledesma	Rialto	CA
Amanda Lee	Encinitas	CA
Edward Lee	Santa Clara	CA
Gary Lee	Palm Springs	CA
Mary Lee	Stockton	CA
Steven Lee	Lakeside	CA
Teresa Lee	Arcadia	CA
Virginia Lee	Half Moon Bay	CA
David Leech	Redwood City	CA
Cassia Leet	Oakland	CA
Sarah Lehrer-Graiwer	Los Angeles	CA
Bill Leikam	Palo Alto	CA
Laura Leipzig	Berkeley	CA
Miranda Leiva	Sherman Oaks	CA
Steve Lerman	Sacramento	CA
B. Lerner	San Jose	CA
Jim Leske	N Hollywood	CA
Pam Letourneau	Santa Rosa	CA
Marjorie Lev	Sacramento	CA
Ellen Levine	Castro Valley	CA
Lark Levine	Santa Monica	CA
Sandy Levine	Altadena	CA
Alina Levinson	Placentia	CA
Judie Lewellen	Pearblossom	CA
Alan Lewis	Encinitas	CA

Cheryl Lewis	San Francisco	CA
Donna Lewis	Van Nuys	CA
George Lewis	Los Osos	CA
Maxine Lewis	Oakland	CA
Patrick Lewis	Emeryville	CA
Suzanne Lewis	Stockton	CA
Viki Lewis	San Francisco	CA
Sylvia Lewis Gunning	Thousand Oaks	CA
Andrea Lieberman	Los Angeles	CA
Dan Lieberman	Wildomar	CA
Joe Lilli	Pacific Palisades	CA
Carolyn Lilly	San Diego	CA
Olivia Lim	Davis	CA
Christopher Lima	Camarillo	CA
Elizabeth Lima	Anaheim	CA
Cecilia Lin	Laguna Niguel	CA
Stephanie Linam	Benicia	CA
Karen Linarez	Carmichael	CA
Barb Lincoln	Walnut Creek	CA
Amy Lippert	Martinez	CA
Alison Litton	Los Angeles	CA
Elaine Livesey-Fassel	Los Angeles	CA
Ivan Llata	Cudahy	CA
Renee Locks	Mill Valley	CA
Jimi Logsdon	Chico	CA
Wally Longshore	Riverside	CA
Jon Longsworth	Aptos	CA
Erin Loos	Thousand Oaks	CA
Lindsey Loperena	Santa Cruz	CA
Joe Loree	Berkeley	CA
Catherine Loudis	San Anselmo	CA
Jo Louie	Thousand Oaks	CA
Heather Lounsbury	N Hollywood	CA
Marcia Lovelace	Oakland	CA
Patsy Lowe	Palm Springs	CA
Bonnie Lowery	Los Angeles	CA
Avila Lowrance	Grass Valley	CA
Kristen Lowry	Etobicoke	CA
Lorraine Lowry	Etobicoke	CA
Luis Lozano	Long Beach	CA
Dana Lubin	Valley Village	CA
Iris Lubitz	Mountain View	CA
John Lucich	Clearlake	CA
Brenda Luebke	Mountain View	CA
Brian Luenow	San Francisco	CA
Danalyn Luke	Van Nuys	CA
Richard Luke	Los Altos Hills	CA
Debra Lurie	Richmond	CA
Renee Lusian	Seal Beach	CA

Rick Luttmann	Rohnert Park	CA
Linda Joy Lyerly	Cardiff By The Sea	CA
Erin Lynch	Los Angeles	CA
Michal Lynch	Santa Barbara	CA
Wendy Lynch	Los Angeles	CA
Esther Lyndon	Mckinleyville	CA
Georgia Lynn	Bakersfield	CA
Rhonda Lynn	Sacramento	CA
Franceska Lynne	Hollywood	CA
Marsha Lyon	Escondido	CA
C M	Lincoln	CA
RENE MADERA	Chula Vista	CA
VIRGINIA MARIPOSA	Santa Barbara	CA
MARY MARTINEZ	South Gate	CA
JOHN MAYBURY	Pacifica	CA
SANDRA MCNEA	San Diego	CA
CHRIS MORANO	Guerneville	CA
Molly MacGregor	Santa Rosa	CA
Diane MacInnes	Tujunga	CA
Chris MacKrell	Long Beach	CA
Sara MacKusick	Berkeley	CA
Hannah MacLaren	Altadena	CA
Ismael Macias	Sacramento	CA
Donald Mackay	South Pasadena	CA
Claudia Mackey	Stockton	CA
Mel Mackler	San Diego	CA
David MacMurray	Tujunga	CA
Loren Madsen	Laytonville	CA
Stanley Maeschen	Cathedral City	CA
Catherine Magill	Palo Alto	CA
Jim Maguire	Moreno Valley	CA
Michael Maharry	Fairfield	CA
Gloria Linda Maldonado	Redwood City	CA
Susan Maletsky	Sonora	CA
Karen Malley	Anaheim	CA
Sonja Malmuth	Santa Ynez	CA
Marsha Malone	Chino	CA
Stephen Manly	Sacramento	CA
Courtney Mann	North Hollywood	CA
Laura Manning	Goleta	CA
Dana Mantle	Los Gatos	CA
Lorretta Marcel	San Francisco	CA
Martin Marcus	San Diego	CA
Sandra Mardigian	Mill Valley	CA
Alvaro Marin	Huntington Park	CA
Amber Mariscal	MONTEREY PARK	CA
Cheryl Markman	San Jose	CA
Saul Markowitz	Burbank	CA
Diane Marks	Bass Lake	CA

Joan Marks	Tehachapi	CA
Mary Markus	Garden Grove	CA
Patricia Marlatt	Los Angeles	CA
David Marsh	Los Angeles	CA
Sherry Marsh	Oceanside	CA
Geri Marshall	Modesto	CA
Rj Marshall	Grover Beach	CA
Brad Martin	Fresno	CA
Bradford Martin	Redlands	CA
Cara Martin	Los Angeles	CA
Mickey Martin	Diamond Bar	CA
Jennifer Martinez	San Jose	CA
Michele Martinez	Hayward	CA
Jennifer Suzanne Martino	Dixon	CA
Anna Mashevich	Sherman Oaks	CA
Cheryl Maslin	Alameda	CA
Eileen Massey	Oakland	CA
Thomas Masterson	Chico	CA
Rebecca Mastoris	Watsonville	CA
Patricia Matejcek	Santa Cruz	CA
James Mathews	San Mateo	CA
Dale Mattes	Pasadena	CA
Kate Matthews	Sunnyvale	CA
Tamara Matz	Los Angeles	CA
Timothy Maurer	Anaheim	CA
Casee Maxfield	Los Angeles	CA
Ally May	Sonoma	CA
Geraldine May	Santa Margarita	CA
Julie May	Los Angeles	CA
Alberta Mayo	Sierra Madre	CA
Persephone Maywald	Orinda	CA
Devin Mc	Santa Rosa	CA
Brian Mc Credie	Thousand Oaks	CA
Teresa McBride	Mountain Ranch	CA
Janet McCalister	Paradise	CA
Louis McCarten	Glendale	CA
Kelly McClanahan	Ventura	CA
Andrea McClure	Napa	CA
Judith McClure	Canyon Country	CA
Sandra McConnell	West Sacramento	CA
Steve McCourt	Joshua Tree	CA
Mary McCue	Mountain View	CA
Paul McDermott	Los Angeles	CA
Claude McDonald	San Jose	CA
Marie McDonough	Raymond	CA
Rebecca McDonough	Menlo Park	CA
Holly McDuffie	North Hollywood	CA
Marcia McDuffie	Rodeo	CA
Maureen McGee	Pacific Palisades	CA

Ron McGill	Irvine	CA	
Noelle McGuinness	Santa Monica	CA	
Julian McIntyre	Laguna Beach	CA	
Rene McIntyre	San Francisco	CA	
Marshal McKitrick	Sacramento	CA	
Shoshanah McKnight	Santa Cruz	CA	
Lynette McLamb	Forest Knolls	CA	
Rohana McLaughlin	San Anselmo	CA	
Kinsey McLean	Los Angeles	CA	
Shawnee McLemore	San Diego	CA	
Gail McMullen	Los Angeles	CA	
Nick McNaughton	Los Angeles	CA	
Elizabeth McQuiston	San Rafael	CA	
Dale McRaven	Hidden Hills	CA	
Kelly McVey	Anaheim	CA	
Lindsey Mcmanus	LONG BEACH	CA	
Cathy Mcpeek	Palm Springs	CA	
Stacey Mcrae	Indio	CA	
Sherry Meddick	Silverado	CA	
Ernest Medeiros	Forestville	CA	
Oliver Medzihradsky	South Lake Tahoe	CA	
Mary Lou Meeks	Palo Alto	CA	
Ken Meersand	Shell Beach	CA	
Apryl Mefford-Hemauer	Santa Monica	CA	
Michelle Mehlhorn	Richmond	CA	
Marianna Mejia	Soquel	CA	
Hillary Melin	Culver City	CA	
Rose Marie Menard	San Francisco	CA	
Molly Mendez	Oakley	CA	
Gabrielle Menendez	Napa	CA	
Richard Mercer	San Rafael	CA	
Michael Merenda	Santa Barbara	CA	
Jane Merkel	Eureka	CA	
Rodney Merrill	Berkeley	CA	
Michael Merz	San Rafael	CA	
Twyla Meyer	Pomona	CA	
M Meyers	Upland	CA	
Joel Meza	San Francisco	CA	
Debora Michel	Laguna Hills	CA	
Douglas Milburn	Wrightwood	CA	*I love wild fish.*
A.M. Miller	Sunnyvale	CA	
Bob Miller	Woodland Hills	CA	
Carole Miller	North Hollywood	CA	
Donna Miller	N. Hollywood	CA	
Jim Miller	Carlsbad	CA	
Nancy Miller	Santa Maria	CA	*Do the right thing.*
Robert Miller	Aliso Viejo	CA	*In addition, with the acidification of the oceans, this must be taken into account. Just this week I read an article about an oyster farmer who lost ALL of his larvae - they did not develop into spat. At an ocean acidification symposium just last week it was reported:*

“Climate change is making oceans warmer and more acidic. ‘We are beginning to understand what will happen. I think we can expect the worst,’ Gattuso told Tierramérica. Gattuso is one of nearly 600 scientists from around the world who presented their research on Sep. 24-27 at the Third International Symposium on the Ocean in a High-CO2 World: Ocean Acidification in Monterey, California.”

Steven Miller	Lakeside	CA
Constance Milligan	Berkeley	CA
Maureen Milligan	Marina Del Rey	CA
Michael Mills	San Francisco	CA
Randy Mills	Culver City	CA
Pat Mimeau	San Francisco	CA
PD Minn	Northridge	CA
Adolfo Miralles	San Dimas	CA
Lore Miranda	Carlsbad	CA
Brent Mitchell	Carlsbad	CA
Ina Mitchell	Van Nuys	CA
Jolina Mitchell	Marina Del Rey	CA
Linda Mitchell	San Rafael	CA
Eileen Mitro	Ukiah	CA
Michael Mitsuda	Fremont	CA
Donna Mo	Glendale	CA
Tas Moanna	North San Juan	CA
Carol Mock	Fremont	CA
Michael Moeller	Hemet	CA
Sasha Moiseyev-Foster	Palo Alto	CA
Bianca Molgora	San Francisco	CA
Diane Monaghan	Burbank	CA
Janet Monfredini	San Francisco	CA

PLEASE PLEASE PLEASE BE PROACTIVE AND HELP US CARETAKE OUR OCEANS AND IT’S ECOSYSTEMS.

Dean Monroe	N Hollywood	CA
James R (Randy) Monroe	Concord	CA
Christie Monson	El Cerrito	CA
Anthony Montapert	Ventura	CA
Delia Moon	Santa Barbara	CA
Howard Moore	San Diego	CA
Hugh Moore	Hawthorne	CA
Melissa Moore	Arcata	CA
mary Moore	Oakland	CA
Jeffrey Morales	Upland	CA
Karla Morales	N Hollywood	CA
Tanya Morales	Valley Vlg	CA
Donald Morey	Walnut Creek	CA
Linda Morgan	San Pablo	CA
Niles Morgan	Rocklin	CA
Keith Morris	Los Angeles	CA
Marjorie Moss	Del Mar	CA
Phyllis Mottola	Bishop	CA
Peter Mounier	Morro Bay	CA
Ann Moyer	Westlake Village	CA
Mark Mulder	San Jose	CA

Christine Mulholland	Huntington Beach	CA
Kris Muller	Berkeley	CA
Alixandra Mullins	Aptos	CA
James Mundy	Inglewood	CA
Alex Munguia	Daly City	CA
Jeanne Munoz	San Francisco	CA
Myra Munoz	Alhambra	CA
Kimberly Murphy	San Diego	CA
Marci Murphy	Ojai	CA
Verona Murray	Oroville	CA
Catherine Murty	San Francisco	CA
Brandon Musselman	West Hollywood	CA
Adele Myers	Meadow Valley	CA
Deborah Myers	Vacaville	CA
S NICOLA	Los Angeles	CA
Gary Naake	Nevada City	CA
Janet Nace	Saratoga	CA
Renee Nadalin	Carmel	CA
Nikki Nafziger	Vallejo	CA
Jerry Nailon	Sacramento	CA
Jim Nakata	Citrus Heights	CA
Tom Nash	Rohnert Park	CA
Thomas Nass	Pioneer	CA

Thomas O. Nass' Paraphrase and Enhancement of W.C. Lowdermilk , U.S. Dept of Agriculture 1948, from "Conquest of the Land Through 7,000 Years" This Holy Earth Thou shall inherit this Holy Earth as a Faithful Steward, respecting, protecting and conserving its Environment, its Resources and its Productivity for future generations. Thou shall safeguard its Fields from erosion; its Soils and sub-Surface from Chemical Saturation; its Waters, its Ground Waters and its Air from chemical Pollution and over-heating. Its Oceans from over fishing; its Forests from desolation; its Mineral Resources from depletion; its Hills from overgrazing by thy herds and its Creatures from extinction. All this so that thy descendants may enjoy its abundance as once did thee. As all Nations do share in the Ownership of this Holy Earth. Ergo, if any Nation or its leaders should fail in the responsibilities of their Stewardship, then all of thy Crop land shall become sterile ground with wasting gullies; thy waters unfit to drink; thy air too thick to breath; the meat of thy herds and thy flocks, as the spawn of thy waters and thy oceans, unfit to eat. If any of the above should come to pass, then thy descendants shall gradually diminish in their number and eventually depart in their entirety from off the face of this Holy Earth. Why? Because insatiable, sociopathic, corporate, GREED and ignorance of their ignorance of all things except their "Bottom Line" shall have decreed it so. Corporate "PROFITS" and a "Clean Environment" are not, and never will be, compatible. Corporate Credo -to which their sycophants subscribe: "Rather no Planet at all than a Planet where our insatiable, sociopathic GREED cannot be satisfied. Restrictions, Safety Regulations and the Environment be Damned!"

Maurita Nations	Templeton	CA
Clark Natwick	Pacifica	CA
Sandra Nealon	Laguna Beach	CA
Candace Neff	San Leandro	CA
Mary Nelson	Mission Viejo	CA
Scott Nelson	Bethel Island	CA

Richard Adrian Nelson, Jr.	Santa Barbara	CA	
Alice Neuhauser	Manhattan Beach	CA	
Carol Newton	Los Angeles	CA	
Roger Newton	Chula Vista	CA	
Tran Nham	Long Beach	CA	
Penny Nichols	Middletown	CA	
Sharon Nicodemus	Sacramento	CA	
Sharon Niederhaus	Portola Valley	CA	
Randi Nielsen	Richmond	CA	
Sharon Nienberg	Redondo Beach	CA	
Christina Nillo	W Hollywood	CA	
Tiki Nilsen	Los Angeles	CA	
Katherine Nolan	Cupertino	CA	
William Nolan	Browns Valley	CA	
Dale Noonkester	Potrero	CA	
James Noordyk	San Diego	CA	
Laila Noori	San Jose	CA	
Deborah Nord	Albion	CA	
Linda Norrington	Los Alamitos	CA	
Richard North	Valencia	CA	
Lisa Northrup	Buellton	CA	
Toni Notar	Hollister	CA	
Courtney Nouh	Valencia	CA	
Maria Nowicki	San Francisco	CA	
Britney Nucci	Manhattan Beach	CA	
Carlos Nunez	Reseda	CA	
Gertrude Nuttman	San Francisco	CA	
Marcie O'Brien	Los Angeles	CA	
Cathleen O'Connell	Boulder Creek	CA	
Carita O'Connor	Los Alamitos	CA	
Kevin O'Connor	Davis	CA	
Sherry O'Connor	Hollywood	CA	
Willa O'Connor	Kensington	CA	
Kelly O'Donnell	Los Angeles	CA	
Polly O'Malley	Los Angeles	CA	
RICHARD OLNEY	San Francisco	CA	
Noel Oates	La Jolla	CA	
Edward Oberweiser	Fort Bragg	CA	
Bruce Odelberg	Kirkwood	CA	*Please, this is an important issue for the future of our oceans*
Susanna Odry	Fish Camp	CA	
Descendants Oftheearth	Oxnard	CA	
Rick Ohren	Richmond	CA	
Audrey Okubo	San Jose	CA	
Dylan Oldenburg	Pacific Palisades	CA	
Jan Oldham	Santa Barbara	CA	
Ann Oliver	Sacramento	CA	
Jerry Oliver	Sylmar	CA	
Diane Olson	Santa Monica	CA	*THIS WOULD BE SUCH A GOOD LONG TERM APPROACH TO KEEPING OUR OCEANS HEALTHY YOU MUST PROCEED WITH IT AS QUICKLY AS POSSIBLE.*

M. Olson	Sunnyvale	CA	
Gerald Orcholski	Pasadena	CA	*Don't you think you need to finish what you so admirably started.*
Karen Ornelas	San Pedro	CA	
Valerie Orner	San Mateo	CA	
Lionel Ortiz	Bayside	CA	
Jessie Osborne	Vista	CA	
Wendy Oser	Berkeley	CA	
Herman Osorio	Lincoln	CA	
David Osterhoudt	Rancho Santa Margarita	CA	
Julie Ostoich	Sacramento	CA	
Kristen Ostro	San Francisco	CA	
Kathleen Ott-Davis	San Leandro	CA	
Tina Overland	Encinitas	CA	
Laura Overmann	Burlingame	CA	
Roger Overton	Winterhaven	CA	
Julie Owen	Berkeley	CA	
Randy Owens	Elk Grove	CA	
Shirley Ozenberger	El Cerrito	CA	
ROBERT PARKER STELLATO	Redwood City	CA	
Grace Padelford	Los Angeles	CA	
Urmila Padmanabhan	Fremont	CA	
Garril Page	San Anselmo	CA	
James Page	Petaluma	CA	
Marlon Paine	Venice	CA	
Michelle A. Palladine	Palm Springs	CA	
Phillip Palmejar	San Diego	CA	
Francis Palmer	Sacramento	CA	
Danielle Palomo	Hemet	CA	
Jon Pankin	Mill Valley	CA	
Robert Pann	Los Angeles	CA	
Jennifer Pardini	Fremont	CA	
Melina Paris	Rolling Hills Estates	CA	
Noel Park	Bellflower	CA	
Samuel Park	Fullerton	CA	
Susie Park	Long Beach	CA	
Anna Parker	Fresno	CA	
Janice Parker	Sonora	CA	
Laura Parks	Ben Lomond	CA	
Patricia Parsons	Sacramento	CA	
Jeannie Pascuzzi	Orange	CA	
David Patinella	Los Angeles	CA	
Tatjana Patitz	Malibu	CA	
Cynthia Patrick	Fremont	CA	
Jennifer Patrick	Reseda	CA	
Jack Patterson	Truckee	CA	
Vincent Patti	Long Beach	CA	
Gary Patton	Santa Cruz	CA	
Elizabeth Paulson	Hesperia	CA	
Gregory Pavlidis	Simi Valley	CA	

Laura Pavloff	Big Sur	CA	
Jerry Peavy	Chico	CA	
Laura Peck	Indio	CA	
karin Peck	Carmichael	CA	
Donna Pedroza	Alameda	CA	
susan Pelican	Woodland	CA	
Andrea Pellicani	Santa Rosa	CA	
Nicola Peluso	Santa Rosa	CA	
GreciaPena Pena	Los Angeles	CA	
Suzanne Pena	Fullerton	CA	
Terrence Pennington	Benicia	CA	
Daniel Penunuri	Bellflower	CA	
Dean Peppard	Downey	CA	
Lauren Pepper	Gilroy	CA	
Dan Perdios	Palm Springs	CA	
Luise Perenne	Fountain Valley	CA	
JAime Perez	FEDERAL	CA	
James Perkins	Costa Mesa	CA	
K Perlman	Aptos	CA	
Cyrle Perry	Orinda	CA	
Judy Perry	Fremont	CA	
Yuka Persico	Simi Valley	CA	
Dawn Peterson	Santa Rosa	CA	
Nancy Peterson	Scotts Valley	CA	
Ronald Peterson	Carmichael	CA	
Stanley Peterson	Los Banos	CA	
Kyle Petlock	Los Angeles	CA	
Carolyn Pettis	Santa Clarita	CA	
Long Pham	Westminster	CA	
Tami Phelps	Redding	CA	
Regina Phillips	Winnetka	CA	
Deborah Pierce	San Francisco	CA	
Nuri Pierce	La Mesa	CA	*We have exploited the ocean bounty with little regard for sustain-ability. We have now seen what a blind attitude that was. So it is time to ensure that the ocean remains healthy and productive. So for this I am writing to urge the council to adopt a Fishery Ecosystem Plan in a timely manner and to make sure it includes concrete measures to keep plenty of prey in the water. With the Pew Environmental Group who monitors the ocean I urge you to support the base of hte food chain on which we all living beings depend.*
Amy Pierre	Oakland	CA	
Gary Pierson	Jackson	CA	
Christopher Pinckley	Lafayette	CA	
Ed Pinson	Monrovia	CA	
Jayne Pitchford	Santa Monica	CA	
Richard Placone	Palo Alto	CA	*PLEASE COMPLETE YOUR TASK. OUR OCEANS ARE UNDER CON-STANT ATTACK FROM NOT JUST THE FISHING INDUSTRY, BUT NOW THE US NAVY WITH ITS SONIC UNDERWATER BLASTS. HUMAN LIFE DEPENDS UPON A HEALTHY OCEAN. WHO EVER THOUGHT HUMAN ACTIVITIES COULD DESTROY SUCH A VAST RESOURCE, BUT WE ARE MANAGING TO DO JUST THAT*
Jeff Plapp	San Diego	CA	

Alice Polesky	San Francisco	CA
Josephine Polifroni	Danville	CA
Jeri Pollock	Altadena	CA
Stina Pope	Pacifica	CA
Monteque Pope-LeBeau	Los Angeles	CA
Kathy Popoff	San Pedro	CA
Ana Porcellino	Santa Clarita	CA
Susan Porter	Pasadena	CA
Robert Pousman	Malibu	CA
Kamal Prasad	Santa Rosa	CA
Lynne Preston	San Francisco	CA
Brittany Price	Huntington Beach	CA
Faith Price	Encinitas	CA
Kevin Price	Glendale	CA
Laurie Price	Redwood City	CA
Nancy Pritchard	Eureka	CA
Penelope Prochazka	Pasadena	CA
Stephanie Proctor	Van Nuys	CA
Steven Proe	Greenwood	CA
Mary Prophet	Berkeley	CA
Lauri Provencher	Los Angeles	CA
James Provenzano	Los Angeles	CA
Charlotte Prozan	Sanfrancisco	CA
Paula Pruner	North Hollywood	CA
Cindy Psareas	Irvine	CA
Richard Puaoi	Novato	CA
Stephen Purvis	Santa Monica	CA
Brad Putz	Sonora	CA
Matthew Quellas	Los Angeles	CA
Pat Quimby	Los Angeles	CA
Leslie Rabb	Los Angeles	CA
Velma Race	Madera	CA
Ruta Radzins	San Francisco	CA
Brad Rae	Lake Forest	CA
Linda Rae Savage	San Leandro	CA
Annette Raible	Petaluma	CA
Sara Rajan	Soquel	CA
David Raleigh	San Luis Obispo	CA
Angelica Ramirez	Los Angeles	CA
Eury Ramos	Hayward	CA
Paul Ramos	Solvang	CA
Rudy Ramp	Arcata	CA
Mel Randall	Studio City	CA
Dee Randolph	Chico	CA
Cynthia Ratliff	Santa Cruz	CA
Karen Ratzlaff	Santa Rosa	CA
Maria Rausis	Mountain View	CA
Anita Ray	San Jose	CA
Maryellen Redish	Palm Springs	CA

Alainna Reece	La Mesa	CA
Frank Reed	Northridge	CA
Randi Reed	North Hollywood	CA
Brenda Reese	Campbell	CA
Gary Reese	San Clemente	CA
Andrew Reich	Los Angeles	CA
Jaimie Reichert	Bakersfield	CA
John Reilly	Lincoln	CA
Dominique Reimann	San Diego	CA
Don Reinberg	Mill Valley	CA
Robin Reinhart	San Diego	CA
Emil Reisman	Encino	CA
Gail Reisman	Newport Beach	CA
Simone Rendell-Shelby	Los Angeles	CA
Ann Rennacker	Fort Bragg	CA
Phil Reser	Chico	CA
Alicia Retes	San Diego	CA
Socorro Reyes-McCord	San Jose	CA
Kevin Reynolds	Hayward	CA
Sharon Reynolds	Mount Shasta	CA
Chris Rice	Sunol	CA
Jay Rice	Novato	CA
Steven Richards	Fremont	CA
Lynette Ridder	Concord	CA
Heather Rider	Los Angeles	CA
Dale Riehart	San Francisco	CA
Nancy Riggleman	Tollhouse	CA
Brent Riggs	Inglewood	CA
Martin Riley	Corona	CA
Arlene Rinaldo	San Jose	CA
Sean Ring	Santa Cruz	CA
Jen Rios	San Jose	CA
Alisa Risso	Mission Viejo	CA
Donna Ritola	Petaluma	CA
Cierna Ritts	Garden Grove	CA
Barbara Robbin	Studio City	CA
Lance Robert	San Diego	CA
Cristina Roberts	El Centro	CA
Gail Roberts	Jamul	CA
James Roberts	Pomona	CA
Katherine Roberts	San Francisco	CA
Steven Roberts	Oceanside	CA
Merilie Robertson	Canoga Park	CA
Nadia Robertson	North Hollywood	CA
Steve Robey	Berkeley	CA
Lisa Robie	Oakland	CA
Etta Robin	Bakersfield	CA
Jennifer Robins	Huntington Beach	CA
Sidney Robles	Napa	CA

Terrell Rodefer	Van Nuys	CA
Colleen Rodger	San Francisco	CA
Sharon Rodrigues	Fremont	CA
Kevin Rodriguez	San Diego	CA
Christina Roe	Fresno	CA
Gregg Roebuck	Los Angeles	CA
James Rogers	Richmond	CA
Kathleen Rogers	Paramount	CA
Margaret Rogers	Redwood City	CA
Kathi Rolbeck	Placerville	CA
David Romain	Richmond	CA
Mary Romanek	Santa Monica	CA
Michael Romanelli	Santa Monica	CA
Gwen Romani	Castaic	CA
Gwen Romani	Castaic	CA
Arlene Romero	Lincoln	CA
Valerie Romero	Quincy	CA
Terres Ronneberg	Tracy	CA
Van Rookhuyzen	San Francisco	CA
Jessie Root	Oceanside	CA
Greg Rosas	Castro Valley	CA
Louisa Rosenberg	Orinda	CA
Richard & Carol Rosenstein	Los Angeles	CA
Howard Rosenthal	San Mateo	CA
David Ross	Santa Cruz	CA
Glenn Ross	Eureka	CA
Wilson Ross	San Francisco	CA
Ray Rossi	Santee	CA
Michael Rotcher	Mission Viejo	CA
Julie Roth	Hermosa Beach	CA
Roxanne Rothafel	Santa Cruz	CA
Patricia Rothchild	Bodega Bay	CA
Gidalia Rothman	San Francisco	CA
Ronald Rotter	Berkeley	CA
Susan Rowe	Coarsegold	CA
Louise Rozansky	Chatsworth	CA
Allen Rozelle	Santa Cruz	CA
Scott Rubel	Los Angeles	CA
Susan Rubin	Los Angeles	CA
Mark Rudningen	Citrus Heights	CA
Rikje maria Ruiter	Utrecht	CA
Sylvia Ruiz	Los Angeles	CA
Thomas Rummel	Los Angeles	CA
Julia Russell	Sacramento	CA
Michael Russell	San Francisco	CA
Lucymarie Ruth	Richmond	CA
Katharine Ruthroff	Eldridge	CA
Ben Ruwe	Felton	CA
Anne Ryan	San Francisco	CA

Chad Ryan	Grass Valley	CA	
Shelly Ryan	Antioch	CA	
jacqueline Ryan	San Anselmo	CA	
Svetha S	Los Angeles	CA	
CARMEN SANCHEZ SADEK	Los Angeles	CA	*¡¡¡MUCHAS GRACIAS!!!*
NANCY SCHLEGEL	Carmel Valley	CA	
JAKE SCHWARTZ	RTALUMA	CA	
LINDA SEELEY	San Luis Obispo	CA	
PATRICE SENA	Pasadena	CA	
CAROLE SHELTON	Los Angeles	CA	
SUSAN STAFFPRD	Fresno	CA	
Christina Sabin	Grass Valley	CA	
Ellen Sabine	Napa	CA	
Darla Sadler	San Jose	CA	
Roger Sadler	Highland	CA	
Nina Sagheb	San Diego	CA	
Don Saito	San Jose	CA	
Laura Salanitro	Newport Beach	CA	
Vidal Salas	Highland	CA	
Freda Salatino	Felton	CA	*Please expedite a Fishery Ecosystem Plan, with concrete measures to keep plenty of prey in the water.*
Joe Salazar	Santa Rosa	CA	
R Salido	La Habra	CA	
Katherine Salinas	Arcata	CA	
Mary Salome	San Francisco	CA	
Antoinette Samardzic	Los Angeles	CA	
Donna Sams	San Diego	CA	
Sybil Sanchez	Petaluma	CA	
marcia Sandberg	Covina	CA	
David Sanders	Glendora	CA	
Karen Sanders	Sonoma	CA	
Urmila Joi Sandhu	Willits	CA	
Gustavo Sandoval	San Mateo	CA	
Natasha Sankovitch	La Jolla	CA	
Kathryn Santana	Bradbury	CA	
Deborah Santone	San Ramon	CA	
Nancy Sanzone	San Ramon	CA	
Julie Sasaoka	Concord	CA	
Maryann Satriano	Imperial Beach	CA	
Patricia Savage	Mammoth Lakes	CA	
Carol Savary	San Francisco	CA	
Buck Sawyer	Oxnard	CA	
Carol Sawyers	Santa Cruz	CA	
Jillian Saxty	Alameda	CA	
Fred Sayre	mokelumnje hill	CA	
Kira Schabram	Valley Spgs	CA	
Billie Schadt	Valley Village	CA	
David Scharf	Los Angeles	CA	
Mark Schecter	Cayucos	CA	
Karen Scheuermann	Cottonwood	CA	

Lauren Schiffman	El Cerrito	CA	
Henry Schlinger	Burbank	CA	
Nadya Schmeder	Napa	CA	
Debra Schonfeld	San Diego	CA	
Dawn Schrey Colvin	San Pablo	CA	
Gabriele Schubert	San Diego	CA	
Gillian Schultz	Sunnyvale	CA	
Evelyn Schumacher	n/a	CA	
Joan Schur	Long Beach	CA	
Jeanne Schuster	Pasadena	CA	
Lee Schuster	Mira Loma	CA	
Arna Schutz	West Hills	CA	
Don Schwartz	Larkspur	CA	
Eric Schwartz	Santa Barbara	CA	
Martha Schwartz	Santa Cruz	CA	
Dena Schwimmer	Los Angeles	CA	
David Scott	Ontario	CA	
Edgar Scott	Redondo Beach	CA	
Johanna Scott	Reseda	CA	
Deanna Seagraves	Soquel	CA	
Ronald Season	Calabasas	CA	
John Sefton	Trabuco Canyon	CA	
Ellen Segal	Palm Springs	CA	
Miyuki Seko	Fountain Valley	CA	
Lisa Selby	Santa Rosa	CA	
Janet Seldon	San Francisco	CA	
Victor Selten	Palm Springs	CA	
Meg Seltzer	Studio City	CA	
Rob Seltzer	Malibu	CA	
Yoko Senesac	Torrance	CA	
Christine Sepulveda	Anaheim	CA	
Cathie Serletic	San Francisco	CA	
Michael Serra	Venice	CA	
Brenda Serrano	Sonoma	CA	
Neena Sessa	South San Francisco	CA	
Percy Severn	Newbury Park	CA	
Paul Shabazian	Granada Hills	CA	
Elizabeth Shafer	Huntington Beach	CA	
Casey Shaffer	Chico	CA	
Parag Shah	Mountain View	CA	
Gerald Shaia	Sun Valley	CA	
Evan Shamoon	Los Angeles	CA	
Timothy Shanahan	Fountain Valley	CA	
Susie Shapira	San Francisco	CA	
Virginia Sharkey	Santa Rosa	CA	
Pat Sharp	Grass Valley	CA	
Jayna Sheats	Palo Alto	CA	
Gabriel Sheets	Merced	CA	
Dorothy Shelley	Napa	CA	*I am a resident of Napa,California and I want to urge you to adopt a strong Fishery Ecosystem Plan to protect the Pacific Marine Ecosys-*

tem. It is important that a healthy forage fish population is permitted to thrive

Marilyn Shepherd	Trinidad	CA
Lindsey Shere	Healdsburg	CA
Leslie Sheridan	Clearlake	CA
wayne Sheridan	sf	CA
Richard Sherman and family	Berkeley	CA
Nick Shestople	Temecula	CA
J. Shoemaker	Sacramento	CA
Martha Shogren	Sebastopol	CA
Nathaniel Shrage	Claremont	CA
Laura Shrewsbury	Venice	CA
Lois Shubert	Camarillo	CA
Mary Lou Shurtleff	Sacramento	CA
Marguerite Shuster	Sierra Madre	CA
John Shutt	Redondo Beach	CA
Mercy Sidbury	Sebastopol	CA
Eileen Siedman	Mill Valley	CA
Sheila Silan	Somerset	CA
Joe Silk	Riverside	CA
Uly Silkey	San Francisco	CA
Dan Silver	Los Angeles	CA
Jon Silver	Portola Valley	CA
Bella Silverstein	Studio City	CA
Julian Siminski	Studio City	CA
Ed Simmons	San Diego	CA
Johanna Simmons	Brentwood	CA
Jamie Simon	Encinitas	CA
Philip Simon	San Rafael	CA
E Sylvia Simpson	Helendale	CA
Laura Simpson	Mckinleyville	CA
Paul Sinacore	Tujunga	CA
Debra Singer	Oakland	CA
Loni Sipes	Sacramento	CA
Angela Sirmenis	Northridge	CA
Burt Siskin	Chatsworth	CA
Kate Sky	Gualala	CA
Beverly Slapin	Berkeley	CA
Julie Slater-Giglioli	West Hollywood	CA
Nicole Slaton	Davis	CA
Robert Slavik	San Diego	CA
Crystal Slusher	San Diego	CA
Bobbi-Lee Smart	Anaheim	CA
Austin Smith	Los Angeles	CA
Bret Smith	Santa Cruz	CA
Carol Smith	Gilroy	CA
David Smith	Irvine	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	
Sam Smolker	West Hollywood	CA	
William Sneiderwine	San Diego	CA	
Todd Snyder	San Francisco	CA	
David Soares	Pollock Pines	CA	
Monique Soares	Watsonville	CA	
Fred Sokolow	Santa Monica	CA	
Rita Sokolow	Los Angeles	CA	
Barbara Sommars	Long Beach	CA	
Rachel Sonnenblick	Santa Cruz	CA	
Reyna Sorauf	Santa Cruz	CA	
Robert Sorel	Ojai	CA	
Susanna Sorin	Artesia	CA	
Joyce Sortland	Grass Valley	CA	
shannon Southard	Folsom	CA	
Michael Souza	San Diego	CA	
Michael Spadoni	Rail Road Flat	CA	
Margaret Spak	Menlo Park	CA	
Donita Sparks	Los Angeles	CA	*YOU CAN BE HEROES!!!*
Kathryn Spence	San Francisco	CA	
Julie Spickler	Menlo Park	CA	
Dollie Spinks	Concord	CA	
Simone St Clare	Martinez	CA	
Deborah St. Julien	San Jose	CA	
Angela Stablein	Los Angeles	CA	
tom Stampalia	Los Angeles	CA	
Elizabeth Standard	N Hollywood	CA	
Steven Standard	Bellflower	CA	
Edh Stanley	Sacramento	CA	
Paul & Becky Statman	Santa Monica	CA	
Barrie Stebbings	Bolinas	CA	
Cheryle Steele	Whittier	CA	
Kenneth Steele	Redding	CA	
Bradford Lee Steele, Ph.D.	Springville	CA	
Charleen Steeves	Topanga	CA	
Eric Steffen	Richmond	CA	
Irene Steffen	Castroville	CA	
Wayne Steffes	Redding	CA	
Richard Steiger	San Jose	CA	
Diane Steinberg	Los Altos Hills	CA	
Joseph Steinberger	San Francisco	CA	
Therese Steinlauf	Marina Del Rey	CA	*Thank you, especially for caring!!*
Barry Stelling	Sonoma	CA	
Dorothea Stephan	Winzer	CA	
John Steponaitis	San Francisco	CA	
Arlene Stevens	Sacramento	CA	
Christine Stewart	Escondido	CA	
Gail Stewart	Berkeley	CA	

Michael Stewart	Elk Grove	CA	
Richard Stewart	Santa Ana	CA	
Richard Stewart	Westminster	CA	
Sylvia Stewart	Brisbane	CA	*SAVE OUR OCEANS SAVE OUR OCEANS SAVE OUR OCEANS SAVE OUR OCEANS*
Joanna Stiehl	San Francisco	CA	
Holly Still	Menlo Park	CA	
Ron Stock	Paso Robles	CA	
Connie Stomper	Santa Monica	CA	
Francene Stonebraker	Oakland	CA	
Mikerra Stonehawk	Tustin	CA	
Michelle Storace	Danville	CA	
Emily Storar	Sacramento	CA	
Tiffany Story	Summerland	CA	
Geoffrey Stradling	Encino	CA	
Marisa Strange	Long Beach	CA	
Kathleen Strasser	Martinez	CA	
Gerald Stratman	Glen Ellen	CA	
Anthony Stratton	Elk Grove	CA	
Jewels Stratton	San Francisco	CA	
Bill Straus	Encino	CA	
Blackie Straussburg	El Segundo	CA	
Alison Strieker	Santa Barbara	CA	
Caitlin Strom-Martin	Santa Rosa	CA	
Mary Ellen Strote	Calabasas	CA	
Malcolm Stuart	Los Angeles	CA	
Debbie Sturt	Pacific Grove	CA	
Carol Suchecki	Culver City	CA	
Richard Sudden	Paso Robles	CA	
Steven Sugarman	Malibu	CA	
Ann Sullivan	Lakeside	CA	
Edward Sullivan	San Francisco	CA	
Susan Sullivan	Los Angeles	CA	
Patrice Summers	Santa Barbara	CA	
Amber Sumrall	Soquel	CA	
Melissa Sunderland	Sherman Oaks	CA	
Sarah Sundquist	Sherman Oaks	CA	
Beryl Sussman	San Francisco	CA	
Andrew Sutphin	Westlake Village	CA	
John Sutton	Los Angeles	CA	
Erin Suyehara	Torrance	CA	
Paula Swanson	Petaluma	CA	
Kathryn Swartz	Thousand Oaks	CA	
Noel Swerdlow	Sierra Madre	CA	
Mark Swoiskin	Mill Valley	CA	
Angee Sylvester	Lancaster	CA	
Joseph Szabo	Los Angeles	CA	
Peter T. Harrell	Yreka	CA	
S. JULIE TANKENSON	Los Angeles	CA	
Marlene TRAN	San Francisco	CA	

Kenneth Tabachnick	Woodland Hills	CA	
Michael Tabib	Sebastopol	CA	
Jaycel Tacchi	San Rafael	CA	
Jan Tache	Penn Valley	CA	
Barbara Tacker	Newbury Park	CA	
Carol Taggart	Menlo Park	CA	
Mark Takaro	Berkeley	CA	
Dianne Tanaka	Vallejo	CA	*Please - Do Ur Job...or step down if U can't or won't*
Lara Tanaka	Solana Beach	CA	
Barbara Taps	Laguna Niguel	CA	
Georgina Tarry	Moreno Valley	CA	
Kathleen Taugher	Sonoma	CA	
Carol Taylor	Miranda	CA	
Deborah Taylor	San Jose	CA	
Emily Taylor	Los Angeles	CA	
J. Holley Taylor	Penn Valley	CA	
Jennifer Taylor	Arcata	CA	
Melvin Taylor	Sacramento	CA	
Robert Taylor	Porterville	CA	
Timothy Taylor	Los Angeles	CA	
John Teevan	Chula Vista	CA	
Cindy Tejeda	Los Angeles	CA	
Susan Telese	Los Angeles	CA	
Joanne Tenney	Escondido	CA	
Hilda Teran-Franklin	Sonoma	CA	
Michael Terry	Santa Monica	CA	
Terelle Terry	Sacramento	CA	*An ecosystem needs all of its parts. That is why it is called a system. We need to protect the smallest part of this web of life. The job needs to be complete.*
Clarissa Thier	Panorama City	CA	
Kay Thomas	Riverside	CA	
Leonard Thomas	Antelope	CA	
Mike Thomas	San Diego	CA	
Pamala Thomas	Santa Monica	CA	
Patricia Thomas	Palo Alto	CA	
Robert Thomas	San Francisco	CA	
eleanor Thomas	Livermore	CA	
Renee Thomas-Gage	Santa Cruz	CA	
Richard Thomason	Chula Vista	CA	
Bonnie Thompson	Los Osos	CA	
Doug Thompson	Morongo Valley	CA	
Lawrence Thompson	Livermore	CA	
Russell Thorp	San Rafael	CA	
Jan Throndson	Corona Del Mar	CA	
Paula Tiberius	North Hollywood	CA	
Nadya Tichman	Oakland	CA	
Amber Tidwell	Los Angeles	CA	
Philippe Tilikete	Sherman Oaks	CA	
Gabriela Till	San Diego	CA	
Justine Tilley	Los Angeles	CA	

Lori Tishgart	Ross	CA	
Jude Todd	Santa Cruz	CA	
Michael Todisco	Laguna Niguel	CA	
Pela Tomasello	Santa Cruz	CA	
Michael Tomczyszyn	San Francisco	CA	
Tracey Tomtene	Vancouver	CA	
Michael Toobert	Grass Valley	CA	
Sharon Torrisi	Hermosa Beach	CA	*I live on the coast of California for a reason and I want to protect the oceans and all the creatures that depend on its bounty for survival. Please protect forage fish and in doing so you will protect the eco-system, fisheries and the way of life we love*
Jennifer Toth	Santa Clarita	CA	
Lana Touchstone	Vallejo	CA	
Donna Toward	Palm Springs	CA	
Carlos Townsend	Fountain Valley	CA	
Sarah Townsend	San Jose	CA	
Karen Toyohara	La Mesa	CA	
Meghan Tracy	Long Beach	CA	
Bruce Traficante	San Francisco	CA	
Gene R. Trapp & Jo Ellen Ryan	Davis	CA	
Jamie Trask	Mission Viejo	CA	
Carol Tredo-Yolton	Eureka	CA	
Dennis Trembly	Los Angeles	CA	
Bart Trickel	Oakland	CA	
Heidi Trinkle	Pacific Grove	CA	
Tia Triplett	Los Angeles	CA	
Susan Trivisonno	San Jose	CA	
Christine Trumbly	Santa Rosa	CA	
Jessica Tsao	San Jose	CA	
Ann Tubbs	San Francisco	CA	
Greg Tucker	Palo Cedro	CA	
Trish Tuley	Idyllwild	CA	
Mary Tullock	Rohnert Park	CA	
Aiting Tung	Newbury Park	CA	
Joan Turner	Mill Valley	CA	
Sara Turner	Grass Valley	CA	
Michele Tusinac	Oakland	CA	
Samuel Two Bears	Windsor	CA	
Steve Tyler	Orange	CA	
Luci Ungar	Corte Madera	CA	
Ruth Ungar	Oakland	CA	
Art Unger	Bakersfield	CA	
Lisa Ussmann	Costa Mesa	CA	
Jason V	Los Angeles	CA	
Erika Vadopalas	Moss Beach	CA	
Sylvia Valdez	Bishop	CA	
Diana Valle	San Francisco	CA	
deborah s Van Damme	Irvine	CA	
Keaven Van Lom	Truckee	CA	
James Van Valkenburgh	Sacramento	CA	

Robin VanTassell	San Rafael	CA	
Maureen Vanderbosch	Laguna Niguel	CA	
Julie Vandergrift	Fullerton	CA	
Gretchen Vanderlip	Clayton	CA	
Kenneth Vanstory	Benicia	CA	*Please act NOW... maintenance is always MUCH more effective & less expensive than repair...look at the Grand Banks...the earth doesn't need another such example.*
Sherry Vatter	Los Angeles	CA	
Ava Venturelli	Burbank	CA	
Damai Vergara-Hegi	San Juan Capistrano	CA	
Sakura Vesely	Martinez	CA	
Paul Vesper	Berkeley	CA	
Diana Vest Goodman	San Francisco	CA	
Jason Vick	Irvine	CA	
Martin Victor	Burbank	CA	
Barbara Viken	San Francisco	CA	
Carlene Visperas	Concord	CA	
Leanore Vlastelica	San Luis Obispo	CA	
Rowena Vogel	Granada Hills	CA	
Vitaly Volmensky	Pacific Grove	CA	
joe And Mary Volpe	Ventura	CA	
Aajonus Vonderplanitz	Santa Monica	CA	
Richard Vos	San Diego	CA	
Richard Vos	San Diego	CA	
Siamak Vossoughi	San Francisco	CA	
Michael Voyek	Simi Valley	CA	
CODY WALTERS	Bakersfield	CA	
VICTORIA WIERIG	San Diego	CA	
Herman Waetjen	San Anselmo	CA	
Dean Wagner	Napa	CA	
Ed Wainio	San Diego	CA	
Harold Wakefield	Woodland Hills	CA	
Jeremy Wakefield	Oakland	CA	
Deborah Walden	La Verne	CA	
Aura Walker	Los Angeles	CA	
Bill Walker	Santa Cruz	CA	
David Walker	Santa Maria	CA	
Deborah Walker	Concord	CA	
Doyle Walker	Vacaville	CA	
Elizabeth Walker	Vacaville	CA	
Laura Walker	San Francisco	CA	
Amber Wallace	Costa Mesa	CA	
Margaret Wallace	Royal Oaks	CA	
Wendy Wallace	Redlands	CA	
Aleta Wallach	Santa Monica	CA	
Sissy Wallach	Palm Springs	CA	
Violet Wallach	Venice	CA	
Willaim Wallin	Richmond	CA	
Diana Walsh	Mill Valley	CA	
Steve Walworth	La Crescenta	CA	

Abby Wanamaker	Woodland Hills	CA
T.K. Wang	Los Angeles	CA
Lew Warden	Big Bear City	CA
Dee Warenycia	Roseville	CA
Charles Warner	Fontana	CA
Ollie Warner	San Pablo	CA
Tim Warner	Los Angeles	CA
Ari Warren	Soquel	CA
Ronald Warren	Sherman Oaks	CA
Scott Warwick	Monrovia	CA
Ray Waters	Hermosa Beach	CA
Maria Watkins	Capitola	CA
Elaine Watson	Los Osos	CA
Fran Watson	Spring Valley	CA
Susan Watts-Rosenfeld	Riverside	CA
Susan Wayne	xxx	CA
Tracy Weatherby	Mountain View	CA
Glenn Webb	Pinole	CA
Patricia Webber	Coronado	CA
Jamie Weber	Anaheim	CA
William Webster	Oroville	CA
Roger Weed	Walnut Creek	CA
Sharon Weeks	Paso Robles	CA
Karen Wehrman	Castro Valley	CA
Kenneth Weidner	Berkeley	CA
Wendy Weikel	Berkeley	CA
Henry Weinberg	Santa Barbara	CA
Mark Weinberger	San Francisco	CA
Nona Weiner	San Jose	CA
Gary Weinstein	North Hollywood	CA
Mike Weiss	Benicia	CA
Russell Weisz	Santa Cruz	CA
Joanna Welch Lasken	Escondido	CA
Jeannette Welling	Thousand Oaks	CA
LuAnn Wherry	San Diego	CA
Linda Whetstine	Poway	CA
Julie White	Chico	CA
Vilma White	Temecula	CA
Angelica Whitefeather	Los Angeles	CA
Sherri Whittenburg	Antioch	CA
Jill Wiechman	Newbury Park	CA
Chuck Wieland	San Ramon	CA
Monica Wiesener	Calabasas	CA
Nancy Wiest	West Hills	CA
Richard Wightman	Arcadia	CA
Vicki Wiker	San Clemente	CA
Antoinette Wilcox	Sunnyvale	CA
Briana Wilcox	Riverside	CA
Gail Wildman	Mira Loma	CA

Jennifer Will	Morgan Hill	CA
Gerry Williams	Thousand Oaks	CA
Jayna Williams	Ontario	CA
Mara Williams	Sonoma	CA
Monica Williams	Oakhurst	CA
Wayne Williams	Sherman Oaks	CA
Maxine Williams-Gboizo	Santa Monica	CA
Shawn Williamson	Studio City	CA
Cheryl Willis	San Francisco	CA
Jen Willis	SB	CA
Jennifer Willis	San Francisco	CA
Jeff Wilson	Santa Monica	CA
Sara Wilson	Los Angeles	CA
Ken Windrum	Los Angeles	CA
Michael Winn	Antelope	CA
Karen B. Winnick	Beverly Hills	CA
Amanda Withrow	Los Angeles	CA
Andreas Wittenstein	Woodacre	CA
Wendy Wittl	Santa Barbara	CA
Marc Woersching	Valley Village	CA
Lynn Wolf	Saugus	CA
Maurice Wolf	Laguna Woods	CA
Charles Wolfe	Sylmar	CA
Isaac Wollman	San Luis Obispo	CA
Jeffrey Womble	Lodi	CA
Michelle Wong	South Pasadena	CA
Lauren Wood	Los Angeles	CA
Monica Wood	Calabasas	CA
Zion Woods	San Diego	CA
Gerrit Woudstra	lemmer	CA
Denise Wright	Los Angeles	CA
Jim Wright	Murphys	CA
Madeline Wright	Los Angeles	CA
Michele Wright	Laguna Beach	CA
Aimee Wyatt	Long Beach	CA
Tom Wyman	Riverside	CA
Laura Wynkoop	San Dimas	CA
William Yoskowitz	Chico	CA
Denise Yanez	Solvang	CA
Judy Yao	Redondo Beach	CA
Lawrence Yard	Lompoc	CA
Jolene Yates	Lodi	CA
Bryann Ybarra-Weckmann	Willows	CA
Brittney Yore	Davis	CA
Charles York	North Hollywood	CA
Allan And Leigh Young	Novato	CA
Ellen Young	Davis	CA
Sharon Young	Red Bluff	CA
Vincent Zabaly	Burbank	CA

Michael Zagone	Los Angeles	CA
Guy Zahller	Aptos	CA
Eric Zakin	San Mateo	CA
Bia Zamudio	Van Nuys	CA
Jamie Zazow	Santa Monica	CA
John Zediker	Garden Grove	CA
Johanne Zell	Santa Rosa Valley	CA
Steven Zeluck	San Francisco	CA
Elizabeth Zenker	Arcata	CA
Joel Zetzer	West Hollywood	CA
Alysha Zgrabik	Thousand Oaks	CA
Kim Ziegler	Bakersfield	CA
Michael Ziegler	Long Beach	CA
Mark Zimoski	Valley Glen	CA
Jan Zoya	Los Angeles	CA
Katie Zukoski	Chico	CA
Connie Zweig	Calabasas	CA
Beverley Abbey	Morro Bay	CA
Sondra Adam	Walnut Creek	CA
Vinaya Alahan	Guerneville	CA
Connie Alexander	Los Angeles	CA
Dave Alexander	Bellflower	CA
John Alexander	Chico	CA
C.E. Allen	Santa Ynez	CA
Elisabeth Armendarez	Laguna Beach	CA
Marsha Armstrong	Los Gatos	CA
Ed Atkins	BIG BASIN	CA
Victor Ballesteros	San Rafael	CA
Des Banzhaf	Grass Valley	CA
Andrea Bassett	london	CA
Claire Beardsley	Claremont	CA
Corey Benjamin	Los Angeles	CA
Sally Berman	Grass Valley	CA
Adolfo Bermeo	Topanga	CA
Jane Biggins	Ukiah	CA
Betsi Bilyck	San Francisco	CA
Megan Bishop	Walnut Creek	CA
Rollin Blanton	Los Angeles	CA
Shabnam Bormand	Woodland Hills	CA
Gane Brooking	Ventura	CA
Myrna Brown	Rosemead	CA
Robert Brown	Burbank	CA
Walter Brown	Palm Springs	CA
Babette Bruton	Los Gatos	CA
Betty Buchanan	Bakersfield	CA
Marilyn Cambier	Oak View	CA
M. Canter	Tiburon	CA
Nicole Caputo	Petrolia	CA
Camille Cardinale	Los Angeles	CA

Guy Cargulia	San Diego	CA
Laura Carmona-Mancilla	Ventura	CA
Seth Carr	Signal Hill	CA
Chris Carrieri	Santa Rosa	CA
Christina Castle Rey	Fort Bragg	CA
Heather Cauldwell	Monterey	CA
Stacie Charlebois	Santa Rosa	CA
Celeste Chase	Shasta Lake	CA
Ana Chavez	Riverside	CA
Anne Chavez	San Leandro	CA
Grace Chen	Redondo Beach	CA
Katria Child	San Francisco	CA
Pete Childs	Rancho Mirage	CA
Fernando Christensen	Los Angeles	CA
Thomas Clark	Los Angeles	CA
Heather Clough	Ventura	CA
Morgan Coffey	Santa Barbara	CA
Damon Colclough	San Diego	CA
Mary Coleman	Los Angeles	CA
Dan Corral	Hollister	CA
Adam Cote	Santa Barbara	CA
Uma Cox	Brentwood	CA
Robert Crivinar	San Francisco	CA
Nanette Cronk	Truckee	CA
Reyna Cruzado	Culver City	CA
William Cull	Covelo	CA
Susan Curtis	Long Beach	CA
Josiane Dalcourt	San Diego	CA
Jennifer De Poyen	San Diego	CA
Renee De Vicq	Fullerton	CA
Sheedy Dehdashti	Del Mar	CA
Carol Dickason	Sonoma	CA
George & Phyllis Drummond	brentwood	CA
Deborah Dunivant	Burbank	CA
Matthew Ebright	Cupertino	CA
Ian Edwards	Woodacre	CA
Brad Ekstrand	Los Angeles	CA
Josh Elbaum	Los Angeles	CA
John Elliott	Berkeley	CA
Glenn Embrey	Redondo Beach	CA
Angie Emery	Indio	CA
Joan Epstein	Benicia	CA
Dinda Evans	San Diego	CA
Inda Evans	San Diego	CA
Marcia Field	Santa Barbara	CA
Kay Fields	Palo Alto	CA
Simon Firth	Mill Valley	CA
Mary Foley	el dorado hills	CA
Rex Franklyn	Tiburon	CA

Cynthia Fregeau	Victorville	CA	
Johngannon Gannon	Los Angeles	CA	
Erin Garcia	Sherman Oaks	CA	
Karen Garnett	Sacramento	CA	
Annick Gentet	San Diego	CA	
Susan Gill	San Anselmo	CA	
Arturo Giraldez	Stockton	CA	
Mark & Susan Glasser	Los Angeles	CA	
Ellen Golden	San Mateo	CA	
Nancy Golden	San Mateo	CA	
David Goodyear	San Francisco	CA	
Deana Graff	San Diego	CA	
Nina Greenberg	Los Angeles	CA	
Probyn Gregory	LA	CA	
Chris Gruber	Palm Springs	CA	
Jerry Guzman	ca	CA	
Jeannette Hanna	Sacramento	CA	
Stuart Hartley	San Diego	CA	
Nancy Hartman	Lafayette	CA	
Peter Hatch	Aptos	CA	
Marie Henley	Aptos	CA	
Gary Hennemuth	San Francisco	CA	
Rosa Henry	Hemet	CA	
Larry Hermann	Castro Valley	CA	
Walker Hibben	Newport Beach	CA	
Bernard Hochendoner	Patterson	CA	
Steve Holzberg	Folsom	CA	
Clay Howard	Fairfax	CA	
Elaine Huff	San Francisco	CA	
Randy Hunt	Los Molinos	CA	
Monica Jackson	Laguna Beach	CA	
Darynne Jessler	Valley Village	CA	*Kindly regard my opinion as valid even though I am sending this fantastic letter drafted by an organization I support. I work full time, I care deeply about many, many issues and do not have time to draft personalized letters about them all. Do not fault me for this. I am a hard working American who cares about ensuring balanced planning of ecosystems. Try to imagine how little time I have to draft and send letters... I'm single and I work full time. We are talking zero time for letter writing. I am sure I am not alone. You must not disregard ANY of the form letters you receive. You would be wrong to assume that just because it's a form letter that that individual does not care that much about the issue. I do care! We all care! Every single person who sends this form letter cares deeply about this issue!*
Helen Johnson	Ventura	CA	
Leisa Johnson	Long Beach	CA	
Frederique Joly	Venice	CA	
Lance Jordan	San Diego	CA	
Natalie Kalustian	Northridge	CA	
Morgan Kanae	Lemoore	CA	
Lee Kaplan	Encino	CA	
Kimberly Kehl	Canyon Cntry	CA	
Lauren Kelley	Glendale	CA	

Starr Kennelly	Boulder Creek	CA	
Elena Kermani	San Diego	CA	
Renee Klein	Marina Del Rey	CA	
Rebecca Koo	San Jose	CA	
Vicki Kopinski	Menifee	CA	
Carolyn Kubecka	Santa Rosa	CA	
Ron Kutch	San Jose	CA	
Sharon Lacy	Sebastopol	CA	
Leila Larkin	Windsor	CA	
Jane Larsen	Encinitas	CA	*IF WE DON'T SOON ALL THE FISH WILL BE GONE!!!!*
Linda Lemieux	Lakewood	CA	
Nicholas Lenchner	Santa Rosa	CA	
Louise Lewis	Granada Hills	CA	
O Lewis	Los Angeles	CA	
Kortney Lillestrand	Laguna Beach	CA	
Carol Lillis	Albion	CA	
Jan Lochner	Sebastopol	CA	
Jacklyn Loughbom	Manhattan Beach	CA	
Michael Lueras	Santa Monica	CA	
Carol Maehr	Monterey	CA	
Vicki Maheu	San Diego	CA	
Carol Majors	Porter Ranch	CA	
Janet Maker	Los Angeles	CA	
Jacquie Malette	West Covina	CA	
Janet Marbury	Redwood City	CA	
Jesse Marcus	Santa Monica	CA	
Barbara Markowitz	Los Angeles	CA	
Nick Marling	Elk Grove	CA	
Jennifer Martinez	Novato	CA	
John Martinez	Los Angeles	CA	
Kara Masters	Topanga	CA	
Ronald Maxson	Los Angeles	CA	
Mickey Mccarthy	san francisco	CA	
Alejandra Menna	Hollywood	CA	
Alison Merkel	Oak Park	CA	
Melissa Miller	Concord	CA	
Harriet Mitteldorf	Pebble Beach	CA	
Elisa Molina	Redwood City	CA	
Terrence Moore	Ojai	CA	
Mary Etta Moose	San Francisco	CA	
Steve Morris	Los Angeles	CA	
Lance Moseley	Marina Del Rey	CA	
Peter Muhr	San Diego	CA	
Rob Myers	ANAHEIM	CA	
Dawn Navis	Carlsbad	CA	
A. Negele	Venice	CA	
Pam Nelson	Warner Springs	CA	
Maria L Nieto	Pittsburg	CA	
Amir Niknam	Northridge	CA	

Jaye Norrhcote	Bloomington	CA
Lewis Nottke	Vista	CA
John Pasqua	Escondido	CA
Karin Peck	Carmichael	CA
Anne Perkins	Santa Monica	CA
Maureen Perron	Half Moon Bay	CA
David Pinzon	Culver City	CA
Steve Pizzurro	Long Beach	CA
Pam Plummer	Long Beach	CA
Iam Polcyn	Encinitas	CA
Judith Pope	Venice	CA
Craigmedicareforall Ratnour	fort dick	CA
Sabrina Reade	Moreno Valley	CA
Michael Rifkind	Santa Cruz	CA
Denise Roberts	Thousand Oaks	CA
Les Roberts	Fresno	CA
Les Roberts	Fresno	CA
Sam Romero	Stockton	CA
Rob Rondanini	Roseville	CA
Raymond Rossi	Santee	CA
Ralph Roug	Lake Forest	CA
Susan Rudnicki	Manhattan Beach	CA
M Sanders	Petaluma	CA
Michael Sarabia	Stockton	CA
Ray Saturno	El Cerrito	CA
Sandra Schachter	Carmel Valley	CA
Berdalee Schepps	Guerneville	CA
Julie Schloss	Novato	CA
Jon Schroeder	Novato	CA
Michael Schultz	Concord	CA
Jo Sebern	Fallbrook	CA
Maura Sheehan	Encinitas	CA
Qumars Shenasai	Van Nuys	CA
Sundae Shields	Oxnard	CA
Pamela Shoop	Camarillo	CA
Susie Simon	Long Beach	CA
Anita Simons	La Jolla	CA
Joseph Sinda	Long Beach	CA
John Sloan	Marina	CA
Kimaria Smith	Ceres	CA
Lawrence Smith	Mendocino	CA
Erica Sommers	Ventura	CA
Mandy Spitzer	Santa Cruz	CA
Leslie Spoon	Los Osos	CA
Emily St Louis	Milpitas	CA
J Stanton	Dana Point	CA
Lori Stayton	Sherman Oaks	CA
Donald Struggles	Oceanside	CA
Autumn Sun	Santa Cruz	CA

Julie Svendsen	Burbank	CA
F Sylvester	Millbrae	CA
Mandi T	Saratoga	CA
Geraldine Teitelbaum	Garberville	CA
Simon Tejada	Baldwin Park	CA
Kathy Tharp	Fontana	CA
Kimberly Thatcher	Forestville	CA
Paula Thompson	San Diego	CA
Miranda Todd	Redondo Beach	CA
Jami Tolpin	Sherman Oaks	CA
Eugene Tssui	Emeryville	CA
John Vachet	Ojai	CA
Mathias Van Thiel	Hayward	CA
Jennifer Van Zyl	Los Angeles	CA
Kay Von Tress	Menlo Park	CA
Christine Waddell	Emeryville	CA
Steven Waldrip	Carmel	CA
Nathan Walworth	Santa Cruz	CA
Carolyn Watkinson	Atwater	CA
Michael Watson	Sonoma	CA
Philip Welanko	Vallejo	CA
Elizabeth Wharton	Oakland	CA
Heather Wilber	Santa Cruz	CA
Doris Ann Wilcox	Burbank	CA
Anna Williams	Glendale	CA
Bernie Williams	Canoga Park	CA
Betty Winholtz	Morro Bay	CA
Scott Woker	San Diego	CA
Anne Wolf	Santa Rosa	CA
James Otha Wolfenden	big sur	CA
Janice Wood	Lafayette	CA
Tim Woods	Santa Cruz	CA
Aimee Wyatt	Long Beach	CA
Sheila Wyse	Sherman Oaks	CA
Silvana Zelmanovich	bsas	CA
E Zuniga	Santa Monica	CA
Jason Barlow	Boise	ID
Jane Beattie	Ketchum	ID
Dick Bullock	Priest River	ID
Debbie Bush	Priest River	ID
Amanda Campbell	Meridian	ID
D Carino	Boise	ID
Barb Crumpacker	Coeur D Alene	ID
Gloria D'Andrea	Cataldo	ID
Anne Donnolo	Hayden	ID
Paul Ellison	Twin Falls	ID
Kenneth Fisher	Pinehurst	ID
Stephen Hackney	Grangeville	ID
Daniel Hawley	Ketchum	ID

Amy Herber	Nampa	ID	
Carol Kampenhout	Moscow	ID	
Andre Kohler	Pocatello	ID	
Ann-Marie Little	Hayden	ID	
Fritz Meitinger	Bad Tölz	ID	
Michael Miller	Boise	ID	
Sharon Mueller	Idaho Falls	ID	
Katherine Noble	Hailey	ID	
william Rise	Coeur D Alene	ID	
Richard Rusnak Jr	Nampa	ID	
Gustaf Sarkkinen	Moscow	ID	
Jim Sylva	Hansen	ID	
Bonnie Tanner	Eagle	ID	
Bill Ventre	Boise	ID	
Douglas Wagoner	Post Falls	ID	
Mark Weber	Twin Falls	ID	
JUANITA ARJONA	MERIDA	OR	
Nan Adams	Eugene	OR	
Edye Allen	Portland	OR	
Vincent Alvarez	Milwaukie	OR	
Hector R. Amaro	Salem	OR	
Darryn Ambrose	Portland	OR	
Carol Ampel	Medford	OR	*As a citizen from the Pacific coast, I am concerned that the ocean ecosystem is under multiple threats. The loss of the small things, such as forage fish, is one that can quickly unravel the whole.*
Helen Anderson	Troutdale	OR	
Sue Anderson	Aloha	OR	
Terry Andrews	Gold Beach	OR	
Barbara Arlen	Corvallis	OR	
Margalo Ashley-Farrand	Portland	OR	
Susanna Askins	Portland	OR	
Steve Aydelott	Bend	OR	
Darcie Babcock	Portland	OR	
Ward Batson	Albany	OR	
Jacquie Begemann	Canby	OR	
Jennifer Belveal	Sweet Home	OR	
Bonnie Bennett	Eugene	OR	
Beverly Bentley	Medford	OR	
Samuel Berg	Newberg	OR	
Karen Blasche	Hillsboro	OR	
Dana Bleckinger	Yachats	OR	
Sheila Bob	Portland	OR	
Melantha Bobrick	Bend	OR	
Pamela Bond	Lebanon	OR	
Patty Bonney	Portland	OR	
Paul Borcherding	La Grande	OR	
Sarah Bouwsma	Portland	OR	
Susan Boyce	Myrtle Creek	OR	
tom Bradley	Portland	OR	
Peter Branch	Eugene	OR	

David Bridgeman	Beaverton	OR	*I suggest you follow SCIENCE.*
Michael Brown	Eugene	OR	
Cassandra Browning	Salem	OR	
Ruthann Carter	Hillsboro	OR	
Kathy Casson	Portland	OR	
Hellene Chapman	Roseburg	OR	
Eileen Chieco	Ashland	OR	
Marci Clark	Long Creek	OR	
Ann Cobban	Grants Pass	OR	
Mary Cody	Ashland	OR	
Claire Cohen	Lake Oswego	OR	
Felicia Colvin	Seal Rock	OR	
Virginia Conley	Springfield	OR	
Brian Connolly	Bend	OR	
Abigail Corbet	Portland	OR	
Demelza Costa	Sweet Home	OR	
Renee Cote	Wolf Creek	OR	
Nina Council	Ashland	OR	
Victoria Countryman	Portland	OR	
Mark Covell	Astoria	OR	
Kelly Cowger	Portland	OR	
Edward Craig	Eugene	OR	
Rebekah Creswell	Portland	OR	
Ramona Crocker	Beaverton	OR	
Scott Crockett	Florence	OR	
Oceanah D'amore	Talent	OR	
Amy Danielson	Eugene	OR	
Wanda Darland	La Pine	OR	
Ed Davie	Forest Grove	OR	
Chelsea Davis	Portland	OR	
Karen DeBraal	Springfield	OR	
William Dekking	Fairview	OR	
Margaret Denison	CORVALLIS	OR	
Lori Dennis	Eugene	OR	
Karen Deora	Portland	OR	
Sharon Doggett	Crooked River Ranch	OR	
Tabitha Donaghue	Portland	OR	
Harris Dubin	Eugene	OR	
Ben Ear;e	Portland	OR	
Meaghan Edwards	Portland	OR	
Sharyn Egan	Milwaukie	OR	
Paula Eppler	Portland	OR	
Janet Estep	Portland	OR	
John Evans	Eugene	OR	
Angela Fazzari	Portland	OR	
Jamie Fillmore	Beaverton	OR	
Doby Finn	Monmouth	OR	
Shawneen Finnegan	Portland	OR	
Cheryl Fisher	Milwaukie	OR	

Laurie Fisher	Tigard	OR
Laura Fleming	Eagle Point	OR
Nancy Fleming	Portland	OR
John Flinn	Portland	OR
Rachel Foxman	Portland	OR
Ivy Fredrickson	Portland	OR
James Freeberg	Ashland	OR
Matt Freedman	Eugene	OR
Lyle Funderburk	Portland	OR
Tara Gallagher	Portland	OR
Mary Garcia	Scotts Mills	OR
Marceline Gearry	Portland	OR
Jim Geear	Medford	OR
Toni Geer	Seal Rock	OR
Gary Gilardi	Hood River	OR
Erna Gilbertson	Eugene	OR
Mariea Gill	Medford	OR
Monica Gilman	Estacada	OR
James Gilmore	Portland	OR
Richard Glass	Eugene	OR
John Goeckermann	Grants Pass	OR
Teresa Goldfarb	Portland	OR
Arthur Goodman	Albany	OR
Richard Gorringe, Ph. D.	Portland	OR
Gene Gossett	Portland	OR
Michael Gotmer	Eugene	OR
Arika Grace-Kelly	Portland	OR
Charlie Graham	Hillsboro	OR
David Grant	Medford	OR
Pauline Gravier	Mcminnville	OR
Wendy Green	Toledo	OR
Leonard Greene	Tualatin	OR
Lena Griffin	Portland	OR
L.Susan Griffiths	Beaverton	OR
Gwen Hadland	Hillsboro	OR
Ron Hahn	Madras	OR
Claudia Hall	Beaverton	OR

“THE GREATNESS OF A NATION & ITS MORAL PROGRESS CAN BE JUDGED BY THE WAY ITS ANIMALS ARE TREATED.” MAHATMA GANDHI AMERICA WAS BEAUTIFUL, ANIMALS THRIVED, THE AIR WAS CLEAR, THE WATER CLEAN....THEN, “MAN DISCOVERED” THE CONTINENT. SINCE THAT TIME, WE HAVE PLACED OUR ENVIRONMENT IN JEOPARDY. WE HAVE FOULED THE AIR & DIRTIED THE WATERS. WE HAVE CAUSED THE EXTINCTION OF SPECIES, IN THE AIR, ON THE LAND, & IN THE SEA! PLEASE, I BEG YOU, PROTECT THE LITTLE FISH WHO FEED THE BIGGER FISH, SEABIRDS, & MARINE MAMMALS! THIS IS THE OCEANS CIRCLE OF LIFE! THIS IS THE CIRCLE WHICH WILL NOURISH AND ENRICH ALL LIFE. WHEN YOU INITIATE MEASURES TO PROTECT FORAGE SPECIES, YOU PROTECT & RECOGNIZE THE IMPORTANCE OF ALL SEA LIFE, ULTIMATELY, YOU PROTECT HUMAN LIFE! ENVISION THE RESTORATION OF CLEAR AIR, CLEAN WATER, THE IMPORTANCE OF ALL, NO MATTER THE SIZE, THEN, LIFE WHICH WILL FLOURISH! NOW TURN THAT VISION TO REALITY! THANK YOU, FOR READING MY PLEA.

Yvonne Hall	Elmira	OR
Phil Hanson	Portland	OR
Keeley Harding	Mount Hood Parkdale	OR
Robert Harrington	Eugene	OR
Helen Logan Hays	Oregon City	OR
Erika Heins	Toledo	OR
Linda Hendrix	Bend	OR
Travis Herb	Ashland	OR
Ann Hollyfield	Seal Rock	OR
Lindsay Hope Kern	Portland	OR
Sondra Huber	Hillsboro	OR
Danny Hull, B.S. Biology	Klamath Falls	OR
Kat Hunter	Cornelius	OR
Steven Jacobs	Portland	OR
J Millynn James	Portland	OR
Lars Jefferson	Albany	OR
Richard Jensen	Ashland	OR
Sandra Joos	Portland	OR
Brad Kalita	Chiloquin	OR
Franklin Kapustka	Aloha	OR
Joel Kay	Milwaukie	OR
Daniel Keller	Portland	OR
Betty Kennedy	Coos Bay	OR
Shabad Khalsa	Portland	OR
Mary Kimsey	Portland	OR
Rebecca Kimsey	Sublimity	OR
Suzanne Kindland	Cannon Beach	OR
Christine Kleiman	Ashland	OR
Basey Klopp	Bend	OR
Bette Koetz	Dexter	OR
William Lee Kohler	Eugene	OR
Walter Kortge	The Dalles	OR
Linda Kostalik	Gleneden Beach	OR
Thomas Kostes	Portland	OR
Ted Kozlowski	Portland	OR
G LEBLANC	Eugene	OR
SHARON LEE	Bend	OR
Rick Lambert	Independence	OR
Pat LeBaron	Medford	OR
Brendan Lee	Portland	OR
Alma Leon	Waldport	OR
Joan Levine	Portland	OR
Alicia Liang	Portland	OR
Stu Lips	Eugene	OR
Henry Lohr	Albany	OR
Karla Long	Albany	OR
Charles Looney	Scappoose	OR
Stacie Loose	Salem	OR
Gerald Lorenz	Salem	OR

Dean Loros	Eagle Point	OR	
Diane Luck	Portland	OR	
Jane Luddecke	Portland	OR	
Nathan/K.T. Lund	Bend	OR	
David Lunde	North Bend	OR	
William Mac Bean	White City	OR	
David Maceira	Salem	OR	
Richard Mackin	Portland	OR	
Jan Maddron	North Bend	OR	
William Mahoney-Watson	Lake Oswego	OR	
Emilie Marlinghaus	Bend	OR	
Setsuko Maruki-Fox	Grants Pass	OR	
Rik Masterson	Portland	OR	
M Masucci	Bend	OR	
Timothy Mathiason	Salem	OR	
Lisa Matthews	Medford	OR	
Michelle Matthews	Portland	OR	
Michele McFErran	Lake Oswego	OR	
Emily McGehee	Portland	OR	
Wendy McGowan	Roseburg	OR	
Erika McIntire	Tigard	OR	
Charlotte McKernan	Ashland	OR	
Linda McPhee	Newport	OR	
Jon A. McWillliams	Portland	OR	*Thank you for taking the time to read and act on my request. One area I would like to know more about is how this management system will work with or fit into the Marine Reserves that are working around the world on coastlines of many countries. I look forward to hearing from you regarding my question. Whatever is done to preserve our oceans must take into consideration of the fishing community. I want the goal to be to have protected areas that will help foster the fishing sport and industry forever, without destroying an industry that is necessary for food, sport and job creation.*
Warren Menges	Tillamook	OR	
Paulette Meyer	Portland	OR	
Jeannine Mihalek	Beavercreek	OR	
H Millard	Salem	OR	
Irene Mills	Portland	OR	
Douglas Monson	Medford	OR	
Melda Montgomery	Yamhill	OR	
Bernie Moser	Saint-Leu	OR	
Chris Moser	Corvallis	OR	
Gerald Moss	Unity	OR	
Roy Moss	Grants Pass	OR	
Stuart Moyle	Port Orford	OR	
Mark Mullbock	Portland	OR	
Nicholas Nakadate	Portland	OR	
Grace Neff	Albany	OR	*Being a resident of the West Coast I am very concerned with the health of the Ocean. With the water becoming more acidic the fish are already in a bad situation and more must be done to stop this from progressing.*
Zachary Nelms	Portland	OR	
Randall Nerwick	Milwaukie	OR	

Jonathan Netherton	Fairview	OR
David Nichols	Portland	OR
Gina Norman	Portland	OR
Maureen ONeal	Portland	OR
Barry Oaks	Eugene	OR
Stephen Oder	Corvallis	OR
Marlene Olveda	Portland	OR
Paul Ordway	Eugene	OR
Ananda Osterhaus	Portland	OR
Vicky Palmerton	Grants Pass	OR
Anita Parish	Sweet Home	OR
Jayme Park Miller	Oregon City	OR
Hugh Peach	Beaverton	OR
Deneen Peckinpah	Ashland	OR
Todd Peres	Portland	OR
Dave Plaehn	Corvallis	OR
Jacqueline Poehner	Beavercreek	OR
R. David Poehner	Beavercreek	OR
Jackie Porrovecchio	Gresham	OR
Melissa Presa	Astoria	OR
Steven J. Prince	Eugene	OR
Dean Pryer	Eugene	OR
LEILANI ROBERTS	Eugene	OR
Michelle Rabin	Hood River	OR
K.I. Rasmussen	Junction City	OR
Mary Ridge	Portland	OR
Larry Rinne	La Pine	OR
Brock Roberts	Portland	OR
Nancy Roberts	South Beach	OR
Berklee Robins	Lake Oswego	OR
Cassie Robles	Hillsboro	OR
Lisette Root	Cave Junction	OR
Eric Ross	Sweet Home	OR
Sioen Roux	Salem	OR
Stephanie Rufner	Beaverton	OR
Patricia Sanitate	Springfield	OR
Todd Sargent	Portland	OR
Debra Saude	Sweet Home	OR
Dan Sauer	Salem	OR
David Saul	Eugene	OR
Ellen Saunders	Manning	OR
Scott Schaefer	Medford	OR
Robert and Dolores Scheelen	Medford	OR
William Schmonsees	Bend	OR
Casey Schnaible	Medford	OR
Linda Schwartz	Cannon Beach	OR
Peter Sergienko	Portland	OR
Star Shake	Eugene	OR
Audrey Shapiro	Medford	OR

Stuart R. Shaw	Salem	OR
Rio Shayne	Portland	OR
Sheila Shearer	Hood River	OR
Steve Sheehy	Klamath Falls	OR
Ian Shelley	Portland	OR
Paul Shively	Portland	OR
Dean Shrock	Eugene	OR
S Siegner	Portland	OR
Karen Sinclair	Grants Pass	OR
Gwendolyn Sky	Cave Junction	OR
Erica St. John	Hillsboro	OR
Nicole Staudinger	Portland	OR
Katherine Stewart	Eugene	OR
Tracina Stewart	Portland	OR
Joan Stiehl	Portland	OR
Addie Streeter	Portland	OR
J Stufflebeam	Oregon City	OR
Kristen Swanson	Eugene	OR
David Sweet	Portland	OR
Linda Swift	Keno	OR
Paulette Switzer-Tatum	Beaverton	OR
Kristophet Taft	Portland	OR
John Tangney	Happy Valley	OR
Tonie Tartaglia	Newport	OR
Lisa Taylor	Aloha	OR
Sarah Teubner	Portland	OR
April Theod	Milwaukie	OR
Bob Thomas	Myrtle Creek	OR
Janie Thomas	Eugene	OR
Pamela Thomas	Portland	OR
Lauren Thompson	Portland	OR
Shawn Thompson	Portland	OR
Ann Tiedeman	Beaverton	OR
Laurie Todd	Portland	OR
Debora Tramposh	Portland	OR
J. Gregory Twain	Portland	OR
James Tyree II	Portland	OR
Richard Ullom	Portland	OR
Timothy Ulrey	Portland	OR
Michelle Unger	Portland	OR
Natalie Van Leekwijck	Beaverton	OR
April Vanderwal	Portland	OR
Sarah Vito	Eugene	OR
Estelle Voeller	Medford	OR
Judith Walker	Portland	OR
Paula Walker	Brightwood	OR
Steve Walsh	Gresham	OR
Wally Walsh	Portland	OR
Jeff Walton	Bend	OR

Paul Walton	Beaverton	OR	
Rose Wasche	Lake Oswego	OR	
Ann Watters	Salem	OR	
Joyce Watts	Eugene	OR	
Susan Wechsler	Corvallis	OR	
Jay Weeden	Eugene	OR	
Wendy Welborn	Corvallis	OR	
Janette Wells	Bend	OR	
Jason Wells	Portland	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	*Thank you for your time and consideration in this urgent matter.*
Gary Wickham	Port Orford	OR	
Sarah Wiebenson	Portland	OR	
Kelly Wieber	Portland	OR	
Laura Wiley	Eugene	OR	
Sandra Wiley	Eugene	OR	
Seth Willson	Grants Pass	OR	
William Wilson	Portland	OR	
John Witte	Portland	OR	*Let's keep the the fish meal ships the hell off the ocean! The little guys have a right to exist and thrive!*
Deanna Woods	Portland	OR	
Alex Woolery	Portland	OR	
Rachel Young	Grants Pass	OR	
MARGUERY LEE ZUCKER	Eugene	OR	
Julie Zamost	Eugene	OR	
Linda Zigich	Medford	OR	
Robyn Acuff	Bend	OR	
Sophie Alweis	West Linn	OR	
Melinda Ball	Medford	OR	
Bruce Bauer	Medford	OR	
Ashlee Becker	Eugene	OR	
Eddie Bond	Eugene	OR	
Judy Bridges	Portland	OR	*PLEASE PROTECT OUR OCEANS. LITTLE FISH MATTER. WE HAVE THE SCIENCE ON THIS. LETS ACT TO PROTECT OUR PRECIOUS OCEANS' ABUNDANCE.*
Mary Cassell	Eugene	OR	
Sarah Daus	Portland	OR	
Michael Espinosa	Medford	OR	
Melanie Feder	Philomath	OR	
Carol Gerl	Lincoln City	OR	
Tina Gillis	Tigard	OR	
Dody H	Jacksonville	OR	
Jeremy Henry	Portland	OR	
Kathy Kirsh	veneta	OR	
Ric Levendosky	Oregon City	OR	
Antonia Lindsey	Damascus	OR	

Max Mensing	yachats	OR	
Helga Motley	Ashland	OR	
Laura Osborn	West Linn	OR	
Michele Paul	Gleneden Beach	OR	
Debra Poscharscky	Portland	OR	
Ryan Rounkles	Eugene	OR	
Roger Schmidt	Portland	OR	
Sandra Schomberg	Corvallis	OR	
Fabian Smith	Portland	OR	
Terry Tyler	Bend	OR	
Anne Vermillion	Portland	OR	
Ted Wheelock	West Linn	OR	
Carl Yoshida	Gresham	OR	
Peter Branch	Eugene	OR	
Donna Crane	Eugene	OR	
Kaytlin Crawford	Milton Freewater	OR	
Doby Finn	Monmouth	OR	
Candy Hammond	Rockaway Beach	OR	
Laura Hanks	Portland	OR	
Chuck Hens	Bend	OR	
Jennie Jones	Portland	OR	
Thomas Lange	Portland	OR	
Patricia and Mi Lovejoy	Helix	OR	
Toby McElravey	Portland	OR	
Janiece Staton	Beaverton	OR	
Satya Vayu	Portland	OR	
Maria White	Beaverton	OR	
Martina Abba-Richard	Port Townsend	WA	
Laura Ackerman	Spokane	WA	
Catherine Adams	Seattle	WA	
Winn Adams	Bellingham	WA	
Crystal Aguilar	Bellevue	WA	
Colleen Albert	Covington	WA	
Gary Albright	Snohomish	WA	*Do the right thing.*
Caroline Allen	Sammamish	WA	
H Allen	Olympia	WA	
Terri Allen	Deming	WA	
Tim Allen	Seattle	WA	
Carla Alzuro	Seattle	WA	
Marin Andersen	Seattle	WA	
Becky Anderson	Bellingham	WA	
Lynnette Anderson	Seattle	WA	
biff Michael Appia	Spokane	WA	
Christine Armond	Shelton	WA	
David Arntson	Bothell	WA	
Ardith Arrington	Seattle	WA	
Connie Arveson	Lake Tapps	WA	
April Atwood	Seattle	WA	
Sean Bailey	Seattle	WA	

Linda Bainbridge	Greenbank	WA	
Norman Baker	Sequim	WA	
Robert Ball	Spokane Valley	WA	
Katherin Balles	Bremerton	WA	
Robert Bamford	Seattle	WA	
Wesley Banks	Vancouver	WA	
Lynne Bannerman	Seattle	WA	
Nick Barcott	Lynnwood	WA	
Margery Barlow	Packwood	WA	
Rick Barrett	Seattle	WA	
Janine Baughn	Spanaway	WA	
Harvey Beagle	Yakima	WA	
Albert Bechtel	seattle	WA	
Gary Bennett	Bellingham	WA	
Patricia Bereczki	Vancouver	WA	*Save the Pacific Ocean Food Web.*
Karuna Berryman	Ellensburg	WA	
Rachael Bigham	Seattle	WA	
patricia Blackburn	Tacoma	WA	
David Blair	Bellingham	WA	
Doris Blair	Shelton	WA	
Anna Blake	Seattle	WA	
Antoinette Bonsignore	Kirkland	WA	
Christian Bookter	Goldendale	WA	
Tamborine Borrelli	Yelm	WA	
Caroline Bowdish	Pasco	WA	
JC Bower	Sumner	WA	
Shary Bozied	Seattle	WA	
Lael Bradshaw	Camano Island	WA	
Teri Breitenbach	Carnation	WA	
John Bremer	Bellingham	WA	
Diane Britton	Seattle	WA	
Penny Brooks	Edmonds	WA	
Nancy Brown	Puyallup	WA	
Robert Brown	Fircrest	WA	
Anthony Buch	Seattle	WA	
Lee Buffington	Mercer Island	WA	
Sherry Bupp	Redmond	WA	
Claudio Burdisso	Seattle	WA	
Jack Burg	Seattle	WA	
Judy Burke	Hoodsport	WA	
Tim Burns	Federal Way	WA	
Lowell Bushey	Pullman	WA	
STUART CLIFT	Lake Stevens	WA	
Beatrice Calame	Kirkland	WA	
Dr Callahan	Yelm	WA	
Cami Cameron	Vancouver	WA	
Cami Cameron	Vancouver	WA	
Karen Campbell	Renton	WA	
Glen Carroll	Seattle	WA	

David Casey	Seattle	WA	
Jamie Caya	Vancouver	WA	
Scott Cecile	Everett	WA	
Noryne Chappelle	Vancouver	WA	
Mary Chavez	Spokane	WA	
Jenny Clark	Bothell	WA	
Marcia Clarke	Bothell	WA	
Robyn Cleaves	Tacoma	WA	
Peter Cohen	Seattle	WA	
Sandra Cole	Vancouver	WA	
Amanda Collins	Seattle	WA	
Lyle Collins	Yakima	WA	
Preston Collins	Yelm	WA	
Randall Collins	Seattle	WA	
Mike Conlan	Redmond	WA	
Patrick Conn	Kent	WA	*Please do it!*
James Cooke	Kennewick	WA	
Conor Corkrum	Seattle	WA	
Sarah Cortes	Seattle	WA	
Michael Cowsert	Port Orchard	WA	
Allison Cox	Vashon	WA	
Ian Cox	Seattle	WA	
Laura Craig	Yelm	WA	
Lia Craven	Tacoma	WA	
Diane Crummett	Soap Lake	WA	
Marjorie Curci	Beaver	WA	
Shelley Dahlgren, PhD	Issaquah	WA	
Felicia Dale	Snohomish	WA	
Mondonna Danesh	Port Orchard	WA	
David Daniels-Lee	Ocean Shores	WA	
Beth Dannhardt	Zillah	WA	
Kevin Darcy	Bellingham	WA	
Ruth Darden	Seattle	WA	
Alta Dauel	Lynnwood	WA	
Allison Davie	Spokane	WA	
Amanda Davis	Burien	WA	
Galen Davis	Seattle	WA	
Shannon Davis	Port Townsend	WA	
Suska Davis	Olympia	WA	
Rob Day	Seattle	WA	
Renee DeMartin	Seattle	WA	
Brandie Deal	Bothell	WA	
Rory Denovan	Seattle	WA	
Penny Derleth	Deer Park	WA	
Stephan Derout	Olalla	WA	
Joyce Dillenberger	Bellingham	WA	
Bruce Dobson	Langley	WA	
Ellen Dorfman	Olympia	WA	
Paulette Doulatshahi	Mercer Island	WA	

Eleanor Dowson	Mill Creek	WA	
John Dunn	Vashon	WA	
Tim Durnell	Rice	WA	
Danny Dwinell	Shoreline	WA	
Del E. Domke	Bellevue	WA	
Susan Eagan	Poulsbo	WA	
Carolyn Eden	Bainbridge Island	WA	
Deborah Efron	Bellevue	WA	
Stephen Eichelberger	Tacoma	WA	
Chris Eisenberg	North Bend	WA	
Leah Eister-Hargrave	Seattle	WA	
Glenn Eklund	Oak Harbor	WA	
Carol Else	Lakewood	WA	
Andreas Enderlein	Seattle	WA	
Nancy Enz Lill	Spokane	WA	
Esmeralda Espinaco	Bellevue	WA	
Joe Evans	Renton	WA	
Michael Evans	Battle Ground	WA	
Gill Fahrenwald	Olympia	WA	
Chris Falcone	Monroe	WA	
Janet Feiring	Blaine	WA	
Claudia Fernandez	Seattle	WA	
Sharon Fetter	Puyallup	WA	
Mary Fields	Seattle	WA	
Peggy File	Camano Island	WA	
Robert Fishburn	Spokane	WA	
Katie Fleming	Friday Harbor	WA	
Carolyn Fletcher	Issaquah	WA	
Thelma Follett	Bellingham	WA	
Nolan Foss	Edmonds	WA	
Rodolfo Franco	Seattle	WA	
Luther E. Franklin	Issaquah	WA	
Vanessa Franzen	Bellevue	WA	
Paul Franzmann	Walla Walla	WA	
David French	Coupeville	WA	
Cara Friang	BEACON HILL	WA	
Stephen Friedrick	Steilacoom	WA	
Ann Frodel	Poulsbo	WA	
Kramer Fry	Seattle	WA	
Gail Fuhlman	Spanaway	WA	
Charles Gadway	White Salmon	WA	
Maradel Gale	Bainbridge Island	WA	*As a beach naturalist, I spend a lot of time in and around the Puget Sound. One thing I observe is the importance of the small forage fish, such as smelt, sandlance, achnovies to the food chain. Our iconic species, salmon, depend on these small fish as they move from the fresh water to the shallow salt water and eventually into the ocean.*
Tatyana Galushko	Edmonds	WA	
Sanjay Gangadhara	Bellevue	WA	
Suz Garcia	Bellevue	WA	

Vicki Gardner	Kent	WA
Jim Gay	Seattle	WA
Jim Gayden	Vancouver	WA
Greg German	Port Townsend	WA
Gary Gibson	Burien	WA
John Gieser	Seattle	WA
Ivy Giessen	Marysville	WA
Pat Glenham	Mountlake Terrace	WA
Hal Glidden	Bellingham	WA
Sally Good	Lake Stevens	WA
Linda Goodling	Washougal	WA
David Goodman	Vancouver	WA
John Gordon	Port Townsend	WA
Alice Goss	Clinton	WA
Anne Graham	Ferndale	WA
Linda Graham	Olympia	WA
Joyce Grajczyk	Kent	WA
Rev. Leah Gratiot McDuffie	Seattle	WA
Kathleen Grauman	Edmonds	WA
Lee Ann Greaves	Spokane	WA
Natasha Green	Bellingham	WA
Steve Green	Sedro Woolley	WA
Lee Greenawalt	Gig Harbor	WA
Jenny Gronholt	Tacoma	WA
Kim Groom	Orting	WA
Sean Guffey	Prosser	WA
Rand Guthrie	Snohomish	WA
Anita Gwinn	Amboy	WA
Charles H. Sarin	Bellingham	WA
Margaret HaSHMI	Bellingham	WA
A.M. Hall	Tacoma	WA
Carolyn Hall	Renton	WA
Suzanne Hamer	Woodinville	WA
Michelle Hamilton	Marysville	WA
Jason Hann	Redmond	WA
Jilian Hannah	Kirkland	WA
Jens Hansen	Bellingham	WA
Steve Hansen	Bellingham	WA
Donna Hanson	Pullman	WA
Bruce Harpham	Federal Way	WA
Nathaniel Harrison	Seattle	WA
Marie Hart	Friday Harbor	WA
Thomas Hart	Seattle	WA
Lorraine Hartmann	Seattle	WA
Florence Harty	White Salmon	WA
Jo Harvey	Pacific	WA
Margaret Hastings	Blaine	WA
Lloyd Hedger	Tacoma	WA
Jill Heishman	Seattle	WA

Jennifer Hendrickson	Bothell	WA	
Carole Henry	Seabeck	WA	
Domingo Hermosillo	Kent	WA	
Amy Heyneman	Bainbridge Island	WA	
Elizabeth Hickman	Auburn	WA	
Nancy Hieronymus	Friday Harbor	WA	
Richard Hieronymus	Friday Harbor	WA	
Michael and Barbara Hill	Elbe	WA	
Janice Holkup	Seattle	WA	
Julie Holtzman	Snohomish	WA	
Deborah Homenko	Port Angeles	WA	
Kathleen Hostetler	Vashon	WA	
William Howald	Marysville	WA	
Monique Huang	Issaquah	WA	
Winfield Hutton	Seattle	WA	
Jausen Hyldahl	Seattle	WA	
Lura B. Irish	Lakebay	WA	
Karen Isaacson	Woodinville	WA	
Danya Jablon	Mercer Island	WA	
Michelle Jacobsen	Seattle	WA	
Clara Jacobson	Olympia	WA	
Nancy Jacques	Bainbridge Island	WA	
Judith Janes	Spokane Valley	WA	
Gayle Janzen	Seattle	WA	*The prey fish are in desperate need of protection. If they are gone, the rest of the food chain will collapse*
Sue Jarrard	Castle Rock	WA	
Patricia Jerrells	Shelton	WA	
Angie Johnson	Seattle	WA	
Mary Johnson	Seabeck	WA	
Clayton Jones	Seattle	WA	
Kyana Jones	Lake Forest Park	WA	
Dorothy Jordan	Lynden	WA	
Nancy Jordan	Oak Harbor	WA	
Brookie Judge	Seattle	WA	
Emmerich Juhas	Seattle	WA	
KEVIN KREISS	Seattle	WA	
Blair Kangley	Seattle	WA	
Peg Keough	Sammamish	WA	
Kathy Kestell	Spokane	WA	
Valerie Keys	Gig Harbor	WA	
Jim Kistner	Twisp	WA	
Claudia Klikoff	Winlock	WA	
Tatiana Korry	Seattle	WA	
Dina Kovarik	Seattle	WA	
Summer Kozisek	Bonney Lake	WA	
Mark Krukar	Seattle	WA	
Donald LaMoure	Seattle	WA	
Nadine LaVonne	Seattle	WA	
Barbara Laudan	Lynden	WA	
Charlene Lauzon	Lynnwood	WA	

Diana Law	Burien	WA
Gene Lawson	Lynnwood	WA
Joan Lawson	Seattle	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
Virgene Link	Anacortes	WA
Shanel Liston	Bellevue	WA
Jennifer Liu	Seattle	WA
Delphi Locey	Seattle	WA
Kandace Loewen	Seattle	WA
Saab Lofton	Seattle	WA
J. Logan	Redmond	WA
Kerry Logan	Wenatchee	WA
Ernie Loreen	Point Roberts	WA
Allison Lovell	Bellingham	WA
Richard Low	Ferndale	WA
Claire Lumina	Seattle	WA
Richard Lunt	Seattle	WA
Dave Luxem	Burien	WA
Linda Luzadder	Kent	WA
June MacArthur	Port Orchard	WA
Ronald MacArthur	Port Orchard	WA
Diann MacRae	Bothell	WA
Anne Mack	Mercer Island	WA
Justin Maddox	Lake Stevens	WA
Lynne Magie	Bothell	WA
Adam Malarchick	Gig Harbor	WA
Kathleen Malley	Tacoma	WA
Michaelene Manion	Port Orchard	WA
Aahley Mankus	Cle Elum	WA
Scott Marckx	Port Townsend	WA
Buzz Marcus	Greenbank	WA
Shannon Markley	Seattle	WA
Millard Martin	Hansville	WA
Scott Martin	Seattle	WA
Stephen Matera	Seattle	WA
Vicky Matsui	Seattle	WA
Marietta Matthews	Ellensburg	WA
Barbara Matthiessen	Port Orchard	WA
Donna Maupin	Snohomish	WA
Roberta McBride	Edmonds	WA
Ai McCarthy	Redmond	WA
Bonny McCormick	Vancouver	WA
Evan McCoy	Seattle	WA
Rebecca McElhiney	Rochester	WA

Heather McFarland	Auburn	WA
Mary McGovern	Steilacoom	WA
Patty McInnis Gray	Issaquah	WA
Christine McLean	Gig Harbor	WA
Linda McPhee-Zitter	Sammamish	WA
Megan Mcinnis	Snoqualmie	WA
Audrey Meade	Seattle	WA
Patricia Meeks	Bingen	WA
Ramona Menish	Bellingham	WA
Raelyn Michaelson	Seatac	WA
Amanda Mikalson	Farmington	WA
Claire Mikalson	Farmington	WA
Jim Milstead	Bellingham	WA
Thomas Miskovsky	Tacoma	WA
kay Moretti	Seattle	WA
Susan Morse	Vancouver	WA
Ali Mosa	Poulsbo	WA
Robert Mueller	Kenmore	WA
Tina Mulcahy	Bothell	WA
Daveen Munn	Everett	WA
Julie Munoz	Mountlake Terrace	WA
Katherine Nelson	Kent	WA
Matthew Nelson	Kent	WA
Joe Neumann	Seattle	WA
Rita Nicholson	Lacey	WA
John Niendorf	Friday Harbor	WA
Rebecca Nimmons	Bellevue	WA
Janet Norem	Lake Forest Park	WA
Rollin Odell	Kingston	WA
Marylin Olds	Kingston	WA
Derek Oliver	Yelm	WA
Marsha Osborn	Tacoma	WA
Lynne Oulman	Bellingham	WA
Robert Packett	Silverdale	WA
Nick Page	Ferndale	WA
Peggy Page	Stanwood	WA
Jeffrey Panciera	Seattle	WA
Jeannie Park	Seattle	WA
Dorothy Parshall	Langley	WA
Sharon Parshall	Fall City	WA
Patricia Parsley	Ferndale	WA
Richard Pate	Olympia	WA
Hiroko Patterson	Silverdale	WA
James Patton	Redmond	WA
Thomas Payne	Yelm	WA
Fay Payton	Carnation	WA
J B Pearce Sr	Seattle	WA
Rae Pearson	Seattle	WA
Kristin Pearson-Franks	Issaquah	WA

Betsy Pendergast	Port Townsend	WA	
Phil Pennock	Seattle	WA	
Lela Perkins	Everett	WA	
Nicole Perkins	Kirkland	WA	
Douglas Peterson	Port Townsend	WA	
Darrell Phare	Bellingham	WA	
Penny Platt	Anacortes	WA	
Michelle Playter	Olympia	WA	
Darrell Plouffe	Everett	WA	*We need to get real serious now before it is to late. The includes Shark protection also. When over 250,000 sharks are killed for fins a day what does that say about us?*
Gary Porter	Edmonds	WA	
Johni Prinz	Ocean Shores	WA	
Mark Proa	Seattle	WA	
Kathleen Procter	Vancouver	WA	
Mary Prubant	Bellevue	WA	
Kelly Ragsdale	Longview	WA	
Susan Ragsdale	Spokane	WA	
Ben Rall	Lakewood	WA	
Miguel Ramos	Bellingham	WA	
Pearl Ranstrom	Vashon	WA	
Joyce Rauch	Auburn	WA	
Deborah Rawlings	Vancouver	WA	
Mark Redmond	Seattle	WA	
Bill Rehberg	Bellevue	WA	
Dennis Reid	Shoreline	WA	
Kathy Reid	Seattle	WA	
Michelle Reitmajer	Spanaway	WA	
Sarah Richards	Mukilteo	WA	*Please use the power you have to save our ocean.*
Greg Ridge	Brush Prairie	WA	
James Roberts	Palouse	WA	
Barbara Robinson	Spokane	WA	
Erik Robinson	Vancouver	WA	
Kit Robinson	Seattle	WA	
Forrest Rode	Seattle	WA	
Constance Rodman	Seattle	WA	
Karen Rogers	Vashon	WA	
Linda Romero	Vancouver	WA	
Barbara Rosenkotter	Deer Harbor	WA	
Amanda Rudisill	Olympia	WA	
Elena Rumiantseva	Seattle	WA	
Sandra Russell	Pullman	WA	
Dawn Rutherford	Seattle	WA	
CATHY STEWART	Vancouver	WA	
Z. Saez	Spokane	WA	
John Sailer	Port Townsend	WA	
Craig Savage	Shoreline	WA	
Janet Schafer	Kent	WA	
Darlene Schanfald	Sequim	WA	
Barry Scharf	Redmond	WA	

Taen Scherer	Seattle	WA	
Lola Schiefelbein	Richland	WA	
Eileen Schimpf	Spokane Valley	WA	
Dan Schneider	Seattle	WA	
Amy Schoppert	Tacoma	WA	
Kathleen Schormann	Yakima	WA	*Please protect out oceans and marine life.*
Gail Jane Schwartz	Seattle	WA	
Ronlyn Schwartz	Langley	WA	
Carol Scott	Bellingham	WA	
Cathy Seay	Everett	WA	
Mary Sebek	Seattle	WA	
Spencer Selander	Castle Rock	WA	
Steven Serbousek	Bremerton	WA	
Paula Shafransky	Sedro Woolley	WA	
Diane Shaughnessy	Tacoma	WA	
L Sherwood	Bham	WA	
Ursula Shoe	Redmond	WA	
Penny Short	Sammamish	WA	
Foletta Sierra	Yakima	WA	
Robert Simpson	Friday Harbor	WA	
Dana Sindona	Redmond	WA	
Barb Siray-Nieto	Mukilteo	WA	
Angela Smith	Seatac	WA	
Baker Smith	Seattle	WA	
Marla Smith	Vashon	WA	
Mike Smith	Seattle	WA	
Theodore Smith	Seattle	WA	
Barbara Snapp	Mercer Island	WA	
Seth Snapp	Bellingham	WA	
Scott Species	Seattle	WA	
John Spencer	Edmonds	WA	
Darlene St. Martin	Mount Vernon	WA	
Daniel David Stabel	Aberdeen	WA	*Goddammit, I live in a west coast fishing economy*
Mike Stahl	Seattle	WA	
Jack Stansfield	Stanwood	WA	
Jeff Steenbergen	Seattle	WA	
Holly Stephenson	Blaine	WA	
David Stetler	Everett	WA	
Dennis Steussy	Des Moines	WA	
Mary Stevens	Mill Creek	WA	
Rachel Stewart	Seattle	WA	
Tonya Stiffler	Shoreline	WA	
Ann Stockdale	Gig Harbor	WA	
Lorie Stoneberger	Lynnwood	WA	
Donna Stonecipher	Seattle	WA	
Brian Sullivan	Lakewood	WA	
Pam Summa	Seattle	WA	
Jennifer Svenson	Vashon	WA	
Linda Swan	Snohomish	WA	

Shannon Sweeney J.D.	Shoreline	WA	
Thomas Swoffer	Ravensdale	WA	
Paul Talbert	Seattle	WA	
Jeanne Taylor	Bellingham	WA	
Kat Thomas	Seattle	WA	
Gay Thompson	Selah	WA	
Sheryl Thompson	Everett	WA	
Debbie Thorn	Kirkland	WA	
Beatrice Tiersma	Custer	WA	
Leilani Timpe	Kirkland	WA	
Stephanie Trasoff	Blaine	WA	
Lynne Treat	Chehalis	WA	
Dennis Tudos	Kent	WA	
Alexandra Tufnell	Bothell	WA	
Jack Tull	Seattle	WA	
David Turnoy	Eastsound	WA	
John Tuxill	Bellingham	WA	*Given the uncertainties raised by disturbing trends in ocean temperatures and chemistry (e.g. acidification), it is all the more essential that forage fish populations be given the best possible chance to adapt to broader environmental changes, and that we have monitoring programs in place to track their status.*
Tim Upham	Tumtum	WA	
Steve Uyenishi	Seattle	WA	
Selim Uzuner	Carnation	WA	
Janis VanWyhe	Ridgefield	WA	
Fabiola Vasquez	Seattle	WA	
Ileana Vasquez	Seattle	WA	
Louis Vestuto	Tumwater	WA	
John Vieira	Mount Vernon	WA	
Karen Vincent	Burlington	WA	
John Vinson	Olympia	WA	
Jennifer Willette	Stanwood	WA	
Florence Wagner	Lopez Island	WA	*The sea is one of the greatest sources of food for the world. We must not only protect this environment, we must nurture it.*
Jeriene Walberg	Seattle	WA	
Kyle Waller	Puyallup	WA	
Jonathan Walter	Tumwater	WA	
Scott Washburn	Seattle	WA	
Marilyn Watson	Clinton	WA	
Joyce Weir	Newport	WA	
Marie Weis	Fox Island	WA	
Wendi Werner	Everett	WA	
Preston Wheaton	Olympia	WA	
Earl White	Kent	WA	
Elizabeth White	Seattle	WA	
Thomas Wicks	Bellevue	WA	
Scott Widdas	Silverdale	WA	
Brigitte Wiechmann	Bellevue	WA	
Stephanie Wiklund	Federal Way	WA	
Rebecca Willhight	Pasco	WA	

Emily Willoughby	Tukwila	WA
Julie Wilson	Longview	WA
Dean Windh	Lakewood	WA
Nicole Wing	Seattle	WA
Marguerite Winkel	Spokane	WA
Esther B. Wolf	Seattle	WA
Kathleen Wolfe	Des Moines	WA
Andrew Wollman-Simson	Deming	WA
Gordon Wood	Seattle	WA
Ken Woolard	Tacoma	WA
Patti Wright	Bellingham	WA
Jennifer Wyatt	Mountlake Terrace	WA
Traci York	Coupeville	WA
David Young	Seattle	WA
Susan Zajonc	Spokane	WA
Lynn Ziegler	Poulsbo	WA
Ken Zontek	Yakima	WA
Glen Zorn	Seattle	WA
Saliha Abrams	Carson	WA
Carol Anderberg	Langley	WA
C Batten	Oak Harbor	WA
Chris Boernke	Deming	WA
Shari Brewer	Darrington	WA
Trina Cooper	Federal Way	WA
Mark Craig	Gold Bar	WA
Karen Cronacher	Seattle	WA
Tanya de Bruijn	Palouse	WA
John Del Signore	Bellingham	WA
Susie Demiglio	Elma	WA
Don Dicken	Ellensburg	WA
Zoi Encinas	Kenmore	WA
John Eschen	Grand Coulee	WA
Ric Garcia	Grayland	WA
Delia Gerhard	Seattle	WA
Gene Groom	Orting	WA
Gaye Guida-Dennis	Seattle	WA
Teresa Haskell	Lacey	WA
Carole Huelsberg	Port Townsend	WA
Jeri Ichikawa	Renton	WA
Sue Maxwell	Tonasket	WA
Brad McNeil	Snohomish	WA
Jerry Miller	Vancouver	WA
Ronnie Mitchell	Bellingham	WA
Madelaine Moir	Sequim	WA
Gary Murrow	Olympia	WA
Nora Regan	Port Townsend	WA
Allan Silverthorne	Normandy Park	WA
Leslie Smith	Bellingham	WA
Mollie Smith	Chehalis	WA

William Ulich	Seattle	WA	*Over 90% of all the world's large fish have already been caught. If we cut their food supply the fisheries will crash, leaving only toxic algae behind.*
Tina Whitman	Eastsound	WA	
Paul Zurfluh	Fircrest	WA	
Lys Burden	Port Townsend	WA	
Jack Burg	Seattle	WA	
Martha Carlisle	Belfair	WA	
Allison Donald	Renton	WA	
Karissa Henzel	Walla Walla	WA	
Rebecca Jacobsen	Vancouver	WA	
Jean Jensen	Graham	WA	
Christopher Matthias	Seattle	WA	
Heather McFarland	Auburn	WA	
Shelly Peterson	Tacoma	WA	
Johni Prinz	Ocean Shores	WA	
JoAnna Redman-Smith	Kent	WA	
Holly Stephenson	Blaine	WA	
Lisa Tracy	Snohomish	WA	
Mare Wahosi	Gig Harbor	WA	
Marie Weis	Fox Island	WA	

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October 19, 2012

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

Dear Chairman Wolford and Council Members,

For more than two decades, San Francisco Baykeeper has worked to reverse the environmental degradation of the past and promote new strategies and policies to protect the San Francisco Bay. Much of our work is focused on protecting San Francisco Bay waters, and we believe a healthy oceanic ecosystem is vital to the waters' vitality. Our ultimate mission is to protect and enhance the water quality of the San Francisco Bay for the benefit of its ecosystems and human communities.

The San Francisco Bay is home to a remarkable array of species, including salmon, harbor seals, sea lions, and brown pelicans. Many of the species in our bay, including those named above, rely heavily on forage fish as their main source of food. We see forage fish are the cornerstone of the ecosystem along the Pacific coast, and believe their protection is of utmost importance. We thank the Council for their decision to recognize the importance of forage fish to a productive ecosystem, and ask the Council to fulfill its commitment to adopt strong protection for these currently unmanaged forage fish.

Our coastal ecosystem is under increasing pressure. The Pacific marine environment is affected by large-scale changes in climate, coastal habitat degradation, invasive species, and rising demand to feed a growing world. A resilient ecosystem depends first and foremost on a balanced food web, which is why conservation of prey fish is widely recognized as a pillar of ecosystem-based fishery management. For these reasons, we urge the Council to adopt a strong Fishery Ecosystem Plan in a timely fashion. A strong Fishery Ecosystem Plan will maximize the benefit we derive from the ocean by weighing the tradeoffs between large-scale fisheries targeting prey fish versus leaving them in the water to feed ocean wildlife, including highly sought after fish like halibut, salmon, and tuna.

It's important that the Council adopt a plan that's actually useful in improving fishery management, rather than a weighty document that sits on a shelf. The Council's top priority should be to ensure the stability 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 showing leadership on this critical policy issue.

Sincerely,

Deb Self

Deb Self
Executive Director

www.baykeeper.org
Pollution hotline: 1-800 KEEP BAY

785 Market Street, Suite 850
San Francisco, Ca 94103

Association of Northwest Steelheaders
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October 30, 2012

Mr. Dan Wolford, Chairman
Pacific Fishery Management Council

Dr. Donald McIsaac, Executive Director
Pacific Fishery Management Council

Re. Northwest Sport Anglers Concern for Sport Fish Forage.

Northwest sport anglers are becoming more aware and concerned with the threat to salmon, tuna, halibut and other important fisheries by reduced ocean forage. Offshore anglers have firsthand experience with "bait balls" and their importance to their sport and the industries that support it. Inland anglers know that the size and numbers of returning salmon and steelhead is largely dependent on abundant forage.

Essentially every angler given the opportunity to sign on to the following message to the PFMC, filled out a card with this message.

> Thank you for establishing a clear objective to prohibit the development of new fisheries targeting forage species until you can ensure that it would not harm the marine ecosystem or undermine existing fisheries for bigger species such as salmon, tuna, and halibut.
>
> We urge you to follow through on your commitment to initiate firm regulatory protections of forage fish upon completion of the council's Fishery Ecosystem Plan.

Sincerely,

Norman E. Ritchie, P.E.
Portland, OR

Richard Riley
Rockaway Beach, OR

Len Clarke
Portland, OR

Bill Hedlund
Tillamook, OR

Bob Oleson
Wilsonville, OR

Marvin Leach
McMinnville, OR

Lisa Phipps
Tillamook, OR

George Buckingham
Tillamook, OR

Ralf A, Coopers
Eugene, OR

Garland Burback
Cottage Grove, OR

James Costello
Cottage Grove, OR

Russell Mendorl
Cottage Grove, OR

Bill Robbins
Eugene, OR

Bob Chipley
Eugene, OR

William Byliss
Eugene, OR

Chris Douglass
Creswell, OR

Ray Rice
Eugene, OR

Glenn Stevens
Eugene, OR

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Louis S. Nagy III
Springfield, OR

Thomas W. Swarts
Veneta, OR

Bob Drulllinger
Lorane, OR

Charles Drullinger
Eugene, OR

Gary Lutman
Lorane, OR

Mark Wiederhold
Eugene, OR

John G. Nagy
Springfield, OR

Douglas Edwards
Eugene, OR

Eric M. Mason
Eugene, OR

Leland L. Mason
Eugene, OR

Rod Fosback
Eugene, OR

Paul Sbnagia
Eugene, OR

Jim Martin
Eugene, OR

Russell Nishitani
Tualatin, OR

Ton Vanderplaat
Forest Grove, OR

David Risacre
Gresham, OR

Victoria McOmie
Portland, OR

Les Fahey
Portland, OR

Tom Hendrickson
Portland, OR

Anna M. Miller
Portland, OR

Dennis VavRosky
Portland, OR

Gary A. Benson
Portland, OR

John Meek
Beaverton, OR

John Crowell
Lake Oswego, OR

Steve Ogden
Beaverton, OR

Duane Kitzmiller
Milwaukie, OR

Carol Clark
Beaver Creek, OR

Richard Krispel
Portland, OR

Bruce Wickward
Portland, OR

Pam McGraw
Milwaukie, OR

Judy A. Munroe
Milwaukie, OR

Matt Rockweit
Portland, OR

Thomas Smoot
Portland, OR

Jeff Stoeger
Portland, OR

Doug Kersey
Troutdale, OR

Bob Pinegar
Troutdale, OR

Todd Keller
Portland, OR

Nona Bowling
Portland, OR

Scott Bowling
Portland, OR

Victor F. Laurence
Happy Valley, OR

Kerin Dimeler-Laurence
Happy Valley, OR

Joli Ann Ritchie
Portland, OR

Daniel Ritchie
Gresham, OR

Ron VanBeak
Portland, OR

Lonnie E. Thurston
Fairview, OR

Anglers dedicated to enhancing and protecting fisheries and their habitats for today and the future.

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Mel Stanislawski
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Robert Gronlund
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Milwaukie, OR

Larry Beaver
Gresham, OR

Timothy D. Maples
Canby, OR

Larry Palmer
Portland, OR

Russ Sumida
Gresham, OR

Doug Briggs
Troutdale, OR

Joy Gannett
Gresham, OR

Howard Anderson
Portland, OR

Ed Frankel
Vancouver, WA

Neal W. Harris
Vancouver, WA

Bill Kirkpatrick
Portland, OR

Art Israelson
Portland, OR

Colonel Thomas
Gresham, OR

William A. Koepke
Newberg, OR

Gary Riddle
Sherwood, OR

Steve Schnider
Dundee, OR

Mike Maybury
Dundee, OR

Dian Maybury
Dundee, OR

Kris Simkins
McMinnville, OR

Bob Askey
Newberg, OR

Jerry Lindblom
McMinnville, OR

Jason Lindblom
Sheridon, OR

Mark Smith
St. Paul, OR

Robert D, Burke
Milwaukie, OR

Russell Bassett
Molalla, OR

Don Pasqual
Eugene, OR

Joe Domenico
Portland, OR

Jeff Kirkman
Canby, OR

Eric Koellaer
Portland, OR

Carl D. Patrick
Newberg, OR

I move that the Council adopt the preliminary draft Fishery Ecosystem Plan (FEP) (Agenda Item K.1.a, Attachment 1) for public review with the following changes:

1. The following statement would be added to the "Purpose and Need" section:

   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 would 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.

2. Section 6.2 would be removed from the FEP and added to the Council's broader Research and Data Needs document.

3. Chapter 7 would be removed from the FEP and become a stand-alone document. The following statement would be added to the top of this stand-alone Initiatives document:

   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.

   Amendment: Add a new chapter 7.0 linking the stand alone initiatives document to the FEP (Kirchner/Feldner)
   Substitute Amendment: Direct the EPDT ~~Add a new chapter 7.0~~ to include language in the FEP that links the stand alone initiatives document to the FEP and specifies a draft process by which the Council would consider modifying the intiatives document. (Culver/Wolford) Amendment carried unan.

4. FEP Initiative 1 should reference the preliminary draft list of forage fish species that the EPDT developed with an explanation that this draft would be available as a starting point for the ad hoc committee tasked with completing this initiative, and the draft list should be appended to this stand-alone Initiatives document.

5. The following proposals would be added to the Initiatives document:

   a. The Amendment 24 initiative described in Agenda Item K.1.c, Supplemental GMT Report (last paragraph on page 1)
   b. An initiative to develop a list of core ecosystem indicators that could be tracked through the Annual Report. The intent would be to have a discreet set of indicators that would be useful for Council routine management; additional indicators may be brought forward and tracked in the Annual Report at the discretion of the NMFS Science Centers.

These draft documents would be made available on the Council's website and their availability would be announced to the Council's e-mail notification listserv as soon as the changes above are made.

In addition, for the March briefing book, the Ecosystem Plan Development Team would review and consider the comments made by the Council's advisory bodies and incorporate changes, as appropriate, except for the changes suggested in the Supplemental HMSAS Report, and the changes suggested by the Habitat Committee to Section 4.3.1.1, and the request for an additional section addressing a framework for FEP integration.

INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

The National Oceanic and Atmospheric Administration (NOAA) has been working on an initiative to incorporate ecosystem principles in ocean and coastal resource management. An Integrated Ecosystem Assessment (IEA) is a synthesis and quantitative analysis of information on relevant natural and socioeconomic factors in relation to specified ecosystem management goals and is an important element in the implementation of ecosystem approaches to management. This is a relatively new assessment tool that is being first applied to the California Current Large Marine Ecosystem (CCLME).

The 2012 IEA for the CCLME builds on work done in 2011 that was presented to the Council at its November 2011 meeting. The IEA team and the Ecosystem Plan Development Team (EPDT) have been working towards broadening the IEA to include species from each of the Council's four fishery management plans and to explore ways to best bring IEA information into the Council management process. An immediate application is to incorporate IEA results into the EPDT's annual report on the status of the CCLME (see Agenda Item K.3).

At the June 2012 Council meeting in San Mateo, California, the Council considered future meeting plans including the review of a series of workshops proposed for 2012 and 2013. One of the proposals is to hold a workshop on the IEA to introduce, in greater detail, the IEA tool to the Council and Council participants, to identify which IEA products are best suited for application to the Council process, and to plan for future technical reviews of IEA tools and methods.

At this meeting, Dr. John Stein, Director of the Northwest Fisheries Science Center (NWFSC), and Dr. Cisco Werner, Director of the Southwest Fisheries Science Center (SWFSC) will provide a report on the review and implementation of the 2012 IEA as well as plans for an IEA workshop in 2013 (Agenda Item K.2.b, Attachment 1. The Science Centers and the IEA team are interested in Council feedback on ways to expand and improve the IEA for optimal use in Council management and feedback on the purpose, format, participants, and timing of IEA workshops in 2013.

Council Action:

1. **Provide feedback on the IEA report and proposed workshops.**
2.

Reference Materials:

1. Agenda Item K.2.b, NWFSC and SWFSC Report.

Agenda Order:

a. Agenda Item Overview — Mike Burner
b. Fisheries Science Centers' Report — John Stein and Cisco Werner
c. Reports and Comments of Advisory Bodies and Management Entities
d. Public Comment
e. **Council Action**: Council Discussion

PFMC
10/12/12

IEA Workshop

The NOAA California Current IEA team proposes to host a 1-1/2 day workshop in either mid-winter or June 2013, at a location to be determined. The purpose of this workshop is to orient and introduce the Council to 2012 IEA products and tools, identify which products are of potential use to the Council, develop terms of reference for a more in-depth review of those products and tools and how they would be brought into Council processes, and to set a plan and timeline for additional workshops to allow for more in-depth technical review of the selected products and tools.

The general idea of this workshop is to break down the current IEA into discrete components, receive feedback on which components have the most potential for immediate or future use by the Council and define the next steps to review these components. Key representatives from appropriate Council Committees/Advisory Bodies will be invited. We propose to work with Council staff, SSC and EPDT Chairs/Co-Chairs to plan the initial workshop and future IEA review meetings to optimize scheduling, content, and logistics of all groups involved.

IEA 2012

The aim of the California Current IEA is to understand the web of interactions that links ecosystem drivers and pressures to components of the California Current Ecosystem and use this knowledge to estimate how changing environmental conditions and management actions affect the status of its ecosystem components.

When fully developed, the CCIEA will include the following five major ecosystem components:

- Habitat—including seafloor and water column biotic and abiotic components.
- Wild fisheries—this EBM component is centered on the condition of fishery stocks included in the coastal pelagic species, highly migratory species, groundfish, and salmon fishery management plans.
- Ecosystem integrity—refers to the structure and function of marine and coastal ecosystems and ecological communities.
- Vibrant coastal communities—including social, economic, and cultural well-being and human health as related to the marine environment.
- Protected resources—species legally designated as protected (e.g., under the Marine Mammal Protection Act, Migratory Bird Treaty Act, Endangered Species Act).

The current iteration of the CCIEA (2012 CCIEA) is focused on four EBM components:

- Ecosystem Integrity
- Fisheries (groundfish, Pacific salmon and coastal pelagic species)
- Protected species (marine mammals, seabirds, Pacific salmon)
- Vibrant coastal communities

Status, trends and impacts of oceanographic/climatic drivers and anthropogenic pressures are addressed throughout the IEA. Included are large-scale climate forcing, regional scale oceanographic processes, marine transportation, energy development, coastal zone development, pollution, habitat degradation, among others.

The 2012 CCIEA is organized into 4 sections. The first section covers scoping and engagement and describes the ongoing and developing dialogue among scientists, managers and stakeholders. The next section describes the status and trends of key Ecosystem Drivers and Pressures and is split into two chapters—'*Oceanographic and Climatic Drivers*', and '*Anthropogenic Pressures'*. The third section describes the status, trends and risks faced by the key ecosystem components described above. Finally, in Section 4, *'Management Scenario Analysis'*, we articulate a series of scenarios that link large-scale drivers to pressures in the California Current, and then use a variety of techniques to estimate how the status of ecosystem components might change under different scenarios.

The 2012 CCIEA Report is currently undergoing peer review (by 59 reviewers). The CCIEA is presented as a "layered" document that will be published on the web in December 2012. The content of the IEA is tiered from general overview ("soundbite" or take-home message), to Executive Summary level, to very specific (detailed report and data). Thus, the Report is intended to provide information that is useful to a variety of audiences--from informed stakeholder and policy makers to managers and scientists. Because it will be on the web, readers will be able to "dive in" from the highlights through summary information to the details of the data and analyses.

The 2012 CCIEA products are currently being incorporated, as appropriate, into the draft Fisheries Ecosystem Plan, the draft Annual Ecosystem Condition Report, and the Science Centers' EFH analysis to be delivered to the Council in April 2013.

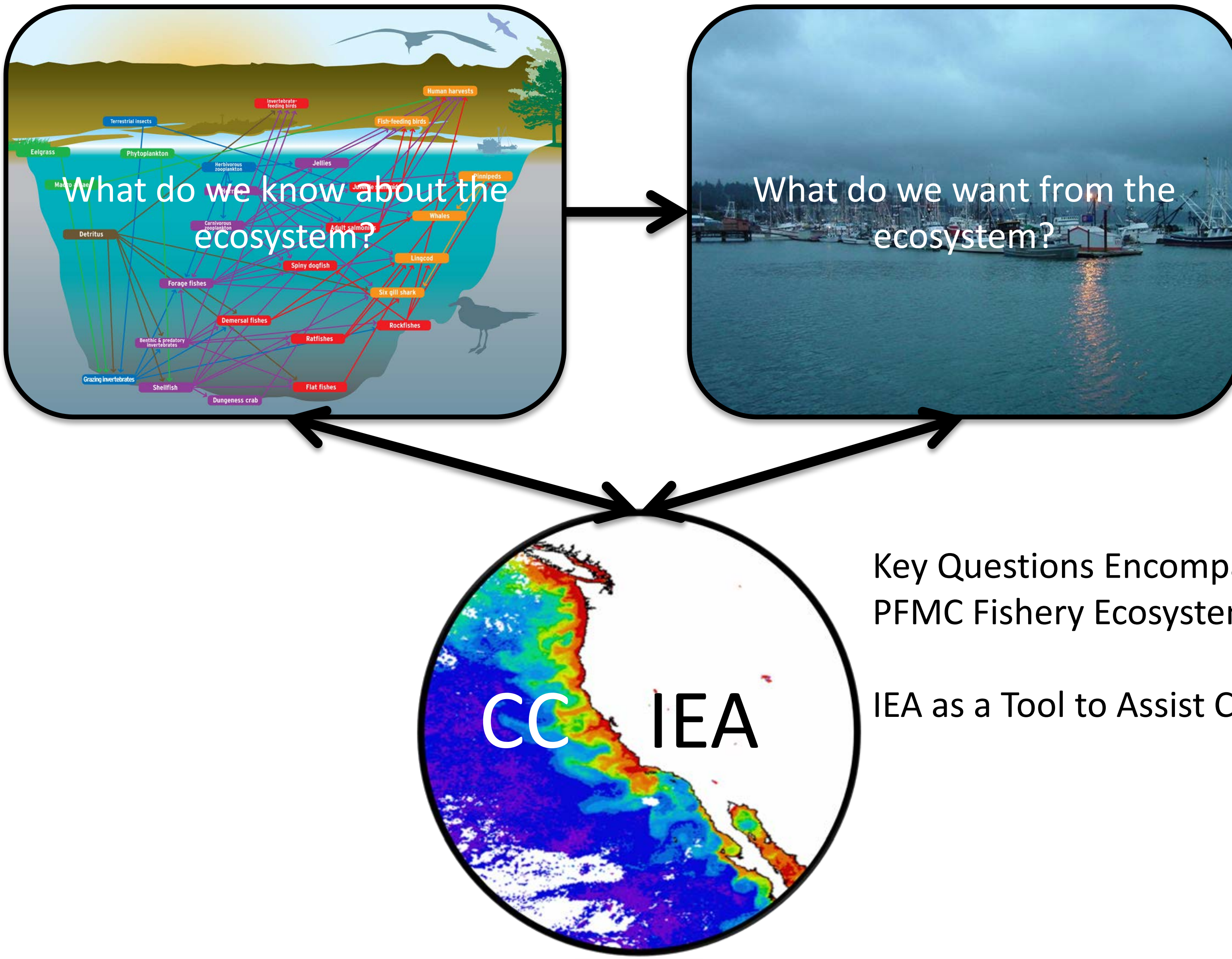
Levin, P.S., and B. Wells (eds.). Draft in Review. California Current Integrated Ecosystem Assessment: Generation 2. Available at: http://www.noaa.gov/iea/california.html (December 2012).

California Current Integrated Ecosystem Assessment

UPDATE AND DISCUSSION

Objectives

- Provide a brief update on the state of the California Current Integrated Ecosystem Assessment (CCIEA)
  - What are we doing (high level)?
  - How we are doing it
  - Examples of products
- CCIEA Next Steps
- Engagement with PFMC (Workshop)



Key Questions Encompassed by PFMC Fishery Ecosystem Plan

IEA as a Tool to Assist Council

2009

CCIEA Planning Begins

2010

Build IEA science toolkit

- Indicator framework
- Risk assessment framework
- Analytical tools
  - Ecosystem models
  - Improved fishery models using environmental covariates

1st Generation CCIEA Complete

2011

Expand engagement with PFMC, NMSP, NOAA OR&R, WCGA, Canada

- EPDT
- Nov, 2011 Discussion document

2012

2nd Generation CCIEA Complete

2010 IEA 1.0

Limited Breadth

- Ecological Integrity
- Salmon (California)
- Groundfish
- Green Sturgeon Habitat

2012 IEA 2.0

Expanded Breadth

- Ecological Integrity
- Protected Species
  - mammals,
  - birds,
  - Salmon (Washington, Oregon and California)
- Fisheries
  - Groundfish,
  - CPS
- Human Communities

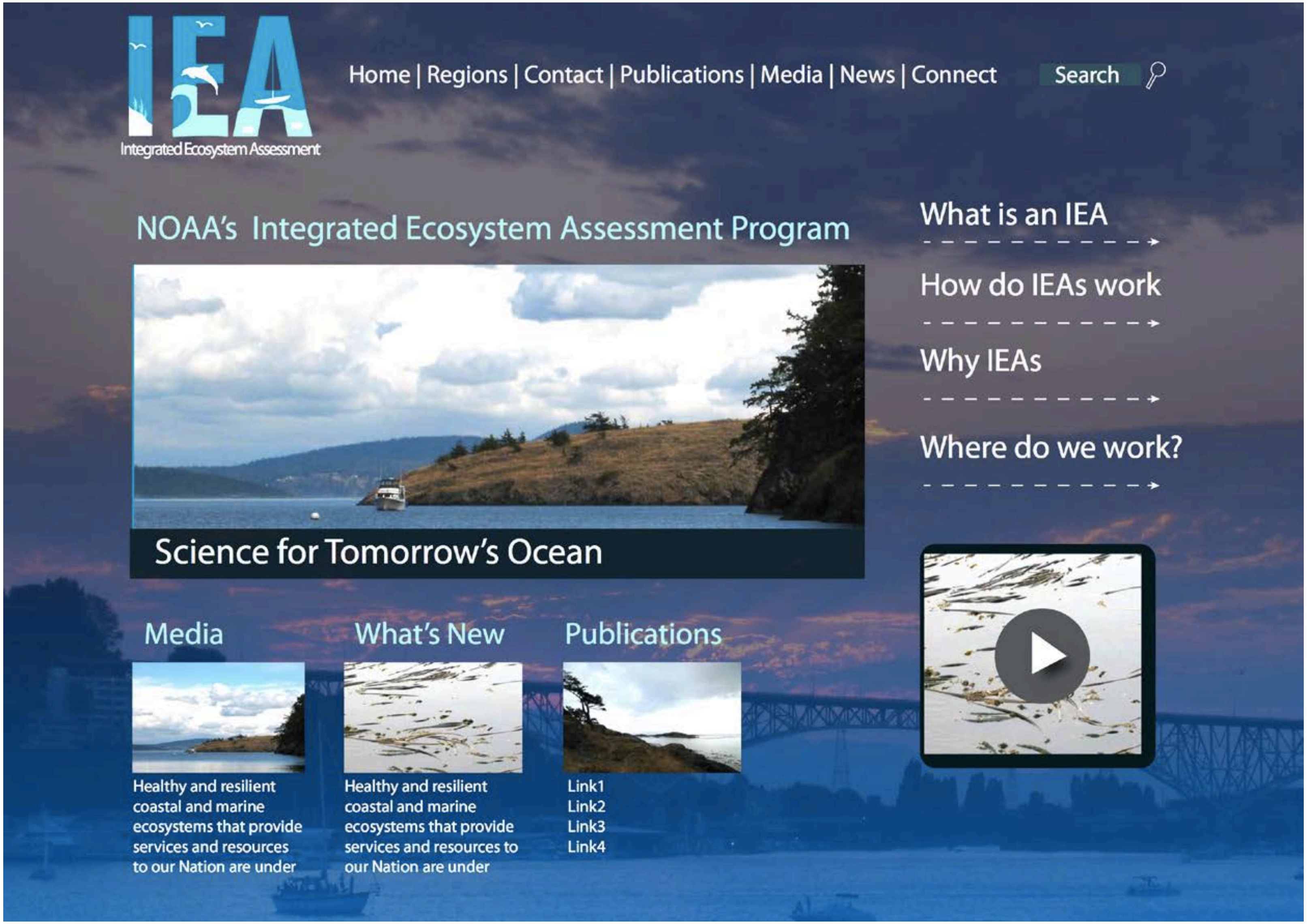
2010 IEA 1.0

Peer-review *via* journal articles

2012 IEA 2.0

Large-scale technical peer-review process with 57 reviews received to date

Web-based, Layered Publication



Next Steps -- IEA 3.0

Continue to expand and improve

- Habitat
- More Human Dimensions
- HMS

More integration, synthesis

Reference levels

IEA Workshop

CCIEA Products

used by PFMC

Summary of atmospheric and ocean conditions

- PFMC draft State of the California Current Report

Summary of non-fisheries human pressures

- PFMC EFH Phase 1 report Addendum (forthcoming)

Status and trends of major components of the California Current Ecosystem

- PFMC draft State of the California Current Report

Risk assessment of groundfish fisheries on marine mammals

- Report to PFMC, March 2012, Agenda Item F.3.b

CCIEA Products

ready for consideration by the PFMC

Atlantis end-to-end ecosystem model

- Impacts of forage-fish fishing on ecosystem structure and function, other fisheries
- Impacts of new fisheries on existing fisheries, ecosystem structure and function
- Cumulative impacts of fisheries on ecosystem structure and function
- Impacts of catch shares on ecosystem structure and function, fisheries landings, revenues
- Impacts of gear switching, spatial closures on fisheries, revenues, and ecosystem health
- Climate change impacts on fisheries, ecosystem health

Wave energy analyses

- Potential conflicts between wave energy development, fisheries, and habitats

Risk Assessment

- Risk to fisheries from (non-fisheries) human activities
- Risk to habitat from fisheries and other human activities

Pacific Salmon Analyses

- Evaluation of the biological and economic consequences of dam removal for salmon
- Inclusion of prey and habitat covariates into salmon forecast models.
- Modeling stream temperature and flow characteristics to promote improved habitat and survival.

Proposed CCIEA Workshop

2 days winter / early spring 2013

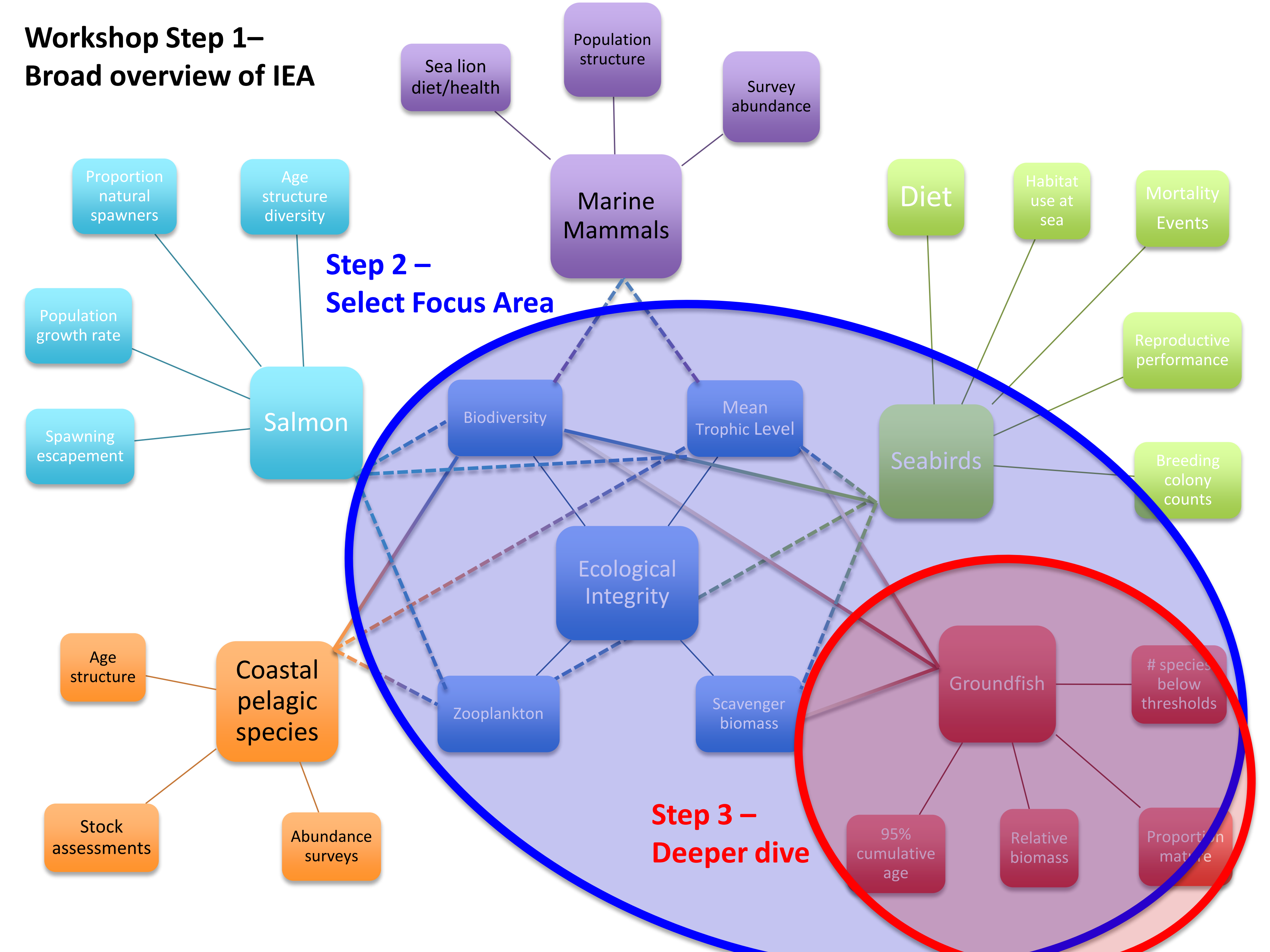
Workshop Objectives

- Substantive and technical overview of CCIEA Products
- Determine utility for PFMC
- Develop TOR for review, etc.

Who should be there?

- Representation from across technical groups

Follow-up deeper dive review



Workshop Step 1–
Broad overview of IEA
Step 2 –
Select Focus Area
Step 3 –
Deeper dive
Marine Mammals
Sea lion diet/health
Population structure
Survey abundance
Salmon
Proportion natural spawners
Age structure diversity
Population growth rate
Spawning escapement
Seabirds
Diet
Habitat use at sea
Mortality Events
Reproductive performance
Breeding colony counts
Coastal pelagic species
Age structure
Stock assessments
Abundance surveys
Ecological Integrity
Biodiversity
Mean Trophic Level
Zooplankton
Scavenger biomass
Groundfish
species below thresholds
95% cumulative age
Relative biomass

Proposed CCIEA Workshop

2 days winter / early spring 2013

Workshop Objectives

- Substantive and technical overview of CCIEA Products
- Determine utility for PFMC
- Develop TOR for review, etc.

Who should be there?

- Representation across technical groups

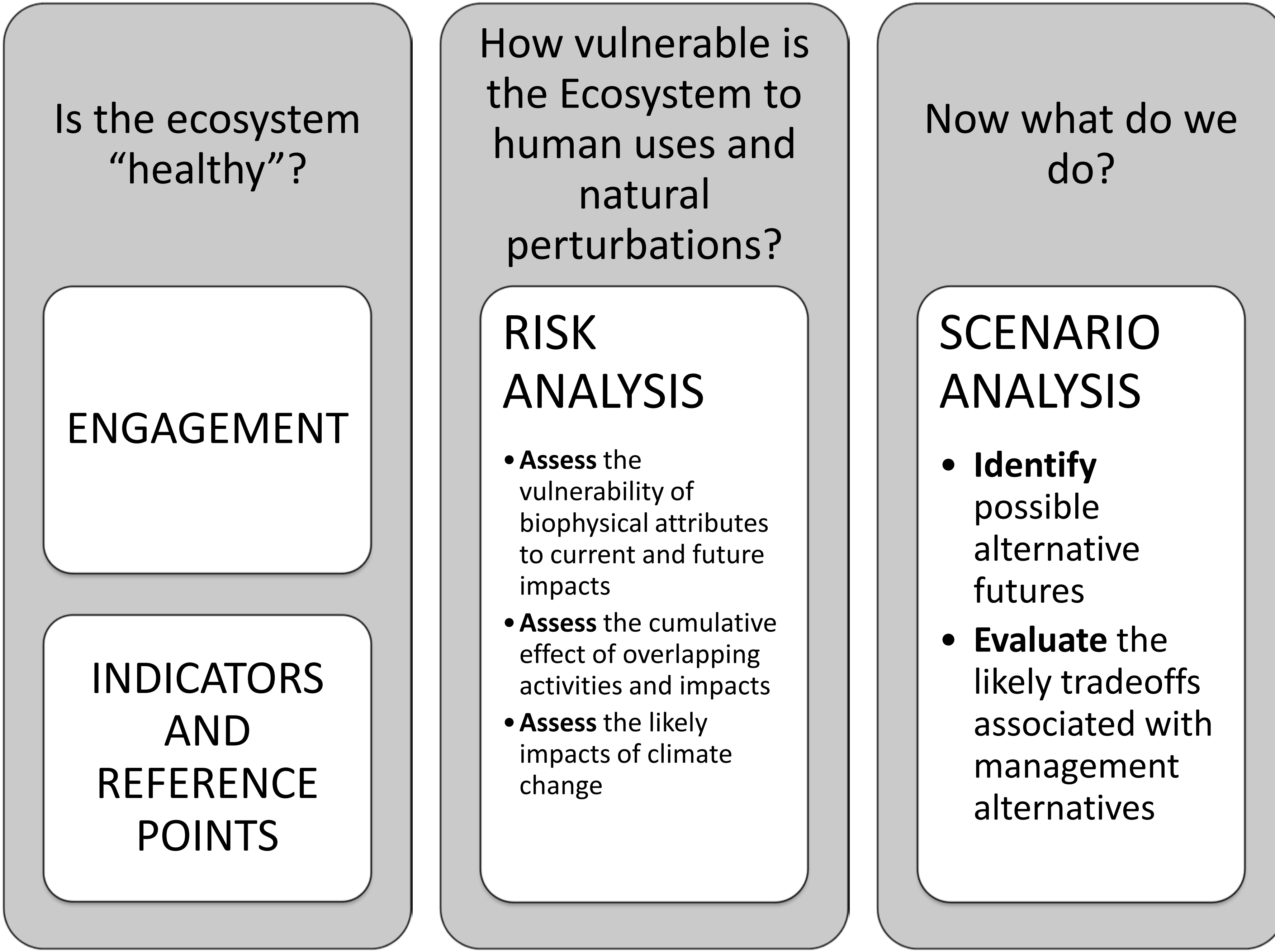
Follow-up deeper dive review

CCIEA

Integrated Ecosystem Assessment

Thank you

Question and Answer


Is the ecosystem "healthy"?
ENGAGEMENT
INDICATORS AND REFERENCE POINTS
How vulnerable is the Ecosystem to human uses and natural perturbations?
RISK ANALYSIS
• Assess the vulnerability of biophysical attributes to current and future impacts
• Assess the cumulative effect of overlapping activities and impacts
• Assess the likely impacts of climate change
Now what do we do?
SCENARIO ANALYSIS
• Identify possible alternative futures
• Evaluate the likely tradeoffs associated with management alternatives

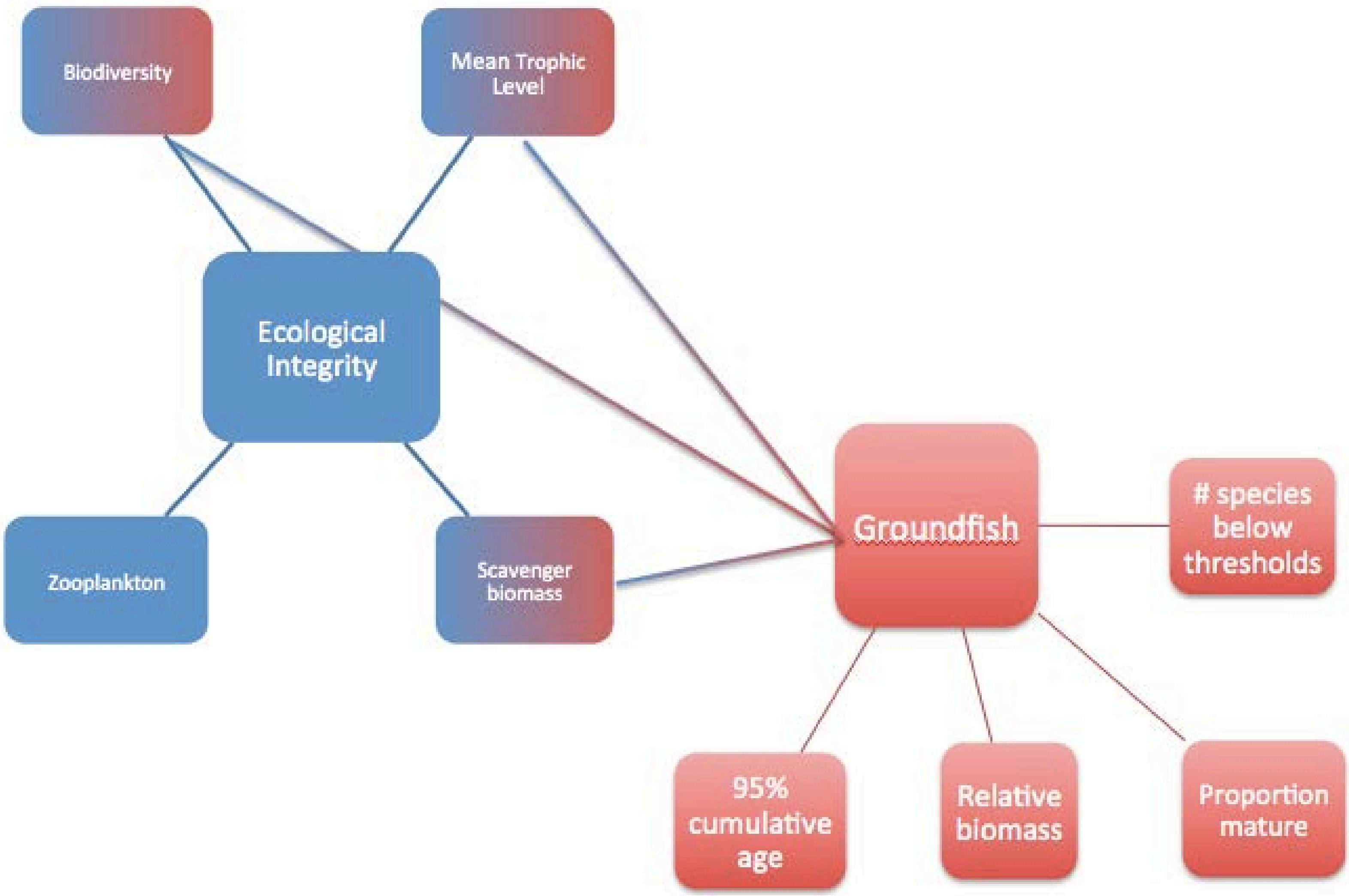
Is the ecosystem “healthy”?

ENGAGEMENT

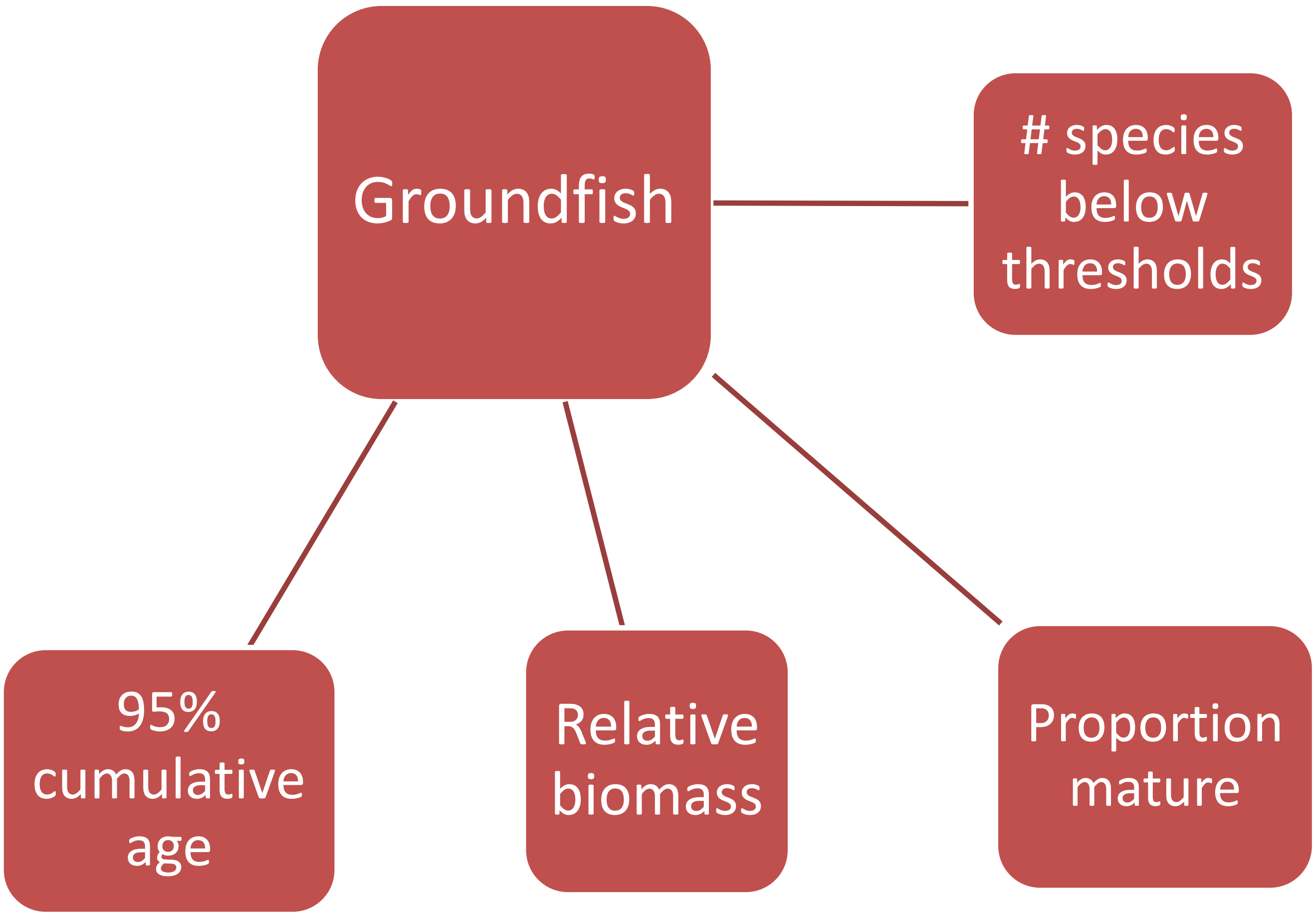
INDICATORS AND REFERENCE POINTS

- IEA results presented in EPDT Draft State of the California Current Ecosystem Report
- Reference Points – Discussion topic

Workshop Step 2 – Identify Subcomponent of IEA of Interest to PFMC



Workshop Step 3 – Go Even Deeper Into the IEA



COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON THE INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

The Coastal Pelagic Species Advisory Subpanel (CPSAS) received a presentation on the Integrated Ecosystem Assessment (IEA) and proposed implementation schedule from Brian Wells and Phil Levin from the Southwest Fisheries Science Center. We appreciate efforts to include necessary biological data from the Southern California Bight and look forward to continued improvement in coordinating biological and oceanographic data from multiple sources to improve understanding of the California Current Ecosystem and fishery-ecosystem interactions and potential trade-offs.

We note that an IEA workshop is proposed around the same timeframe as the planned sardine harvest parameters workshop, and encourage coordination of the two workshops, as the invited participants are likely to be very similar. In that regard, we recommend that both workshops include the authors of the Amendment 8 harvest control rule: Drs. Richard Parrish, Alec MacCall, and Larry Jacobson, as scientists with deep experience in oceanographic cycles and coastal pelagic species.

PFMC
11/05/12

ECOSYSTEM ADVISORY SUBPANEL REPORT ON THE INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

The Ecosystem Advisory Panel (EAS) looks forward to the release of the Integrated Ecosystem Assessment (IEA) report and the opportunity to provide additional, more detailed comments.

The IEA synthesizes varied and broad ecosystem information and holds promise as a layered reference document that can be matched to the questions posed and their level of complexity.

A critically-needed next step is to conduct an evaluation of the IEA models and tools including identification and validation of applications and connections to fishery management decisions. The EAS supports and would like to participate in the proposed IEA workshop. The EAS encourages the Council to include balanced representation at the workshop, including fishing industry perspectives.

Preliminary examples of IEA results have demonstrated real world applications that elucidate ecosystem-based principles. The graphical representations of IEA outputs presented can distill large amounts of data covering long time series into a format that is relatively easy to comprehend.

The annual state of the California Current Ecosystem Report (Agenda K.3.a, Supplemental Attachment 1) and the IEA are closely related and, in conjunction, can provide both detailed and extensive ecosystem information, as well as summarized results that are tailored to specific Council management needs. In addition, the EAS notes that chapters six and seven of the draft Fishery Ecosystem Plan (Agenda Item K.1.a, Attachment 1) provide examples of scientific analyses that could be conducted with IEA tools.

PFMC
11/05/12

Agenda Item K.2.c
Supplemental GAP Report
November 2012

GROUNDFISH ADVISORY SUBPANEL REPORT ON
THE INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

Dr. Brian Wells (Southwest Fisheries Science Center) briefed the Groundfish Advisory Subpanel (GAP) on the status of the Integrated Ecosystem Assessment (IEA). Dr. Wells highlighted that a primary goal of the IEA process is to develop tools that are accessible and useful to the Council and fishery stakeholders. Of critical importance to the GAP, Dr. Wells noted that information about the human dimension is currently included in the IEA (notably, the I/O PAC Model for Personal Income Impacts) and given equal weight to other model parameters.

Dr. Wells highlighted the strong intent of the IEA team to have an open, constructive dialog with the Council and fishery stakeholders. A series of workshops is being planned to identify IEA products that would be most useful to the Council and to review those product before they are finalized. One aim of these workshops appears to be to open lines of communication between the IEA customers and the IEA developers. The GAP recommends the Council endorse these workshops and work with its advisory bodies to identify representatives to attend the workshops. The GAP presumes travel costs for workshop participants would be covered by National Marine Fisheries Service.

The GAP appreciates receiving periodic reports about development of the IEA and the opportunity to provide our input at this nascent stage in the IEA development process.

PFMC
11/05/2012

GROUNDFISH MANAGEMENT TEAM REPORT ON INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION

The Groundfish Management Team (GMT) thanks Drs. Phil Levin and Brian Wells for meeting with us to discuss the work they are doing with Integrated Ecosystem Assessments (IEAs) as well as a proposed workshop that would be hosted by the National Marine Fisheries Service (NMFS) Northwest and Southwest Fisheries Science Centers.

First, we are interested in the upcoming workshop proposed by the Science Centers and hope to have representatives from the GMT included in the list of attendees. This will be an important exercise to scope the type of information and products that can improve ecosystem understanding in the Council's fisheries management, including groundfish. Further, as noted in Agenda Item K.1.c, the Fishery Ecosystem Plan (FEP) is a good compendium on the state of ecosystem understanding in the California Current, but the IEA can serve as a more iterative process for feeding ecosystem information into the Council process. This will be particularly true should targeted products be developed as a result of the type of interaction envisioned in the proposed workshop.

The GMT further notes that expediting a review of Atlantis (the basis for several IEA outputs) needs to be undertaken as soon as feasible.[1] Having such a model that has been peer reviewed by the Scientific and Statistical Committee (SSC) could help to inform process improvement under Amendment 24. This might not need to be as rigorous as a stock assessment review, but would affirm whether it represents the best available science to inform ecosystem-based management. One of the primary questions that we hope to answer in development of a Tier 1 National Environmental Policy Act (NEPA) document concerns "significant impacts" to the marine environment, specifically when our understanding of significant impacts changes. These ecosystem assessments could document the cumulative impacts of fisheries to the marine environment, which is at the heart of the significant impacts question inherent in NEPA.

PFMC
11/06/12

[1] This recent publication is one IEA output Kaplan, I. C., Gray, I. A., Levin, P. S., 2012. Cumulative impacts of fisheries in the california current. Fish Fish, n/a. URL http://dx.doi.org/10.1111/j.1467-2979.2012.00484.x

HABITAT COMMITTEE REPORT ON INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

The Habitat Committee (HC) received a briefing on the California Current Integrated Ecosystem Assessment (IEA) from Dr. Phil Levin and Brian Wells. The IEA Team has developed modeling tools and information that are already being used by the Ecosystem Plan Development Team.

The HC also received a briefing on the California Current Ecosystem Integrated Report. The HC commends the distillation of the larger IEA to serve the needs of the Council. However, the document is highly technical, and may need further clarification if it is to be understood by the public.

The spatial scale of the IEA does not seem to match the actual coastal distribution of Fishery Management Plan species. For instance, albacore tuna, salmon and Pacific whiting, as well as numerous rockfish species, migrate to and from Canada and Alaska and out of the California Current. More information may be needed to understand larger scale drivers.

There is a similar effort by the Canadian Department of Fisheries and Oceans to characterize the state of the ocean on the Canadian West Coast. This report does provide information on the ecosystem status of cross-border stocks, and may be of interest to the Council.

PFMC
11/03/12

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON THE INTEGRATED ECOSYSTEM ASSESSMENT IMPLEMENTATION REPORT

Dr. Phil Levin (NWFSC) briefed the Scientific and Statistical Committee (SSC) on the current status of the Integrated Ecosystem Assessment (IEA), and emphasized that the IEA team wishes to makes its products more accessible and useful to the Council. He outlined plans for a series of workshops to identify IEA products that would be most useful to the Council and to review those products.

The IEA aims to provide scientific information for a wide audience. Products of potential interest to the Council include as ecosystem indicators and associated reference points, the impacts of fishing for forage species, and analyses of the cumulative impact of fisheries, among others.

The SSC supports holding an initial workshop with the following goals:

- list the products which are being developed as part of the IEA;
- identify which IEA products are likely of greatest interest to the Council, taking account of the priorities in the Council's Research and Data Needs document as well as any priorities for Fishery Ecosystem Plan initiatives identified during this meeting; and
- develop approaches to reviewing different IEA products.

The workshop would take place over two days, likely during Spring 2013. It would be chaired by the leaders of the IEA and include participation by members of the SSC ecosystem sub-committee. The workshop would produce a report addressing the three goals listed above, which would then be presented to the Council. The results of the workshop, and subsequent Council deliberation, would allow planning and initiation of the much more substantive process of reviewing those IEA products identified as of most interest to the Council.

PFMC
11/04/12

CALIFORNIA CURRENT ECOSYSTEM REPORT

The Pacific Fishery Management Council (Council) has scheduled an annual summary report on the state of the California Current ecosystem (CCE). The report is part of the Council's overall initiative to develop a Fishery Ecosystem Plan (FEP) (see Agenda Item K.1) to advance ecosystem-based fishery management in the Council process.

The Council has tasked the Ecosystem Plan Development Team (EPDT) with development and presentation of the first annual report at the November Council meeting. The Council has requested that a focus of the report should be biophysical trends known to affect shifts in abundance of Council-managed species. The Council is also interested in annual reports that are not voluminous, but provide clear, straightforward explanations of the trends and indicators most relevant to Council managed fisheries.

At the June 2012 Council meeting, the Council approved an outline of the annual report that included report sections on Pacific basin-scale climate indicators, regional climate indicators, regional lower trophic level biological indicators, regional higher trophic level biological indicators, and human dimensions indicators. The Council's annual report is intended as a synthesis of information and analyses from external efforts and more detailed reports on the CCE. In particular, NOAA's Integrated Ecosystem Assessment (IEA) initiative (see Agenda Item K.2) and its team of scientists were an integral part of this year's inaugural effort.

The 2012 IEA effort was recently completed and is currently undergoing an extensive peer-review process. Additionally, under Agenda Item K.1, the Council will be reviewing a first draft of its developing Fishery Ecosystem Plan. Completion and coordination of the review materials for these two efforts were the priority of the EPDT and the IEA team. It is anticipated that the Council's Annual State of the Ecosystem Report will be distributed at the November Council meeting in Costa Mesa, California and posted to the Council web page shortly after the Council's supplemental comment deadline of October 23, 2012.

<u>Council Action</u>:

1. **Review the Annual State of the California Current Ecosystem report.**
2. **Provide feedback on future annual or interim ecosystem reports.**

<u>Reference Materials</u>:

1. Agenda Item K.3.a, Supplemental Attachment 1: Annual State of the California Current Report.

<u>Agenda Order</u>:

a. Agenda Item Overview — Mike Burner
b. Report of the Ecosystem Plan Development Team — Yvonne deReynier
c. Reports and Comments of Advisory Bodies and Management Entities
d. Public Comment
e. **Council Action**: Council Discussion

PFMC
10/16/12

DRAFT ANNUAL STATE OF THE CALIFORNIA CURRENT ECOSYSTEM REPORT

Introduction

At its June 2012 meeting, the Council requested that the Ecosystem Plan Development Team (EPDT) provide the Council with a draft Annual State of the California Current Report. The Council recommended that the report focus on those biophysical trends known to affect shifts in abundance of Council-managed species. This document summarizes and synthesizes key environmental, biological and socio-economic indicators in the California Current Ecosystem (CCE). Indicators are based on the best available scientific research and are intended to be informative with respect to environmental or socio-economic conditions that affect the productivity or distribution of managed fish populations and their associated fisheries.

Many of the physical and lower trophic level indicators reported in this document are commonly reported in a number of published reports or online resources on the state of the CCE. These indicators represent information and data commonly and widely associated with changes in physical and biological conditions throughout the CCE, and within the North Pacific more generally. The nature of the effects of climate variability and physical forcing on ecosystems are complex, including: variability in not only primary and secondary productivity, but in the distribution, species composition, reproductive success and energy flow within marine ecosystems. Thus, while climate indices can suggest broad scale patterns of ecosystem productivity, although they may be less useful in predicting abundance trends or productivity at a species-specific level.

Additional indicators, such as summarized status and trends for salmon and groundfish populations, and catch statistics for major U.S. West Coast fisheries, may be readily available elsewhere in Council documents or online databases, but not necessarily in a synthesized format. Still other indicators, such as the magnitude of aquaculture activities off the U.S. West Coast, seafood demand throughout the U.S., and indices of benthic structures and commercial shipping activities, represent external activities 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.

This report is a joint effort between the Council's Ecosystem Plan Development Team (EPDT) and NOAA's California Current Integrated Ecosystem Assessment (IEA) team. In winter 2012-2013, NOAA's IEA team will be reporting to the public on the 2012 IEA results. This report for the Council's November 2012 meeting is a short synthesis of IEA results that the EPDT interpreted as most helpful to the Council, given past Council guidance on drafting an annual state of the ecosystem report.

This report is in the early stages of development, far from flawless, and needs a more refined evaluation of the indices and information that might best meet the Council's needs. However, this report is also an important first step towards the greater objective of bringing ecosystem information into the Council process, so that the Council can continue to consider ecosystem status, trends and indicators in its decision-making.

1 Basin-Scale Climate (Physical) Indicators

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. Many of these fluctuations have been shown to be a consequence of larger scale changes in ocean conditions throughout the Pacific, including changes observed in the tropics (the El Niño/Southern Oscillation) and changes in the north Pacific and subarctic (indexed by the Pacific Decadal Oscillation and the North Pacific Gyre Oscillation). Although a suite of additional potential indices and variables exist, and the science behind both the mechanisms and the consequences of each continues to evolve, a great deal has been learned about just what these indicators represent and how the consequences of variability in these indicators leads to changes in the physical and biological conditions experienced throughout the CCE.

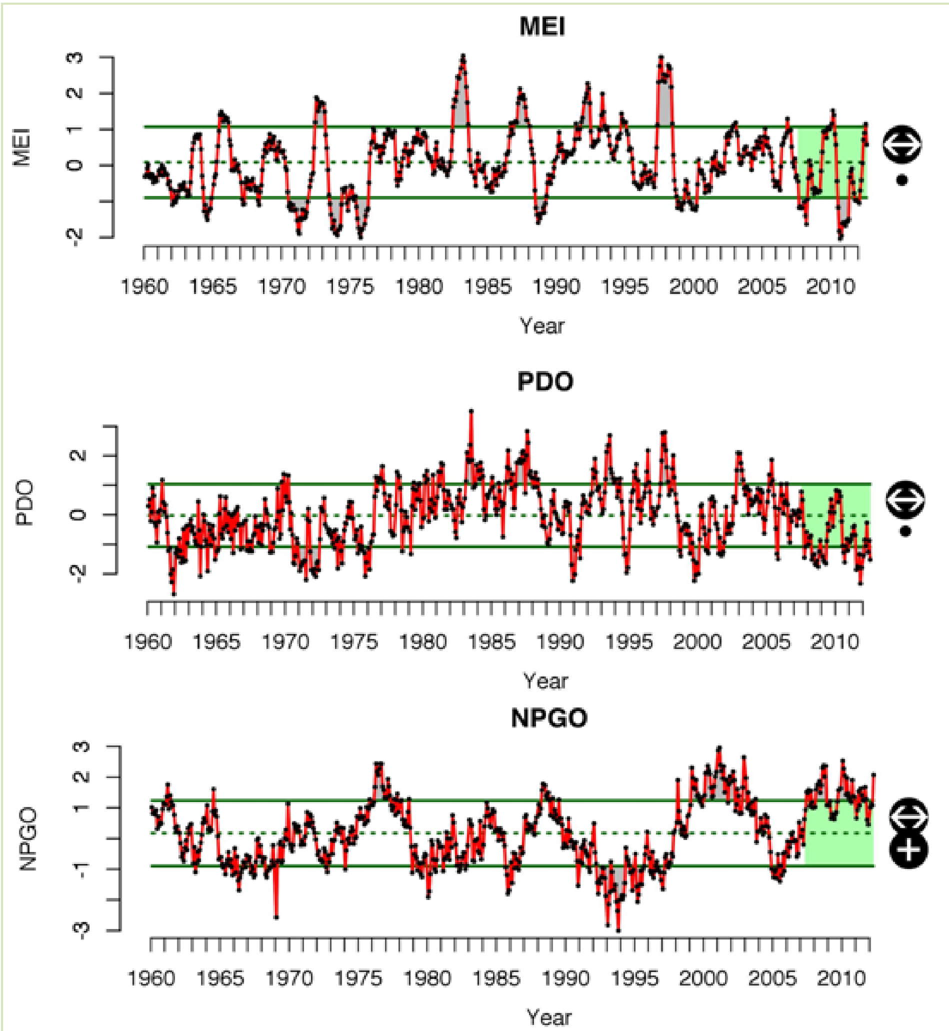


Figure 1.1: Monthly values of basin-scale climate indicators used to access environmental variability impacts on ecosystems in the California Current ecosystem. The three time series are Multivariate ENSO Index (MEI), Pacific Decadal Oscillation (PDO), and North Pacific Gyre Oscillation (NPGO). In general, negative values of MEI and PDO along with positive values of NPGO mark periods of increased productivity. The arrows represent positive (↗), negative (↘) or lack of (←→) trend over the past 5 years while a +, -, or • indicate greater than, less than, or within 1 standard deviation from the mean.

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 CCE) and the globe. There are several means of assessing the state of the ENSO cycle; in this report, we use the Multivariate ENSO Index (MEI), which is based on a set of physical variables measured in the equatorial Pacific. Positive values of the MEI represent El Niño conditions, while negative values represent La Niña conditions. El Niño conditions in the CCE are associated with warmer surface water temperatures and weaker upwelling winds. From late 2009 to early 2010, a short duration El Niño with stronger than average downwelling-favorable winds was observed. The El Niño was quickly followed by increased offshore transport with La Niña conditions in the summer of 2010. Since then, the MEI has been mostly negative, indicating that the CCE is experiencing La Niña conditions that include high productivity and subarctic ocean conditions. However, the effects of any given El Niño or La Niña event are highly variable – some events lead to major impacts throughout the CCE, while others showing major impacts in the tropics have relatively modest impacts at higher latitudes.

In general, the biological effects that result from during "positive MEI" (e.g., El Niño) conditions are lower primary and secondary productivity (e.g., phytoplankton and zooplankton), often leading to reduced recruitment of many groundfish species, lower survival of salmon smolts, and distributional shifts (to the north, as well as onshore from offshore waters) of most migratory species (such as coastal pelagics, HMS, and Pacific hake). For example market squid abundance (and catches) often decline to very low levels during El Niño events, and rebound strongly during strong La Niña events. Highly migratory species such as tunas and billfish are also more frequently available to fishermen during El Niño events, and recreational fishing effort often shifts to those and other warm water targets, and away from rockfish and other cooler water species, particularly in the waters of the Southern California Bight.

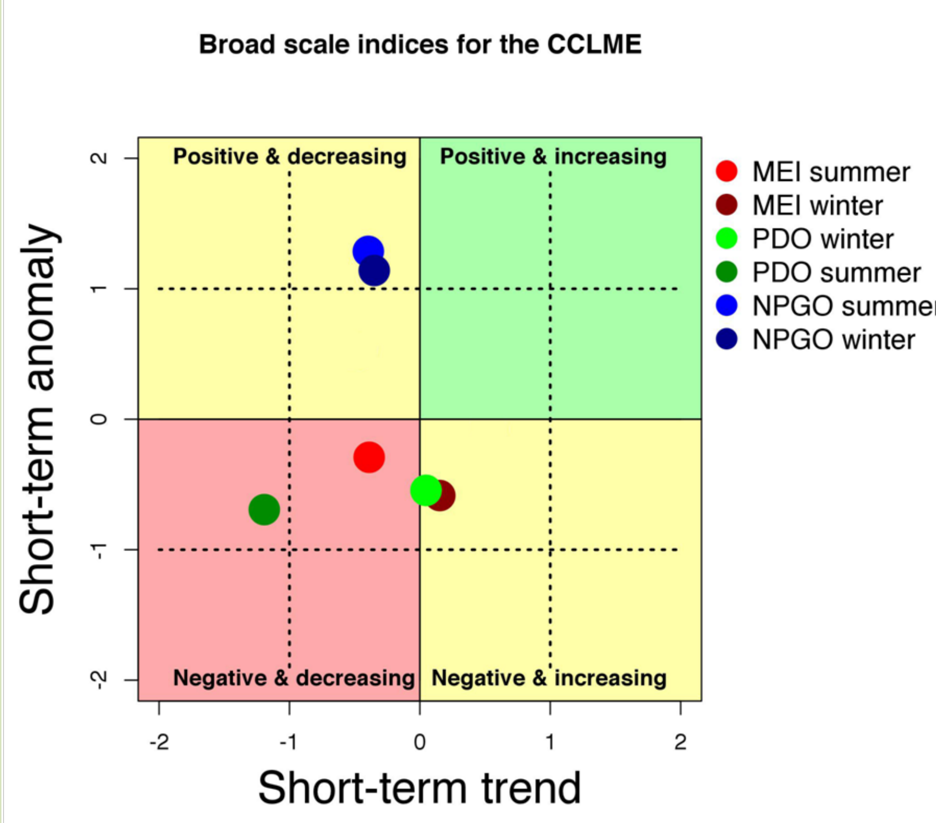


Figure 2.2: Five-year trend plotted against anomaly from the long term mean for broad scale ocean indices. The CCE is in a positive NPGO state, negative PDO, and negative MEI all indicating a cooler, more productive CCE. Winter is the mean from January-March and summer is the mean from June-August.

The Pacific Decadal Oscillation (PDO) is a low frequency signal in North Pacific sea surface temperatures that is correlated with biological productivity in the Northeast Pacific. The "low frequency" refers to the observation that the average conditions over multi-decade periods tends to be cooler or warmer, although year-to-year values continue to vary, the multidecadal periods are often referred to as "regimes." Cold (regimes, indexed by negative values of the PDO, are associated with enhanced productivity in the CCE and vice versa. Such conditions were observed from the mid-1940s through the late 1970s, and in most years since 1999. During positive PDO regimes, which were observed from the late 1970s through the late 1990s, and for several years in the mid-2000s, coastal sea surface temperatures in both the Gulf of Alaska and the CCE tend to be higher, while those in the North Pacific Gyre tend to be lower. However, sea surface temperatures in the CCE are not as reliably predicted by the PDO as those in more northerly regions.

The effects of the PDO were first described as strongly related to low frequency variations in salmon productivity throughout the North Pacific, and there continues to be strong evidence for an association between the PDO and salmon production in most regions of the North Pacific. The PDO has since been associated with variability in over 100 physical and biological time series, including sea level pressure precipitation and streamflow indices in the Pacific Northwest, time series of zooplankton species composition, and recruitment and abundance indices for commercially important species. In general, the PDO is associated with increases in the productivity of the North Pacific Ocean environment and many of the commercially important populations of interest. However, the PDO rarely explains the majority of the variance in any given time series, and is consequently not an exclusive indicator of the likely productivity of any given stock or population.

The North Pacific Gyre Oscillation (NPGO) is a climate index that has been described relatively recently to relate to the low frequency signal in sea surface heights over the Northeast Pacific. The variability in sea surface heights is a driver of variations in the circulation of the North Pacific Gyre, which in turn relate to the source waters for the California Current. Positive values of the NPGO are linked with increased equatorward flow in the California Current from the Gulf of Alaska to the Eastern Tropical Pacific, which in turn is associated with increased surface salinities, nutrients, and Chlorophyll-a values in the CCE.

Negative values of the NPGO are associated with decreases in surface salinities, nutrients and Chlorophyll, inferring less subarctic source waters for the California Current and generally lower productivity. For example the NPGO was strongly negative during the 2005 and 2006 years, which in turn were associated with record low levels of juvenile groundfish productivity, salmon smolt survival and seabird reproductive success in parts of the CCE. The NPGO has been positive through 2011 and most of 2012, indicating strong circulation in the North Pacific gyre and a generally more productive CCE.

Figure 1.1 tracks MEI, PDO, and NPGO values over time, while Figure 1.2 shows more recent trends in these indices. In summary, these three large-scale indices of ocean conditions all generally point to a cooler, and more productive California Current ecosystem over the 2010 through current (late 2012) period. The negative MEI for both summer and winter indicates slight La Niña conditions (although MEI values are increasing since mid-2012), the NPGO is positive indicating more productive source waters for the CCE, and the negative PDO values indicate a cool, more productive phase of the CCE. These all should be generally indicative of higher productivity and recruitment throughout the California Current, particularly for cooler-water species.

2 Regional Climate (Physical) and Lower Trophic Level Indicators

Local wind fields that drive coastal upwelling ultimately drive the primary production at the base of the food web, and several indices explore how to best capture upwelling signals that associate with productivity. Similarly, relative sea level, the date of spring transition, and other more regional variables are often good indicators of productivity, distribution or recruitment patterns for many species of commercial and ecological interest.

2.1 Regional Upwelling Indices

Upwelling is critically important to productivity and ecosystem health in the CCE. Local wind fields that drive coastal upwelling ultimately drive primary production at the base of the food web, and several indices explore how to best capture upwelling signals associated with productivity. The timing, strength, and duration of upwelling in the CCEis highly variable, and is forced by large-scale atmospheric pressure systems. While this report includes only a basic upwelling anomaly, the full IEA and other reports often include variables such as the Spring transition date (STI; calender date at which the system transitions from a winter-downwelling to spring-upwelling regime, and very region-specific), a cumulative upwelling index (CUI; which reflects the cumulative sum of upwelling throughout the season), the length of upwelling season (LUSI; the number of days from the STI to the end of the upwelling season), and the total upwelling magnitude (TUMI; the final value of the CUI). Any or all of these indices may relate more appropriately to the productivity or the survival of any particular region or population, although as with any climate index, such relationships can be complex.

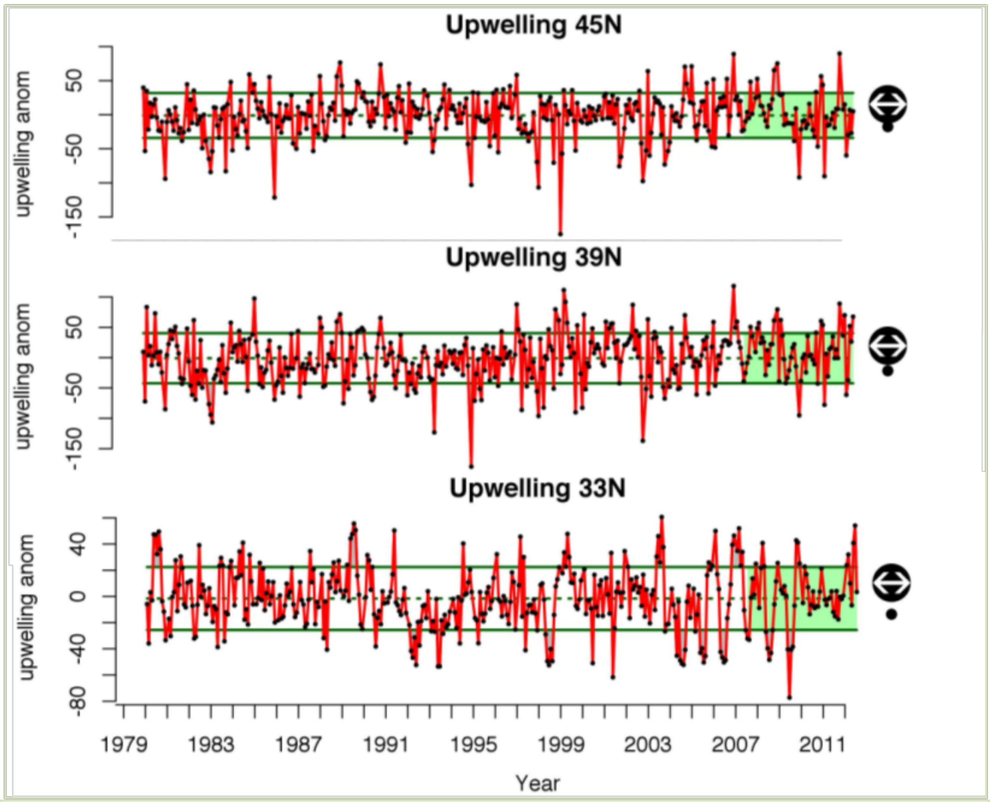


Figure 2.1: Monthly upwelling anomalies calculated at three locations along the California Current (indicated by latitude North) with seasonal means removed from the upwelling index. Positive values of the anomalies correspond to increased coastal upwelling and, consequently, productivity. The arrows represent positive (↗), negative (↘) or lack of (←→) trend over the past 5 years while a +, -, or • indicate greater than, less than, or within 1 standard deviation from the mean.

Figure 2.1 shows monthly upwelling anomalies for three locations within the CCE (monthly anomalies reflect the relative amount of upwelled water in a given month after subtracting the mean, such that the seasonal cycle is removed). This is a derivative from the upwelling index (UI). Since the La Niña conditions since the summer of 2010, there has been increased upwelling and productivity persisted through early 2012 from Baja through central California. Upwelling anomalies throughout the CCE have generally been near normal or positive since 2011, indicating favorable upwelling conditions. The anomaly plots shown in Figure 2.1 do not give an indication of the timing of the spring transition.

2.2 Dissolved Oxygen Levels and Hypoxic Events

Low dissolved oxygen concentrations in CCE coastal and shelf waters is a relatively recent issue. When dissolved oxygen concentrations fall below 1.4 ml L^{-1} (=2 mg L^{-1}= 64 uM), the waters are considered to be 'hypoxic' with limited oxygen available to organisms. Dissolved oxygen (DO) concentrations in the ocean are dependent on a number of physical and biological processes, including circulation, ventilation, air-sea exchange, production and respiration. In Oregon, upwelling transports hypoxic waters onto productive continental shelves, where respiration can reduce water-column DO and thus subject coastal ecosystems to hypoxic or anoxic conditions. Off southern California, the boundary between oxygenated and hypoxic waters has shoaled in recent years.

Although hypoxia in the CCE is the result of different mechanisms from Gulf of Mexico or Chesapeake Bay dead zones, there still is evidence of increased stress and mortality due to hypoxia – particularly off the Oregon coast. DO values have been declining over the past 14 years for Central California and 28 years for Southern California, evident through 2008. Between NOAA, state and tribal agencies, and West Coast academic

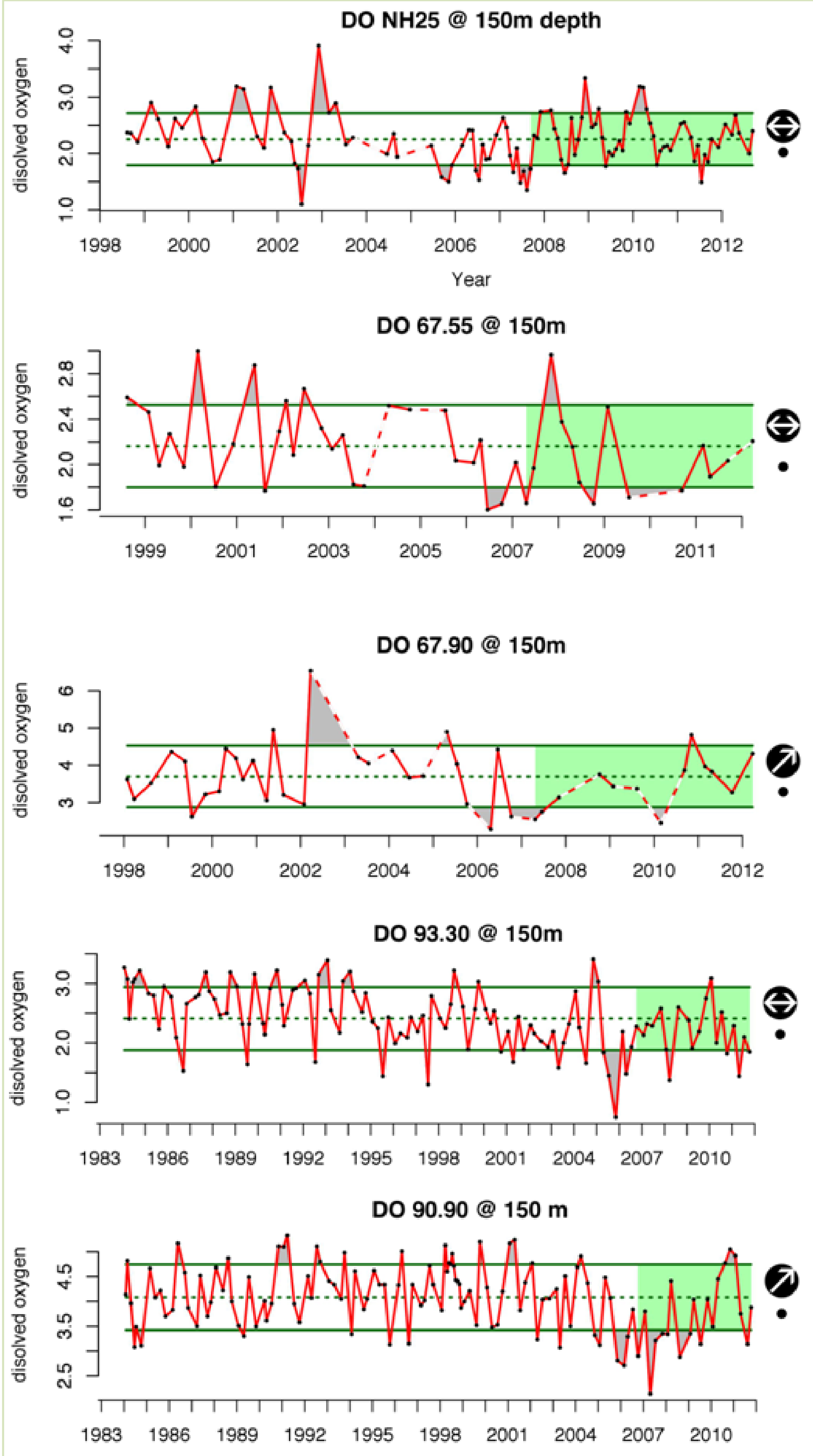


Figure 2.2: Dissolved Oxygen trends in the CCE, 1983-2011. Dissolved oxygen measured at 150 m depth for northern (Newport Line station NH25), central (calCOFI stations 67.55 and 67.90), and southern California (calCOFI stations 93.30 and 90.90). Stations 93.30, 67.55, and NH25 are located within 50 km from the shore, while stations 90.90 and 67.90 are located over 300 km from shore. Dashed lines show areas with a gap greater than 6 months. The arrows represent positive (↗), negative (↘) or lack of (←→) trend over the past 5 years while a +, -, or • indicate greater than, less than, or within 1 standard deviation from the mean.

institutions, there are a variety of oceanographic monitoring stations off the U.S. West Coast, including several where oceanographic data (like DO levels) are collected. Figure 2.2 shows DO trends derived from offshore sampling station data at several locations. In the past 5 years, oxygen has increased at the offshore California stations (67.90 and 90.90). Near shore DO values are almost always lower than those offshore (67.55 vs. 67.90 and 93.30 vs. 90.90). All three inshore stations from Oregon to Southern California had mean values of approximately 2.3 ml L-1. Declining DO is a concern for the CCE as it can result in habitat compression for pelagic species, more severe hypoxic events on the shelf, and resultant physiological stress or even die-offs for less mobile species.

There is variability between DO time series of nearshore and offshore stations, indicating that oxygen is influenced by multiple processes and that spatial averaging may not appropriate. The DO time series presented above are from shelf waters and may not adequately correlate with nearshore hypoxic events, where other datasets may be more informative.

2.3 Northern Copepod Biomass Anomaly

Zooplankton are the foundation of the ocean food web, linking oceanographic conditions and primary production to upper trophic levels and fueling the delivery of ocean ecosystem services. As such, they are useful as a leading indicator of future changes in fish stocks.

The northern copepod biomass anomaly is the ratio of northern and southern copepod species off of the Oregon coast. Two of the cold–water species, Calanus marshallae and Pseudocalanus mimus, are lipid–rich, and the index may represent the amount of lipid available to pelagic fishes for whom these fatty compounds appear to be essential.

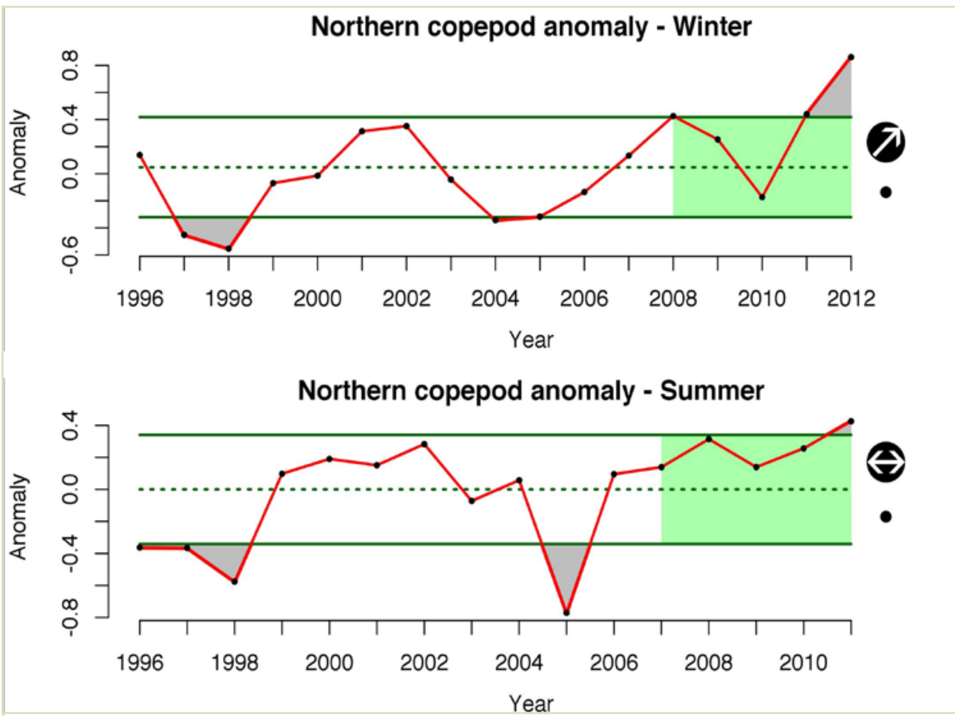


Figure 2.3: Northern copepod biomass anomaly for 1996-2012 in the waters off of Oregon during the winter (Oct-April) and summer (May-Sept). Dark green horizontal lines show the mean and ± 1.0 s.d. (solid line) of the full time series. The shaded green area is the last five years of the time series, which is analyzed to produce the symbols to the right of the plot. The upper symbol indicates whether the modeled trend over the last 5 years increased (↗), or decreased (↘) by more than 1.0 s.d., or was within 1.0 s.d (←→) of the long-term trend. The lower symbol indicates whether the mean over the past 5 years was greater than (+), less than (-), or within (•) 1.0 s.d. of the long-term mean. Data courtesy of Bill Peterson.

The northern copepod anomaly has fluctuated between 1996 – 2012. In the last five years, the anomaly increased in the winter, but there was no trend in the summer. For both seasons, the mean of the last five years was within 1.0 s.d. of the long term mean of the full time series, although in the winter values for the last two years were above 1.0 s.d. of the long-term mean, as is the last data point for the summer time series.

Threshold values for the northern copepod anomaly have not been set; however, positive values in the summer period are correlated with stronger returns of fall and spring ocean-type Chinook to Bonneville dam, and values greater than 0.2 are associated with better survival of coho. Overall the high anomalies in recent years, especially for the summer data, suggest that ocean conditions are in a generally productive state for California Current fisheries.

2.4 Copepod Species Richness off Washington and Oregon

The number of copepod species present (copepod species richness) is linked to food chain structure, and William Peterson and colleagues (NWFSC) have linked survival of coho salmon (*Oncorhynchus kisutch*) in the CCE. Low species richness is correlated with the southern transport of northern waters, high abundance of lipid-rich northern copepods and increased growth and survival of some fish species.

Species richness for copepods (quantified as the number of species per sample of approximately 200-400 individuals) was highly variable over time. Species richness for the winter assemblage showed an increasing trend in the short-term suggesting worsening ocean conditions in the short term. The mean of the last five years was within 1.0 s.d. of the long-term mean. While highly variable, species richness for the summer did not show any recent trends beyond typical cycling seen in the earlier parts of the time series.

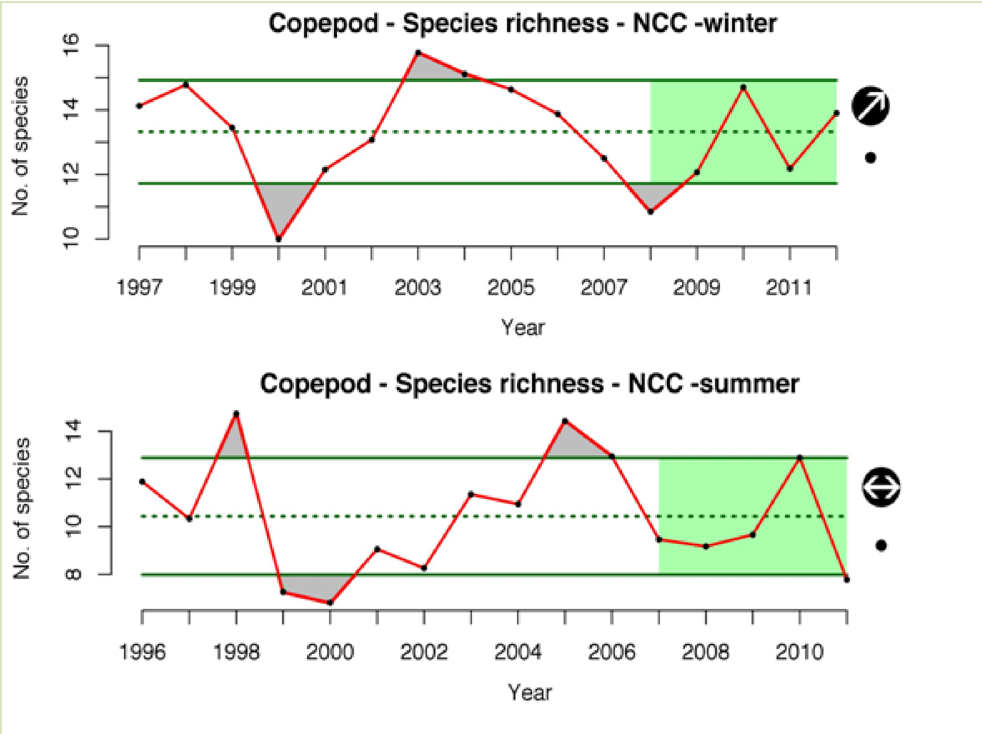


Figure 2.4: Copepod species richness for the summer in waters off Oregon in the northern California Current (NCC) from 1997-2012. Dark green horizontal lines show the mean and ± 1.0 s.d. (solid line) of the full time series. The shaded green area is the last five years of the time series, which is analyzed to produce the symbols to the right of the plot. The upper symbol indicates whether the modeled trend over the last 5 years increased (↗), or decreased (↘) by more than 1.0 s.d., or was within 1.0 s.d (←→) of the long-term trend. The lower symbol indicates whether the mean over the past 5 years was greater than (+), less than (-), or within (•) 1.0 s.d. of the long-term mean. Data courtesy of Bill Peterson.

3 Regional Biological Higher Trophic Level Indicators

These indicators can be empirical or model based, and should either directly or indirectly relate to the productivity or condition of managed or protected species or assemblages. Ideally, they should offer some perspective on the relative condition of species, species assemblages or communities that might not necessarily be reflected by species-specific metrics.

3.1 Coastal pelagic species: anchovy, sardine, and forage diversity

The time series shown in Figure 3.1 represent trends in northern anchovy and Pacific sardine based on a decade (1998-2009, 2011, and 2012) of NMFS research cruises off in the Southern California Bight (SCB), off central California, and off Oregon and Washington. While a number of species were collected, anchovy and sardine were the only forage species that were enumerated in all three surveys and therefore, can be used to compare patterns along the coast. However, each time series represents a very different survey methodology with different selectivity and often different survey objectives. Thus, none should be considered to be accurate reflections of the abundance of these species throughout the entire CCE, for which stock assessments provide the most accurate synthesis of information.

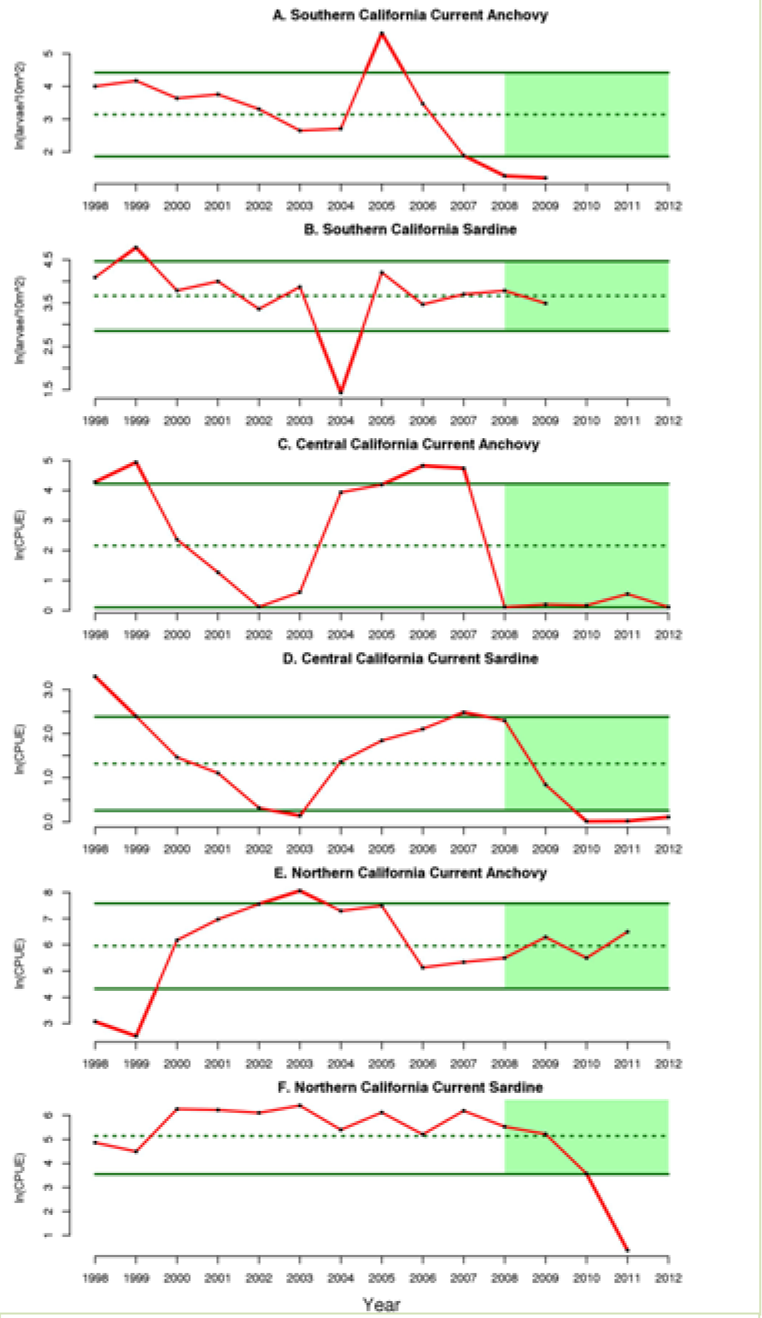


Figure 3.1 CPS Survey Abundance, 1998-2011/12

The time series represent similar periods of collection for each survey, although the availability of data varies for each. The dashed green line shows the average abundance of the log-transformed time series and the solid green lines represent +/- 1 standard deviation. The green region represents the last five years and can be used to compare recent trends between surveys, although the differences in data availability should be taken into account.

In recent years the abundance of anchovy was below average and declining in Southern California Bight surveys, continues to be well below average in central California, but remains average in northern California. In the southern regions, sardine remain near average in recent years, but since 2009 sardine presence in surveys has declined in central California and northern California.

A more diverse forage base generally indicates a more resilient and healthy ecosystem. The species enumerated and richness of the three surveys for which we have sampled the forage base are quite different, but comparing trends between each can give a broad sense of the relative change in the forage base across the CCE.

In Figure 3.2, the Simpson's Diversity Index is calculated for the decade 1998-2009, 2011, 2012 (1 – lambda). Simpson's Diversity Index represents the likelihood that two species collected at random will be different species from each other (a greater number indicates greater diversity). This value was determined based on all the fish that were enumerated during the cruises for central and Northwest surveys. For the Southern California Bight, the preliminary diversity value was calculated for sardine and anchovy, plus mesopelagic species representing warm and cool water assemblages, and should not be regarded as representative of the full forage diversity (which includes mackerels, smelts, squids, and numerous mesopelagic species not included here).

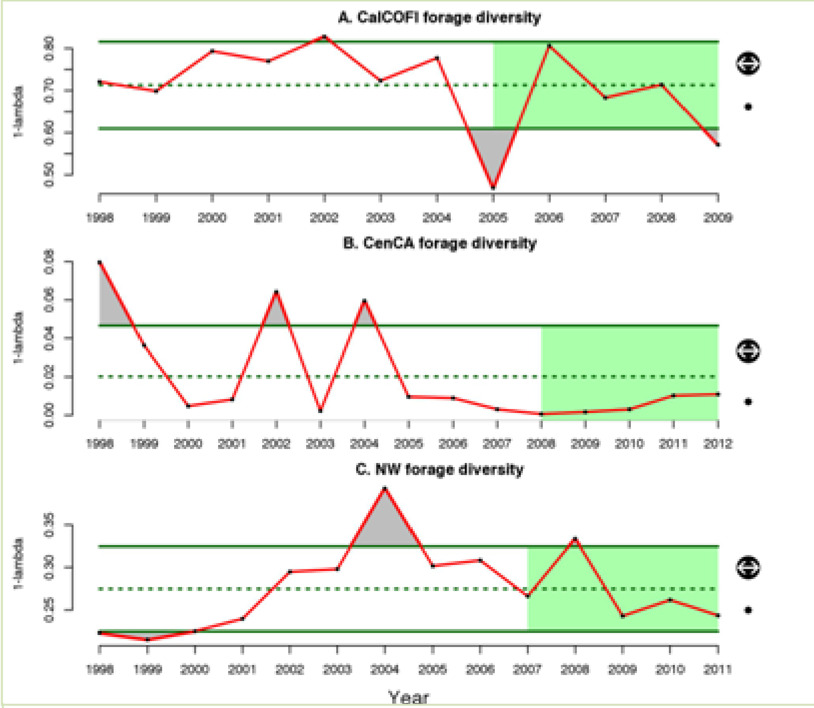


Figure 3.2 Simpson's Diversity Index, 1998-2011/12

Generally, the diversity of the CCE forage community shows limited indications of decline in the Southern California Bight and Northwest regions, but has appeared stable off central California in the last five years.

3.2 Salmon: Chinook salmon abundance

Chinook salmon are iconic members of North Pacific rim ecosystems. Salmon support large commercial and recreational marine and freshwater harvest. Because they are anadromous with extensive migrations, salmon connect marine and freshwater ecosystems. Here, we compare the trends in spawning escapement (which incorporates the cumulative effect of natural and anthropogenic pressures) along the CCE to evaluate the coherence in production dynamics as well as get a more complete image of their health across the greater portion of their ranges. We examine populations that have data representation to 1983 (the shortest time series is Central Valley data which begins in 1983) so that trends can be compared between populations. Due to shorter and inconsistent data series we have restricted our analysis to only Chinook salmon.

Figure 3.3 summarizes information from multiple time series. Before plotting, time series were normalized to place them on the same scale. The short-term trend (x-axis) indicates whether the escapement increased or decreased significantly over the last 10-years of the time series. The y-axis indicates whether the mean escapement of the last 10 years is greater or less than the mean of the full time series. Dotted lines show ± 1.0 s.d. The legend indicates the stocks that we examined.

In California, Central California winter and coastal populations remain stable but there is a significant negative slope in spawning escapement. However, the mean abundance in the last ten years is not significantly different from the long-term mean (since 1983). In Oregon and Washington, Snake River spring-summer salmon, Willamette River, and upper Columbia River spring salmon escapement remain stable, but lower Columbia River salmon is declining while Snake River fall salmon is increasing (and is above the long term mean). Since 1983 the California Chinook salmon populations represented here are generally declining while more northern populations are generally remaining largely stable or increasing.

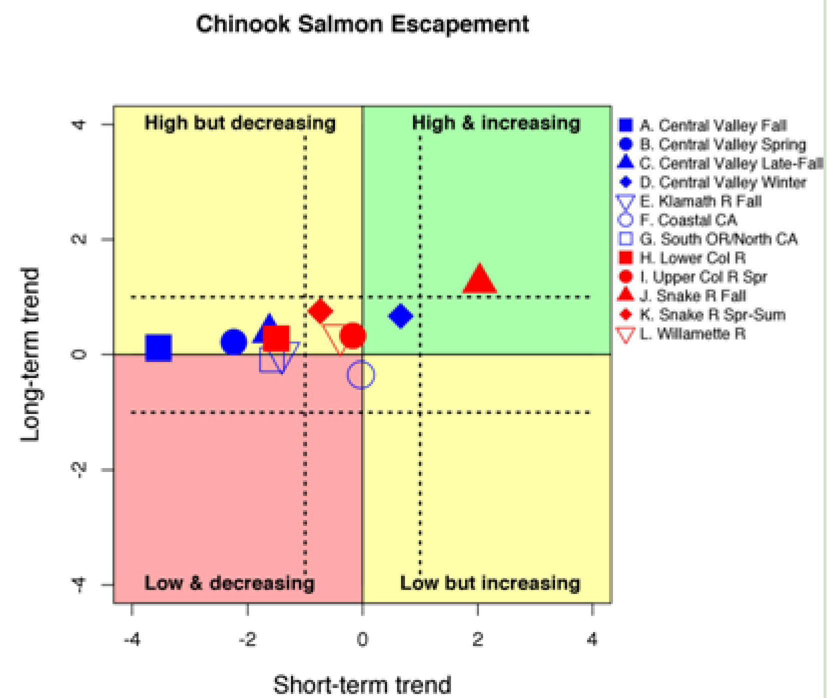


Figure 3.3: West Coast salmon escapement trends

3.3 Groundfish: Stock Status Relative to Biological Reference Points

Most assessed groundfishes are above the biomass limit reference point, and are thus not overfished (Figure 3.4). The four assessed stocks currently in an overfished state are all rockfishes. Approximately 30 of the 90-plus managed groundfish species within the groundfish FMP have been evaluated (either recently or historically) for the overfished threshold based on stock assessment results. Results for those assessments conducted over the most recent three assessment cycles are reflected in this figure (although those from the most recent round of stock assessments are not yet included). For species that have not undergone stock assessments, data from the NWFSC annual trawl survey (or other surveys) are not sufficient for evaluating whether or not a stock is below the overfished threshold. Although methods have been developed to estimate allowable catches for unassessed species, formal status determinations for such species are not currently feasible. In general, these results suggest that most groundfish populations that have been formally assessed in the CCE are at or above their target biomass levels, and most are at or below half of the total allowable catch or mortality level (the two notable exceptions being sablefish and darkblotched rockfish, both of which are still comfortably below the total allowable mortality level). Individual trajectories for each stock are available in the stock assessments themselves for each species, by far the vast majority (albeit not all) of these species demonstrate stable or increasing abundance trends.

In Figure 3.4, stock status is plotted relative to being overfished (x-axis) and overfishing (y-axis) for all species assessed since 2007. The vertical broken line indicates the target biomass reference point. The vertical solid lines indicate the limit reference point showing an overfished status (red for elasmobranchs, rockfishes, and roundfishes; purple for flatfishes). The horizontal line indicates overfishing wherein total mortality exceeds the allowable biological catch. For example, sablefish is below the target (black vertical broken line), but above the limit (red vertical solid line) biomass target, and below the overfishing limit (horizontal solid line). Symbols indicate the terminal year of the assessment in which the reference points are determined.

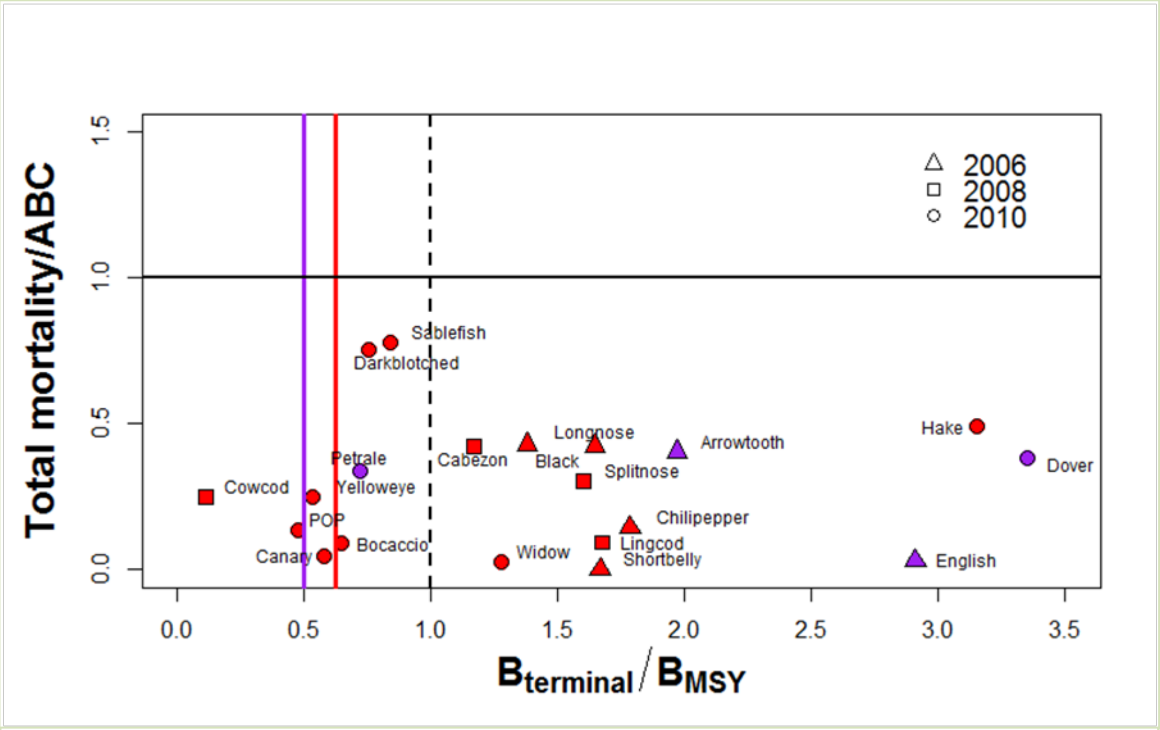


Figure 3.4: West Coast groundfish stock statuses

3.4 Mean Trophic Level of West Coast Groundfishes

Mean trophic level (MTL) is the biomass-weighted average trophic level of species in an ecosystem and provides a synoptic view of their trophic structure. Conceptually, MTL is linked to top-down control and trophic cascades – a decline in MTL represents a decrease in the ability of predators to 'control' prey populations and may have far-reaching consequences to ecological communities. Declines in MTL also reduce the primary productivity required to support a given level of catch.

Groundfish MTL was calculated from the West Coast Groundfish Bottom Trawl Survey, meaning that this section addresses MTL of groundfish taken in the survey, not necessarily the MTL of groundfish species within the CCE. Trophic level for each species was obtained from Fishbase.org.

MTL for surveyed groundfishes declined from 2003 until 2010, increasing marginally in 2011. The fluctuation over the entire time series was approximately 0.08 from a high of 3.72 in 2004 to a low of 3.64 in 2010, which represents a ~25% decrease in the primary productivity required to support a given amount of catch. Over the last five years of the time series, groundfish MTL declined by more than 1.0 s.d. of the long-term mean. The mean of the last five years of the time series is within 1.0 s.d. of the full time series. However, given the short length of the time series (nine years), comparing the mean of the last five years with the mean of the full time series is of limited value, and the reader should focus on the short-term trend. Importantly, fluctuations in MTL are not uncommon.

A potential cause of the decrease in surveyed groundfish MTL was due to a decline in abundance of Pacific hake *Merluccius productus* and spiny dogfish *Squalus acanthias*. Hake in particular consume large amounts of forage fish and krill, and their lower abundance may mean an increase in food resources for other species that utilize these prey.

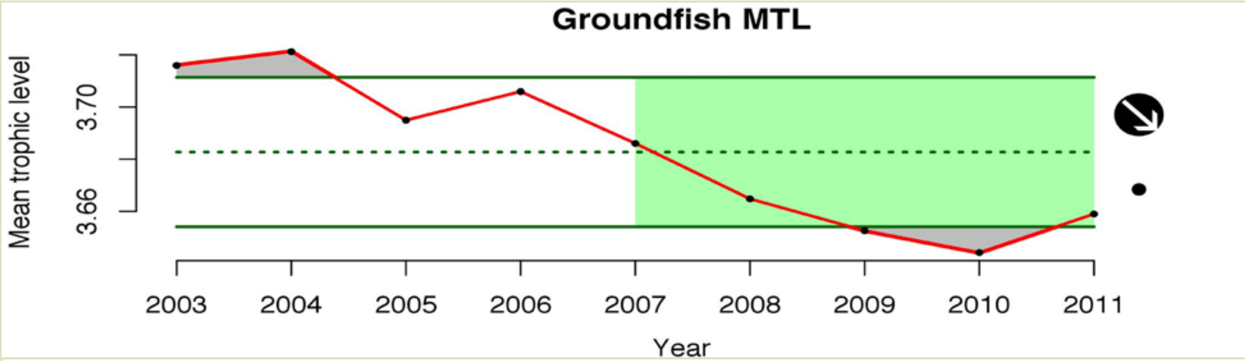


Figure 3.5: Area-weighted mean trophic level (MLT) for west coast groundfishes from 2003 – 2011. . Dark green horizontal lines show the mean and ± 1.0 s.d. (solid line) of the full time series. The shaded green area is the last five years of the time series, which is analyzed to produce the symbols to the right of the plot. The upper symbol indicates whether the modeled trend over the last 5 years increased (↗), or decreased (↘) by more than 1.0 s.d., or was within 1.0 s.d (←→) of the long-term trend. The lower symbol indicates whether the mean over the past 5 years was greater than (+), less than (-), or within (•) 1.0 s.d. of the long-term mean. Data are from the West Coast Groundfish Bottom Trawl Survey.

3.5 Mammals: California Sea Lion Pup Production

California sea lions are of great interest as a charismatic species, for its impacts on fisheries (e.g., depredation of salmon fishing lines and direct predation of returning salmon), and as indicators of environmental variability. Figure 4.4 shows a time series of pup counts within the CCE. Pup counts, year to year, represent reproductive success as well as, over the longer time frame, the abundance of adults.

The primary indicators of the abundance of California sea lions in the CCE are aerial surveys conducted in July by NMFS's Southwest Fisheries Science Center. Pups and other age/sex classes are counted from color photographs taken at rookeries and haul outs during aerial surveys of islands and the mainland coast of California.

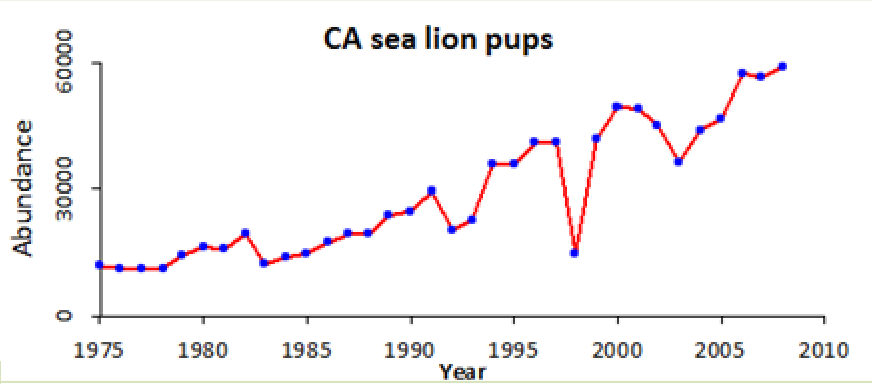


Figure 3.6: California sea lion pup production, 1975 - 2010

It is evident from Figure 3.6 that sea lion production has increased in the 40 years since the 1972 enactment of the Marine Mammal Protection Act.

4 Human Dimensions

These indicators can be empirical or model based, and should either directly or indirectly relate to the productivity or condition of managed or protected species or assemblages. Ideally, they should offer some perspective on the relative condition of species, species assemblages or communities that might not necessarily be reflected by species-specific metrics. The status of each indicator below was evaluated against two criteria: recent short-term trend and status relative to the long-term mean—reported as short-term status and long-term status, respectively.

Short-term trend. An indicator was considered to have changed in the short-term if the trend over the last five years of the time series showed an increase or decrease of more than 1.0 standard deviation (SD) of the mean of the entire time series.

Status relative to the long-term mean. An indicator was considered to be above or below historical norms if the mean of the last five years of the time series differs from the mean of the full time series by more than 1.0 SD of the full time series.

Time series figures. Time series are plotted in a standard format. Dark green horizontal lines show the mean (dotted) and ± 1.0 SD (solid line) of the full time series. The shaded green area is the last five years of the time series, which is analyzed to produce the symbols to the right of the plot. The upper symbol indicates whether the modeled trend over the last 5 years increased (↗), or decreased (↘) by more than 1.0 SD, or was within 1.0 SD (↔) of the long-term trend. The lower symbol indicates whether the mean of the last five years was greater than (+), less (-), or within (•) 1.0 SD of the long-term mean.

4.1 Total landings by major fisheries

The best source for information on stock-specific fishery removals is typically stock assessments that report landings, estimate amount of discard, and evaluate discard mortality, but these are only available for assessed species. For non-assessed stocks, fishery removal data are best summarized in the Pacific Fisheries Information Network (http://pacfin.psmfc.org).Landings provide the best long-term indicator of fisheries removals. Landings of coastal pelagic species were above historic levels over the last five years; crab and shrimp landings increased over the short-term but were still within historic levels; and landings of salmon and groundfish species (excluding hake) were at consistently low levels for the last five years. All other species groups were consistently within historic landing levels.

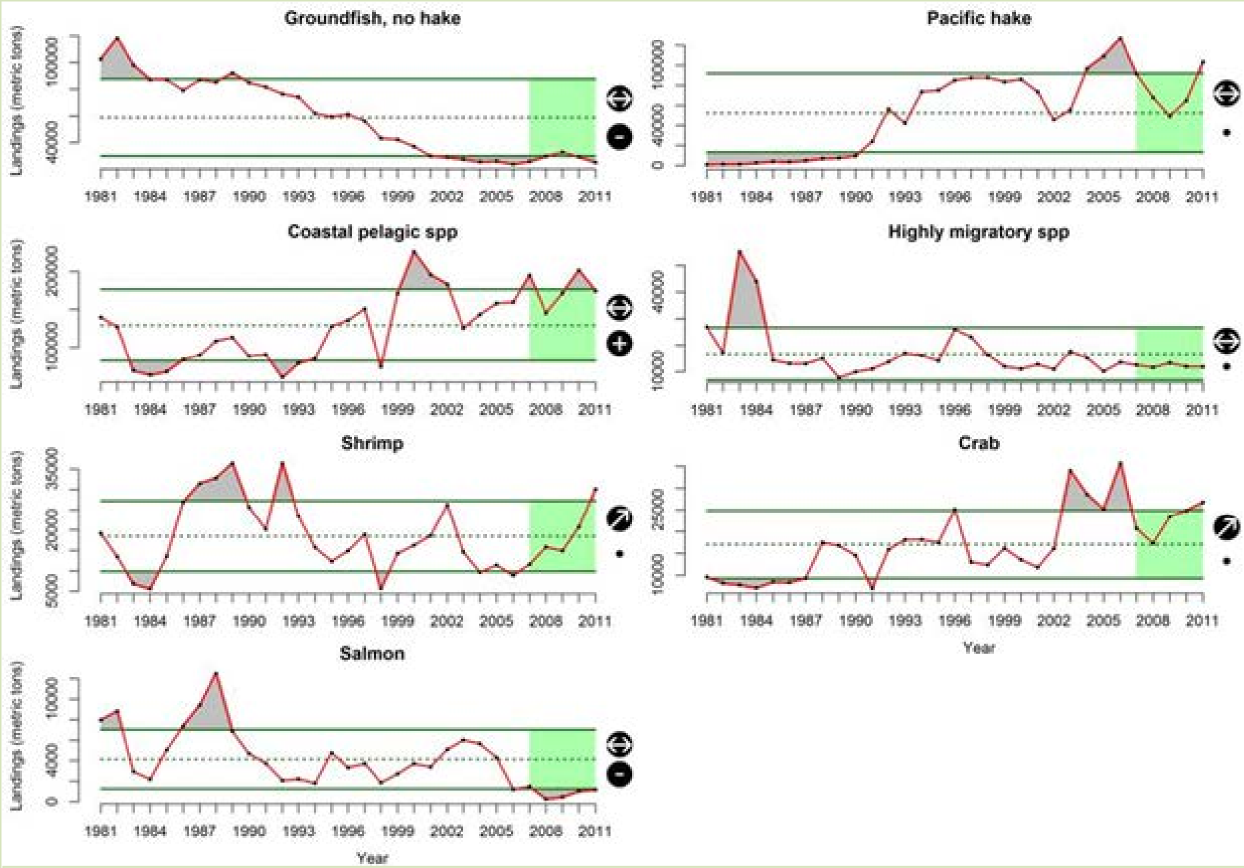


Figure 4.1: Annual landings of seven major West Coast commercial fisheries

4.2 Aquaculture production and seafood demand trends

Shellfish aquaculture in the CCE increased over the last five years, but was within the long-term historic average. Finfish aquaculture has been constant over the last five years and at the upper limits of the long-term average. Any increases in shellfish or finfish aquaculture production over the next few years will likely cause these indicators to be above historic levels.

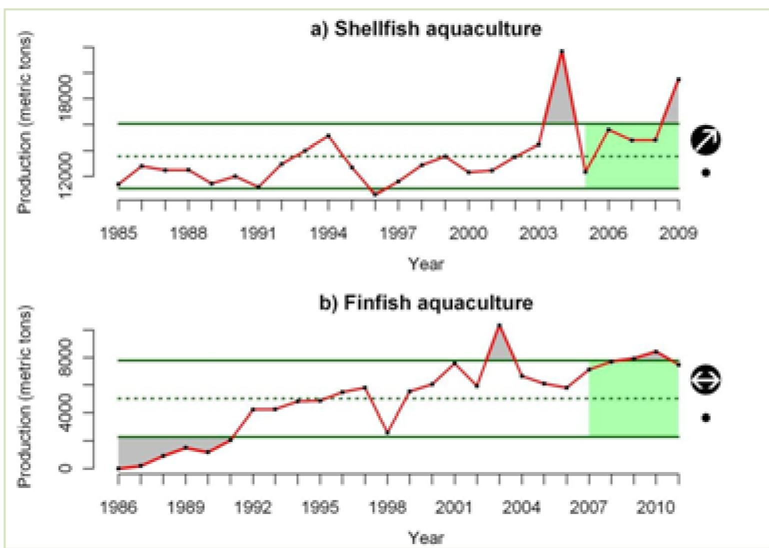


Figure 4.2: U.S. production of a) shellfish (clams, mussels and oysters) and b) finfish (Atlantic salmon, Salmo salar) in marine waters of the CCLME.

Shellfish aquaculture data was acquired from the California Department of Fish and Game and the Oregon Department of Agriculture. Washington State does not have good production estimates, so data from NOAA's Fisheries of the United States annual reports were used for Washington State. The only marine netpen finfish aquaculture operations occur in Washington State and data came from the Washington Department of Fish & Wildlife.

Seafood demand in the U.S. has been relatively constant over the last five years for both total and per capita consumption, but the short-term average of total consumption was is up. With total demand already at historic levels, increasing populations, and recommendations by the U.S. Dietary Guidelines to increase our intake of seafood, these indicators will likely increase over the next few years. These data are based on total (imports and commercial landings) edible and non-edible seafood reported in NOAA's "Fisheries of the United States" annual reports describing the utilization of fisheries products (http://www.st.nmfs.noaa.gov/st1/publications.html).

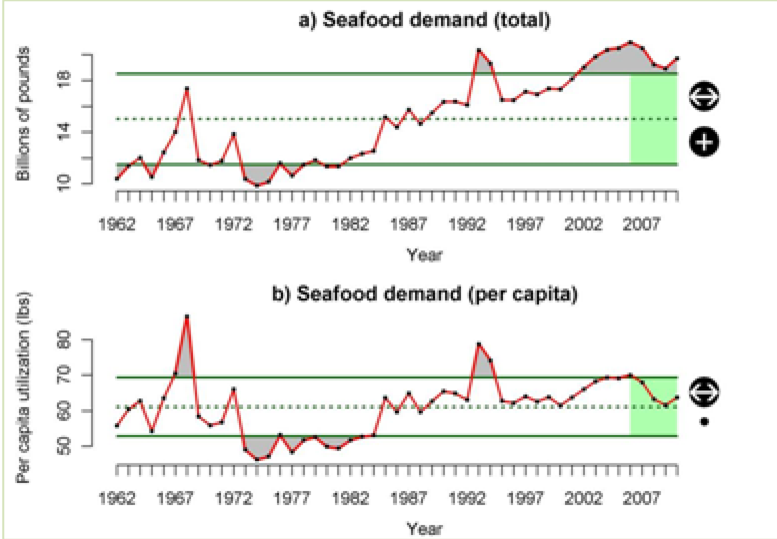


Figure 4.3: a) Total and b) per-capita utilization of edible and non-edible fisheries products across the United States.

4.3 Fleet diversity indices

Catches and prices from many fisheries exhibit high inter-annual variability leading to high variability in fishermen's income. Kasperski (AFSC) and Holland (NWFSC) recently examined > 30,000 vessels fishing off the West Coast and Alaska over the last 30 years. This work shows that variability of annual revenue can be reduced by diversifying fishing activities across multiple fisheries or regions. Diversification can be measured with the Herfindahl-Hirschman Index (HHI) which ranges from a high 10,000 for vessel that derives all its income from a single fishery and declines toward zero as revenues are spread more evenly across more fisheries.

Levels of diversification for groupings of vessels vary greatly, and levels of diversification for these vessel groupings exhibit different trends over time. The current fleet of vessels fishing on the US West Coast and in Alaska (those that fished in 2010) is less diverse than at any point in the past 30 years. The trends over time are due both to entry and exit of vessels and changes for individual vessels. Over time less diversified vessels have been more likely to exit which increases the average diversification level (decreases HHI). However vessels that remain in the fishery have become less diversified, at least since the mid 1990s, and newer entrants have generally been less diversified than earlier entrants. The overall result is a moderate decline in average diversification (increase in HHI) since the mid 1990s or earlier for most vessels groupings. Notwithstanding these trends in average diversification, there are wide range of diversification levels and strategies within as well as across vessel classes and some vessels remain highly diversified.

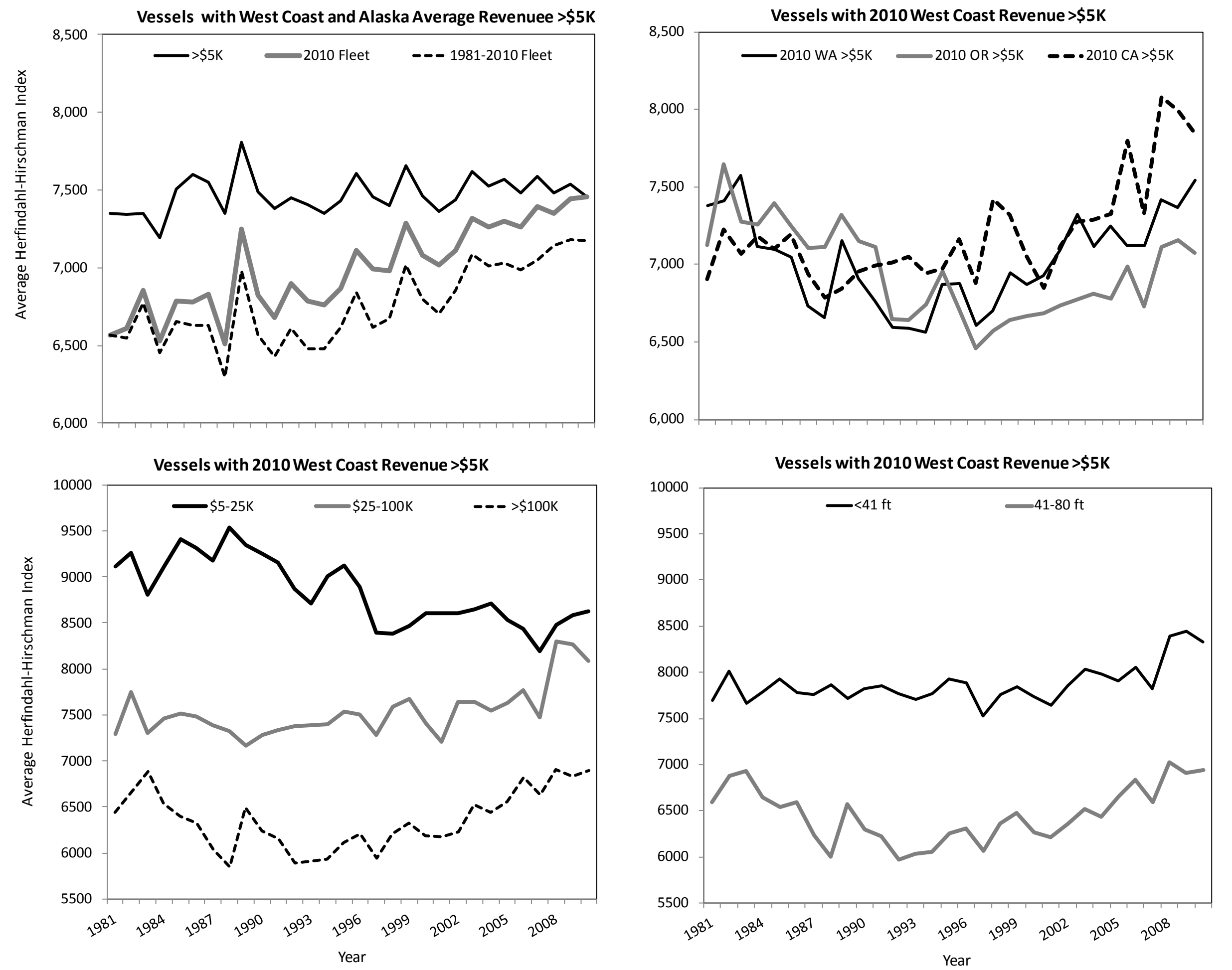


Figure 4.4: Trends in average diversification for US West Coast and Alaskan fishing vessels with over $5k in average revenues (top left panel) and for vessels with 2010 West Coast revenue >$5k (top right and bottom

4.4 Trends in benthic structures, shipping activity, nutrient input and offshore oil and gas activity

The effects of benthic structures, such as oil rigs, wells and associated anchorings, on managed species will be initially destructive with the loss or modification of habitat, but these risks may dissipate in the long term by potential enhanced productivity brought about by colonization of novel habitats by structure-associated fishes and invertebrates (e.g., rockfish, encrusting organisms, etc.). However, activities associated with oil & gas extraction can disturb the associated epifaunal communities, which may provide feeding or shelter habitat for species of interest. Benthic organisms, especially prey species, may recolonize disturbed areas, but this may not occur if the composition of the substrate is drastically changed or if facilities are left in place after production ends.

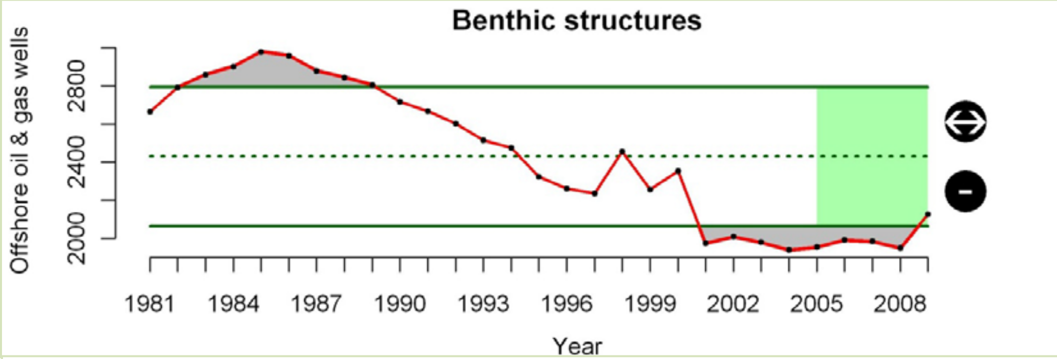


Figure 4.5: The number of offshore oil and gas wells in production or shut-in within the CCE.

Approximately 90% of world trade is carried by the international shipping industry and the volume of cargo moved through U.S. ports is expected to double (as compared to 2001 volume) by 2020. Fisheries impacts associated with increased commercial shipping include interactions between fishing and shipping vessels; ship strikes of protected species; underwater noise levels that impact fish spawning, migration, communicative, and recruitment behaviors.

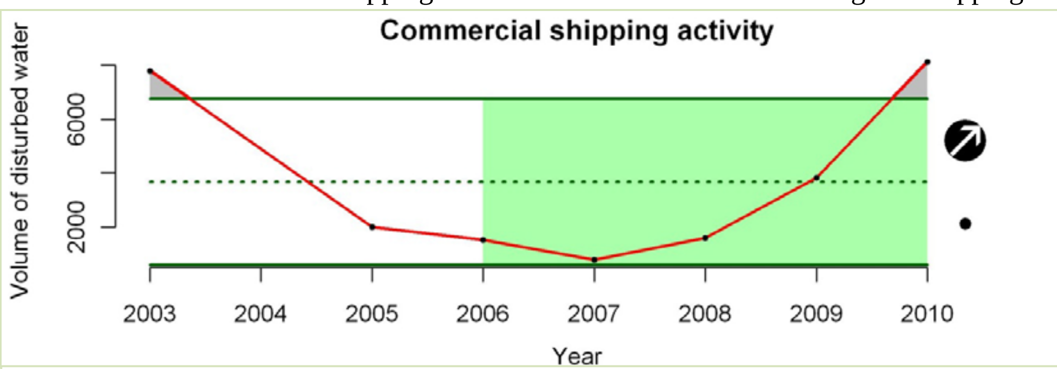


Figure 4.6: Volume (millions m3) of water disturbed during transit of commercial shipping vessels along the coast of the CCE.

Commercial shipping activity in the CCE increased over the last five years, but the short-term mean was within the long-term mean of the entire dataset. Data come from the U.S. Army Corps of Engineers and integrate distance traveled and draft and breadth of all port-to-port coastwise traffic for foreign and domestic vessels.

Elevated nutrient concentrations are a leading cause of contamination in streams, lakes, wetlands, estuaries, and ground water of the United States. Excessive nutrients accelerate eutrophication, which produces a wide range of other impacts on aquatic ecosystems and fisheries, including: algae blooms; declines in aquatic vegetation; mass mortality of fish and invertebrates through poor water quality (e.g., via oxygen depletion and elevated ammonia levels); and alterations in long-term natural community dynamics.

Nutrient input was constant over the last five years of the dataset (1997 – 2001) and the short-term average was within 1SD of the long-term average of the time series (Fig. 4.7). Overall, the application of nitrogen and phosphorus has leveled off at a relatively high level compared to levels in the 1940's and 1950's. Steep increases occurred since the beginning of this time series until the early 1980's.

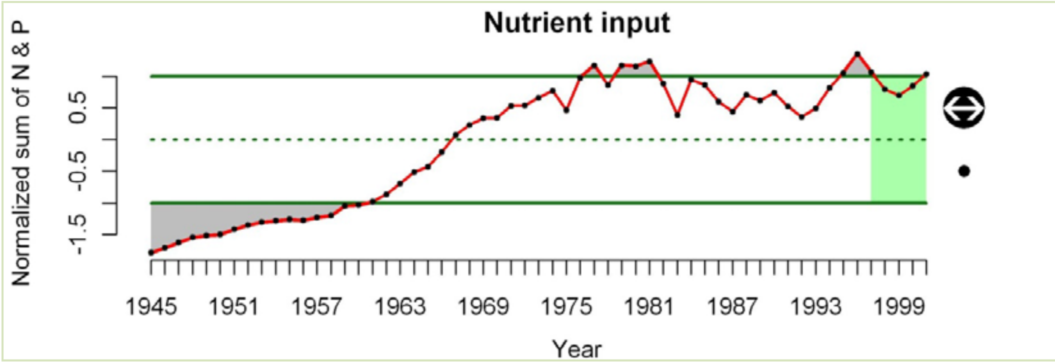


Figure 4.7: Normalized index of the sum of nitrogen and phosphorus applied as fertilizers in WA, OR and CA.

Data consist of county-level inputs of nitrogen and phosphorus via fertilizers in WA, OR and CA (http://pubs.usgs.gov/sir/2006/5012/). Please see IEA document for complete methodology. Data from 2001 – 2010 are being compiled by the USGS and should be available for updating this indicator within the latter half of 2012.

The environmental risks posed by offshore exploration and production of oil and gas are well known. They include the loss of hydrocarbons to the environment, smothering of benthos, sediment anoxia, destruction of benthic habitat, and the use of explosives. Petroleum products, including PAHs, consist of thousands of chemical compounds which can be particularly damaging to marine fishes. Effects of exposure to PAH in benthic species of fish include liver lesions, inhibited gonadal growth, inhibited spawning, reduced egg viability and reduced growth. The effects of oil rigs on fish stocks is less conclusive, as there may be some benefits associated with the structure associated with rigs.

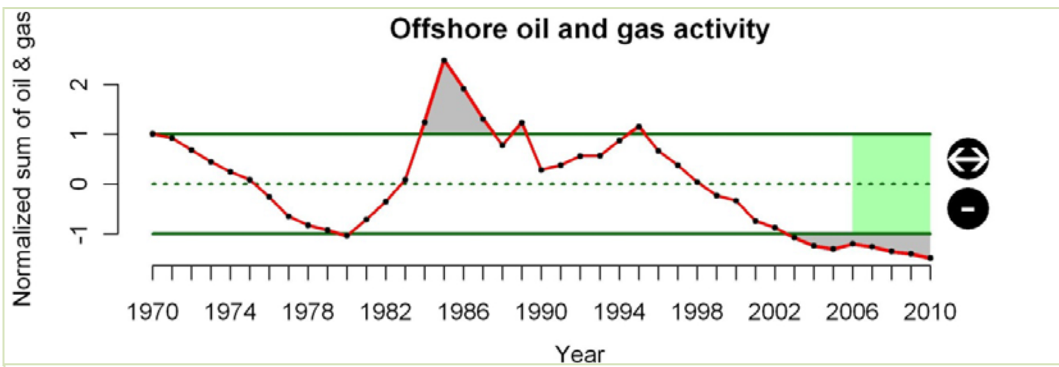


Figure 4.8: Normalized index of the sum of oil and gas production from offshore wells in CA.

Offshore oil and gas activity in the CCE has been constant over the last five years, but the short-term average was greater than 1SD below the long-term average (Fig. 8). A rather steady decrease in oil and gas production has occurred over the last 15 years.

Data were retrieved from annual reports of the California State Department of Conservation's Division of Oil, Gas, and Geothermal Resources (ftp://ftp.consrv.ca.gov/../pub/oil/annual_reports/).

Conclusion

A synthesis of the indicators presented here suggests several things. First, the CCE has for the last several years, and with some exceptions in most years since 1999, generally experienced relatively cool, high productivity coastal ocean conditions. High relative abundance of northern copepods off of Newport are consistent with this observation of high productivity in recent years, and high productivity of fast-growing, high turnover invertebrates (such as market squid, pink shrimp and Dungeness crab) are consistent with the observation that coastal ocean productivity has been high. Although there are signs that a potential strong El Niño event may be developing in the tropics, it is unclear whether this will lead to significant impacts on productivity or the distribution of marine fishes, since the 2010 event did not have strong impacts in this region.

The desire to produce a short and concise summary of ocean condition trends and possible or likely associated impacts constrained the ability to report on many potentially important indicators. This report lacks time series of a range of products that are related to the timing and intensity of upwelling, such as the timing of the spring transition, and the total upwelling, as well as relative transport as indicated by sea level height anomalies. Many of these indices have been shown or suspected to be linked to lower trophic level productivity, salmon survival, crab and shrimp recruitment and other indices of productivity. Time series of primary production, of indices of other forage availability (e.g., market squid, juvenile groundfish, various smelts) and others were similarly excluded. Other indicators that the EPDT collectively thought would be useful and informative were not readily available, such as indicators of seabird breeding success; these may be currently available in other reports and in future Council State of the CCE reports if the Council expresses an interest.

We also recognize that a precise or intuitive connection between some of these indices and near-term Council decisions that might be informed by this information is not always obvious. We sought balance between those indicators that are intuitive and simple, and those that might be more complex and difficult to interpret yet provide some glimmer of insight into the types of ecosystem attributes that are rarely quantified (or quantifiable) using more traditional single species approaches to management.

Consequently, we would close by noting that this November 2012 draft is not a comprehensive summary of status and trends in this ecosystem. Instead, this draft is a starting point for developing a report appropriately tailored to Council needs. There is a wealth of additional information available to interested members of the Council community. Below, we provide a short list of other reports and documents (available or forthcoming). The EPDT and IEA participants encourage all in the Council community to share their opinions regarding what type of information would be more (or less) useful for future reports.

Additional Information

- California Current Integrated Ecosystem Assessment (forthcoming) http://www.noaa.gov/iea/california.html
- California Cooperative Oceanic and Fisheries Investigations, State of the California Current annual report (most recent at http://calcofi.org/publications/calcofireports/v52/Vol_52_36-68.StateofCurrent.pdf)
- Pacific Coast Ocean Observing System (PaCOOS) Climatic and Ecological Conditions Quarterly Reports. http://www.pacoos.org/QuarterlyClimaticEcol.htm
- Ocean ecosystem indicators of salmon marine survival in the Northern California Current http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/documents/peterson_etal_2011.pdf
- Department of Fisheries and Oceans (Canada) State of the Oceans Report. http://dfo-mpo.gc.ca/science/coe-cde/soto/documents/dfo_soto/english/index-eng.htm
- Ecosystem considerations chapter of the North Pacific Fishery Management Council's Stock Assessment and Fisheries Evaluation http://access.afsc.noaa.gov/reem/ecoweb/
- North Pacific Marine Science Organization (PICES) Report on Marine Ecosystems of the North Pacific Ocean 2003-2008 (envisioned to be updated annually online) http://www.pices.int/publications/special_publications/NPESR/2010/NPESR_2010.aspx

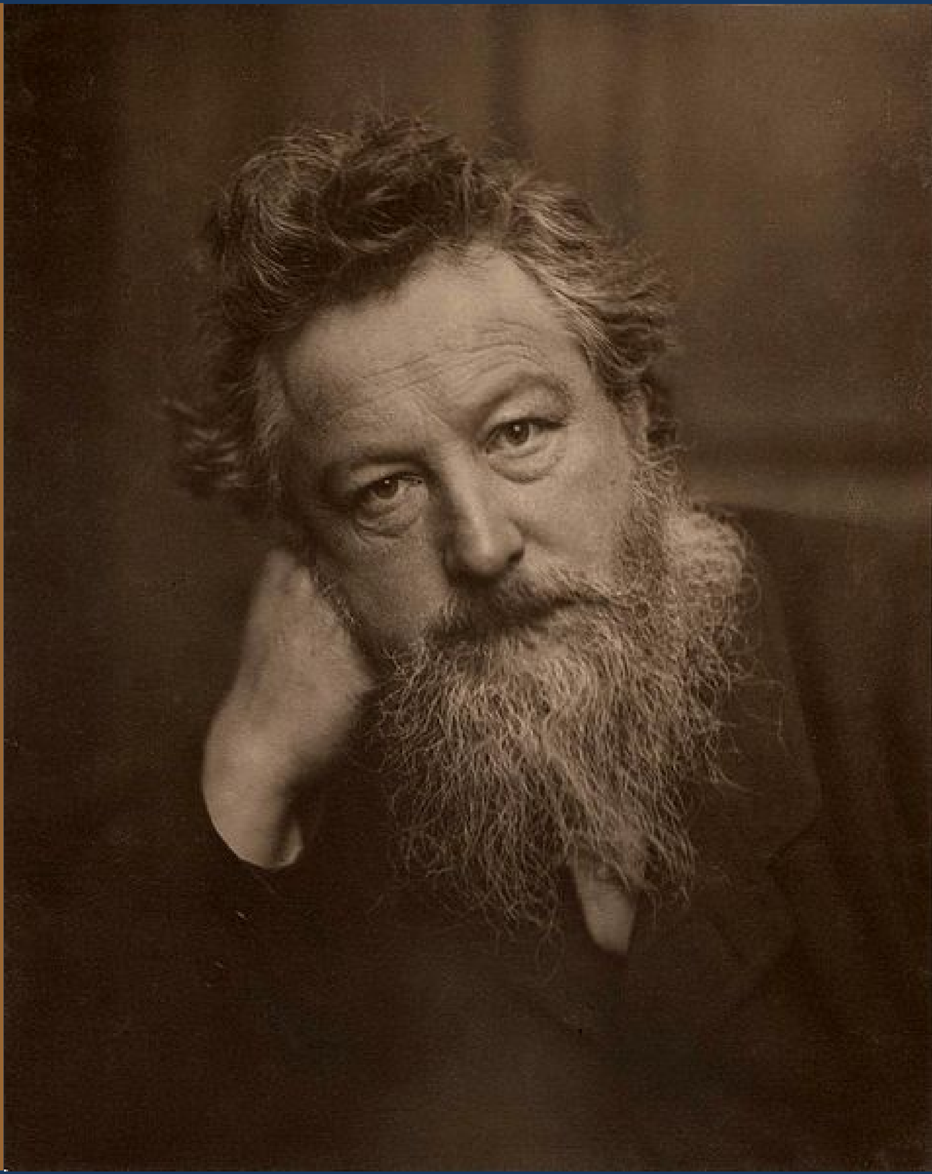
Agenda Item K.3.b
Supplemental EPDT Presentation
November 2012

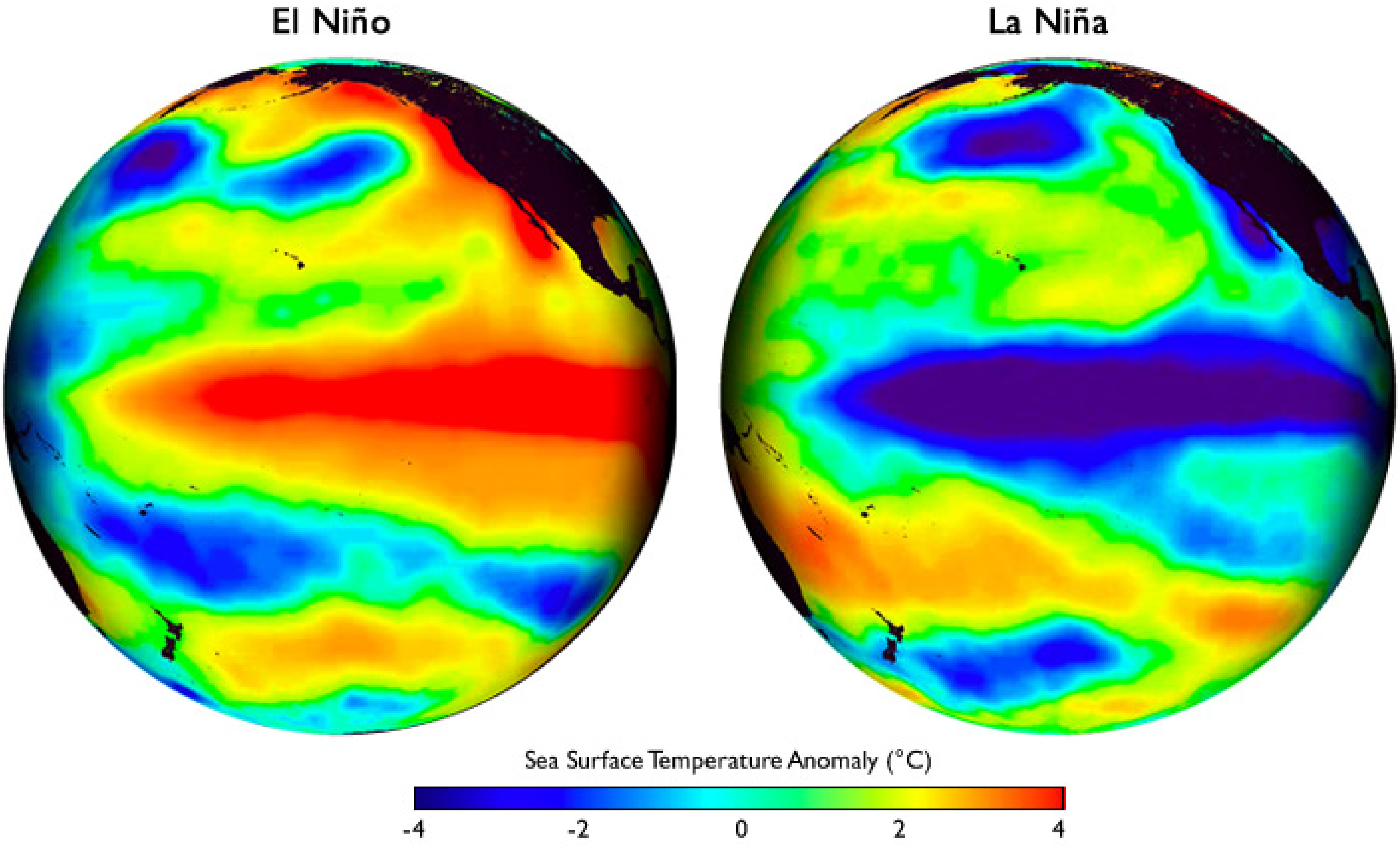
Ecosystem Plan Development Team Draft State of the California Current Ecosystem Report

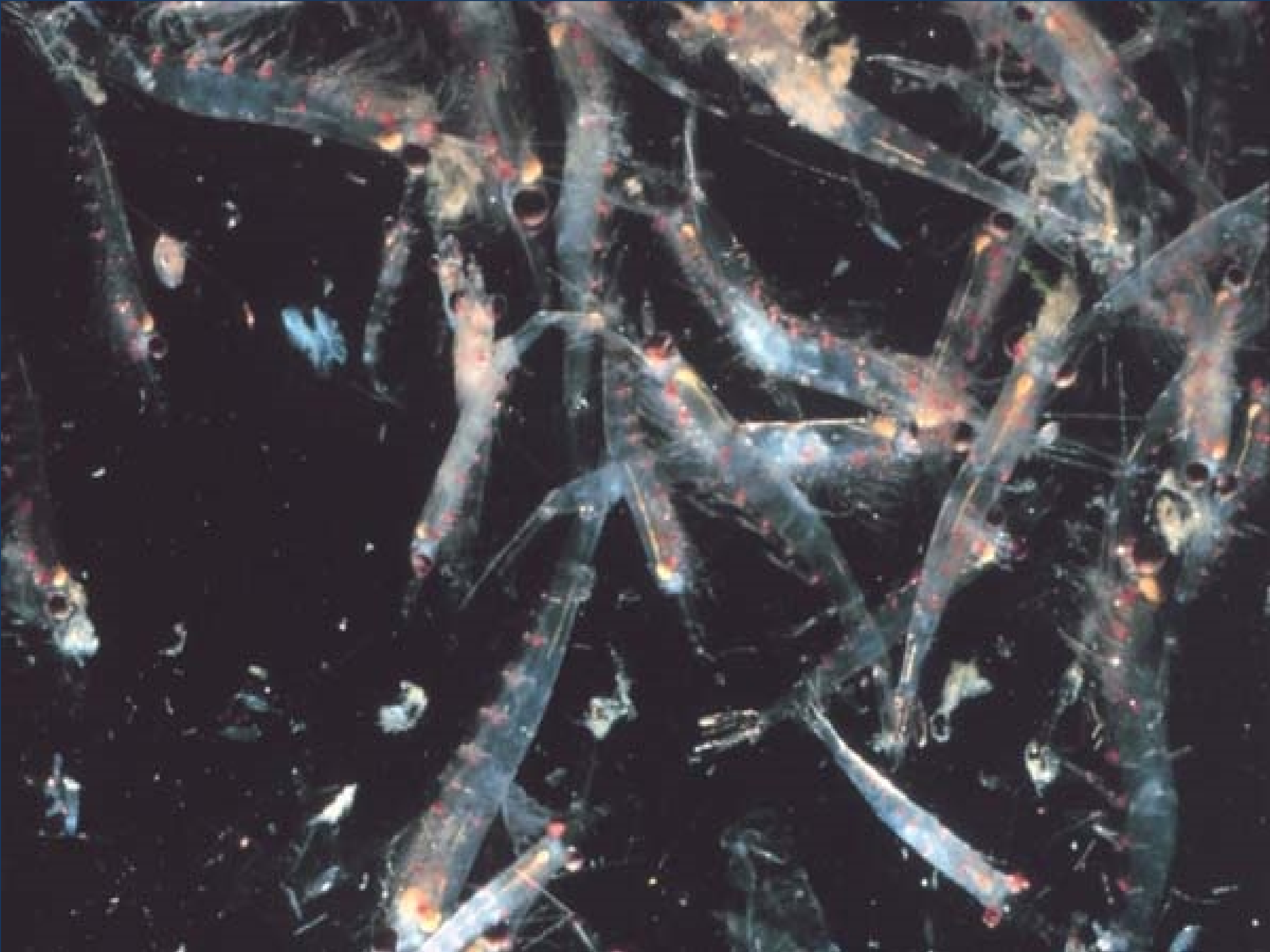
EPDT Presentation for K.3.

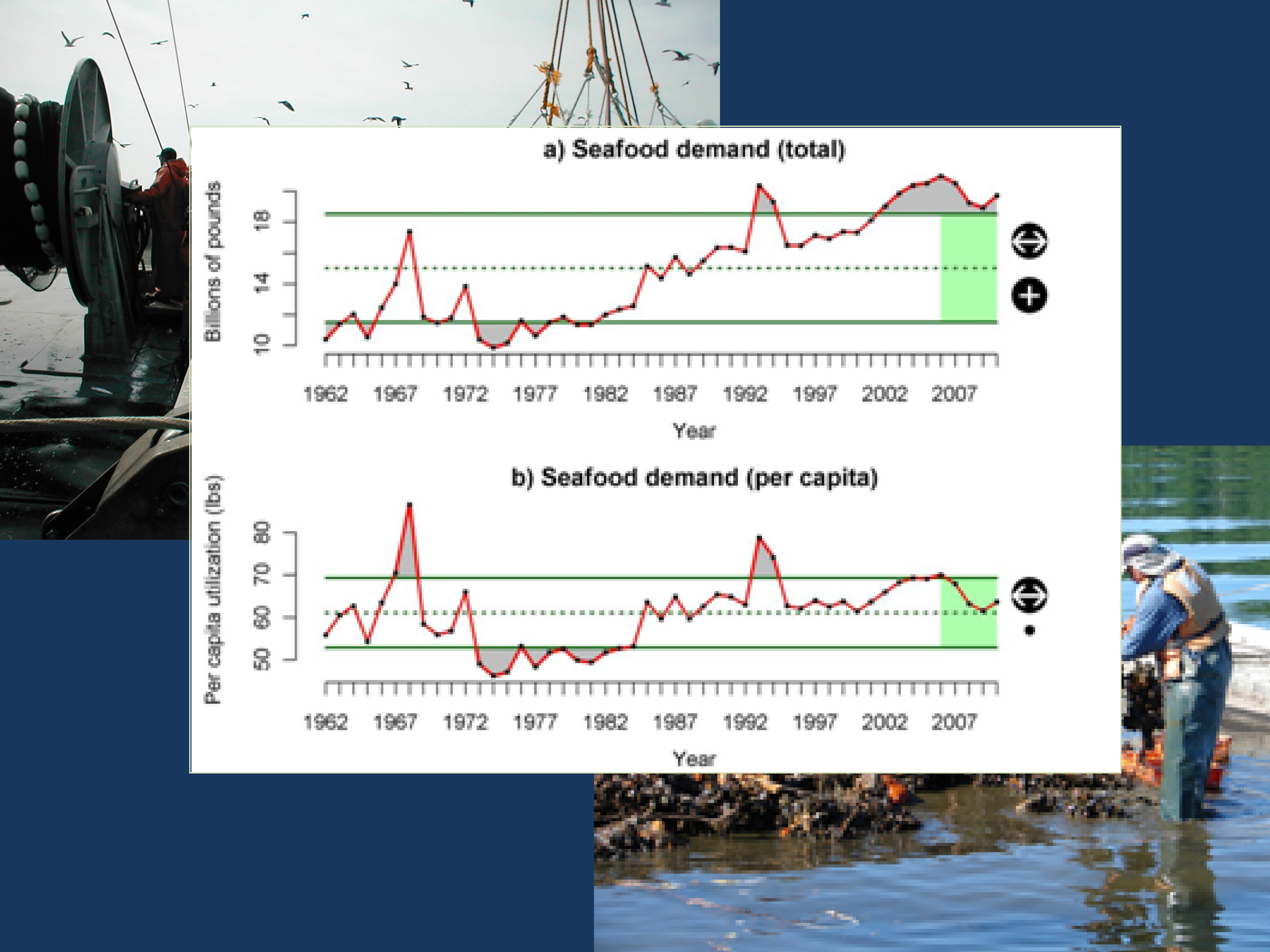
November 6, 2012

"Have nothing in your homes that you do not know to be useful and believe to be beautiful."
William Morris,
1834-1896




El Niño
La Niña
Sea Surface Temperature Anomaly (°C)
-4
-2
0
2
4




a) Seafood demand (total)
Billions of pounds
10
14
18
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
Year
b) Seafood demand (per capita)
Per capita utilization (lbs)
50
60
70
80
1962
1967
1972
1977
1982
1987
1992
1997
2002
2007
Year


EVERGREEN
EVER GIVEN
PANAMA


JFP THREE

California Current Integrated Ecosystem Assessment (forthcoming)
http://www.noaa.gov/iea/california.html

California Cooperative Oceanic and Fisheries Investigations, State of the California Current annual report (most recent at http://calcofi.org/publications/calcofireports/v52/Vol_52_36-68.StateofCurrent.pdf)

Pacific Coast Ocean Observing System (PaCOOS) Climatic and Ecological Conditions Quarterly Reports. http://www.pacoos.org/QuarterlyClimaticEcol.htm

Ocean ecosystem indicators of salmon marine survival in the Northern California Current
http://www.nwfsc.noaa.gov/research/divisions/fed/oeip/documents/peterson_etal_2011.pdf

Department of Fisheries and Oceans (Canada) State of the Oceans Report.
http://dfo-mpo.gc.ca/science/coe-cde/soto/documents/dfo_soto/english/index-eng.htm

Ecosystem considerations chapter of the North Pacific Fishery Management Council's Stock Assessment and Fisheries Evaluation http://access.afsc.noaa.gov/reem/ecoweb/

North Pacific Marine Science Organization (PICES) Report on Marine Ecosystems of the North Pacific Ocean 2003-2008 (envisioned to be updated annually online)
http://www.pices.int/publications/special_publications/NPESR/2010/NPESR_2010.aspx

For those images where sources are not shown directly on image, all are either part of the November 2012 Draft State of the California Current Ecosystem Report, or courtesy of the U.S. National Oceanic and Atmospheric Administration, except:

Slide 2: William Morris by Frederick Hollyer, 1887, in *The Life of William Morris*, ed. J.W. Mackail
Slide 3: Glittering metropolis of stars, National Aeronautics and Space Administration
Slide 8: snuggling lingcod, Alaska Department of Fish and Game.
Slide 13: *Editor of the Valley News at her desk. Browns Valley, MN,* Library of Congress

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON CALIFORNIA CURRENT ECOSYSTEM

The Coastal Pelagic Species Advisory Subpanel (CPSAS) reviewed the draft Annual State of the California Current Ecosystem (CCE) Report (Agenda Item K.3.a, Supplemental Attachment 1). We commend the joint effort of the Ecosystem Plan Development Team (EPDT) and Integrated Ecosystem Assessment (IEA) Teams to compile a condensed summary of information on ecosystem status and trends. Recognizing that this work is in its early stages, we would like to offer the following comments.

The discussion of basin-scale and regional climate indicators is beneficial to understand the physical forcing and variability inherent in the CCE. It would be helpful to mention the impacts of ocean acidification, relative to regional upwelling.

The CPSAS appreciates the attention given to CPS under Section 3.1., coastal pelagic species. As noted in the Annual Report, data presented in this section are from surveys that differ in their objectives and methodologies. The caveats highlighted in this section reduce the ability of these data sources to reliably estimate the abundance and diversity of these forage species. Should the Council wish to develop a more reliable index of Pacific sardine and other CPS, additional species should be enumerated as part of these surveys or additional analyses developed to allow for a more accurate estimation of the abundance of CPS and other forage species. Given the Council's interest in ensuring an adequate forage base, it would be helpful to include information illustrating the total removal of small and large planktivorous fish in the Annual Report.

Finally, in Section 4.1, total landings by major fisheries, we suggest revisiting the use of the term historic. As currently drafted, the report states that "Landings of coastal pelagic species were above historic levels over the last five years." The word "historic" is misleading. Historic [i.e. 1920s-1940s] landings of CPS were vastly larger than the current day fishery. The time series in this report began in 1981, during low biomass years and under a different fishery management program. The Amendment 8 created a significantly more precautionary harvest framework for CPS.

We appreciate the Council's and Teams' consideration of these comments and would once again like to acknowledge and thank the EPDT and IEA Teams for the tremendous time and efforts involved in compiling this report as well as the draft FEP and IEA.

PFMC
11/05/12

ECOSYSTEM ADVISORY SUBPANEL REPORT ON THE CALIFORNIA CURRENT ECOSYSTEM REPORT

The Ecosystem Advisory Subpanel (EAS) appreciates the opportunity to review and comment on the draft California Current Ecosystem Report (Agenda Item K.3.a, Supplemental Attachment 1) and suggests that subsequent draft reports also be widely circulated among Council advisory bodies for review and comment prior to their presentation to the Council.

The EAS interprets the intent of this report to be informative, not prescriptive or analytical with respect to the direction of management decisions. This draft established a useful framework for presenting the ecological context for management by reporting on some indicators and offering a brief synthesis across disparate sources of data.

Since ecosystem conditions will change over time, and the conditions most applicable to fisheries management will change, the report authors need flexibility to highlight appropriate indicators. We suggest that a basic structure for the report (indicated by the subject headings) remain stable, but that the specific data reported shift as necessary and as learning builds. The conclusions should point out the relevance of the data to specific Fishery Management Plans, as appropriate.

The EAS notes that section 3.1 begins to address indicators of forage species abundance and diversity using existing data. The EAS encourages continued work to develop these indicators and to include such information in future annual reports to monitor trends over time and offer perspectives on the condition of the forage base.

The EAS also recommends that there be an effort to establish and use measures reflecting sustainable participation of fishing communities (National Standard 8).

Providing access to supportive citations would allow the scientific community and other diligent reviewers to explore the underlying data sources further.

Overall, the EAS thinks this is a good model for an annual report and appreciates the effort that has gone into it.

PFMC
11/05/12

Agenda Item K.3.c
Supplemental GMT Report
November 2012

GROUNDFISH MANAGEMENT TEAM REPORT ON CURRENT CALIFORNIA ECOSYSTEM REPORT

The draft version of the first annual State of the California Current Ecosystem Report (Agenda Item K.3.a. Supplemental Attachment 1) offers several metrics and trends of ecosystem functioning borrowed from the Integrated Ecosystem Assessment (IEA) report. These measures attempt to offer a composite picture of the ecosystem for management consideration. The Groundfish Management Team (GMT) did not discuss in detail whether these metrics are appropriate ecosystem indicators. In general we think that these provide some yardsticks by which aspects of the ecosystem are measured to help the Council understand how those metrics are changing, and in some cases, in response to impacts managed by this body. The GMT discussed additional potential indicators that might provide a more complete description of the state of the ecosystem. However, the GMT did not develop a complete list here, but may do so as part of the planned workshop described by the authors of this report.

One notable attribute of many of these measures is the attempt to demonstrate how they change over time. Given the need to track cumulative effects on the ecosystem (e.g. by the National Environmental Policy Act and the Magnuson-Stevens Act), the GMT supports these approaches to designate how these metrics change over a specific time. Both trend in change and the magnitude of the change are reported, two dimensions important in characterizing cumulative effects. While we understand that the Scientific and Statistical Committee (SSC) is contemplating work to establish criteria to measure relative health from some of these indices, we suggest that the Council can still use such a report to gauge whether significant changes are occurring even in the absence of status criteria. As we recommended it in Agenda Item I.2.b, Supplemental GMT Report, it is an area for further consideration in the examination of how to improve the groundfish process.

PFMC
11/06/12

Agenda Item K.3.c
Supplemental SSC Report
November 2012

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON THE CALIFORNIA CURRENT ECOSYSTEM REPORT

The Scientific and Statistical Committee (SSC) reviewed the Draft Annual State of the California Current Ecosystem Report. Dr. John Field from the Southwest Fisheries Science Center answered SSC questions regarding the report.

The report is a succinct source of information on trends in climate indicators, fish and sea lion abundance, non-fishing human activities, and major fisheries. 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 Integrated Ecosystem Assessment (IEA) Workshop proposed under Agenda Item K.2.b will provide an opportunity to consider a broader range of IEA products that may warrant inclusion in future versions of the report. The report will likely evolve over time, depending on which indicators are available and best suited to addressing ecosystem concerns identified by the Council.

The SSC offers the following considerations for future iterations of the report, which may require a report that is longer than 20 pages:

- To make the report more accessible, the indicators should be explained in less technical language and further explanation should be provided regarding the relevance of each indicator.

- Section 4.1 provides useful information on major fisheries, including non-FMP fisheries that are commonly pursued in combination with FMP fisheries. In addition to the ecosystem-wide view in Figure 4.1, a landings breakdown by region and fishery would provide additional insight into geographic variation. Ex-vessel price trends should also be provided to help explain effort shifts among fisheries.

- Seafood demand is not a very informative indicator, as it pertains to the U.S. as a whole and demand is satisfied by imports as well as domestic fisheries.

- Non-fishing activities (e.g., aquaculture, benthic structures, shipping activity, and offshore oil/gas) should be described regionally to the extent possible. If shipping activity is being included as a source of habitat effects, then that indicator (volume of water disturbed) should be put in perspective (e.g., by comparing to water disturbance associated with storm activity). However, if it is intended to suggest risks to marine animals and fishing vessels posed by shipping, then the volume of shipping traffic would be a more appropriate indicator.

- To avoid confusion in interpretation, the most recent five years in the trend lines should be coded a different color from the green/yellow/red coding used in Figures 2.2 and 3.3.

PFMC
11/05/12