ECOSYSTEM FISHERY MANAGEMENT PLAN

The Pacific Fishery Management Council (Council) is considering ecosystem-based approaches to fishery management and is in the process of developing an Ecosystem Fishery Management Plan (EFMP) as a vehicle for bringing ecosystem-based principles into the Council decision-making process under its existing Fishery Management Plans (FMPs). The Council has also been exploring the EFMP's potential to broaden its current authority to species not currently in existing FMPs.

At its March 2011 and September 2010 meetings, the Council reviewed reports from its Ecosystem Plan Development Team (EPDT) and its Ecosystem Advisory Subpanel (EAS) on issues including the EFMP's goals and objectives, purpose and need, geographic scope, and regulatory authority. The EPDT also reported on the state of ecosystem science and how that science could be brought into the Council process via annual reports, stock assessments, and harvest specification processes. The Council's Habitat Committee and Scientific and Statistical Committee (SSC) have also provided reports to the Council during this exploratory phase of EFMP development.

At its March 2011 meeting, the Council requested broader input from its Advisory Bodies on the development of EFMP and scheduled formal action on several key aspects of future EFMP development. The Council specifically tasked its advisor's to review the EPDTs September 2010 Report (Agenda Item H.1.a, Electronic Attachment 1), the EPDT's March 2011 Report (Agenda Item H.1.a, Electronic Attachment 2), and a draft purpose and need statement submitted by Oceana at the March 2011 Council meeting (Agenda Item H.1.a, Attachment 3). These documents were posted on the Council web page in April and many of the Council Advisory Bodies were able to address the matter at meetings between March and June. The resulting Advisory Body reports and recommendations are provided in these briefing materials, where available. The EPDT is schedule to meet during the June Council meeting to prepare its recommendations.

At this meeting, the Council is scheduled to adopt the EFMP's statement of purpose and need and to provide guidance on whether the plan should have regulatory authority and management unit species. Although not a formal part of this June session, the Council SSC, via its Ecosystem-Based Subcommittee, has provided recommendations on the state of ecosystem science and potential ways of incorporating ecosystem science into stock assessments and fishery management. The SSC, the EPDT, and the EAS have also met with members of the National Oceanic and Atmospheric Administration's Integrated Ecosystem Assessment (IEA) Team to discuss ways to conduct peer reviews of ecosystem modeling efforts and how to best tailor IEA results for Council use. The Council is scheduled to receive a presentation on a pilot IEA effort for the California Current Large Marine Ecosystem at its September 2011 meeting in Boise, Idaho.

Council Action:

1. **Provide guidance on whether the Ecosystem Plan should have regulatory authority and management unit species.**
2. **Adopt the purpose and need of the EFMP.**
3. **Provide guidance on a schedule and list of tasks for future work on EFMP development.**

Reference Materials:

1. Agenda Item H.1.a, Electronic Attachment 1: September 2010 EPDT Report, *Ecosystem-Based Management Planning for U.S. West Coast Fisheries*. (**Document available on the Council web page [www.pcouncil.org/ecosystem-based-management/current-review-materials], the June 2011 Briefing Book CD, and June Briefing Book webpage**).
2. Agenda Item H.1.a, Electronic Attachment 2: March 2011 EPDT Report, *Discussion Document: Assessing Ecosystem Policy Principles and Bringing Ecosystem Science into the Pacific Fishery Management Council Process.* (**Document available on the Council web page [www.pcouncil.org/ecosystem-based-management/current-review-materials], the June 2011 Briefing Book CD, and June Briefing Book webpage**).
3. Agenda Item H.1.a, Attachment 3: Draft Purpose and Need Statement submitted by Oceana at the March 2011 Council Meeting.
4. Agenda Item H.1.b, EAS Report.
5. Agenda Item H.1.b, SSC Ecosystem-Based Management Subcommittee Report.
6. Agenda Item H.1.b, CPSMT Report.
7. Agenda Item H.1.b, CPSAS Report.
8. Agenda Item H.1.b, GMT Report.
9. Agenda Item H.1.b, STT Report.
10. Agenda Item H.1.b, SAS Report.
11. Agenda Item H.1.b, Supplemental EPDT Report.
12. Agenda Item H.1.b, Supplemental GAP Report.
13. Agenda Item H.1.b, Supplemental Habitat Committee Report.
14. Agenda Item H.1.b, Supplemental HMSMT Report.
15. Agenda Item H.1.b, Supplemental HMSAS Report.
16. Agenda Item H.1.c, Public Comment.

Agenda Order:

a. Agenda Item Overview — Mike Burner
b. Reports and Comments of Advisory Bodies and Management Entities
c. Public Comment
d. **Council Action:** Provide guidance on whether the Ecosystem Plan should have regulatory authority and management unit species and adopt the EFMP's purpose and need statement

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ECOSYSTEM FISHERY MANAGEMENT PLANNING FOR U.S. WEST COAST FISHERIES

August 2010

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1 Introduction

At its November 2009 meeting, the Pacific Fishery Management Council (Council or Pacific Council) discussed ecosystem-based fishery management planning and assigned the following series of tasks to Council staff and to the Council's newly-formed Ecosystem Plan Development Team (EPDT) and Ecosystem Advisory Subpanel (EAS):

- Schedule presentations by scientists from the National Marine Fisheries Service (NMFS) Northwest and Southwest Fisheries Science Centers on the state of the science in support of ecosystem-based fishery management.
- Review the Council record of dialogue on ecosystem-based fishery management including statements by the Council, its advisory bodies, and the public.
- Review the existing Council fishery management plans (FMPs) to identify existing approaches and commonalities regarding ecosystem approaches to management.
- Inventory ecosystem-related management tools for their applicability to the ecosystem-based fishery management planning process.
- Review existing ecosystem-based fishery management efforts of other regional fishery management councils (FMCs).
- Prepare a report to the Council that includes statement of purpose and need; a list of initial goals and objectives; a range of options on the geographic range of an ecosystem-based fishery management planning document, the regulatory scope of the plan, and the management unit species within an Ecosystem FMP (EFMP); and list miscellaneous issues to be addressed by an EFMP.

This report is intended to be the EPDT's response to the final task on the Council's list, although it touches on some of the other tasks. The EPDT developed this report with substantial, and greatly appreciated, aid and comment from the EAS. This report is the EPDT's first product for Council and public review, and it concerns a subject that has a broad range of interpretations both within and beyond the Pacific Council process. The EPDT considers this report and any suggestions or recommendations herein as preliminary guidance intended to help and inform the Council as it initiates its discussions on ecosystem-based fishery management.

Note: Throughout this report, we use the term "EFMP" broadly, to include any kind of ecosystem planning document the Council might choose to develop. We recognize that the term "FMP" has a particular definition under the law, and that the Council has not yet chosen the format of the ecosystem planning document it wishes to develop. The Council may or may not choose to develop a document with the authorities and obligations of an FMP. The term "EFMP" is used herein for the sake of simplicity, because that is the term the Council process has used since it first began discussing these issues. No Council decision is implied in our use of the term.

2 Pacific Council Interests in Ecosystem Fishery Management Planning

In recent years, U.S. FMCs have expressed broad interest in ecosystem-based fishery management, with each council taking a different approach to incorporating ecosystem information into their fishery management processes. In keeping with published literature, the Pacific Council has discussed implementing ecosystem-based fishery management in a deliberative and iterative fashion, gradually adopting ecosystem goals, objectives and management actions, rather than a revolutionary upheaval to replace current management structures and objectives (EPAP 1999, Link *et al.* 2002, Pikitch *et al.* 2004, Field and Francis 2006, Francis *et al.* 2007, Murawski 2007, Marasco *et al.* 2007). The Council has implemented ecosystem-based fishery management principles through several existing actions, including a krill fishing ban, conservative harvest control rules for forage species, implementation of extensive area closures and marine protected areas, and the use of ocean survival indicators for determination of allowable fishery effects on coho salmon. The Council has also employed spatial management concepts for years and has recommended closed areas to rebuild overfished species, minimize bycatch, and preserve essential fish habitat.

In November 2006, the Council moved to begin development of an EFMP for waters off Washington, Oregon, and California. The Council saw an EFMP as providing the fishery management process with additional ecosystem information, and enabling comprehensive and coordinated fishery regulation in the exclusive economic zone (EEZ,) while also allowing more species-specific management to continue under the Council's four FMPs. The Council has expressed the intent to use an EFMP for long-term planning, particularly in improving and coordinating spatial management initiatives.

The Council maintains a detailed history of its EFMP considerations on its ecosystem-based management timeline website (http://www.pcouncil.org/ecosystem-based-management/ecosystem-management-timeline/). Since 2006, the Council has worked primarily through its Habitat Committee (HC) and with its Scientific and Statistical Committee (SSC) and that committee's Ecosystem Subcommittee to discuss bringing ecosystem science and ecosystem-based fishery management into the Council process. In the fall of 2009, the Council acquired funds to begin EFMP development and then appointed members of an EPDT and an EAS, providing initial tasks for these two new advisory groups.

The EPDT is a 13-member group of State, Federal, and Tribal scientists and policy analysts. The EAS is an 11-member multi-disciplinary group representing west coast industry, policy, and conservation interests. The EPDT and the EAS will apply their unique perspectives and broad expertise in close coordination to provide the Council with analyses and recommendations on science in support of ecosystem-based fishery management principles and to develop goals, objectives, and policy alternatives for Council consideration as the EFMP takes shape over the next few years.

The EPDT and the EAS held their first meeting as a joint session in Portland, Oregon on February 10-11, 2010. The meeting focused on the Council's initial tasks and ways the group could most effectively develop the requested report. The meeting also allowed some time to discuss the broad range of perspectives from members of the EAS and the EPDT on ecosystem-based fishery management planning and how it could be applied to the Council process. The EPDT developed its first draft of this report by April 2010, which was then reviewed and discussed by the EAS at its May 4, 2010 meeting in Portland, Oregon. The EPDT subsequently met, again in Portland, Oregon, on July 21, 2010 to review its report and EAS recommendations, and to make plans for revising the report in preparation for inclusion in the Council's September 2010 meeting's briefing book.

3 Consideration and Statement of Purpose and Need for Ecosystem-Based Fishery Management Planning and for a Planning Document

One of the Council-assigned tasks for the EPDT was a draft statement of purpose and need for an EFMP. Although purpose and need statements are required as part of National Environmental Policy Act (NEPA) analysis documents, the Council is not yet at a NEPA analysis stage in its process of considering EFMP development. Therefore, this section instead uses the discussion of purpose and need as an independent planning aid, not as it is more narrowly and formally used in NEPA analysis.

The purpose of and need for an ecosystem-based fishery management framework should come from the Council's mandates, authorities, and policy preferences and the general concepts and principles of ecosystem approaches to management. This section discusses the purpose of and need for ecosystem-based fishery management planning in general, and provides a potential draft statement on the purpose of and need for an ecosystem-based planning document within the Council process.

3.1 Ecosystem-Based Fishery Management Planning

In scientific literature, explorations of the purpose of and need for ecosystem-based fishery management often begin with a definition of what it is. Definitions of ecosystem-based fishery management use new terms —such as ecosystem services, biodiversity, resilience, etc.—yet these terms are just new labels on principles that have long been discussed as part of sustainable development or sustainability. In U.S. fisheries law, the 1976 Fishery Conservation and Management Act used these concepts to define conservation and management measures as assuring 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" (FCMA 1976).

Ecosystem approaches to management are still about societal choice among competing objectives (Shepherd 2004). Fundamentally, ecosystem-based fishery management recognizes that fisheries both affect and are affected by the marine environment, and that what we do to address these effects via policy-making is a matter of societal choice. The purpose of the ecosystem approach is not to prescribe particular policy choices, but rather to promote better understanding of those policy choices. Ecosystem-based fishery management is meant to compliment current single-species approaches to fisheries management by providing additional information that may be used to expand the scope of these approaches into the future. Finally, ecosystem-based fishery management does not create additional mandates to protect the marine environment, but instead seeks to better understand fishery effects on the marine environment through improved information on ecosystem structure, processes and functions. As explained by Walters and Martell (2004), ecosystem-based fishery management aspires to:

> "provide a capability for fisheries scientists to respond to a broader set of policy questions and predictive demands than can single species analysis. These questions lead to a much broader set of options for future ecosystem management than might ever be imagined by thinking only of species populations one at a time."

With that broader set of policy options and the analytical tools to evaluate them, ecosystem-based fishery management should inform the policy process and provide for a transition from the setting of management targets only on individual components of the ecosystem to the setting of management targets on the ecosystem as a whole (NRC 2006). As explained in international guidance on ecosystem-based fishery management, it is intended:

> "to reflect the merging of two different but related and—it is hoped—converging paradigms. The first is that of ecosystem management, which aims to meet its goal of conserving the structure, diversity and functioning of ecosystems through management actions that focus on the biophysical components of ecosystems (e.g. introduction of protected areas). The second is that of fisheries management, which aims to meet the goals of satisfying societal and human needs for food and economic benefits through management actions that focus on the fishing activity and the target resource (FAO 2003)."

Ecosystem-based fishery management focuses both on "the impact of fisheries on the environment (including biodiversity, species interactions, and habitat), and the impact of the environment on fisheries (including natural variability and climate change)" (Garcia and Cochrane 2005). The end goal is to understand the linkages between ecosystem well-being and human well-being (FAO 2003; MEA 2005). Working toward this goal will involve difficult scientific and analytical challenges related to the measuring and monitoring of these linkages, the specification of ecosystem reference points for guiding management actions, and the identification and valuation on the full spectrum of policy choices associated with human well-being (Barbier 2010; Moore and Russell 2010; Quinn and Collie 2005; Link 2005; FAO 2003).

The widespread call for moving toward ecosystem-based fishery management arises out of a recognition that, when we do not explicitly weigh trade-offs, they will be resolved by default (Walters and Martell 2004). Our difficulty in quantifying and analyzing trade-offs and effects does not mean those trade-offs and effects are not occurring. Ecosystem-based fishery management can proceed without quantitative analysis and can be approached "more [as] an issue of context and mindset than of method." (Francis *et al.* 2007). At the same time, the call for ecosystem-based fishery management also recognizes that attempts to account for potential impacts and hidden tradeoffs without quantitative analysis can leave policy makers with uncertain choices and arbitrary bases for decisions (Hilborn 2009; Hilborn and Stokes 2010). The FMC process, where near- and long-term social goals and legal requirements are weighed through integrated scientific analyses, offers a unique venue for bringing together a large suite of interests and ideas for implementing ecosystem-based fishery management.

3.2 Ecosystem-Based Fishery Management Planning Within the Council Process

The purpose of an EFMP is to guide expansion of the Council process from species-specific management programs to include ecosystem science and broader ecosystem considerations and management policies that coordinate Council management across its FMPs and the California Current Ecosystem (CCE).

The needs for ecosystem-based fishery management within the Council process are: (1) to ensure that management of any one of the Council's fishery groups (coastal pelagic species, groundfish, halibut, highly migratory species, and salmon) does not negatively affect the management potential of the other species groups, non managed species, or their habitats; and (2) to keep the Council updated on current and potential effects on the CCE from human and natural causes (e.g., creation of dredge pile islands, industrial contamination, climate change, etc.). Council decisions on fisheries management throughout the CCE should benefit from more and better information on the biophysical and socio-economic systems that support West Coast fish and fisheries.

4 Consideration of Potential EFMP Goals and Objectives

Each of the Council's species group FMPs has a set of goals and objectives (see Appendix B). This section provides potential goals and objectives for a Council EFMP. As with the statement of purpose

and need, the Council's ultimate goals and objectives will depend on the format that the document takes. In providing these potential goals and objectives, we are both responding to one of the Council's directions from November 2009, and providing a basis for public discussion on directions Council planning might take.

The overarching goal of this EFMP is to bring a greater understanding of the CCE to the Council participants and the public, so as to provide broad consideration and analysis of social, economic, and ecological policy options across the Council's areas of responsibility. The EFMP and its associated scientific products are intended to support Council decision-making by more fully addressing the goals and objectives shared by all FMPs for a healthy ecosystem with productive and sustainable fisheries, and vibrant fishing communities.

The Council's four existing FMPs each have suites of goals and objectives that differ in their precise language, but have four common themes that are consistent with an ecosystem approach to fishery management: avoid overfishing, maintain stability in landings, minimize impacts to habitat, and accommodate existing fisheries sectors. (See Appendix B for details.) The Coastal Pelagics FMP also explicitly recognizes the role of the target species in the food web; this is the only FMP that specifies a need to "provide adequate forage for dependent species." The following potential EFMP objectives, in keeping with the potential goal, are intended to be served by a plan or dedicated effort to integrate management across all the FMPs:

- Provide a vehicle to better inform Council decision-making by improving and integrating information that may affect species from multiple FMPs, such as trends in climate conditions or indicator species.
- Identify and address gaps in ecosystem knowledge, particularly with respect to the cumulative effects of fishing on marine ecosystems, and provide recommendations to address such gaps.
- Provide an ecosystem context for Council decisions that may involve common management concerns or trade-offs among species-specific FMPs.
- Provide administrative structure and procedures for coordinating conservation and management measures that address inter-species relationships across FMPs and with ecosystem components not included in the FMPs.
- Provide a nexus to regional and national ecosystem-related endeavors, particularly with respect to the consequences of non-fishing activities.
- Provide a framework for the consideration of cooperative management strategies that might facilitate management actions at appropriate spatial scales.

5 Regulatory Scope and Management Unit Species

At its November 2009 meeting, the Council's direction to the EPDT included a team report on the potential regulatory scope of an EFMP and on potential management unit species within an EFMP. These two questions are strongly connected and are dealt with together in this section.

The Council's and NMFS's regulatory authority over fisheries and marine resources is granted and bounded by the MSA. Under the MSA, FMCs exercise authority over fish and fisheries by the development and amendment of FMPs and the adoption of fishery conservation and management measures. The MSA and its implementing regulations formally define the regulatory authorities within an FMP and define the types of regulatory actions that may be possible for management unit species. In this early stage of the Council's ecosystem based fishery management planning process, the Council can help itself and the public better understand its intent for the future by assessing:

- The particular management actions the Council wishes to recommend for living marine resources and their habitats within the West Coast EEZ, and whether those authorities may be exercised under the MSA;
- Whether there are species the Council wishes to manage or monitor under an EFMP that are not currently managed under a Council FMP, or if any of the current Council FMP species would be more appropriately managed under an EFMP;
- Whether the Council wishes to use the EFMP as a vehicle for the MSA-sanctioned regulatory activities that are not required to be tied to specific species or FMP species groups.

The MSA requires the Council to prepare an FMP "for each fishery under its authority that requires conservation and management" (MSA Section 302(h)(1)). An FMP provides a FMC and NMFS with regulatory authority over fishing activities for the species listed in that FMP's fishery management unit (FMU). Any species of fish within a council's geographic area of authority may be named as part of an FMP's FMU. The Pacific Council's geographic area of authority is the fisheries in the Pacific Ocean EEZ seaward of Washington, Oregon, and California (MSA Section 302(a)(1)(F)).

Section 3(13) of the MSA defines "fishery" as: (A) one or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographic, scientific, technical, recreational, and economic characteristics; and (B) any fishing for such stocks." The term "fish" includes "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds" (MSA Section 3(12).) National Standard 3 directs that: "To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination" (MSA Section 301(a)(3)). The National Standard Guidelines connect these terms by clarifying that, "A fishery management unit (FMU) means a fishery or that portion of a fishery identified in an FMP relevant to the FMP's management objectives. The choice of an FMP's FMU depends on the focus of the FMP's objectives, and may be organized around biological, geographic, economic, technical, social, or ecological perspectives." National Standard 3, taken together with the Council's fish and fishery conservation and management authority means that, if the Council wishes its EFMP to have regulatory authority, the EFMP must have FMU species. Potential Council authority or influence over the management of fish and other marine species in ocean ecosystems may be broadly separated as:

- Fishing activities for FMU species within a Council FMP;
- Fishing activities for species not within a Council FMP;
- Non-fishing activities that may affect the essential fish habitat (EFH) of FMU species within a Council FMP, and;

- Non-fishing activities that may affect the ecosystem(s) of which Council-managed species are a part.

We next discuss each of these types of activities, the manners in which they may be addressed in a FMC process, and how an ecosystem planning or regulatory document may or may not be useful in addressing these activities.

5.1 Fishing Activities for Fishery Management Unit Species

When a FMC chooses the species within an FMP's FMU, it is essentially choosing to manage any directed or non-directed fisheries for those species. Which species this Council includes in its potential EFMP's FMU will depend on how the Council wishes to use the EFMP. For example, if the EFMP were to be used as the primary authority for managing all the fisheries under the Council's jurisdiction, then all those species and their fisheries would be designated as the EFMP's FMU. This approach would be similar to that taken by the Western Pacific Fishery Management Council, which has converted its former species group FMPs into geography-based Fishery Ecosystem Plans (FEPs), which have all the required characteristics of FMPs, yet are arranged by geography rather than taxonomy. However, if the regulatory authority of the EFMP is intended to address either species for which there is neither a current nor future-desired fishery, or to address only issues that cross several of the Council's current species group FMPs, then the EFMP's FMU will be much more limited. We provide a range of potential EFMP formats that address these uses of FMUs in Table 5.1, below.

5.2 Fishing Activities for Species Not Within a Council FMP

Ecosystem-based fishery management for the CCE will bring new information into the Council process on a broad range of marine species, including species not defined as fish under the MSA, and species for which there is no fishery. Some species may be of interest to the Council for their roles as indicators of CCE health and productivity, even if those species are neither under Council management (e.g. state-managed fisheries or lower trophic level species), nor under potential Council jurisdiction except as bycatch to be avoided (like marine mammals, turtles, and seabirds). In describing alternative potential FMUs for the EFMP, this document assumes that the Council may request and discuss information on any species and its ecosystem relationships with other species (or even recommend action by other entities outside MSA authority to conserve and manage those species), regardless of whether it has the authority or inclination to name that species to an FMU in any of its FMPs.

The 2006 revisions to the MSA changed the authorization for Councils to "designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear," to require that such closure (Section 303(b)(2)(C):

> (i) is based on the best scientific information available;
> (ii) includes criteria to assess the conservation benefit of the closed area;
> (iii) establishes a timetable for review of the closed area's performance that is consistent with the purposes of the closed area; and
> (iv) is based on an assessment of the benefits and impacts of the closure, including its size, in relation to other management measures (either alone or in combination with such measures), including the benefits and impacts of limiting access to: users of the area, overall fishing activity, fishery science, and fishery and marine conservation."

The 2006 MSA revisions also added authority for FMCs to designate fishery closure zones to protect deep sea corals from physical damage by or interactions with fishing gear (MSA at Section 303(b)(2)(B)).

In support of this provision, the 2006 reauthorizing act also added Section 408 to the MSA, which requires NOAA Fisheries to establish a deep sea coral research and technology program. The agency's 2007 report, The State of Deep Coral Ecosystems of the United States, discusses current scientific information on deep sea corals and includes a chapter on west coast deep sea corals (NMFS 2007).

The MSA authorizes FMCs to exercise these general authorities without specifying how they are to be organized within FMPs. The South Atlantic Fishery Management Council (SAFMC) has an FEP that informs their actions taken under the authorities of their species group FMPs. The SAFMC has recently used its FEP to recommend establishing Coral Habitat Areas of Particular Concern, but is implementing those recommendations through linked amendments to each of its species group FMPs (SAFMC 2009). In other words, the SAFMC retains its authority within its species group FMPs, while using its FEP process to facilitate discussions on issues that affect all their FMPs.

5.3 Non-Fishing Activities that may Affect the EFH of Fishery Management Unit Species

Under the MSA, FMCs have the authority to use FMPs to identify EFH for managed species and to identify any adverse effects on EFH. Councils are permitted to comment on and make recommendations to the Secretary of Commerce or any Federal or State agency "concerning any activity authorized, funded, or undertaken or proposed to be authorized funded or undertaken, by any Federal or State agency that, in view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority" (Section 305(b)(3)(A)). Councils are required to comment on and make recommendations regarding activities that are likely to substantially affect the habitat of anadromous species, such as Pacific Coast salmon (Section 305(b)(3)(B)). If the Council chooses to pursue an FEP intended primarily to inform its work across species group FMPs, rather than an EFMP with regulatory authority, it could use that FEP to organize comments on non-fishing activities that may affect EFH in several of its FMPs or that may affect non-Council species that interact with Council-managed species from several FMPs. Alternately, an EFMP with regulatory authority could serve the same cross-FMP organizing function, plus add EFH designations for any species included as part of that EFMP's FMU. Any ecosystem planning process the Council undertakes, whether it results in an FEP, EFMP, or other document, will have the significant benefit of serving as a coherent and comprehensive public statement of the Council's priorities for conservation and management of marine resources in the CCE.

5.4 Non-Fishing Activities that may Affect the Ecosystem(s) of which Council-Managed Species are a Part

Under NEPA, the Council has the opportunity to comment on any federally-managed or -permitted activities that it believes may affect Council-managed species or any portion of the ecosystem or ecosystems of which those species are a part. Similar state environmental review laws also provide comment opportunity on state-managed or –permitted activities. Unfortunately, ensuring that the Council has a voice in NEPA and other environmental review discussions relevant to the CCE can be logistically challenging when mandated review periods for actions affecting the environment do not fit within the Council's meeting schedule. As with non-fishing activities that may affect EFH of Council-managed species, a Council-generated EFMP will help guide analysis by agencies looking at non-fishing activities within the CCE and connected ecosystems. Instead of the Council finding itself in the position of having to alert agencies addressing non-fishing activities that the Council might wish to comment on those activities, it will be able to point to its EFMP at the beginning of the analysis process and request that analyses of non-fishing activities assess the effects of those actions on the species, inter-species relationships, and natural processes of the CCE.

Under the Regulatory Flexibility Act, the Council has an opportunity to comment on any draft regulations that may affect small businesses (such as fishing businesses), small entities (usually non-profit), or small

government agencies (such as small coastal municipalities). The Council could use its EFMP as a basis for assembling more comprehensive information on the dependency of fishing communities on fishery resources, the vulnerability of those communities to changes in resource availability, and the resilience of those communities to economic change. Such an EFMP could help to strengthen the voices of fishing community members as they assess the potential future effects that non-fishing activities may have on the CCE and on their communities.

An EFMP could also have a role in national and West Coast governance of ocean resources. National and regional programs on coastal and marine spatial planning will require input from FMCs. An EFMP would articulate Council priorities for a healthy ocean ecosystem, and could improve the effectiveness of Council engagement with external entities that manage non-fishing activities that may affect the CCE.

5.5 Ecosystem Fishery Management Planning in Other Fishery Management Councils

Three FMCs (North Pacific, Western Pacific, and South Atlantic) have created FEPs for one or more of the ecosystems under their respective authorities. Each council has taken a different approach to the framing of and philosophy behind their FEPs. However, each FMC has also ensured that they have addressed their managed species under the MSA framework for FMP requirements.

North Pacific Fishery Management Council – Aleutian Islands FEP (2007)

> "The goal of this FEP is to provide enhanced scientific information and measurable indicators to evaluate and promote ecosystem health, sustainable fisheries, and vibrant communities in the Aleutian Islands region."
>
> "…the FEP was developed to provide the Council with an understanding of important relationships among ecosystem components, which are not always considered together by managers. The FEP also identifies areas of uncertainty, describes how the Council may currently be addressing the associated risk, and provides suggestions for other tools the Council may wish to consider."

The FEP provides background information and analyses on the Aleutian Islands ecosystem:

- describes and synthesizes the Aleutian Islands ecosystem processes and interactions,
- delineates the regulatory and bio-physical boundaries of the Aleutian Islands,
- conducts a qualitative risk assessment of Aleutian Islands interactions,
- uses management objectives of Aleutian Islands fisheries to identify Council priorities for the FEP,
- identifies ecological indicators appropriate to monitor key ecosystem interactions,
- identifies knowledge gaps and research needs,
- provides a framework by which ecosystem considerations identified herein could be implemented within the current Council structure and management practice.

The North Pacific Fishery Management Council (NPFMC) also completed an Arctic FMP in 2009 (NPFMC 2009), implemented at 50 CFR 679. Very little data or analyses are available on any fish species within the U.S. Arctic EEZ. The Arctic FMP provides an example of an FMP primarily intended to close a large geographic area to fishing for fish stocks about which little is known. The Arctic FMP

has three so-called target species for its FMU, none of which are subject to targeting beyond subsistence fishing, and a suite of ecosystem component (EC) species.[1]

South Atlantic Fishery Management Council – Fishery Ecosystem Plan (2009)

> "The FEP will serve as a source document that will, over time, present more detailed information describing the South Atlantic ecosystem and the impact of the fisheries on the environment. As a living document, the FEP will provide a greater degree of guidance on incorporation of fishery, habitat, or ecosystem considerations into management actions, such as bycatch reduction, prey-predator interactions, maintenance of biodiversity, and identification of spatial management needs."

The SAFMC has a history of detailed and FMP-spanning work on EFH issues. In their EFH work, the SAFMC had considered the effects of fishing and non-fishing activities on both the EFH of individual species in their FMPs and on the collective EFH of all of their FMPs taken together. The South Atlantic FEP grew out of their work on EFH and their desire to have a cross-FMP source of information about biophysical ecosystem of their managed species, and about the effects of fisheries and non-fisheries activities on that ecosystem. The FEP is a multi-volume document that includes, but is not limited to:

- oceanographic and climate features of the South Atlantic Bight,
- locations of South Atlantic Fishery Management Council (SAFC) management areas,
- descriptions of the species and habitats (Council-managed and not) within the South Atlantic Bight,
- the South Atlantic human and institutional environment,
- spiny lobster economics and social environment,
- maps of commercial fisheries catch in the South Atlantic management area, by latitude/longitude blocks,
- perceived threats to the South Atlantic ecosystem and recommendations for addressing those threats, and
- description of research and data needs.

Western Pacific Fishery Management Council – Fishery Ecosystem Plans by Geographic Area (2009)

> "The Magnuson-Stevens Fishery Conservation and Management Act (MSA) authorizes FMCs to create fishery management plans (FMP). The Western Pacific Regional Fishery Management Council developed this Fishery Ecosystem Plan (FEP) as an FMP, consistent with the MSA and the national standards for fishery conservation and management. The FEP represents the first step in an incremental and collaborative approach to implement ecosystem approaches to fishery management in [*the FEP area – same language used across FEPs*]."

In December 2009, the Secretary of Commerce approved five new geography-based FEPs that had been drafted by the Western Pacific FMC for: American Samoa, Hawaii, Mariana Archipelago, Pacific remote island areas, and western Pacific pelagic fisheries. These FEPS all meet the MSA requirements for FMPs and FMP species. The FEPs explicitly do not establish any new fishery management regulations, but are

[1] 50 CFR 600.310(d)(5)(i): *To be considered for possible classification as an EC species, the 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 be 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.*

intended to provide a place from which FMCs may address ecosystem-based management principles in the future.

5.6 Beyond Council Documents

As discussed throughout this report, ecosystem-based fishery management planning is not simply about adding a new document to the suite of FMPs that bound the Council's regulatory authority. Beyond an EFMP, there are numerous actions the Council can take to help itself and the public think more about how Council-managed species interact with each other and their environment, including:

- Review the Council's 2008 Research and Data Needs (PFMC 2008) Section 2.0, Ecosystem-Based Fisheries Management, to determine whether the highest priorities set in this document are being met and if not, whether they can be met.
- Through the SSC, develop recommendations on a desired suite of natural and socio-economic ecosystem science products that could be useful to the Council process.
- As new appointments to Council advisory bodies become available, consider whether those bodies have adequate representation from persons with cross-species or ecology expertise.
- During the Council's EFH review process for its four FMPs, ensure that the EFH, habitat areas of particular concern (HAPCs), and any EFH closed areas designated for all Council species or species groups can be mapped in compatible fashions so that the Council and the public can review EFH designations and other areas across all the Council's FMPs.
- Early in each Council meeting week, preferably on the first meeting day, schedule a presentation on science in support of ecosystem-based fishery management (11/09 Council recommendation). If the Council opens a tradition of scheduling ecosystem issues early in its meeting weeks, then ecosystem concerns can better frame subsequent Council discussions throughout each meeting week.

Table 5.1: Alternative Fishery Ecosystem Plan (FEP) and Ecosystem Fishery Management Plan Formats				
	Advisory FEP	**Umbrella EFMP with Selected FMU and EC Species**	**Regional Omnibus EFMP**	**Coastwide Omnibus EFMP**
Plan Format Summary	Similar to the NPFMC's Aleutian Islands FEP and the SAFMC's FEP, this FEP would provide information on the biophysical processes of and West Coast community ties to the CCE. The FEP would not be a framework for regulations, but would provide information that could be used to support regulations under the Council's species group FMPs.	Fishing activities for Council-managed species would continue to be managed under species group FMPs. Select species that are important to the CCE as a whole would be within the EFMP's FMU, and could be targeted (or not) according to Council management recommendations. Unless designated as an EFMP FMU species, all targeted and non-target bycatch species would continue to be managed under appropriate species group FMPs.	Similar to the WPFMC's FEPs, the West Coast EEZ would be split into several biogeographic provinces, with management frameworks for all the current Council-managed species merge into region-specific FMPs. Existing EC species and management frameworks for those species could be added to the appropriate FMPs under this EFMP format.	This omnibus EFMP would merge all the current FMPs to provide regulatory authority for all Council-managed species within the CCE within the same document. Existing EC species and management frameworks for those species could be added to the FMP under this EFMP format.
		All the ecosystem information available under the Advisory FEP would also be available under any of these EFMP formats. In addition, the existing FMPs could incorporate ecosystem information available under the Advisory FEP through FMP or regulatory amendment.		
Fishery Management Unit (FMU) Species	None. Because this format is informational, no species would be subject to management under this FMP.	FMU would include any species that does not now easily fit within one of the Council's species group FMPs, or is currently beyond any of those FMPs but in need of Council management. EC species, as a component of the fishery, may be included in the EFMP for any of the following reasons: For data collection purposes; for ecosystem considerations related to specification of OY for the Council-managed fisheries; as	All species from current Council FMPs for a given geographic region, plus any additional predators or prey species the Council may wish to add and that fall within the definition of "fish" under the MSA, including EC species.	All species from current Council FMPs, plus any additional predators or prey the Council may wish to add that fall within the definition of "fish" under the MSA, including EC species.

		considerations in the development of conservation and management measures for the Council-managed fisheries; or to address other ecosystem issues. Species that are vulnerable to Council-managed fisheries would continue to be included in the appropriate species group FMP.		
Potential activities regulated and range of authorities	No fishing activity would be regulated under the FEP format.	All fishing activity currently authorized for management under the MSA would continue to be authorized for FMU species.	All fishing activity currently authorized for management under the MSA would continue to be authorized for these regional omnibus EFMPs. EC species could be added to the appropriate EFMPs.	All fishing activity currently authorized for management under the MSA would continue to be authorized for this omnibus FMP. EC species could be added to the EFMP.

6 Geographic Range and Scale

In keeping with the Council's November 2009 direction, this section addresses the potential geographic range and scale of a Council EFMP.

The geographic range of an EFMP for U.S. West Coast fisheries may be evaluated using by three major concepts: management authority, physical and ecological characteristics, and socio- economic or political jurisdictions. The Council has management authority over fisheries within the U.S. West Coast EEZ, which ranges from the Canadian border to the Mexican border and from state marine boundaries (3 nautical miles) seaward to 200 nautical miles offshore. Council authority also includes U.S. vessels fishing for FMP-managed species, when those vessels fish within or seaward of the EEZ and land their fish in California, Oregon, or Washington. Landward of the EEZ, Council authority is seated in EFH designation, and in its responsibility to comment on and make recommendations regarding activities that may affect habitats of fishery resources under its authority.

The U.S. defines the biophysical realm of the CCE using the Large Marine Ecosystem (LME) concept, based on four linked ecological criteria: bathymetry, hydrography, productivity, and tropic relationships. Globally, the California Current LME is one of 64 distinct LMEs (UNEP 2008.) Like most ecosystems, the boundaries of the California Current LME are not strictly delineated, but it can be generally defined as extending from north-central Vancouver Island southward to southern tip of the Baja California. Physically, the California Current is one of four major global "eastern boundary currents," consisting of strong southward flow in the offshore region, and dominated by strong upwelling in the nearshore coastal areas. The ecosystem is characterized by its high productivity, due primarily to nutrient enrichment via upwelling. The system is heavily influenced by basin-scale climate signals, such as the El Niño Southern Oscillation and the Pacific Decadal Oscillation, resulting in highly variable inter-annual and inter-decadal ecosystem productivity. Thus, oceanographic forces play a large role in regulating the CCE's biological populations and communities, and its energy flow and ecological dynamics.

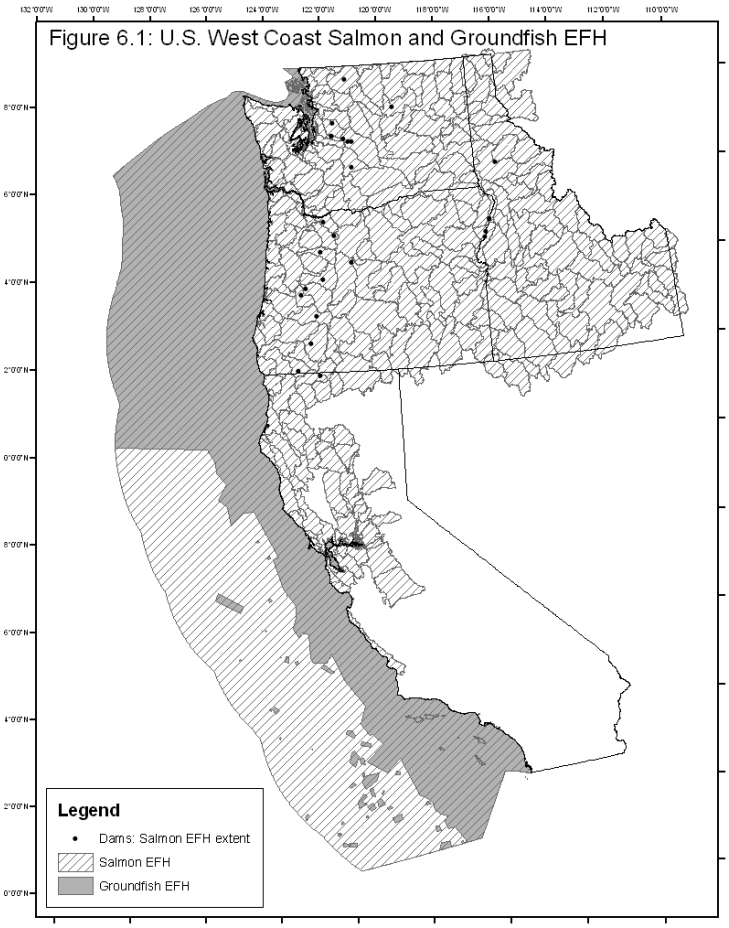

Figure 6.1: U.S. West Coast Salmon and Groundfish EFH

The socioeconomic boundaries of interest to the Council are shaped by the large and small coastal communities and fisheries of California, Oregon, Washington and Idaho. These include the economies of major estuaries, such as the San Francisco Bay, the Columbia River and the Puget Sound, but also those of smaller ports and economies of the four states.

In developing the geographic range of an

EFMP, the Council should consider the dynamic relationship between the three major interacting elements of the ecosystem: the geographic scope and spatial scale of management, biophysical processes, and socioeconomic regions. As with the EFMP's potential management unit species, there are geographic areas that are not under Council authority or influence, but which are of interest to the Council for informational purposes. Two examples are the biophysical boundaries of the ecosystem, including the EEZ itself, plus upland watersheds for Council-managed salmon stocks, and marine waters beyond the U.S. EEZ for highly migratory species. If the EFMP is to be an evolutionary and living document, the Council might limit the initial geographic scope of the EFMP to the U.S. EEZ, with the intent that later EFMP iterations include marine and terrestrial systems beyond the EEZ. As shown in Figure 6.1, the Council's salmon and groundfish EFH together cover the entire West Coast EEZ plus significant upland territory.

In addition to beginning with the EEZ and anticipating later expansion outward, the Council might also consider subdividing the EEZ into smaller biogeographic regions. Based on overall air-sea climate and rainfall patterns, the CCE can be divided into three major regions from north to south: the Pacific Northwest (including northern California), central California, and the Southern California Bight (Lester et al, 2010). Hydrographically, these regions can be further subdivided in the onshore-offshore direction into three major zones: the nearshore zone characterized by strong upwelling, the offshore zone characterized by the strongly southward flowing core of the California Current, and the furthest offshore zone characterized by either downwelling or weak curl-driven upwelling (Rykaczewski and Checkley, 2008). The CCE can also be further divided, based on the Cape to Cape concept (Francis *et al.*, 2008); due to topography, several major (and several more minor) capes along the coast exert substantial influence on both upwelling and the path of the California Current, leading to more localized regions of enhanced upwelling, "upwelling shadow" areas, areas of enhanced retention, and spawning points for meanders, eddies, and jets of the California Current itself. A nested approach to defining smaller, cohesive, segments of the CCE may help the Council to best match the spatial scales of biological populations, ecological communities and human communities for particular management issues.

7 The State of Ecosystem Science

Comprehensive reviews of ecosystem philosophies, principles, modeling approaches and other strategies abound in the scientific literature, as well as in the grey literature of management documents and records. This short review of the state of science for ecosystem-based management is not comprehensive, but is intended to briefly illustrate the general scope of ecosystem science by discussing: (1) philosophical guidelines or principles for implementing an ecosystem approach to fishery management, (2) the role and availability of multispecies and ecosystem models to provide strategic management advice with respect to ecosystem issues and trade-offs among policy objectives, (3) the development and role of ecosystem indicators, including reports on ocean and climate conditions and integrated ecosystem assessments, (4) the potential role of integrated ecosystem assessments, and (5) ecosystem-based management in practice. There is overlap among these broad and general types of tools, but they are distinct enough to frame a short review of how such tools have evolved and could be used by managers.

7.1 Philosophical guidelines or principles for implementing Ecosystem based management

Throughout the published literature it is commonly stated that ecosystem-based fisheries management will require a suite of research efforts and products before it can be successfully implemented. However, many of the more philosophical research efforts and associated publications on ecosystem-based management have addressed management more broadly, rather than on a laundry list of data sources, methodologies and models. This literature argues that broad principles could be adopted to guide management decisions regardless of the quantity and quality of data available to managers. In principle, an ecosystem-based approach to management could be adopted without abundant information, data and precise knowledge of ecosystem interactions, by simply making management decisions in the context of those principles.

One guiding principle addresses the issue of poor knowledge of ecosystem interactions directly, by recommending that management "be cognizant of the levels of ignorance in which it is working" (Mangel *et al.* 1996). This comment recognizes the common criticism that it would be folly to adopt an ecosystem based approach to management because of the presumed immaturity of the science. All management actions involve making decisions in the face of uncertainty, ecosystem-based management simply expands the scope of the uncertainty and trade-offs to a broader scale. Thus, successful implementation of ecosystem-based fishery management may be seen as management within the existing legal and institutional structure, but with additional guiding principles for decision-making.

Examples of Ecosystem Principles and Guidelines for Management (paraphrased) from Scientific Literature

Grumbine's (1994) five goals for sustaining ecological integrity:

- Maintain viable populations of all native species in situ.
- Represent, within protected areas, all native ecosystem types across their natural range of variation.
- Maintain evolutionary and ecological processes (disturbance regimes, hydrological processes, nutrient cycles, etc.).
- Manage over periods of time long enough to maintain the evolutionary potential of species and ecosystem.
- Accommodate human use and occupancy within these constraints.

The Ecosystem Principles Advisory Panel's (EPAP 1999) eight guiding principles for marine ecosystem management:

- The ability to predict ecosystem behavior is limited.
- Ecosystems have real thresholds and limits that, when exceeded, can affect major system restructuring.
- Once thresholds and limits have been exceeded, changes can be irreversible.
- Diversity is important to ecosystem functioning.
- Multiple scales interact within and among ecosystems.
- Components of ecosystems are linked.
- Ecosystem boundaries are open.
- Ecosystems change with time.

Pikitch *et al.* (2004) propose that the overarching objective of ecosystem-based fishery management is to sustain healthy marine ecosystems and the fisheries they support, under these guidelines:

- Avoid degradation of ecosystems, as measured by indicators of environmental quality and system status.
- Minimize the risk of irreversible change to natural assemblages of species and ecosystem processes.
- Obtain and maintain long-term socioeconomic benefits without compromising the ecosystem.
- Generate knowledge of ecosystem processes sufficient to understand the likely consequences of human actions.

Francis *et al.* (2007) ten "commandments" for implementing ecosystem-based fishery management:

- Keep a perspective that is holistic, risk-averse, and adaptive.
- Question key assumptions, no matter how basic.
- Maintain old-growth age structure in fish populations.
- Characterize and maintain the natural spatial structure of fish stocks.
- Characterize and maintain viable fish habitats.
- Characterize and maintain ecosystem resilience.
- Identify and maintain critical food web connections.
- Account for ecosystem change through time.
- Account for evolutionary change caused by fishing.
- Implement an approach that is integrated, interdisciplinary, and inclusive.

These guiding principles provide a holistic approach to fisheries management by emphasizing the relationships between the parts of ecosystem and the whole, informed by data, models and formal quantitative evaluation of tradeoffs and uncertainty that are a part of most management decisions.

While the literature on ecosystem principles is voluminous, key themes emerge. Grumbine (1994) highlighted the need to maintain viable populations and ecosystem types, and evolutionary and ecological processes. Similarly, the Ecosystem Principles Advisory Panel (EPAP 1999) highlighted the importance of diversity to ecosystem function and recognized that exceeding ecosystem thresholds or limits can lead to ecosystem reorganization. Pikitch *et al.* (2004) and Francis *et al.* (2007) list sets of guiding principles, and also recommend the use of indicators to evaluate environmental quality and status. Indicators are recommended so that scientists and managers may use them to consider ecosystem changes through time and evolutionary changes caused by fishing, and to constantly question key assumptions, no matter how basic they might seem. See accompanying text box for details.

Lists of ecosystem principles can provide meaningful guidance and insight for managing with an ecosystem context. These principles might also be reduced into a key overarching principle, for example Holling and Meffe (1996) described the "golden rule" of ecosystem management as "management should strive to retain critical types and ranges of natural variation in resource systems in order to maintain ecosystem resiliency." That golden rule is based on the observation that ecosystems have thresholds and can flip between alternative states when thresholds are breached – such states may or may not be reversible. Given a more socioeconomic perspective, McEvoy (1996) contends that the most important target for achieving sustainability is the "long-term health of the interaction between nature, the economy, and the legal system," recognizing the importance of evaluating the social and economic needs while maintaining ecological structure and dynamics.

7.2 Multispecies and ecosystem models

Typically, the role of all fisheries models, whether single or multispecies, is to understand and inform decision-makers of the consequences of fishing or other human activities to living resources and the ecosystem in which they exist (Hollowed *et al.* 2000). While there have been attempts to model the inter-specific and community dynamics of ecosystems, the complexity of these interactions, coupled with the data requirements needed for model validation and the computing power needed to run complex models, have historically been limiting factors in the development of models for use by managers. However, in recent decades, the science of modeling ecosystem interactions has advanced tremendously and monitoring efforts have assembled data appropriate for developing relatively data rich single and multispecies models for many ecosystems.

A wide range of multispecies and ecosystem models have been developed and published in peer-reviewed literature, and a limited, but growing, number have been used to help inform marine resource management decisions. Comprehensive reviews of the multispecies and ecosystem modeling tools available to marine researchers, with detailed consideration of their strengths, drawbacks, and best practices for developing such models, are available from both NMFS (Townsend *et al.* 2007, Link *et al.* 2009) and the United Nations Food and Agriculture Organization (Plagyani 2007). In short, ecosystem models are complex, predictability is limited, and formally addressing uncertainty poses a unique set of challenges. Yet the science behind such models has significantly improved in recent years, and many regions now have sufficient data to begin applying these models in resource management. Given the increasing number of ecosystem modeling approaches, clearly defined management goals and questions are important. As Hill *et al.* (2007) state, "Predictive models, especially in ecology, are rarely intended to provide an all-encompassing description of how a system actually works, but they are intended to forecast how certain characteristics of the system respond to a specific set of conditions." Models can also serve

as a stimulus and focus for initiating dialogues and discussions on future ecosystem trade-offs among management decisions.

Several published models are available for resources managed by the Pacific Council; an Ecopath with Ecosim model of the Northern California Current (north of Cape Mendocino) developed by Field *et al.* (2006), a seasonal model of the Oregon shelf ecosystem to evaluate the role of jellyfish (Ruzicka *et al.* 2007), and an Atlantis model of the California Current north of Point Conception documented in Brand *et al.* (2007). Some recent model applications include informing decisions such as the krill harvest ban (PFMC 2008), exploration of the role of Humboldt (jumbo) squid in the California Current (Field *et al.* 2007), analyses of potential ecosystem indicators (Samhouri *et al.* 2009), and comparative evaluations of ecosystem status from both single and multispecies perspectives (Worm *et al.* 2009). The Atlantis model in particular is likely to play a central role in quantifying trade-offs in future efforts to develop Integrated Ecosystem Assessments (IEAs) for the California Current (Levin *et al.* 2009).

Ecosystem models have also been used to formally evaluate tradeoffs between Pacific sardine as a directed fishery target and as forage for other commercially and ecologically important species (Hannesson et al 2009; Hannesson and Herrick, 2010). The sardine example represents a growing body of efforts to develop models that account for ecological and economic interactions (Finnoff and Tschirhart, 2003, 2004; Eichner and Tschirhart 2007). Such models consider the benefits and costs related to the use of fishery resources: (1) consumptive use; (2) non-consumptive use; and (3) indirect use of the resource in its natural state, and explore the consequences of alternative management actions to facilitate comparisons and trade-offs among management decisions. Extending this framework to more complex situations (e.g. multiple ecosystem functions, uncertainty, and dynamics) will require a great deal of detailed economic and ecological data, a commonality among all ecological and socioeconomic modeling approaches.

7.3 Ecosystem indicators, status reports, and integrated ecosystem assessments

The third type of ecosystem information for potential Council consideration includes ecosystem status reports, ecosystem indicators, and the results of IEAs. There are several products that could be adopted or otherwise incorporated into the Council ecosystem-based fishery management framework to inform decision making on the significance of environmental conditions to productivity and possible risk, as well as possible trade-offs among competing management objectives.

The State of the California Current (e.g., McClatchie *et al.* 2009) report is a comprehensive summary of physical climate and oceanographic trends (e.g. ocean temperatures, upwelling, basin scale indices such as El Nino) and biological productivity (zooplankton abundance, forage fish abundance, seabird and marine mammal productivity) taken from a wide range of monitoring and research efforts throughout the CCE. While the report is technical in nature, it provides an example of a publication that distills trends in ocean conditions and productivity in a way that may be informative for decision-makers. Similar documents are prepared for the North Pacific Fishery Management Council (The NPFMC Ecosystem Considerations Chapter, Boldt and Zador 2010), for the Department of Fisheries and Oceans in Canada (DFO 2009), and for the entire suite of ecosystems that constitute the North Pacific Ocean (PICES 2005). The Council has already begun to consider a summary of indicators for Pacific salmon management, based on work by Peterson *et al.* (2008) linking a suite of productivity metrics (ocean temperatures, timing of the spring transition, species composition and abundance of zooplankton communities). While these indicators are qualitative, they provide general guidance on the relative degree of productivity to be expected by salmon in the coastal ocean. Similarly, Wells *et al.* (2008) developed a statistical model that relates physical ocean and climate conditions with the productivity of lower, middle and higher trophic level species off of Central California, which could be used as an indicator of ecosystem productivity.

In addition to empirical indices or indicators of ocean conditions and productivity, both single and multispecies models provide estimates of resource productivity and status. The Council is familiar with single species reference points for stock status and trends. Ecosystem models are increasingly being used to develop indicators of ecosystem status, state or health, with one of the most cited criteria for useful indicators being that they can characterize the effects of fishing relative to standing biomass and productivity in an unambiguous and quantifiable manner (Murawski 2000). While the development of meaningful indicators remains a focal area of research, particularly through the use of simulation testing, suites of indicators may provide the most robust results. In general, it seems that indicators of key functional groups or at the level of community organization, such as zooplankton, forage fish and jellyfish, are most likely to characterize ecosystem state most reliably, possibly due to their rapid response to both direct and indirect changes in fishing pressure (Fulton *et al.* 2005; Samhouri *et al.* 2009). By contrast, indicators such as seabird biomass, or trophic level of the (fisheries) catch and total catch perform relatively poorly in simulation studies, although it remains necessary to validate these indicators with empirical data. Socio-economic indicators could represent the varied benefits that society derives from ecosystem services. Evaluating stakeholder interests will define these benefits, which in ecosystem-based fisheries management can be broadly categorized as: commercial fishing, recreation, and the environment. Each group benefits from better commercial fishing, better recreational fishing, bird watching, and other activities, and better stewardship, respectively. These indicators can provide practical and defensible measures of relative ecosystem value that can then be used to evaluate ecosystem-based fishery management planning alternatives.

7.4 Integrated Ecosystem Assessments

In recent years, the concept of IEAs has been promoted as a means to provide an appropriate interface between ecosystem science and the management community. The IEA approach builds upon risk analysis methods, and is best described as "A formal synthesis and quantitative analysis of information on relevant natural and socioeconomic factors, in relation to specified ecosystem management objectives" (Levin *et al.* 2008, Levin *et al.* 2009, deReynier *et al.* 2010). IEAs are not meant to replace current management approaches, but rather to highlight the tradeoffs and conflicts among competing objectives that are associated with management decisions. IEAs would likely draw upon both ecosystem models and model-based or empirical ecosystem indicators, by using risk analysis approaches to determine the probability that a given indicator may shift to, or stay in, an undesirable state in response to human activities and/or natural processes. IEAs could also use a management strategy evaluation approach to simulate ecosystem behavior and allow the ability to forecast changes in ecosystem state in response to management scenarios or decision rules, simultaneous with assessment of the empirical indicators based on in-situ ecosystem monitoring efforts. Recently, the Northwest Fisheries Science Center (NWFSC) and the Southwest Fisheries Science Center (SWFSC) have together secured funding to support preliminary development of IEA products for west coast marine resources, which should provide opportunities for the Council and its advisory bodies to become exposed to and provide feedback upon such initiatives.

7.5 Ecosystem based management in practice

While the science and the literature regarding ecosystem-based management are broad, examples of these products being applied in practice are limited (Tallis *et al.* 2010, Lester *et al.* 2010). The Alaska Fishery Science Center (AFSC) is a world leader in both compiling the necessary data and in developing quantitative food web models using those data (e.g., Aydin and Mueter 2007, Gaichas *et al.* 2009, Kinsey and Punt 2009). Results from AFSC ecosystem research are regularly brought before the NPFMC, and have been used to qualitatively guide decisions in conjunction with the results of traditional single species assessments. For example, in 2006 the NPFMC SSC recognized that while the Eastern Bering Sea Pollock stock was above the target (MSY) level, the stock had been declining due to poor recruitment, and ecosystem indicators suggested declines in zooplankton (prey), while an ecosystem model indicated

an increase in juvenile predation by arrowtooth flounder (predators). The NPFMC SSC consequently recommended adopting a reduction in the maximum permissible ABC to account for these concerns.

Ecosystem advice has also been developed to inform management of Antarctic krill, by the Commission for the Conservation of Antarctic Marine Living Resources. Key management questions for Antarctic krill revolve around how to spatially allocate the allowable catch in a manner that minimizes the potential effects on krill-dependent predators. As the key uncertainties in this question relate to krill movement and advection rates, and the functional relationships between krill and their predators, several biophysical models have been developed to address these questions, and with which to explore competing hypotheses regarding krill movement and advection. As resource managers continue to be confronted with complex issues and trade-offs related to managed species and their complex interactions with climate conditions, other elements of the food web, and direct and indirect human activities, there is clearly a role for greater application of ecosystem principles, models, indicators and assessments of many flavors. Among the greatest challenges now is how to incorporate such guidance into the existing and continually evolving management framework to better understand the tradeoffs associated with management decisions.

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9 Appendix A: Example Practical Considerations for EFMP Alternatives

Need	Status Quo + (Do we need an EFMP?)	Advisory FEP	Umbrella EFMP with Selected FMUs	Regional Omnibus EFMP	Coastwide Omnibus EFMP
Meet PFMC Mission for Sustainable Fisheries Mgmt. **<u>Some Potential Benefits:</u>** 1) Improve information and decision-making 2) Identify information gaps 3) Integrate across species-specific FMPs 4) Provide a nexus with other ecosystem efforts 5) Establish a framework that enables mgmt. at the appropriate ecosystem scale for a species or species complex 6) Create incentives for improved stewardship 7) Encourage innovation by offering alternatives to achieve a more robust portfolio of fishing opportunities	Information and PFMC process improvements are limited and made on a case-by-case basis: Qualify some effects of management decisions and risks for one species on other ecosystem species, habitat, fisheries, communities, etc. Monitor and report other (non-PFMC) ecosystem efforts and provide input, as determined necessary and useful.	Non-regulatory plan provides a cohesive framework: Quantify effects of management decisions and risks for one species on another ecosystem species, habitat, fisheries, community, etc. Coordinated, organized and prioritized focus with identifiable goals for input to other ecosystem efforts.	Adds some regulatory authority/responsibility while maintaining current basic PFMC and FMP organization, structure and decision-making processes.	Revises PFMC and FMP organization, structure and decision-making processes to correspond to relevant ecological relationships. Adopt FMPs with specific FMUS for ecoregions. Some spp. may be included in a single FMP (e.g. cowcod), others in multiple FMPs (e.g. arrowtooth flounder, or northern lingcod) and some in all FMPs (e.g. thresher shark)	Consolidates all existing FMPs into a single FMP. Provides for simultaneous decision-making appropriate for the suite of ecosystem impacts. Provides greater consistency in goals, objectives, & processes across all current FMPs. Flexible FMP structure allows for changes in ecosystem understanding and information without requiring development of new FMPs. Allows for maintenance or revisions to PFMC and advisory group structure, as necessary.

Need	Status Quo + (Do we need an EFMP?)	Advisory FEP	Umbrella EFMP with Selected FMUs	Regional Omnibus EFMP	Coastwide Omnibus EFMP
Some PFMC Examples:					
Species, such as forage species	Qualitatively address forage fish issues: identify suite of spp. affected by anchovy harvests and nature of impacts on FMP species and fisheries, and non-FMP species. Will the salmon resource be affected (harmed) by the proposed anchovy harvest?	Explicitly address forage fish issues: Quantitatively assess sardine harvests on other FMP spp. and fisheries, and non-FMP spp. What are the effects on the salmon resource (and fisheries & communities) of the proposed anchovy harvest? How certain is it that these effects will occur (probabilities)?	Regulatory management for species like krill May selectively add new non-FMP managed species to an FMP	What are the impacts of the harvest of anchovies on other relevant resources, fisheries, habitats, and communities within Region X? What are the probabilities that these impacts will occur?	What are the impacts of the harvest of forage species on all other relevant resources, fisheries, habitats and communities on the West Coast? Make simultaneous management decisions for salmon, whiting, anchovy, sardine, smelt, albacore, etc. based on integrated ecosystem information.
Fisheries	Identify potential effort shifts among fisheries due to harvest opportunities for several target species: Will fishers for albacore tuna switch to fish more for salmon at the proposed salmon harvest level?	Quantify effort shifts among fisheries: To what degree will albacore fishers switch to/from salmon fishing as a result of the proposed salmon harvest level?	Explicitly account for harvest opportunities for FMU species in different FMPs, when setting management measures for these FMU species: Adjust salmon management measures and albacore management measures, as needed, to account for potential	When setting management measures in Region X, explicitly account for harvest opportunities for multiple FMU species within the regional FMP: Within Region X, account for potential efforts shifts between	Simultaneously set management measures that explicitly account for potential effort shifts among fisheries due to harvest opportunities for all FMU species.

Need	Status Quo + (Do we need an EFMP?)	Advisory FEP	Umbrella EFMP with Selected FMUs	Regional Omnibus EFMP	Coastwide Omnibus EFMP
			effort shifts between these fisheries.	salmon and albacore fisheries.	
Habitats	Identify how oceanographic processes may affect FMP fisheries: How does ocean acidification affect the food chain, and ultimately, the abundance of target FMU species?	Update and integrate information on EFH for all FMP species: Assemble available information to quantify areal extent and locations of habitat types important to each FMP species.	When setting harvest levels and management measures, assess and consider the effects of site development (e.g., energy facility), if any, on each FMP species and fishery.	Provide effective input to non-PFMC regarding activities potentially affecting PFMC mission: Within an FMP region, what are the kinds and level of impacts a proposed energy facility may have on the FMP species and fisheries?	For all FMU species, include oceanographic conditions in stock assessments and decision-making processes: Incorporate oceanographic information on the CCE into all stock assessments for FMU species on the West Coast.
Socio-Economic	For various fishing portfolio strategies, identify the annual revenue effects of proposed harvest levels and management measures for multiple FMU species: For small trollers, will they likely to receive more revenue if they switch to a different portfolio, e.g., target lingcod and salmon rather than other nearshore species?	For various fishing portfolio strategies, quantify the effects of proposed harvest levels and management measures for multiple FMU species on annual revenue: How much (more/less) annual income will large trollers receive if they primarily target albacore rather than salmon or groundfish ?	Evaluate socio-economic trade-offs among fishing portfolio strategies, and explicitly consider these when setting harvest levels and management measures for FMU species in different FMPs.	For a regional FMP, evaluate socio-economic trade-offs among fishing portfolio strategies, and explicitly consider these when setting harvest levels and management measures for all FMU species in the FMP.	For the West Coast, evaluate socio-economic trade-offs among fishing portfolio strategies, and explicitly consider these when simultaneously setting harvest levels and management measures for all FMU species and FMP fisheries.

Need	Status Quo + (Do we need an EFMP?)	Advisory FEP	Umbrella EFMP with Selected FMUs	Regional Omnibus EFMP	Coastwide Omnibus EFMP
Some PFMC Implementation Considerations	Within existing PFMC structure, focus more resources to: Acquire, organize, analyze and disseminate relevant ecological information (e.g., multi-species biology, oceanography, habitat, fisheries, socio-economics and their interrelationships) Improve utilization of relevant efforts (summaries, information, analyses) by non-PFMC entities Identify key non-PFMC ecosystem efforts to monitor or engage in. Implements priority revisions to PFMC structure and function (e.g., recommendations from EPDT and other advisory bodies)	Develop Terms of Reference for the delivery and review of ecosystem science to the PFMC PFMC adopt FEP (developed by EPDT)	If non FMP-managed species are included in the EFMP, then PFMC must set ACLs, OFLs, etc. for these new FMU species.	Reorganize information and decision-making from coastwide (generally fishery-related) to a regional basis (ecologically related). Set ACLs, OFL,s etc. for FMU species on a regional basis (e.g., like for fishery sectors in NS1 guidelines). Reorganize and potentially broaden advisory groups to correspond to regional FMPs. May need to revise existing rebuilding plans to account for different geographic scopes and FMU species in regional FMPs.	Provide significant resources and revise PFMC structure and operations to support very complex analytical and decision-making processes Provide for broad and timely communication among all relevant parties for information acquisition, analysis, and decision-making.

Need	Status Quo + (Do we need an EFMP?)	Advisory FEP	Umbrella EFMP with Selected FMUs	Regional Omnibus EFMP	Coastwide Omnibus EFMP
Some Potential Costs and Consequences: a) Resource costs for personnel, meetings, etc. b) Additional technical expertise c) Changes to Council organization or decision-making processes d) More complex decision-making e) Consultation with additional affected constituencies f) Effects on other entities (time, decisions and actions): governments, industry, NGOs, constituents, public g) Evaluation of EFMP performance h) Workload and time commitment from Council family to develop and implement EFMP while continuing current PFMC activities. Others?	Resources to assemble, organize, analyze and disseminate key information. Increase coordination among current advisory bodies.	Add resources and expertise to assemble, organize, analyze and disseminate all relevant information EPDT activities to draft plan PFMC and advisory bodies to review and approve plan SSC develop Terms of Reference for the delivery and review of ecosystem science to the PFMC	Add expertise and stakeholders to advisory panels. May inadvertently affect state-managed fisheries and resources.	Re-form and add advisory panels: likely broaden the range of scientific expertise needed and stakeholders affected. May take much more time to fully transition to new regional approach, for PFMC process adjustments and for developing new regional FMPs.	Timing of decision-making may be disadvantageous for some actions and advantageous for others. Evaluation of the outcomes of PFMC decisions could be more challenging and less timely.

10 Appendix B: Pacific Fishery Management Council Goals and Objectives from Each of its Four Species Group FMPs

This appendix provides the assembled goals and objectives from the Council's four species group FMPs: coastal pelagic species, groundfish, highly migratory species, and salmon. The goals and objectives of the four FMPs share four common themes that are 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:

Pacific Council FMP Shared Goals and Objectives, by FMP Objective/Goal Number

Ecological	CPS	Gr. Fish	Salmon	HMS
Prevent overfishing and rebuild depleted stocks.	7	3	1	10
Provide adequate forage for dependent species.	6			
Describe, identify and minimize adverse impacts on essential fish habitat		5		14
Minimize bycatch (incl. protected species) and encourage full utilization of resources	5	9, 11	4	9, 17
Economic				
Achieve greatest possible net benefit (economic or OY) from resource	2	6	5	5
Promote efficiency and profitability in the fishery, including stability of catch	1	2, 7, 14	6	2
Accommodate existing fishery sectors	4	12	2, 3	4, 18
Minimize gear conflicts.	11	13		13
Minimize adverse impacts on fishing communities and other entities		15, 16	2, 3	3
Use gear restrictions to minimize need for other management measures wherever practicable		8		
Management				
Acquire biological information and develop long term research	8			11
Foster effective monitoring and enforcement.	9	1		12
Establish management measures to control fisheries impacts, use management resources effectively	10	4, 10		3, 15
Encourage cooperative international and interstate management	3		8	1, 6, 7, 8
Promote the safety of human life at sea		17	9	
Support enhancement of stock abundance			7	
Promote outreach and education efforts				16

All four FMPS are currently being amended to meet the new requirements of the MSA and its National Standard 1 guidelines and for other purposes, and are subject to change. The following list of FMP goals and objectives is a snapshot of those goals and objectives that were in place as of August 2010, and is provided herein to help the Council and the public consider the Council's management philosophy across its four FMPs and how that philosophy might be translated into goals and objectives for an EFMP.

10.1 Coastal Pelagic Species

Goals and objectives for the CPS FMP (not listed in order of priority):

1. Promote efficiency and profitability in the fishery, including stability of catch.
2. Achieve OY.
3. Encourage cooperative international and interstate management of CPS.
4. Accommodate existing fishery segments.
5. Avoid discard.
6. Provide adequate forage for dependent species.
7. Prevent overfishing.
8. Acquire biological information and develop long term research program.
9. Foster effective monitoring and enforcement.
10. Use resources spent on management of CPS efficiently.
11. Minimize gear conflicts.

10.2 Groundfish

The Council is committed to developing long-range plans for managing the Washington, Oregon, and California groundfish fisheries that will promote a stable planning environment for the seafood industry, including marine recreation interests, and will maintain the health of the resource and environment. In developing allocation and harvesting systems, the Council will give consideration to maximizing economic benefits to the United States, consistent with resource stewardship responsibilities for the continuing welfare of the living marine resources. Thus, management must be flexible enough to meet changing social and economic needs of the fishery as well as to address fluctuations in the marine resources supporting the fishery. The following goals have been established in order of priority for managing the West Coast groundfish fisheries, to be considered in conjunction with the national standards of the Magnuson-Stevens Act.

Management Goals

Goal 1 - Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.
Goal 2 - Economics. Maximize the value of the groundfish resource as a whole.
Goal 3 - Utilization. Within the constraints of overfished species rebuilding requirements, achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Objectives. To accomplish these management goals, a number of objectives will be considered and followed as closely as practicable:

Conservation

Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.

Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group. Achieve a level of harvest capacity in the fishery that is appropriate for a sustainable harvest and low discard rates, and which results in a fishery that is diverse, stable, and profitable. This reduced capacity should lead to more effective management for many other fishery problems.

Objective 3. For species or species groups that are overfished, develop a plan to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing

communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem.

Objective 4. Where conservation problems have been identified for non-groundfish species and the best scientific information shows that the groundfish fishery has a direct impact on the ability of that species to maintain its long-term reproductive health, the Council may consider establishing management measures to control the impacts of groundfish fishing on those species. Management measures may be imposed on the groundfish fishery to reduce fishing mortality of a non-groundfish species for documented conservation reasons. The action will be designed to minimize disruption of the groundfish fishery, in so far as consistent with the goal to minimize the bycatch of non-groundfish species, and will not preclude achievement of a quota, harvest guideline, or allocation of groundfish, if any, unless such action is required by other applicable law.

Objective 5. Describe and identify essential fish habitat (EFH), adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.

Economics

Objective 6. Within the constraints of the conservation goals and objectives of the FMP, attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.

Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable. Encourage development of practicable gear restrictions intended to reduce regulatory and/or economic discards through gear research regulated by EFP.

Utilization

Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing), in accordance with conservation goals, of the Pacific Coast groundfish resources by domestic fisheries.

Objective 10. Recognizing the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.

Objective 11. Develop management programs that reduce regulations-induced discard and/or which reduce economic incentives to discard fish. Develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Promote and support monitoring programs to improve estimates of total fishing related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.

Social Factors.

Objective 12. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

Objective 13. Minimize gear conflicts among resource users.

Objective 14. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment.

Objective 15. Avoid unnecessary adverse impacts on small entities.

Objective 16. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.

Objective 17. Promote the safety of human life at sea.

10.3 Highly Migratory Species

The general goals and objectives of this FMP are listed below to provide context for [management] actions. They are not listed in order of priority:

1. Promote and actively contribute to international efforts for the long-term conservation and sustainable use of highly migratory species fisheries that are utilized by West Coast-based fishers, while recognizing these fishery resources contribute to the food supply, economy, and health of the nation.
2. Provide a long-term, stable supply of high-quality, locally caught fish to the public.
3. Minimize economic waste and adverse impacts on fishing communities to the extent practicable when adopting conservation and management measures.
4. Provide viable and diverse commercial fisheries and recreational fishing opportunity for highly migratory species based in ports in the area of the Pacific Council's jurisdiction, and give due consideration for traditional participants in the fisheries.
5. Implement harvest strategies which achieve optimum yield for long-term sustainable harvest levels.
6. Provide foundation to support the State Department in cooperative international management of highly migratory species fisheries.
7. Promote inter-regional collaboration in management of fisheries for species which occur in the Pacific Council's managed area and other Councils' areas.
8. Minimize inconsistencies among federal and state regulations for highly migratory species fisheries.
9. Minimize bycatch and avoid discard and implement measures to adequately account for total bycatch and discard mortalities.
10. Prevent overfishing and rebuild overfished stocks, working with international organizations as necessary.
11. Acquire biological information and develop a long-term research program.
12. Promote effective monitoring and enforcement.
13. Minimize gear conflicts.
14. Maintain, restore, or enhance the current quantity and productive capacity of habitats to increase fishery productivity for the benefit of the resource and commercial and recreational fisheries for highly migratory species.
15. Establish procedures to facilitate rapid implementation of future management actions, as necessary.
16. Promote outreach and education efforts to inform the general public about how West Coast HMS fisheries are managed and the importance of these fisheries to fishers, local fishing communities, and consumers.
17. Manage the fisheries to prevent adverse effects on any protected species covered by MMPA and MBTA and promote the recovery of any species listed under the ESA to the extent practicable.
18. Allocate harvest fairly and equitably among commercial, recreational and charter fisheries for HMS, if allocation becomes necessary.

10.4 Salmon

The following objectives guide the Council in establishing fisheries against a framework of ecological, social, and economic considerations.

1. Establish ocean exploitation rates for commercial and recreational salmon fisheries that are consistent with requirements for stock conservation objectives within Section 3.1, specified ESA consultation or recovery standards, or Council adopted rebuilding plans.
2. Fulfill obligations to provide for Indian harvest opportunity as provided in treaties with the United States, as mandated by applicable decisions of the Federal courts, and as specified in the October 4, 1993 opinion of the Solicitor, Department of Interior, with regard to federally recognized Indian fishing rights of Klamath River Tribes.
3. Seek to maintain ocean salmon fishing seasons which support the continuance of established recreational and commercial fisheries while meeting salmon harvest allocation objectives among ocean and inside recreational and commercial fisheries that are fair and equitable, and in which fishing interests shall equitably share the obligations of fulfilling any treaty or other legal requirements for harvest opportunities.
4. Minimize fishery mortalities for those fish not landed from all ocean salmon fisheries as consistent with optimum yield and the bycatch management specifications of Section 3.4.
5. Manage and regulate fisheries so that the optimum yield encompasses the quantity and value of food produced, the recreational value, and the social and economic values of the fisheries.
6. Develop fair and creative approaches to managing fishing effort and evaluate and apply effort management systems as appropriate to achieve these management objectives.
7. Support the enhancement of salmon stock abundance in conjunction with fishing effort management programs to facilitate economically viable and socially acceptable commercial, recreational, and tribal seasons.
8. Achieve long-term coordination with the member states of the Council, Indian tribes with federally recognized fishing rights, Canada, the NPFMC, Alaska, and other management entities which are responsible for salmon habitat or production. Manage consistent with the Pacific Salmon Treaty and other international treaty obligations.
9. In recommending seasons, to the extent practicable, promote the safety of human life at sea.

11 Appendix C: Acronyms Used

Acronym	Term
CCE	California Current Ecosystem
EAS	Ecosystem Advisory Subpanel
EC Species	Ecosystem Component Species
EFH	Essential Fish Habitat
EFMP	Ecosystem Fishery Management Plan
EPAP	Ecosystem Principles Advisory Panel
EPDT	Ecosystem Plan Development Team
FEP	Fishery Ecosystem Plan
FMP	Fishery Management Plan
HAPC	Habitat Area of Particular Concern
HC	Habitat Committee
IEA	Integrated Ecosystem Assessment
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
SSC	Scientific and Statistical Committee

Discussion Document: Assessing Ecosystem Policy Principles and Bringing Ecosystem Science into the Pacific Fishery Management Council Process

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1.0 Introduction

The Pacific Fishery Management Council (Council or Pacific Council) received its first report from its Ecosystem Plan Development Team (EPDT) at its September 2010 meeting. That report, the September 2010 Agenda Item H.1.b., Attachment 1, discussed ecosystem fishery management planning generally, draft goals and objectives for a potential ecosystem fishery management plan (EFMP,) issues to consider for developing the regulatory scope of management unit species for a potential EFMP, the geographic range and scale of an EFMP, and the state of ecosystem science. At that meeting, the Council decided to move forward with an ecosystem fishery management planning process, although the Council reserved the decision on whether to proceed with an EFMP with regulatory authority for some future time. To begin the planning process, the Council tasked its EPDT with reviewing the Council's four fishery management plans (FMPs) to identify existing ecosystem-based management principles, and to scope common management needs that may benefit from a coordinated overarching ecosystem-based fishery management planning framework. This document provides those reviews in Section 2, *Existing Ecosystem-Based Principles and Management Measures*, and Section 3, *Cross-FMP Review of Common Management Needs and Challenges*.

Based on the comments the Council received from its Scientific and Statistical Committee (SSC) and other advisory bodies, Section 4 of this document, *Cross-FMP and Ecosystem Science*, proposes an initial science product development process for the Council arena, discusses science questions for future considerations, and highlights some current science tools that could inform Council decision-making. And, based on Council discussions in September 2010, Section 5 of this document, *Understanding the Cumulative Effects of Fisheries Action*, discusses ways that the scientific information and products described in Section 4 could support analyses of the effects of Council actions taken under its four FMPs.

The EPDT has deliberately called this report a *Discussion Document* because we hope that it will generate discussion within and between the Council, its advisory bodies, and the public. While EPDT members have experience in a diverse array of Council-related science and management programs, our knowledge of Council activities and needs is far from comprehensive. If the issues below continue to be of interest to the Council and the public, we hope that many others join in the discussion to refine and develop an approach for ecosystem-based fishery management in the California Current.

2.0 Ecosystem-Based Principles and Management Measures

Fishery managers need the best possible understanding of the interactions among physical, ecological, socioeconomic, and management issues in the California Current Ecosystem (CCE) for a more integrated approach to decision making. Both long and short term changes in distribution and abundance of individual species, subsequent changes in fishing grounds, shifts in fishing effort among species and changes in market demand, can all have major ecosystem effects. Many FMP species have may have experienced historic stock declines or may have highly variable population levels, most likely due to the cumulative interactions among life history and habitat factors (Levin et al. 2006,) the impact of changing environmental conditions on productivity within the CCE (Brodeur et al. 2008,) and harvest rates. Variability in the biophysical components of the ecosystem must be considered in the context of variability and change in social components of the system (Lester et al. 2010, White and Costello 2011). An ecosystem fishery management planning process can help integrate knowledge and data in the CCE to: 1) promote sustainable human uses of the CCE, 2) allow for a coordinated evaluation of ecosystem health, 3) aid in identifying critical data gaps and common ground within and between current FMPs, and 4) allow for evaluation of ecosystem tradeoffs (e.g. predator/prey interactions). Ecological and economic considerations are of notable importance in providing comprehensive optimum yield estimates; the choice

of yields depends on the relative net benefits provided society through ecosystem interactions (Hannesson et al. 2009; Hannesson and Herrick 2010).

In identifying existing ecosystem-based principles and management measures in place within current FMPs, the EPDT looked for 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, may not be comprehensive and would benefit from review by species group management teams and advisory panels.

2.1 Coastal Pelagic Species FMP

1. Krill harvest prohibition: The coastal pelagic species (CPS) FMP prohibits harvest of all species of euphausiids (krill) that occur within the U.S. West Coast Exclusive Economic Zone (EEZ) to help maintain important predator-prey relationships and the long-term health and productivity of the West Coast ecosystem. These ecosystem conservation principal enhance fishery management by protecting, to the extent practicable, krill resources, which are an integral part the ecosystem. [highly migratory species (HMS), groundfish, salmon, CPS, marine mammals]
2. Conservative Management Strategy: The Council has demonstrated a consistently conservative approach to CPS harvest management and in response to Pacific sardine's ecological role as forage and its importance to west coast fisheries. The Council frequently reviews new science in support of stock assessments and management strategies. 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 resulting and current control rule includes an environmental parameter linking temperature to estimated FMSY. [HMS, groundfish, salmon, CPS, marine mammals]
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. [CPS]
4. Cutoff Parameters: CPS harvest control rules have long utilized "Cutoff" parameters to protect a core spawning population and avoid overfishing. 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 approach an overfished status. 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]
5. Monitored stock harvest strategy: The ABC control rule for monitored stocks consists of a 75 percent reduction from the species overfishing level. This precautionary approach is in response to relatively low harvest levels and/or greater scientific uncertainty about stock status or management. [HMS, groundfish, salmon, CPS, marine mammals]
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]

2.2 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 F_{MSY} 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]

2.3 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]

2.4 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]

3.0 Cross-FMP Review of Common Management Needs and Challenges

The Council's four FMPs cover a broad array of species, with widely diverse life histories and trophic roles within the CCE. Management programs and fishing practices will necessarily differ for species that range from the short-lived and quickly-reproducing CPS, to the long-lived and slow-maturing groundfish species, to the fast-maturing and far-ranging salmon and HMS. The different FMP species fill different roles in the CCE, both in their interactions with each other and with non-FMP species. Figure 3.1, below, provides a simplified schematic of the interactions of our FMP species with each other and with non-Council species groups.

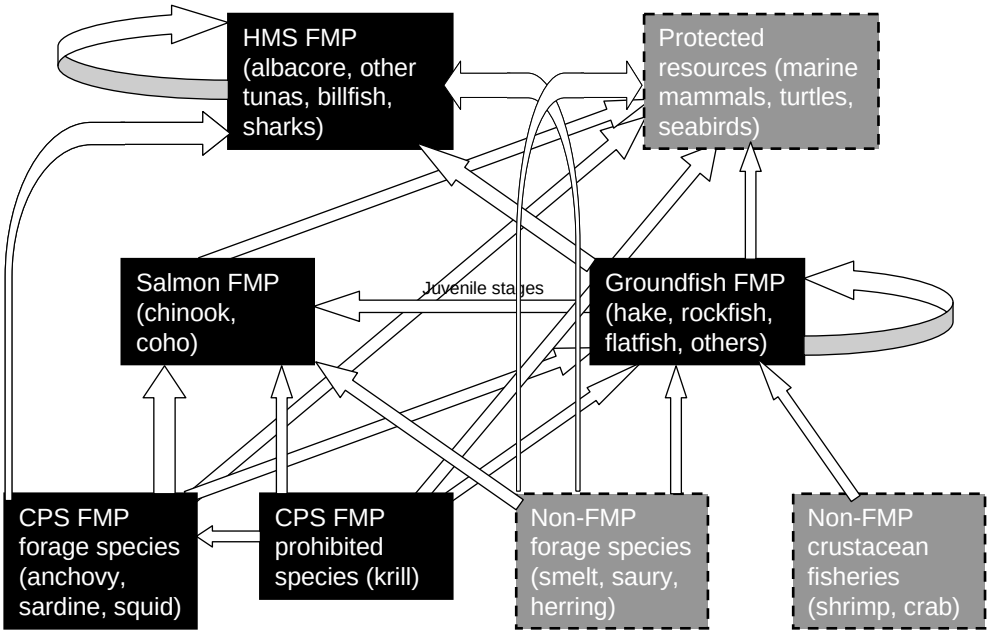

Figure 3.1: Simplified schematic of key trophic interactions between FMP species and others

Figure 3.1 provides a simplified schematic of generalized trophic interactions among the four FMP species groups and some of the major non-managed species groups in the CCE. This figure is not intended to represent the entire food web in any way, or to capture every potential interaction (trophic or otherwise) among the groups, rather the idea was simply to highlight where there are or may be major interactions among groups of FMP-managed and non-Council managed assemblages. For example, krill are an important part of the diets of many species in each of the FMPs, as well as many protected resource species. Similarly, salmon prey primarily on krill, coastal pelagic species (both FMP and non-FMP species, e.g., anchovy, sardine, herring and smelts), and groundfish (primarily young-of-year rockfish and other early life history stages). As such, there is presumably at least some level of connectivity between salmon productivity and the management of all of these other elements of the ecosystem, despite the fact that the functional relationships are poorly understood. Essentially, virtually all of the FMP assemblages have some level of direct trophic interactions with the other FMP assemblages, although the importance and strengths of such interactions vary. More accurate discussions of food webs interactions and food

habits data can be found in the literature (Brand et al. 2007, Daly et al. 2009, Dufault et al. 2009, Field et al. 2006).

While Council process participants and the public are all aware that FMP species have varied life history characteristics and inter-species relationships, the traditional management process helps us to focus on immediate management challenges by separating managed species into the large FMP units. However, this tight species-group focus rarely provides an opportunity to step back and look at how the different FMPs approach similar fishery management challenges or the relationships between species. Below, we provide a series of tables with brief cross-FMP comparisons of how the Council addresses major fishery management issues in each of its four FMPs: harvest policies and overfished/overfishing, bycatch, essential fish habitat (EFH,) and community effects. We chose this particular set of issues as a starting point for discussion in order to highlight the Magnuson-Stevens Fishery Conservation and Management Act's (MSA's) national standard guidelines and EFH requirements.

3.1 FMP Harvest Level Policies and Overfished/Overfishing Issues (Appendix Tables A.1, A.2)

Setting harvest levels is at the heart of a fishery management council's responsibilities, as reflected in the MSA's National Standard 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." The policies that the Council uses to set its harvest levels and to address overfishing and rebuilding overfished stocks must be based in sound scientific advice under National Standard 2, "Conservation and management measures shall be based on the best scientific information available." The Council's harvest policies for the species in its four FMPs are notably different from each other, reflecting diversity of life history characteristics between FMPs. Harvest policies for the FMPs hew to the MSA's National Standard 3 that "To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination."

Beyond basic harvest policies, the MSA also requires ending overfishing where and when it occurs, and requires rebuilding overfished species in as short a time as possible, taking into account the status and biology of overfished stocks of fish, the needs of fishing communities, recommendations of international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem [§304(e)]. For the salmon FMP, the Council has the additional challenge of managing fisheries for a suite of evolutionarily significant units of salmon, some of which are listed as threatened or endangered under the Endangered Species Act (ESA). Among the many challenges of meeting the management requirements of both the MSA and the ESA, the Council has had to wrestle with the confusion of different terminology and standards in the two acts. Amendment 16 to the Salmon FMP is intended, in part, to resolve some of those differences in applying the two acts to the salmon management process.

In Appendix A, at Table A.1 we provide a snapshot of FMP harvest and overfished/overfishing policies. Table A.2 shows the Council's two-year schedule for setting harvest levels for its FMPs, two of which undergo an annual harvest specifications process (CPS and salmon,) and two of which undergo a biennial harvest specifications process (groundfish and HMS). The Council's HMS management work is significantly affected by the timing and management philosophies of the international regional fishery management organizations (RFMOs) that set stock-wide policies for many of the stocks within the HMS FMP.

The Council has a variety of policies and processes that account for both the trophic roles of its managed species and the relationships those species have with their environment. Despite such efforts, a more

rigorous and quantitative analysis of these interactions and the possible trade-offs between managed species that might result from alternative harvest policies is lacking . A more organized ecosystem-based management effort could help the Council better address larger-scale harvest issues like: maintaining long-term age- and size-distribution in managed stock populations, assessing the evolutionary effects of fishing season timing and location; and climate shift effects on stock productivity and predator-prey relationships.

Cross-FMP Harvest Policy Issues

- In keeping with the MSA and the NS1 guidelines, Council harvest policies have been amended to better account for management and scientific uncertainty through the use of buffered harvest levels.
- Groundfish and CPS FMP amendments included Council direction to include ecological considerations in the setting of harvest specifications and in the development of management reference points. An ecosystem-based plan could provide valuable information within and between FMP and non-FMP species when developing harvest levels.
- The rebuilding of stocks declared overfished or listed under the ESA is a central responsibility and goal of Council fishery management. Improved understanding of ecological interactions between species of concern, healthy target stocks, and key predator and prey species could improve recovery efforts. The comprehensive prohibition on krill was, in part, based on an understanding that krill play a vital role in the ecology of many species of concern. Increased understanding of trophic interactions could help validate or improve forage species harvest policy while enhancing rebuilding efforts.
- Harvest policies commonly reduce allowable catch as stocks approach overfished thresholds. This is most notable in CPS harvest control rules where harvest is prohibited rather than restricted when MSST levels are approached for Pacific sardine or reached for Pacific mackerel. Reduction in allowable harvest is also built into groundfish harvest control rules and salmon harvest policies.

3.2 FMP Bycatch Issues (Appendix Table A.3)

Although the ESA and the Marine Mammal Protection Act (MMPA) have long supported bycatch minimization policies, Congress notably strengthened the MSA's approach to bycatch with the implementation of the 1996 Sustainable Fisheries Act. Among other things, the Act added National Standard 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." The revised MSA also included a new requirement that FMPs "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)]. In addition to requiring the minimization of bycatch in domestic fisheries, the MSA also supports the minimization of bycatch in international fisheries.

The 2007 amendments to the MSA supported the Act's bycatch provisions from 1996 by formalizing and more fully funding a bycatch reduction engineering program designed to encourage innovative research into gear modifications for bycatch reduction. 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. As discussed in Table A.3, the groundfish and HMS fisheries have been the primary West Coast beneficiaries of bycatch reduction engineering funding. In addition to

the programs discussed below, NMFS has conducted cross-fishery research into the effects of fishing on incidental take of marine mammals and seabirds.

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.

Cross-FMP Bycatch Issues:

- National Standard 9 has made bycatch a key focus of conservation and management in all four FMPs.
- Bycatch of both fish and non-fish marine vertebrate species (i.e., seabirds, marine mammals, and sea turtles) is of at least some concern in all four FMPs. Bycatch has been highly significant to the HMS, Groundfish, and Salmon FMPs with the latter two driven largely by "weak stock" management of rebuilding rockfish stocks and ESA listed salmon.
- The Council has employed closed areas, gear restrictions, and species handling rules to address bycatch in all four FMPs with some measures (e.g., yelloweye rockfish conservation areas) crossing FMPs.
- The many fishery sectors managed under each FMP are monitored to varying degrees and with different tools such as logbooks and at-sea observers. Monitoring resources are targeted at the sectors for which bycatch is of highest concern, yet there are gaps in monitoring for some fisheries.

3.3 FMP Essential Fish Habitat Issues (Appendix Tables A.4, A.5)

The 1996 Sustainable Fisheries Act brought the concept of essential fish habitat (EFH) into the MSA, and subsequently into FMPs throughout the U.S. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" [§3(10)]. For several fishery management councils, the requirement to identify EFH led to a new and greater understanding of how managed species interact with their physical environment. Although this new understanding has not been universally identified as a move toward ecosystem-based fishery management, some councils used their work on EFH to launch or support further work on ecosystem-based management.

The Act requires NMFS and fishery management councils to identify EFH for their FMPs, identify adverse impacts to that habitat, and ensure the conservation of EFH. Through their FMPs, fishery management councils develop, and NMFS implements, management measures to minimize the effect of fishing activities on EFH.

For non-fishing activities, fishery management councils are permitted to comment on and make recommendations to the Secretary of Commerce or any Federal or State agency "concerning any activity authorized, funded, or undertaken or proposed to be authorized funded or undertaken, by any Federal or State agency that, in view of the Council, may affect the habitat, including essential fish habitat, of a fishery resource under its authority" [§305(b)(3)(A).] The Pacific Council has an additional duty to consider the effects of non-fishing activities on salmon EFH, since fishery management councils are required to comment on and make recommendations regarding activities that are likely to substantially

affect the habitat of anadromous species [§Section 305(b)(3)(B)]. NMFS has consulted on the effects of numerous non-fishing activities on EFH, with the bulk of those consultations designed initially to look at the effects of those activities on salmon EFH while also considering those activities in light of salmon critical habitat requirements under the ESA, but to also take into account effects on groundfish and CPS EFH. Federal regulations at 50 CFR 600.815(10) require that NMFS and fishery management councils conduct a complete review of all EFH information in each FMP as recommended by the Secretary of Commerce, but at least every five years.

Cross-FMP Habitat Issues:

As shown in Appendix A, Table A.4, EFH has been described for all four FMPs, with the groundfish FMP having the most detail, including Habitat Areas of Particular Concern (HAPC) designations and closed areas to protect EFH. Geographic maps of EFH have been developed for all FMPs, except CPS. Three of the four FMPs have also either recently finished a 5-year review of EFH (CPS) or recently initiated a review (Groundfish and Salmon), which suggests that the Council might consider if there could be efficiencies in integrating some of the work between FMPs in future 5-year EFH review processes. An integrated 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. A first step could be to map all EFH data and boundaries in a common tool, like the Groundfish EFH Mapping Tool (http://sharpfin.nmfs.noaa.gov/website/EFH_Mapper/map.aspx or http://pacoos.coas.oregonstate.edu/.) CPS EFH, which has not yet been mapped, is in part defined by a sea surface temperature range between 10 °C to 26 °C, making it annually and seasonally variable; satellite data are available for mapping sea surface temperature changes. General mapping of oceanic events and seasons, such as El Niño/Southern Oscillation (ENSO,) is also possible. A cross-FMP mapping effort could better reveal those habitats important to all four FMPs simultaneously. These common habitats could serve as focal points for Council policy 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.

Unfortunately, limited information about habitat preferences and habitat-specific demographic rates (e.g. survival or growth rates) has resulted in very broad EFH designations. By better understanding what habitats fish use, the demographic rates associated with these habitats, and the factors that make some habitats more valuable than others, it will be possible to make more efficient use of limited resources (Levin and Stunz 2005). When all habitats are considered EFH, prioritization is difficult. New scientific approaches suggest focusing on protecting the habitat-dependent ecological processes that allow populations of fished stocks to persist or expand (Mangel et al. 2006). To this end, the nationally-coordinated NMFS Habitat Assessment Improvement Plan (HAIP) focuses on the marine fisheries aspects of habitat science. The HAIP is intended in part to reduce uncertainty of stock assessments, increase the potential number of advanced stock assessments and contribute to assessments of ecosystem services. The nexus of HAIP, stock assessments and integrated ecosystem assessments has the potential to vastly improve our ability to indentify truly essential EFH.

3.4 FMP Community Effects Issues (Appendix Table A.6. and subsequent figures)

In addition to bringing new management requirements for fish and their habitat, the 1996 Sustainable Fisheries Act recognized the connection of fishing communities to fisheries and fish stocks, particularly through National Standards 8 and 10. National Standard 8 requires that "conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities." National Standard

8 recognized that, while the many new requirements in the Act were expected to end overfishing and ultimately result in healthier and rebuilt stocks, humans are also part of the environment and fishing communities particularly represent the place of humans within the ocean ecosystem.

National Standard 10 requires that "conservation and management measures shall, to the extent practicable, promote the safety of human life at sea." NMFS and fishery management councils have long worked with the U.S. Coast Guard, the states, and the public to address fishery safety issues, but fishing necessarily takes place in a harsh environment and remains a dangerous occupation. Table A.6 in Appendix A provides vessel incident data from the two U.S. Coast Guard West Coast offices, Districts 11 and 13, as well as information on how the Council addresses community effects in recommending fishery management actions. In providing the EPDT with U.S. Coast Guard safety data, Brian Corrigan of District 13 noted that the Dungeness crab fishery, which is not under Council purview, is usually considered the most dangerous fishery off the West Coast (Corrigan, pers. Comm. 2010).

One challenge of the Council's current process is that the Council regularly finds itself of having to make a management decision under one FMP without necessarily having a clear picture of how that decision might affect fishing opportunities under other FMPs. Analyses for the MSA, the National Environmental Policy Act (NEPA,) the Regulatory Flexibility Act (RFA,) and other laws do address some of these cross-FMP issues on a case-by-case basis. However, expanding our thinking about the socio-economic effects of the Council's decisions to an ecosystem context could provide the Council with more resources and information for assessing how their decisions on individual issues fit within the larger picture of all of the Council-generated management programs for fisheries within the CCE.

Cross-FMP Communities Effects Issues:

The importance of FMP fishery resources to fishing communities can be considered in terms of a community's dependence on, or engagement in, the harvesting or processing of commercially or recreationally targeted fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors and related entities that are based in such a community. One hundred and twenty three spatially defined communities in Washington, Oregon, California have been identified as being substantially dependent on or substantially engaged in the commercial harvest or processing of fishery resources (Norman et al. 2007). In addition to coastal tribal fisheries for FMP species, inland treaty tribes conduct commercial, and ceremonial and subsistence fisheries for salmon and steelhead. And, within Idaho, the sport fisheries for salmon and steelhead contribute to the economies of several river communities. From a holistic, ecosystem-based perspective it is important to understand how the structure and function of the CCE affects fishing activity (and vice versa), particularly spatial and temporal fishing patterns and the related impacts on fishing communities. This understanding will help the Council to assess how its specific management actions may affect the overall ecological-socioeconomic landscape.

Economists and other social scientists rely on economic impact, input-output models to gauge the impact of changes in fishing patterns on local and regional economic activity. These models can be coupled with models of the ecosystem to better understand the impact of changes in the ecosystem on fishing communities. The basic data for evaluating community dependence and interdependence on FMP fishery resources is the West Coast commercial fishing landings data found in the Pacific Fisheries Information Network (PacFIN) database. These data together with input from the Council's FMP advisory bodies can be used to assess the socio-economic impacts across fishing communities of a change in the CCE expressed through a change in the abundance and distribution of commercially targeted species.

4.0 Cross-FMP and Ecosystem Science

At the Council's September 2010 meeting, the EPDT received advice and questions from the Council, SSC, and others on the science process and science products that the Council and its advisory bodies might consider for ecosystem-based fishery management planning. In this section: we propose an initial science product development process (4.1), discuss science questions for future consideration, both for FMP species and for more broad ecosystem-wide issues (4.2), and some of the science tools and models that could inform the Council decision-making (4.3).

4.1 Bringing Ecosystem Science into the Council Process

Based in part on advice received from the SSC in September 2010, the EPDT views the incorporation of ecosystem science into the Council process as 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.

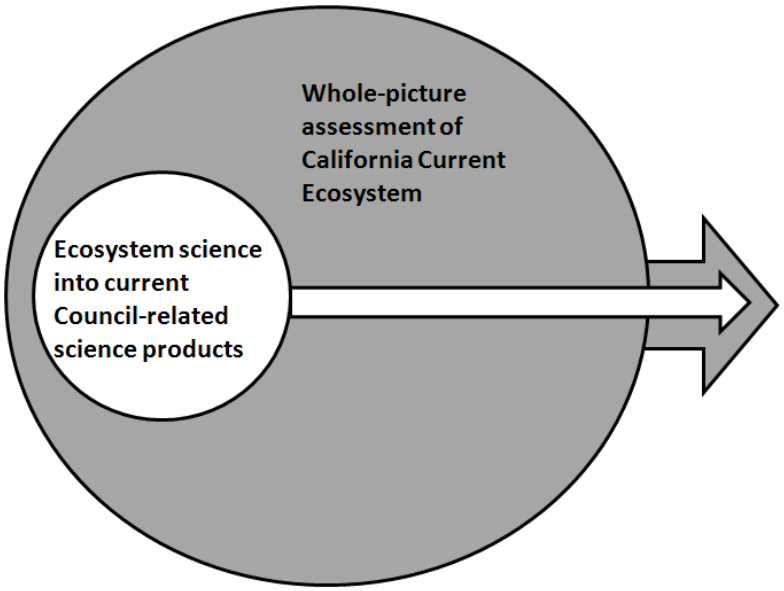

Figure 4.1: Two-part process to bring ecosystem science to the Council

4.1.1 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. 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's Ecosystem-Based Management subcommittee 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 PFMC stock assessments in a limited fashion and also in

the North Pacific Fishery Management Council (NPFMC) 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 impact 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. Research into improving stock assessments has been the focus of programs such as the NOAA Habitat Assessment Improvement Plan.

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 assessment 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 assessment 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. The following proposed schedule recognizes that stock assessment terms of reference and processes are generally prepared well in advance of the year in which they are ultimately used to support fishery management. HMS species are not included in this schedule because HMS stock assessments are conducted by international RFMOs.

Table 4.1: Bringing ecosystem considerations into stock assessment and harvest-setting processes	
CPS	November 2010 – Terms of reference were drafted for CPS stock assessment and methodology review panels that included revisions to begin to bring ecosystem considerations into the next full assessments (currently scheduled for 2014 per the CPS FMP) for Pacific mackerel and Pacific sardine, and for any other CPS species for which the SSC and Council deem such changes to be appropriate. June 2014 – Pacific mackerel full assessment with ecosystem considerations completed for first use in 2014-2015 fishery. November 2014 – Pacific sardine full assessment with ecosystem considerations completed for first use in 2015 fishery.
Groundfish	March 2012 – Proposed list of stock assessments, including recommendations on species assessments to be expanded to include ecosystem considerations, as part of *2013-2014 Terms of Reference for Groundfish Stock Assessment and Review Process*. June 2012 – Final list of stock assessments, including subset of species assessments to be expanded to include ecosystem considerations, as part of *2013-2014 Terms of Reference for Groundfish Stock Assessment and Review Process*. November 2013 – Groundfish stock assessments intended to inform 2015-2016 fishing years complete, including those that have been expanded with ecosystem considerations.
Salmon	April 2012 – As part of developing initial list of potential topics for salmon methodology review, Council and advisory bodies draft potential data and analysis requests for ecosystem information of potential benefit to salmon abundance and assessment models. September 2012 – Council and advisory bodies finalize data and analysis requests for ecosystem information of potential benefit to salmon abundance and assessment models for review by SSC Salmon Subcommittee and Salmon Technical Team. November 2012 – Council finalizes data an analysis requests for ecosystem information of potential benefit to salmon abundance and assessment models, using advice received through salmon-specific advisory bodies, the SSC, other advisory bodies, and the public. April 2013 – As part of developing initial list of potential topics for salmon methodology review, Council and advisory bodies review available ecosystem considerations data and analyses compiled in response to requests developed in 2012. September and November 2013 – Ecosystem considerations incorporated into salmon methodology for 2014 through regular methodology review process. March and April 2014 – 2014 salmon season management developed with methodologies that incorporate the ecosystem considerations developed over 2012-2013.

4.1.2 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. The SSC can provide guidance on the content, review and dissemination of this report…" (H.1.c., Supplemental SSC Report)

At its November 2010 meeting, the Council received a presentation from Patricia Livingston of NMFS's Alaska Fisheries Science Center (AFSC) that, among other things, discussed the AFSC's Ecosystem Considerations chapter of its Stock Assessment and Fishery Evaluation (SAFE) Report. The AFSC first published its Ecosystem Considerations report in 1995 and the ongoing dialogue that report has created between NMFS and the NPFMC has led to many refinements to the report's format and to the information it presents – see box at right. The AFSC's report provides an example of the type of annual ecosystem report that could address the second element of incorporating ecosystem science into the Council decision-making process. However, NMFS and its partner science entities will necessarily have different types of data and analyses for the CCE than those available for ecosystems of interest to the NPFMC. For example, there is currently an annual briefing and report available on physical and biological oceanographic trends and conditions throughout the CCE developed by the California Cooperative Oceanic and Fisheries Investigations (CalCOFI) consortium (McClatchie et al. 2009, Bjorkstedt et all 2010). While the CalCOFI report is technical in nature, it could provide the foundation for a summary of physical and biological trends of key interest to fisheries managers. NMFS and the Pacific Council have an opportunity to benefit from the experience of our colleagues in the North Pacific and in other parts of the country by evaluating lessons others have learned on ecosystem reporting to better design an initial report on conditions in the CCE.

History and Goals of the AFSC Ecosystem Considerations Report *[Adapted from: http://access.afsc.noaa.gov/reem/ecoweb/EcosystemIndex.cfm, as viewed on 12/27/10]*

Since 1995, the NPFMC Groundfish Plan Teams have prepared a separate Ecosystem Considerations section to the annual SAFE report. The first report in 1995 compiled information on Bering Sea, Aleutian Island, and Gulf of Alaska ecosystems, and discussed ecosystem-based management.

In 1996-1999, AFSC added information to the report on these and other areas of interest: biological features of the N. Pacific; effects of bycatch and discard on ecosystem; seabird and marine mammal research; precautionary approach in scientific literature; EFH and effects of fishing gear on habitat; collection of local knowledge; marine protected areas research, and oceanographic changes during 1995-1999.

From 2000 to the present, the AFSC has been adding to and refining the report to meet goals set in 1999, emphasizing indicators of ecosystem status and trends, and ecosystem-based management performance measures. These changes are intended to:

1) Track ecosystem-based management efforts and their efficacy;
2) Track the changes in the ecosystem that are not easily incorporated into single-species assessments;
3) Bring results from ecosystem research efforts to the attention of fishery scientists and managers;
4) Provide a stronger link between ecosystem research and fishery management; and
5) Assess the past, present, and future role of climate and humans in influencing ecosystem status and trends.

The report's ecosystem-based management indices are intended to track management performance in meeting stated ecosystem-based management goals of the NPFMC:

1) Maintain biodiversity consistent with natural evolutionary and ecological processes, including dynamic change and variability;
2) Maintain and restore habitats essential for fish and their prey;
3) Maintain system sustainability and sustainable yields for human consumption and non-extractive uses;
4) Maintain the concept that humans are components of the ecosystem.

In early 2011, NMFS's Northwest and Southwest Fisheries Science Centers will cooperatively release their first iteration of a California Current Integrated Ecosystem Assessment (CCIEA) (Levin and Schwing, in press.) The CCIEA will provide the Council, its advisory bodies, and the public with an illustration of the types of information and analyses that may be possible with data available on the CCE and its component species and physiological features. An annual report on ecosystem conditions and

considerations of particular interest to the Pacific Council would be shaped by the Council and its advisory bodies, and could feature different issues than those explored in this first California Current IEA.

Both the AFSC Ecosystem Considerations report and the CCIEA provide scientific analyses rooted in ecosystem-based management issues for the geographic areas they address. These reports, and similar reports worldwide, use an analysis framework that assesses: the state of the environment; the driving forces that affect the environment, both human-induced and natural; the pressures those driving forces place on the environment; the impacts that the driving forces and resulting pressures have on the state of the environment; and the policy responses that humans may or may not make to address any of the other factors. This analysis framework is known as Driver-Pressure-State-Impact-Response (DPSIR). In simple terms, DPSIR represents a process that essentially asks, "What's going on in the environment, how are we affecting it, and what are our goals for how we might alter our future effects on it?"

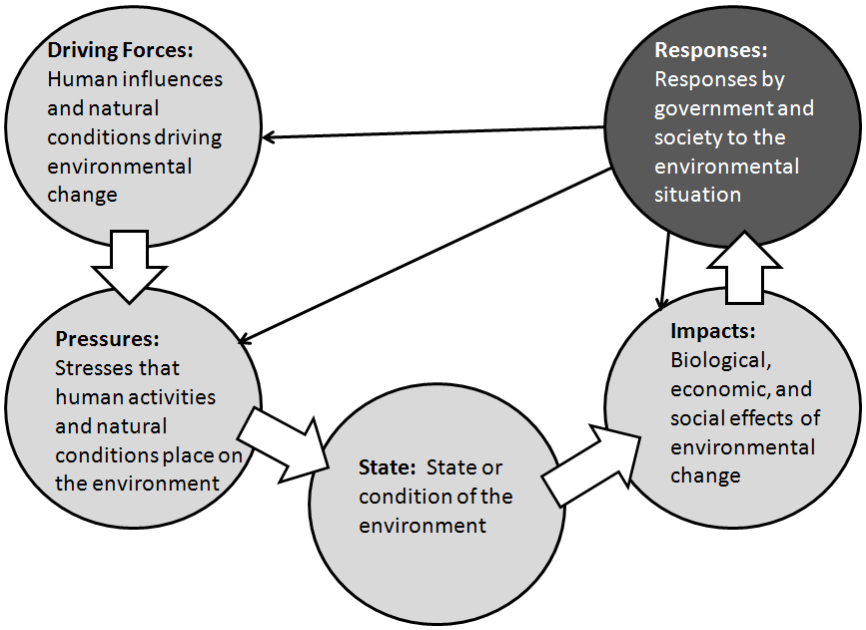

Figure 4.2: DPSIR Framework, illustration adapted from http://www.gulfofmaine.org/state-of-the-gulf/framework.html

As the DPSIR framework illustrates, a key task in assessing the state of the ecosystem is to ask management bodies to articulate their goals for the ecosystem and for their ecosystem-based management efforts. The Council has not yet articulated its ecosystem-based management goals, but this EPDT discussion document is an early step in the Council's ecosystem-based fishery management planning process. In our September 2010 report, we pointed out that the existing FMPs have suites of goals and objectives that have four common themes that are consistent with an ecosystem approach to fishery management: *avoid overfishing, maintain stability in landings, minimize impacts to habitat, and accommodate existing fisheries sectors.* The CPS FMP also explicitly recognizes the role of the target species in the food web, citing a need to *provide adequate forage for dependent species.*

The EPDT proposes an approach to develop an annual report format using existing capabilities at the NMFS Science Centers and leveraging the CCIEA. Currently, the CCIEA includes fisheries and "ecosystem health" among its primary foci. The initial iteration of the CCIEA examined trends in abundance, size structure and spatial distribution of target and non-target stocks (with a strong emphasis on groundfish). The ecosystem health component of the CCIEA examined attributes of ecosystem structure and function, including climate / ocean drivers, primary production, zooplankton and top predators.

For a more Council-focused CCIEA iteration, the EPDT would work with the Science Centers to select a pilot set of species, spread among the four FMPs and of potential interest to the Council. For each species, the next-round CCIEA would report the status of the following:

- Climate / ocean conditions affecting target species
- Juvenile and adult habitat (where data are available)
- Prey availability
- Predation risk
- Other ecological factors (e.g., disease, competitors, etc.)
- Other human activities that affect target species (e.g., water quality, activities affecting habitat, energy development, etc.

Thus, for each species, the report would provide a comprehensive picture of the ecosystem factors affecting stocks in a manner similar to the report in the North Pacific. By embedding this work within the IEA, the Council leverages other work performed within the IEA to get additional information such as:

- Influence of fisheries on protected species
- Effects of non-fishing activities on fish stocks and EFH
- Cumulative impact of fisheries

We envision this as an iterative process wherein the IEA team provides the Council with an initial 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.

Proposed Schedule:
March 2011 – IEA team begins assessment on [2 groundfish, some selected salmon ESUs, 1 CPS)
Sept 2011 – Draft product delivered.

In the North Pacific, NMFS and the NPFMC have had 15 years to develop and refine their Ecosystem Considerations report. NMFS could take a similar approach for the California Current – provide an initial report without first consulting with the Council on its items of interest for that report and rely on later iterations to bring in Council interests. However, ecosystem science and ideas about ecosystem-based management are much more advanced than they were when AFSC first led the way in designing an ecosystem considerations report. The EPDT believes that an initial investment of time to develop a format for and contents of a Council-focused California Current report through the Council process, accompanied by an iterative discussion of the Council's ecosystem-based management goals, will ultimately pay off with a more rapid coalescing of Council policies and science process.

4.2 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:

4.2.1 Cross-FMP – Needed Future Ecosystem Considerations

1. Evaluate the influence of climatic/oceanographic conditions on FMP species. Investigate the potential for incorporating environmental factors within the current stock assessment modeling framework (Stock Synthesis 3). Model effects of climate forcing 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).
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 influencing 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. 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.
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. Review management reference points, including rebuilding reference points, in light of ecosystem interactions. For example, do reference points like Bzero account for ecosystem interactions of a given species, or do they just reference the life history information about that particular stock? (Brand et al, 2007)
10. Investigate how different habitat types contribute to species productivity rates (habitat-specific demographic rates). See Habitat Assessment Improvement Plan (NMFS 2010).
11. Better understand spatial structure (meta-population structure) of managed stocks and investigate what are the most appropriate spatial scales for management.
12. 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.
13. 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.
14. Assess the evolutionary impacts of fishery management measures and fishing practices, and investigate whether those impacts affect yield or sustainability.
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.

4.2.2 CPS FMP – Needed Future Ecosystem Considerations

1. 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.
2. 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) finds that the Scripps Institute of Oceanography SST is no longer valid in terms of predicting sardine reproductive success. 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.
3. 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 come up with a comprehensive 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).
4. NMFS's Southwest Region initiated a pilot observer program for California-based coastal purse seine fishing vessels targeting CPS in 2004 to augment and confirm bycatch rates derived from CDFG dockside sampling. The pilot observer program's primary intent was to gather data on total catch and bycatch, and on interactions between their fishing gear and protected species such as salmon, marine mammals, sea turtles, and sea birds. This program needs to be reviewed to determine whether it should be revived and fully implemented to include standardization of data fields, development of a fishery-specific Observer Field Manual, construction of a relational database for the observer data, and creation of a statistically reliable sampling plan.

4.2.2 Groundfish FMP – Needed Future Ecosystem Considerations

1. Many species show low frequency variability in recruitment due to lower biomass and/or a low productivity environmental regime. For example, the biomass of widow rockfish has decreased steadily since the early 1980s, and recruitment during 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 entirely a function of fishing (Key et al. 2008). Finally, correlations between spring sea surface height (Schirripa 2005), zooplankton indices (Schirripa 2007) and sablefish age-0 survival suggest environmental forcing of recruitment. 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 could reduce the uncertainty of future assessments (Cope and Punt, 2006; He et al. 2007).

2. Provide research 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)).
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. Investigate hake spatial distributions across all years and between bottom trawl and acoustic surveys to estimate 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). Hamel et al (2009) also recommend investigating time-varying availability inshore for lingcod.
5. Review acoustic hake data to assess whether there are spatial trends in the acoustic survey indices that are not being captured by the model (Helser et al. 2006; Helser et al. 2008). Analysis should include investigation of stock migration (expansion/contraction) in relation to variation in environmental factors (Helser et al. 2006; Helser et al. 2008).
6. Investigate time-varying growth rates and maturity schedules as influenced by environmental factors because of apparent low frequency variability (e.g. Pacific hake (Hamel and Stewart 2009), 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., in press).
7. Research consequences of poor environmental conditions on bioenergetic allocation patterns (bocaccio (Field et al. 2009)).

4.2.3 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.
3. Evaluate utility of Pacific pelagic ecosystem models (e.g., Kitchell et al. 1999, Kitchell et al. 2002, Cox et al. 2002, Olson and Watters 2003, Watters et al. 2003, Hinke et al. 2004, Lehodey et al. 2008) for informing Council decisions. Polovina et al. (2009) recently found that with increasing fishing pressure, the catch rates 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 mahimahi, pomfret and escolar increased – consistent with earlier models for this same area (Kitchell et al. 1999, Kitchell et al. 2002). Conversely, some later models did not predict as strong effects of fishing through the food web (e.g., Cox et al. 2002) or did not predict long term changes (e.g., Watters et al. 2003), the resulting release of predation mortality from mid-trophic level populations from declines in top trophic-level predators is consistent with the empirical results described in Sibert et al. (2006) and Polovina (2009).

4.2.4 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 catch distributions.
2. Characterize and map the ocean habitats for anadromous species using data from satellites and electronic tags.
3. Characterize trends in hatchery salmon production and assess the potential for density-dependent effects in freshwater streams, estuaries, and coastal ocean environments. Assess the potential for increasing hatchery production throughout the Pacific Rim to impact body size, age-at-maturity and productivity of salmon in offshore ocean environments.
4. 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.
5. Research is needed on the effects of ecological interactions such as disease, predation and competition on the population dynamics of adult and juvenile salmon. In particular, research is needed on the unique impact of cultured salmon, both hatchery smolts and marine net pen reared fish, on disease and competition.
6. Characterize the influence of nearshore marine, estuarine and freshwater water quality on survival, growth, and reproduction of salmon.

4.2.5 Oceanographic Conditions, Broad-Scale and Long-Term Ecosystem Considerations

The California Current is an "Eastern Boundary Current," an upwelling-dominated ecosystem 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 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.

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 and the northward-flowing Alaska Current. The "current" part of 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, lies the California Undercurrent in the summer, which 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 (but offshore of) the continental shelf break (Hickey 1998, Checkley and Barth 2009). The southward California current is typically considered distinct from the wind-driven coastal upwelling jet 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). One

example is south of Point Conception, where part of the California Current swirls eastward and then northward to form the Southern California Eddy.

Superimposed on the effects of these shifting water masses that drive much of the interannual variability of the California Current, 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 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.

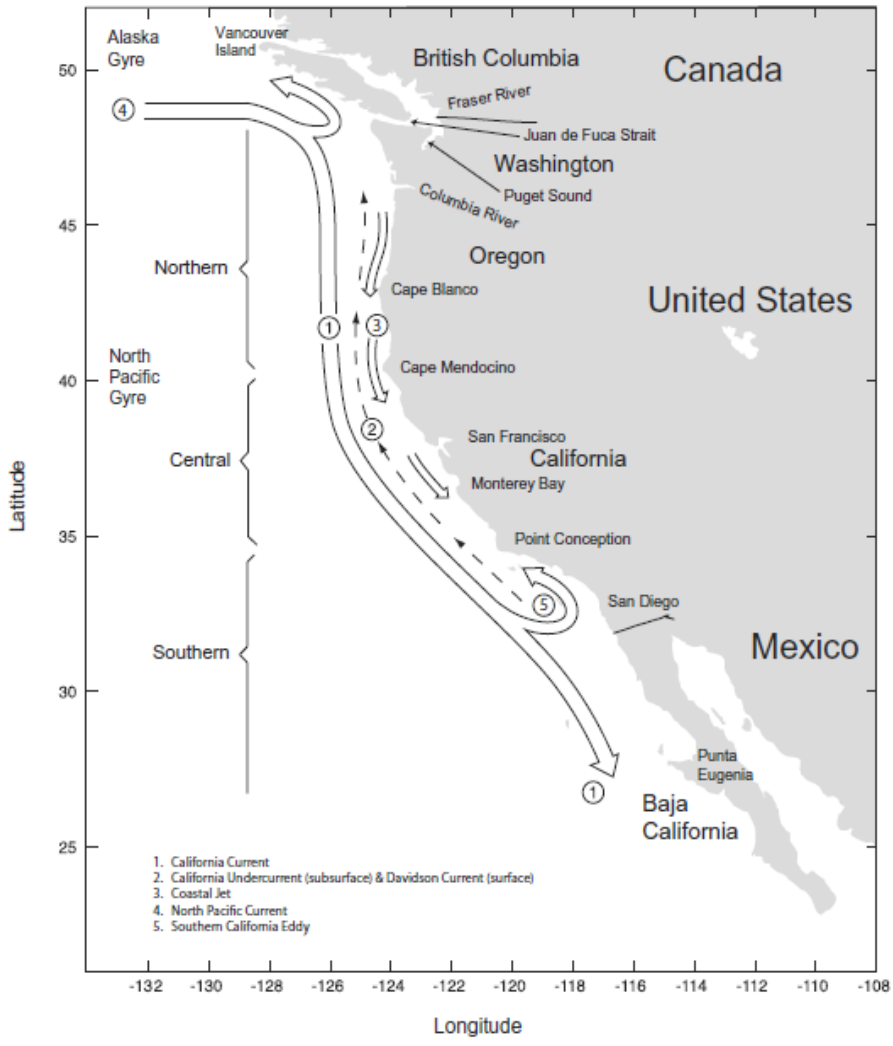

Figure 4.3: Dominant current systems off the U.S. West Coast

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).

Three major aspects of 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, ref: climate IPCC report), 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). There is linkage between these three factors: ocean temperature affects ocean pH, ocean temperature and deep water oxygen levels both can be controlled by large scale circulation patterns, 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.

Temperature

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. 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).

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).

Ocean pH

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; Reibesell 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 pCO2 levels, it is expected that as pCO2 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.

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 used 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.

Oxygen

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). Effects of low oxygen levels on marine organisms are fairly well known: death in most cases if the organisms cannot avoid the area, or reduced growth for those species with some tolerance. Overlaid on this steady decrease, 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 mass fish kills (e.g. recent events off Oregon coast; Chan et al., 2008). The 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 effecting large regions of the CCE (Bograd et al., 2008). On top of the long term, system-wide change 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. Coupling such events with the already depleted deeper waters, may thus lead to fish kills, the likelihood of which will probably increase as the deep water oxygen continues to decrease under the current trend.

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.

Future research considerations that would improve the Council's ability to incorporate temperature, pH, and Oxygen research and information 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

5.0 Understanding the Cumulative Effects of Fisheries Actions

At its September 2010 meeting, the Council discussed the possibility of using information generated from the ecosystem fishery management planning process to support its work on its existing FMPs by broadening the 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 Section 4.0 are all intended to work towards this goal by ultimately improving the quality of ecological information available to inform Council decision-making. A suite of laws guide the issues NMFS and the Council must consider in making fisheries management decisions: MSA, NEPA, ESA, MMPA, the Regulatory Flexibility Act, Executive Order 12866, and others. Several of these mandates ask that we consider not just the particular action under consideration, but the larger management framework that governs that decision. 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.)

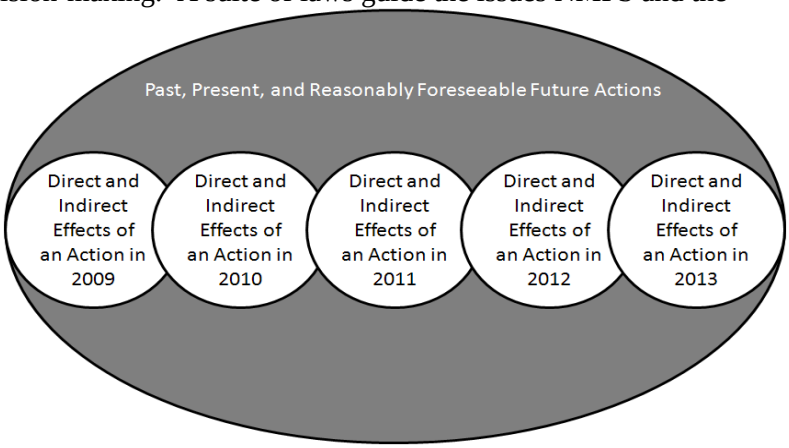

Figure 5.1: Cumulative Effects

Engaging in ecosystem-based management includes expanding our awareness of the range of human activities that affect the CCE. However, Council and NMFS authority is often constrained to considering fisheries actions, with some added authority and requirements to comment on how non-fisheries actions may affect CCE living marine resources and habitat. To assess whether ecosystem-based fishery management planning can aid in Council decision making, the field of effects of actions under Council consideration may be reduced to four broad categories:

1. *Removal of fish from a population*. Fishing activities result in some level of total (directed + incidental) fishing mortality. An action under Council consideration may specify the total permissible mortality level for certain species, for some defined time period – setting an annual catch limit, for example. The ultimate, or cumulative, effects of that action on the environment may be a series of actions, such as setting annual catch limits over successive years. The combined fishing mortality over time may have a broad range of effects, such as changes in age structure of target and non-target species populations, or availability of various species to other species as prey, predators, or competitors. Cumulative effects are likely to also be a product of various other non-fisheries actions, or even more ephemeral trends, such as climate forcing effects on primary productivity.
2. *Removal of other types of organisms from a population.* Our laws and regulations differentiate incidental mortality of protected, nonfish species (e.g., marine mammals) from 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? We are asking ourselves, how multiple, individual regulatory actions affect population and trophic dynamics for these non-fish species.
3. *Destruction of biophysical habitat.* Fishing gear may have adverse effects on physical habitat, such as substrate, or on macrobenthos like corals and sponges. These effects represent the loss of physical habitat and its function in providing shelter and living space for other organisms. If habitat forming organisms may be killed as a result past, present, and

reasonably foreseeable future actions, then it may be appropriate to consider the types of population and trophic dynamic effects mentioned above for fish and non-fish species.

4. *Personal income and other socioeconomic effects.* Ex-vessel revenue is the proximate effect of selling fish (or, for recreational fisheries, revenue resulting from the sale of the 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.

An ecosystem fishery management planning process may provide new information for or otherwise aid in Council decision-making in several ways. First, the scientific processes and research discussed in Section 4.0 would likely produce a detailed description of the affected environment at the ecosystem level. Second, these same scientific processes, research, and products could evaluate ecological linkages between the many Council-managed species at their varied trophic levels, and between the four categories of effects of fisheries actions discussed above. Finally, an evaluation of the effects of fishery management actions on the marine ecosystem could improve our understanding of both the role of fisheries within the ecosystem and the socio-economic role of the ecosystem for the U.S. and its citizens.

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Appendix A: FMP Summary Tables

Table A.1: FMP Harvest Level and Overfished/Overfishing Issues				
	CPS	Groundfish	HMS	Salmon
What harvest policies are used for FMP species?	Actively managed stocks are assessed annually. Environmental indicators are used in Pacific sardine control rules and are a high research priority. "Cutoff" values (biomass levels below which harvest is prohibited) are used to protect spawning stock and avoid overfishing. Scientific uncertainty in assessments is used in combination with a risk-policy choice to reduce ABC relative to OFLs. A 75% reduction from MSY is used to set monitored species harvest levels.	The Council's harvest policies are intended to prevent overfishing and maintain stock abundance near the level that produces maximum sustainable yield (B_{MSY}: $B_{25\%}$ for flatfish and $B_{40\%}$ for all other stocks). Overfished stocks are managed with rebuilding plans to bring stock abundance back to B_{MSY} in as short a time as possible, within constraints. Harvest levels for more abundant species caught in common with overfished species are managed to constrain bycatch of overfished stocks within the rebuilding harvest levels of those overfished stocks.	The Council's harvest policies are intended to implement harvest strategies that achieve optimum yield for long-term sustainable harvests and which provide a foundation to support US positions in cooperative international management of HMS fisheries. Prevent overfishing and rebuild overfished stocks, working with international organizations as necessary.	To achieve optimum yield (OY,) prevent overfishing, and assure rebuilding of salmon stocks whose abundance has been depressed to an overfished level, the salmon FMP establishes, to the extent practicable, conservation objectives to perpetuate the coastwide aggregate of salmon stocks covered by the plan. Each stock has a specific objective, generally designed to achieve MSY, maximum sustained production (MSP), or in some cases, an exploitation rate to serve as an MSY proxy.
What is the minimum stock size threshold (MSST) for designating a stock *overfished*?	P. sardine = 50,000 mt P. mackerel = 18,200 mt *Stock levels at which recovery is assumed to be quickly possible. Although northern	For all flatfish species, the FMP's default proxy MSST is $B_{12.5\%}$, or 12.5% of the stock's unfished biomass level. For all groundfish species other than flatfish, the FMP's default proxy	The HMS FMP defines a default MSST as no less than half of B_{MSY} (when natural mortality exceeds 0.5). If natural mortality is equal to or greater than 0.5 then the MSST would vary between	The FMP does not define MSST or overfishing; instead the Council sets annual fishery escapement levels as conservation objectives, intended to produce MSY over the long-term while

Table A.1: FMP Harvest Level and Overfished/Overfishing Issues				
	CPS	Groundfish	HMS	Salmon
	anchovy does not have a formal MSST, it does have a mechanism to close the fishery if the stock falls below 300K tons.	MSST is $B_{25\%}$	$0.5B_{MSY}$ and $0.75B_{MSY}$ based on the calculation (1-M)B_{MSY}. For vulnerable species the HMS FMP currently suggests a precautionary adjustment from the default value used to calculate the MSST; it would be set generally closer to B_{MSY} than under the default calculation.	preventing overfishing. If a stock falls below its conservation objective (MSY proxy) for three consecutive years, this triggers an "overfishing concern" and the stock is designated overfished. Amendment 16 to the Salmon FMP would set MSST at 1/2 MSY spawning escapement (S_{MSY}) and would designate a stock as overfished if the recent three year geometric mean spawners is below MSST.
What is the *overfishing limit (OFL)* in the FMP?	The OFL is the harvest rate expected to produce MSY and is based on a species specific estimate or proxy of MSY. Actively managed stocks: OFL = Biomass*Fmsy*Distribution. Monitored stocks: OFL=Stocks specific MSY proxy.	The OFL is the harvest rate expected to produce MSY, F_{MSY}. For category 1 stocks (with data-rich, quantitative assessments,) F_{MSY} proxies are $F_{30\%}$ for flatfish, $F_{40\%}$ for whiting, $F_{50\%}$ for rockfish, and $F_{45\%}$ for all other species. For category 2 (data-poor quantitative, or nonquantitative assessments) and category 3 (less- to nonquantitative assessments) stocks, OFL is set based on historical landings levels (typically	The OFL is the harvest rate expected to produce MSY, F_{MSY}. For vulnerable species, a precautionary reduction from the default OY calculation is considered on a case-by-case basis, based on information about the vulnerability of the stock. The FMP has a precautionary threshold of 0.75 F_{MSY}. Amendment 2 to the FMP (passed by Council) emphasizes the case-by-case approach, with 0.75 F_{MSY} as a starting point from	The Salmon FMP does not define overfishing. A *conservation alert* is triggered during the annual preseason process if a natural stock or stock complex is projected to fall short of its conservation objective. Conservation objectives are FMP measures intended to provide guidance during the annual preseason planning process. An *overfishing concern* is triggered if, in three consecutive years, the

Table A.1: FMP Harvest Level and Overfished/Overfishing Issues				
	CPS	Groundfish	HMS	Salmon
	The FMP framework includes ABC control rules that account for scientific uncertainty in assessed stock status and/or relatively scarce data and low landings.	reduced by approximately 50%.) For all three categories, ABC is reduced from OFL, with the percentage reduction from OFL based on the level of scientific uncertainty associated with each stock's OFL.	which to consider alternative values.	postseason estimates indicate that a natural stock has fallen short of its conservation objectives. Amendment 16 to the Salmon FMP proposed to establish an OFL equal to F_{MSY}.
Are any of the stocks within the FMP listed as *overfished*, or has *overfishing* occurred? Are any Council-managed stocks listed as threatened or endangered under the ESA?	Overfished species: none Undergoing overfishing: none	Overfished species: Bocaccio in the Monterey and Conception management areas; canary rockfish; cowcod south of Point Conception; darkblotched rockfish; Pacific ocean perch; widow rockfish; yelloweye rockfish, and; petrale sole. In addition to Council-managed species, three distinct groundfish population segments within Puget Sound (Washington) are listed as endangered (bocaccio) or threatened (canary and yelloweye rockfish). These stocks are not encountered in PFMC-managed fisheries.	Overfished species: none. Undergoing overfishing: yellowfin tuna, bigeye tuna, Pacific bluefin tuna	The Salmon FMP excepts three types of salmon stocks from overfishing criteria: hatchery stocks, stocks for which Council management actions have inconsequential impacts, and stocks listed under the ESA. Of the many evolutionarily significant units of West Coast salmon species, several populations are listed as either endangered or threatened under the ESA: Chinook, 2 endangered and 7 threatened; chum, 2 threatened; coho, 1 endangered and 3 threatened; sockeye, 1 endangered and 1 threatened; steelhead, 1 endangered and 10

Table A.1: FMP Harvest Level and Overfished/Overfishing Issues				
	CPS	Groundfish	HMS	Salmon
		Undergoing overfishing: none		threatened. Sacramento River fall Chinook triggered an overfishing concern in 2004 and are currently considered overfished.
Are additional economic, social, or ecological factors taken into account in setting annual harvests?	Pacific sardine landings tend to be the most constraining for the fishery. Socioeconomic impacts of sardine allocation were analyzed in support of the allocation formula adopted under FMP Amendment 11. This allocation scheme is applied to management annually. The CPSMT and the SSC are working to include additional ecological considerations in CPS management. For the 2011 management cycle the CPSMT reviewed PACOOS reports and trends in sea bird and	The Council's focus is on managing stocks for MSY based on the status and biology of each stock. Social, economic, and ecological factors are not typically taken into account in setting annual harvests for stocks above MSST, although overfished stocks are managed with rebuilding plans to bring stocks back to B_{MSY} in as short a time as possible, after taking those factors into account. The Council has reduced annual harvests based on other considerations for certain stocks (e.g., the 2011-12 ACLs for shortbelly rockfish were set based on the stock's ecological importance). In addition,	All HMS management unit species are managed under the auspices of regional fishery management organizations, to which the US is a party. The Council has not set annual harvests (quotas) for any HMS species. For common thresher shark and shortfin mako shark, the Council has set annual harvest guidelines. The guideline for mako shark is based on the stocks vulnerability and the possible importance of the West Coast EEZ as a nursery habitat.	The Council focuses on protecting weak or ESA-listed natural salmon stocks, while providing harvest opportunity on stronger natural and hatchery stocks. Achieving these objectives is complicated by natural variability in annual stock abundance, in ocean migratory routes and timing, and in the high degree of mixing of different salmon species and stocks in ocean fisheries. Socioeconomic objectives seek to: provide for Indian harvest opportunity as provided in treaties with the United States; maintain ocean salmon fishing seasons that continue established recreational and commercial

Table A.1: FMP Harvest Level and Overfished/Overfishing Issues				
	CPS	Groundfish	HMS	Salmon
	mammal populations when developing recommendations. This is an area of CPS management that would likely benefit greatly from an EFMP.	the Council does have social and economic objectives for utilization of the annual harvest (e.g., managing annual harvests to provide year-round fishing opportunity).		fisheries, while meeting fair and equitable salmon harvest allocation objectives among ocean and inside recreational and commercial fisheries.

Table A.2: PFMC Harvest Level and Management Measures Setting Process

	Odd-Numbered Years					Even Numbered Years				
	March	April	June	September	November	March	April	June	September	November
CPS			Stock assessment review for P. mack. and setting of annual specifications		Stock assessment review for P. sardine and setting of annual specifications			Stock assessment review for P. mack. and setting of annual specifications		Stock assessment review for P. sardine and setting of annual specifications
Groundfish	Final council action on whiting specifica-tions; inseason adjustments	Inseason adjustments	Stock assessment review for next odd-even biennium; inseason adjustments	Final stock assessment review for next odd-even biennium; inseason adjustments	Stock assessments and rebuilding analyses for next odd-even biennium; inseason adjustments	Final council action on whiting specifications; stock assessment planning for 2nd from next odd-even biennium; inseason adjustments	Interim discussion of biennial harvest specifications and mgmt. measures for next odd-even biennium; inseason adjustments	Final council action on biennial harvest specifications (and mgmt. measures) for next odd-even biennium; inseason adjustments	Inseason adjustments	Inseason adjustments
HMS								Preliminary consideration of potential biennial mgmt. measures	Council identification of preferred alternatives for biennial mgmt. measures	Final Council adoption of biennial mgmt. measures
		RFMO recommendations and potential RFMO stock assessment results					RFMO recommendations and potential RFMO stock assessment results			
Salmon	Review of prior year's fisheries and stock abundance forecasts for current fishing year	Final Council action on ocean salmon mgmt. measures for current fishing year. Preliminary list of new or revised methodologies proposed for use for next year.		Final list of topics chosen for salmon methodology review	Final Council approval of salmon methodology revisions for use in the next mgmt. cycle.	Review of prior year's fisheries and stock abundance forecasts for current fishing year	Final Council action on ocean salmon mgmt. measures for current fishing year. Preliminary list of new or revised methodologies proposed for use for next year.		Final list of topics chosen for salmon methodology review	Final Council approval of salmon methodology revisions for use in the next mgmt. cycle.

Table A.3: Bycatch Issues				
	CPS	Groundfish	HMS	Salmon
What standardized bycatch reporting methodologies are used in the FMP's fisheries?	Washington and Oregon state logbooks and California dockside monitoring. State and Federal observer programs are implemented dependent upon funding. Data from historic observations used in management.	Bycatch in commercial fisheries is monitored primarily by the West Coast Groundfish Observer Program. The rationalized trawl fisheries will be monitored with 100% observer coverage. Recreational bycatch is monitored with surveys in the three states (CA and OR also employ at sea observers in the for-hire/charter fleets).	Logbooks are required for all Council-authorized commercial HMS fisheries operating within and outside the West Coast EEZ and for West Coast recreational charter vessels. Observers are required on some HMS fisheries, primarily those with substantive potential for bycatch of ESA species or other species of concern (fish, birds, turtles, and mammals.) There is also dockside monitoring of commercial and recreational landings on the West Coast.	Bycatch estimation is based on observer data and release mortality studies. Bycatch does not include any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade. In addition, under the provisions of the MSA, bycatch does not include targeted salmon released alive under a recreational catch-and-release fishery management program.
How often and in what format does the Council receive bycatch information for this FMP's fisheries?	Annually in CPS SAFE document	The NWFSC compiles information on landings and discards and reports total catch once per year (with roughly a one year lag). The Groundfish Management Team uses bycatch projection models that account for the time lags in discard data.	The SWFSC compiles bycatch information as it becomes available. Bycatch information is reported in the annual HMS SAFE documents. Specific, relevant bycatch information is also provided to the Council when it considers HMS fishery management actions (e.g., biennial management measures, EFPs or other fishery changes).	Annually in SAFE document, with focus on a review of the prior year's fisheries. In salmon preseason planning process, management options are assessed for the effects on the amount and type of salmon bycatch and bycatch mortality. Salmon bycatch and mortality estimates for salmon fisheries are reported throughout the preseason process.
Are any gear specifications or modifications required	When fishing for CPS, deploy a net if a southern sea otter is	Gear regulations to minimize bycatch include: selective flatfish trawl	Most HMS fisheries have some gear specifications to reduce or prevent bycatch (e.g., drift	Only hook-and-line gear is allowed in ocean salmon fisheries and many fisheries are

Table A.3: Bycatch Issues				
	CPS	Groundfish	HMS	Salmon
to reduce or prevent bycatch?	observed within the area that would be encircled by the purse seine net.	gear specifications; trawl gear footrope/bobbin size restrictions; pot gear must include "rotten cotton" escape panel; longline gear must be regularly tended.	gillnet fisheries, longline fisheries, purse seine fisheries).	limited to the harvest of fin-marked hatchery stocks (mark-selective fisheries). Gear modifications such as the mandatory use of barbless hooks/ Plugs, the prohibition of fish attractors or bait, and restrictions on the number of spreads per troll line are used to minimize bycatch and/or release mortality.
Are any area closures required to reduce or prevent bycatch?	Washington state waters closed to sardine fishing for salmon and forage reasons (not Council required).	There are coastwide Rockfish Conservation Areas (RCAs,) for which the precise depth closures may vary by season and latitude, since these closures are intended to minimize incidental catch of overfished rockfish in depth zones where they commonly co-occur with more abundant groundfish stocks while maintaining some fishing opportunities for healthier stocks. There are also several RCAs with static boundaries off California and Washington, with a focus	Bycatch has been identified as a concern in the HMS drift gillnet, longline, and large-vessel purse seine fisheries. Within the EEZ, leatherback turtle conservation area is seasonally closed to drift gillnet fishing to prevent bycatch of these turtles. There is also a summer closure area for drift gillnet fishing during El Niño years to prevent bycatch of loggerhead turtles, (The HMS FMP also accounts for state area closures for the drift gillnet fishery to reduce bycatch of thresher sharks and other species.) RFMOs may also adopt conservation measures with area closures for HMS fisheries. EEZ is closed to HMS harvest of great white, basking and	Conservation areas closed to salmon fishing are established around certain river mouths and ocean areas are closed seasonally or annually to avoid concentrations of salmon stocks of concern. Additionally, salmon fisheries are restricted by mandatory and voluntary conservation areas to aid in the rebuilding of yelloweye rockfish populations.

Table A.3: Bycatch Issues				
	CPS	Groundfish	HMS	Salmon
		on protecting overfished cowcod and yelloweye, respectively; and Salmon Conservation Zones intended to minimize salmon bycatch in the whiting fishery.	megamouth sharks for conservation purposes, and to Pacific halibut and Pacific salmon.	
Have any of the fisheries participated in the MSA bycatch reduction engineering program?	No.	*FY08:* conservation engineering funding for researching groundfish gear alterations to reduce bycatch (selective flatfish trawl) *FY09:* seabird bycatch avoidance research for groundfish fisheries; monitoring seabird distribution and abundance in the California Current; continuing of FY08 gear technology research *FY10*: Continued gear technology funding, with additional new focus on open escape window bycatch reduction device (BRD) for Chinook salmon and rockfish bycatch in whiting mid-water trawl fishery; for bycatch *of* groundfish, rather than in	*FY08:* collaborative research to reduce post-release mortality for common thresher sharks taken in the recreational fishery off California *FY09:* continuation of FY08 thresher shark research *FY10*: continuation of thresher shark research; incidental take a post-release mortality of blue shark research in drift gillnet and longline swordfish fisheries	No.

Table A.3: Bycatch Issues				
	CPS	Groundfish	HMS	Salmon
		the groundfish fisheries, FY10 also saw funding for BRD research in the Pacific shrimp trawl fishery to reduce juvenile rockfish bycatch		
Which **fish** species are of greatest concern as bycatch within the FMP's fisheries?	ESA-listed salmon	ESA-listed salmon; rockfish species managed under overfished species rebuilding plans	In addition to the prohibited shark and salmon species listed above, the fish species of greatest concern as bycatch are those proposed to be listed as EC species. Also, non-targeted HMS species taken incidentally in HMS fisheries, such as tuna species with overfishing occurring being taken in other tuna fisheries (e.g., purse seine).	Minimizing the bycatch of threatened and endangered salmonid ESUs is the primary concern in salmon fisheries, and bycatch of fish other than salmon is generally very limited. Regulations allow for retention of most groundfish species and limited numbers of Pacific halibut that are caught incidentally.
What are the known gaps in monitoring for bycatch of **fish** species within the FMP's fisheries?	Detailed information on the number, species and size of salmon bycatch. Oregon and Washington have state logbook programs but salmon must be immediately released if captured.	WCGOP coverage varies between sectors with the focus on the limited entry trawl and fixed gear fisheries. Some fisheries that catch rockfish are not observed at all (e.g., salmon troll and directed halibut fishery).	Drift gillnet fisheries and longline fisheries have mandated observer programs. These fisheries have declined in recent years in the EEZ and bycatch data are considered adequate at this time.	Observer data is either dated or nonexistent for some fisheries. The observed and forecast mortality associated with mark-selective fishing is an ongoing research priority. Genetic Stock Identification is a developing tool to better understand the mixing and migration of various natural salmon stocks.

Table A.3: Bycatch Issues				
	CPS	Groundfish	HMS	Salmon
Which **non-fish (mammals, turtles, birds)** species are of greatest concern as bycatch within the FMP's fisheries?	None. A Biological Opinion was prepared on the interaction of the sardine fishery with southern sea otters, but interaction rate is extremely small.	Bycatch of marine mammals, seabirds, and turtles is rare, occurring in fewer than 2% of observed trips in 2002-2008. Bycatch estimates for California sea lions were highest of the marine mammals taken in the groundfish fisheries, with these animals primarily taken in trawl nets. Bycatch estimates for black-footed albatross were highest of the seabirds taken in the groundfish fisheries, with these birds primarily caught by longline gear in the limited entry primary sablefish fishery.	Bycatch of several mammals, birds, and turtles are major concerns for HMS drift gillnet, longline and purse seine fisheries, both within and outside the EEZ. Biological opinions have been prepared to address some of these concerns. Many fishing gear requirements and fishing activity restrictions are implemented to prevent and reduce bycatches of these species.	The bycatch of non-fish species in salmon fisheries is negligible.
What are known gaps in monitoring for bycatch of **non-fish (mammals, turtles, birds)** species within the FMP's fisheries?	Currently no observer program for CPS vessels.	Bycatch is monitored using the same methods as for fish species, so although take of non-fish species is recorded, sampling design is focused on capturing the bycatch of fish in a statistically significant manner.	Bycatch is monitored using the same methods as for fish species, primarily observers and logbooks.	None.

Table A.4: EFH Issues				
EFH Issues	CPS	Groundfish	HMS	Salmon
Brief description of FMP's EFH	The east-west geographic boundary of CPS finfish and market squid EFH is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington to the limits of the exclusive economic zone (EEZ) and above the thermocline where sea surface temperatures range between 10°C to 26°C. The southern boundary is the US-Mexico maritime boundary, while the northern boundary varies both seasonally and annually with temperature.	All waters and substrate within areas with a depth less than or equal to 3,500 meters shoreward to the mean higher high water level or the upriver extent of saltwater intrusion, including seamounts in depths greater than 3,500 meters. (50 CFR 660.395)	In general, management unit species are found within temperate waters. The FMP does not provide a multi-species EFH designation. Instead, the FMP at 7.2 describes species- and life-state-specific EFH for: common thresher shark, pelagic thresher shark, bigeye thresher shark, shortfin mako shark, blue shark, albacore tuna, bigeye tuna, northern bluefin tuna, skipjack tuna, yellowfin tuna, striped marlin, swordfish, and dorado.	Water bodies occupied or historically accessible in WA, OR, ID, and CA in 4th field hydrologic units identified at 50 CFR 660, except for where certain identified dams represent the upstream extent of Pacific salmon access. EFH also includes marine and estuarine areas shoreward of the boundaries of the EEZ and shoreward of state marine boundaries off the coasts of California, Oregon, Washington, and Alaska. (50 CFR 660.412)
Brief description of FMP's Habitat Areas of Particular Concern	None.	Groundfish HAPCs include both mapped areas and described habitat types. In addition to the mapped area HAPCs, provided in the FMP at Section 7.3, groundfish HAPCs include the following habitat types: estuaries, canopy kelp, seagrass, and rocky reefs.	None.	None, although a list of potential HAPCs is under consideration as part of the Salmon FMP's 5-year review.
Does the FMP have any closed areas to protect EFH? Do	No.	Yes: large (>700 fm/>1280 m) coastwide closure, plus 51 enclosed areas. Yes:	No.	No.

Table A.4: EFH Issues				
EFH Issues	CPS	Groundfish	HMS	Salmon
those closed areas apply to fisheries not managed under the FMP?		prohibitions vary between areas, but apply to bottom trawl (including non-groundfish trawl) and bottom contact gear (including for spp. other than groundfish).		
Where is the FMP in its EFH 5-year review process?	Finished in 2010/	Review initiated in 2010. Council to affirm process schedule in 03/11 or 04/11	Not yet initiated	Review initiated over 2009-2010. Final Council action anticipated in April 2011
Is the EFH currently mapped? If not mapped, why not? How can the EFH be best described/communicated?	No, although there are maps of general locations of temperature boundary line.	Yes, see: http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management/Groundfish-EFH/Index.cfm	Yes, but it is mapped for individual species, not aggregated for all FMP species. See: http://www.pcouncil.org/wp-content/uploads/HMS_AppF.pdf	Yes, see: http://www.nwr.noaa.gov/Salmon-Habitat/Salmon-EFH/Index.cfm
What consultations has NMFS done on the effects of non-fishing activity on the FMP's EFH?	Since the 1996 Sustainable Fisheries Act introduced the concept of EFH, NMFS's Northwest Region has completed >300 consultations on the effects of various non-fishing activities on CPS EFH, many of which were consultations combined with groundfish and salmon EFH consultations. Projects ranged from tidal and erosion area construction, military training, dredging, cable laying, and other activities.	Since the 1996 Sustainable Fisheries Act introduced the concept of EFH, NMFS's Northwest Region has completed >300 consultations on the effects of various non-fishing activities on groundfish EFH, many of which were consultations combined with CPS and salmon EFH consultations. Projects ranged from tidal and erosion area construction,	None.	Since the 1996 Sustainable Fisheries Act introduced the concept of EFH, NMFS's Northwest Region has completed >1800 consultations on the effects of various non-fishing activities on salmon EFH, ranging from construction projects in or near waterways, wastewater treatment, dredging, and other projects. Most of these

Table A.4: EFH Issues				
EFH Issues	CPS	Groundfish	HMS	Salmon
		military training, dredging, cable laying, and other activities.		consultations (>1700) were combined EFH and Endangered Species Act consultations on the habitat effects of the proposed action.

Table A.5: Critical habitat designations and proposed designations for ESA listed species on the West Coast	
Marine mammals	
Killer whale (*Orcinus orca*) – Southern Resident (Northwest U.S)	Portions of Puget Sound (WA)
Stellar sea lion (*Eumetopias jubatus*)	Oregon and California rookeries
Marine and anadromous fish	
Chinook salmon (*Oncorhynchus tshawytscha) – 9 listed ESUs*	CA, OR, WA streams and rivers
Coho salmon (*Oncorhynchus kisutch) – 4 listed ESUs*	CA, OR, WA streams and rivers
Chum salmon (Oncorhynchus keta) – 2 listed ESUs	OR and WA streams and rivers
Sockeye salmon (*Oncorhynchus nerka*) – 2 listed ESUs	WA and ID streams and rivers
Steelhead trout *(Oncorhynchus mykiss) – 11 listed DPSs*	CA, OR, WA, ID streams and rivers
Green sturgeon (Acipenser medirostris) – southern DPS	WA, OR, CA nearshore areas
Marine and anadromous fish	*Proposed freshwater creeks and associated estuaries*
Pacific eulachon/smelt[1] (Thaelichthys pacificus) – southern DPS	*of WA, OR, CA*
Sea turtles	
Leatherback sea turtle[2] (*Dermochelys coriacea*)	*Proposed marine waters off WA, OR, CA*
Marine invertebrates and plants	
Black abalone[3] *(Haliotis cracherodii)*	*Proposed nearshore waters off CA*

DPS – distinct population segment
ESU – evolutionary significant unit

[1] Critical habitat for Pacific eulachon was proposed on January 5, 2011. The proposed designation includes areas within the states of California, Oregon, and Washington. The proposed areas are a combination of freshwater creeks and rivers and their associated estuaries which comprise approximately 470 km (292 mi) of habitat. (76 FR 515).

[2] Critical habitat for Leatherback sea turtles was proposed on January 5, 2010. The proposed designation includes two adjacent marine areas totaling approximately 119,400 km² stretching along the California coast from Point Arena to Point Vincente; and one 63,455 square km²) marine area stretching from Cape Flattery, Washington to the Umpqua River (Winchester Bay), Oregon east of a line approximating the 2,000 meter depth contour. Proposed critical habitat extends from the surface down to a depth of 80 m (75 FR 319).

[2] Critical habitat for black abalone was proposed on September 28, 2010. The proposed designation includes approximately 390 square kilometers of critical habitat for the endangered black abalone, pursuant to section 4 of the Endangered Species Act (ESA). Specific areas proposed for designation include rocky habitats from the mean higher high water (MHHW) line to a depth of 6 meters (m) within the following areas on the California coast: Del Mar Landing Ecological Reserve to Point Bonita; from the southern point at the mouth of San Francisco Bay to Natural Bridges State Beach; from Pacific Grove to Cayucos; from Montan˜ a de Oro State Park to just south of Government Point; Palos Verdes Peninsula from the Palos Verdes/Torrance border to Los Angeles Harbor; the Farallon Islands; An˜ o Nuevo Island; San Miguel Island; Santa Rosa Island; Santa Cruz Island; Anacapa Island; San Nicolas Island; Santa Barbara Island; Catalina Island; and San Clemente Island. (75 FR 59900)

Sturgeon
http://www.nmfs.noaa.gov/pr/pdfs/criticalhabitat/greensturgeon.pdf

proposed leatherback
http://www.nmfs.noaa.gov/pr/pdfs/criticalhabitat/leatherback_proposed.pdf

stellar sea lion
http://www.nmfs.noaa.gov/pr/pdfs/criticalhabitat/stellersealion_ca_or.pdf

killer whale
http://www.nmfs.noaa.gov/pr/pdfs/criticalhabitat/killerwhale_sr.pdf

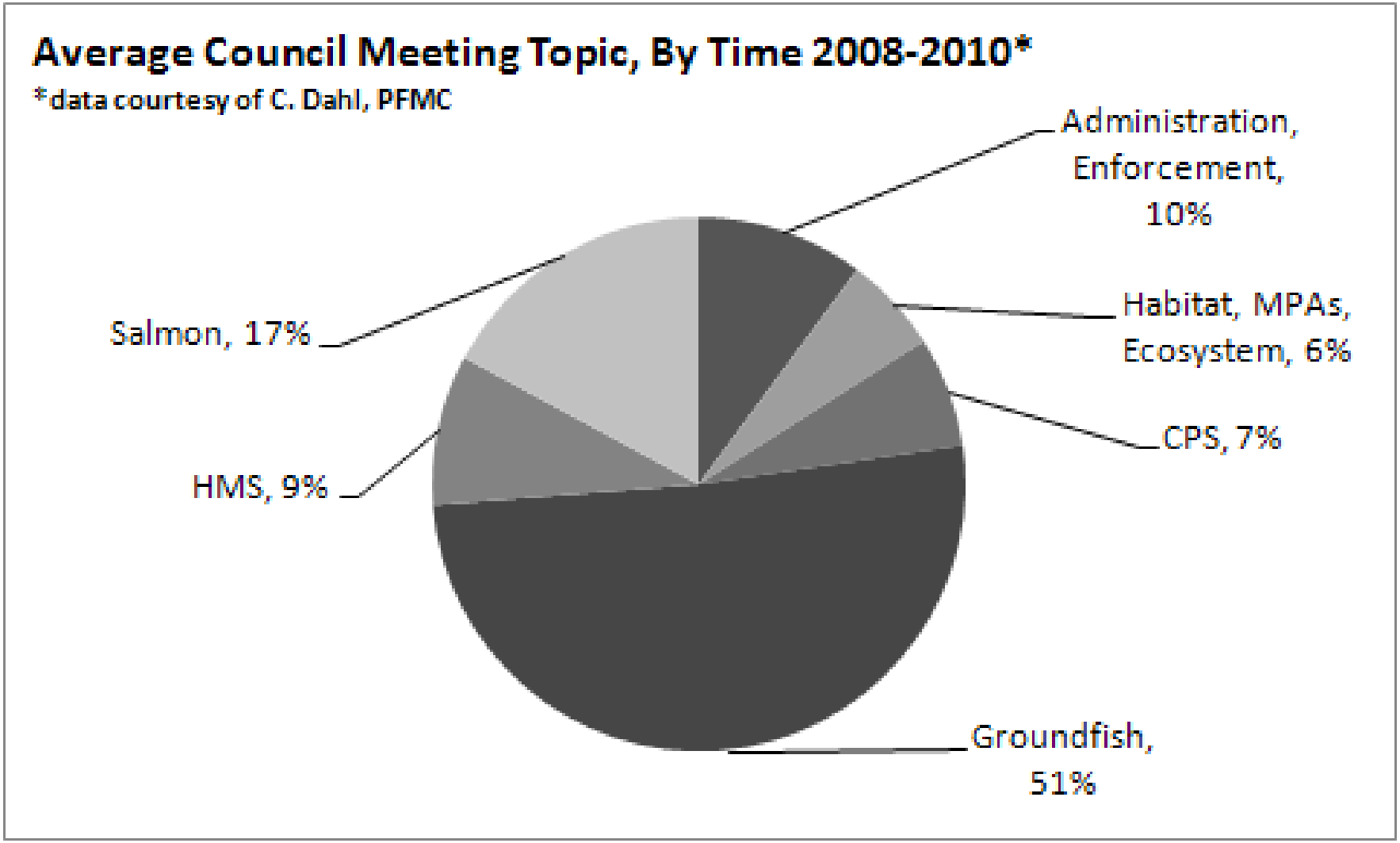
NW salmon
http://www.nwr.noaa.gov/Salmon-Habitat/Critical-Habitat/upload/NWR-CH-map.pdf

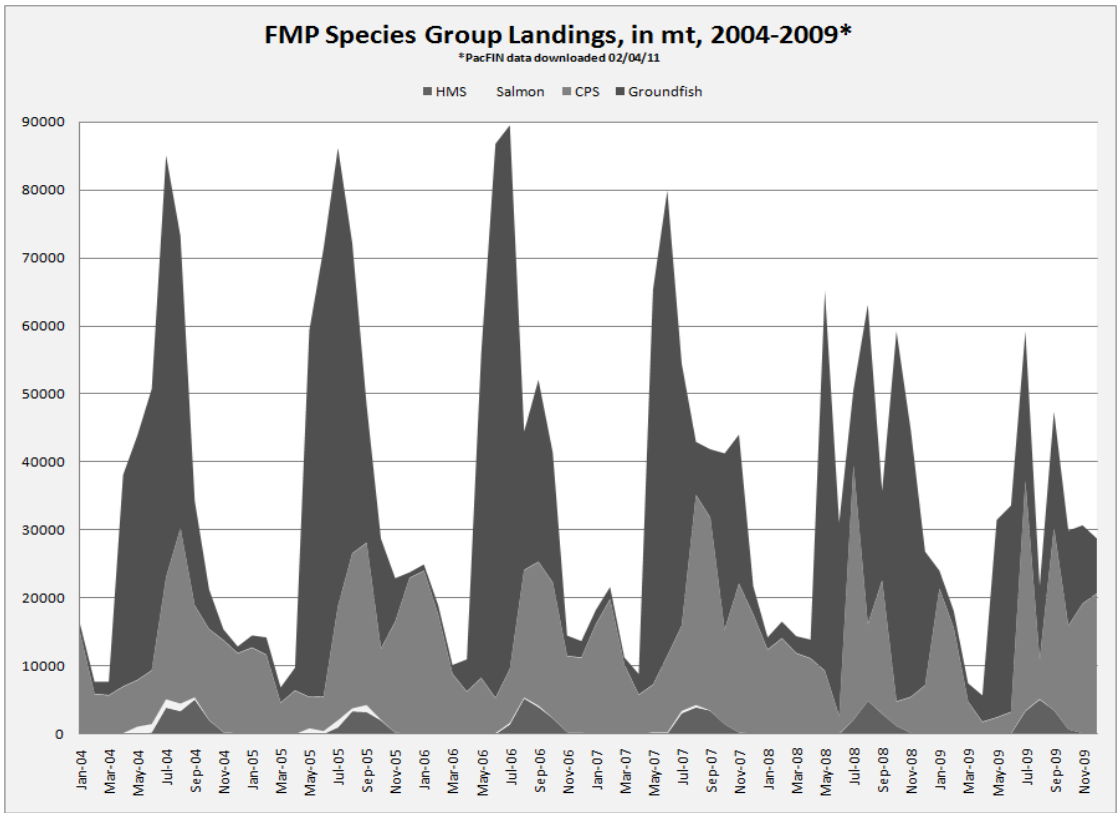
Cali. Salmon
http://www.nwr.noaa.gov/Salmon-Habitat/Critical-Habitat/upload/SWR-CH-map.pdf

eluachon
http://www.nwr.noaa.gov/Other-Marine-Species/upload/eulachon-CH-maps.pdf

Table A.6: Community Effects Issues				
	CPS	Groundfish	HMS	Salmon
Recorded safety issues, vessel incidents, mortalities for fisheries under this FMP?	USCG District 11 2006-2010 data: 10 squid fishery vessel incidents, from which one life was lost and seven vessels were lost. USCG District 13 2000-2008 data: 4 sardine fishery vessel incidents, from which two lives were lost and four vessels were lost.	USCG District 11 2006-2010 data: 9 vessel groundfish fishery vessel incidents, from which two lives were lost and seven vessels were lost. USCG District 13 2000-2008 data: 10 groundfish fishery vessel incidents, from which six lives were lost and five vessels were lost.	USCG District 11 2006-2010 data: 1 tuna fishery vessel incident, no lives nor vessels lost. USCG District 13 2000-2008 data: 8 tuna fishery vessel incidents, from which two lives were lost and seven vessels were lost.	USCG District 11 2006-2010 data: 7 salmon fishery vessel incidents (3 of which were combination crab/salmon trips,) from which three lives were lost and five vessels were lost. USCG District 13 2000-2008 data: 17 salmon fishery vessel incidents, from which eleven lives were lost and sixteen vessels were lost.
Has fishing community dependence on FMP resource and resilience to changes in resource availability been assessed?	Socioeconomic and community impacts from Pacific sardine harvest policy were assessed for Amendment 11 which established a long-term allocation scheme.	The Council assesses impacts to fishing communities during the biennial management measures process.	The Council assesses impacts to fishing communities during the biennial management measures process and when considering other management measures (such as possibly establishing a high seas shallow-set longline fishery), and at times, when providing recommendations to RFMOs.	Socioeconomic impacts are assessed by port area, both historically (see Amendment 14-App. B) and for the proposals under the preseason management cycle.
How does Council receive policy process input from	The Council receives community input primarily from the Coastal Pelagic Species Advisory	The Council process receives input from public comment and the	The Council process receives input from public comment and the	The Council process receives input from public comment and the Salmon

Table A.6: Community Effects Issues				
	CPS	Groundfish	HMS	Salmon
FMP's fishing communities?	Subpanel and the public.	Groundfish Advisory Panel each Council meeting.	HMS Advisory Panel each Council meeting. NMFS reports on RFMO processes and activities, which may involve community input via US advisory groups and delegations to RFMOs.	Advisory Panel each Council meeting and at annual public hearings.
How is economic and social information monitored and considered in the decision-making process?	The annual CPS SAFE contains information on fishery economics and socioeconomic impacts of harvest policies are considered through the Council and NEPA processes.	Economic and social information is monitored mainly by tracking landed catch and effort by port/area and is taken into account most prominently in the rebuilding plans as part of the assessment of the "needs of the fishing community." Regular monitoring of other socioeconomic information is limited. Information considered by the Council is compiled from existing sources (e.g., the U.S. Census) and a few voluntary surveys administered by NMFS. NMFS is implementing a mandatory economic data collection program for the trawl rationalization program.	Economic and social information is monitored mainly by tracking landed catch and effort by port/area and is reported in annual SAFE documents and considered during the biennial management cycle and when other management actions (e.g., EFPs) are being considered. It is also considered in the Council's formation of recommendations to RFMOs.	Economic and social information is monitored mainly by tracking landed catch and effort by port/area and is reported and considered during the preseason management cycle. Data for previous years as well as projections for each to the alternative management options are available to the public and the Council through a series of preseason documents.


Average Council Meeting Topic, By Time 2008-2010*
*data courtesy of C. Dahl, PFMC
Administration, Enforcement, 10%
Habitat, MPAs, Ecosystem, 6%
CPS, 7%
Groundfish, 51%
HMS, 9%
Salmon, 17%


FMP Species Group Landings, in mt, 2004-2009*
*PacFIN data downloaded 02/04/11
HMS
Salmon
CPS
Groundfish
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Jan-04
Mar-04
May-04
Jul-04
Sep-04
Nov-04
Jan-05
Mar-05
May-05
Jul-05
Sep-05
Nov-05
Jan-06
Mar-06
May-06
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Jan-07
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May-07
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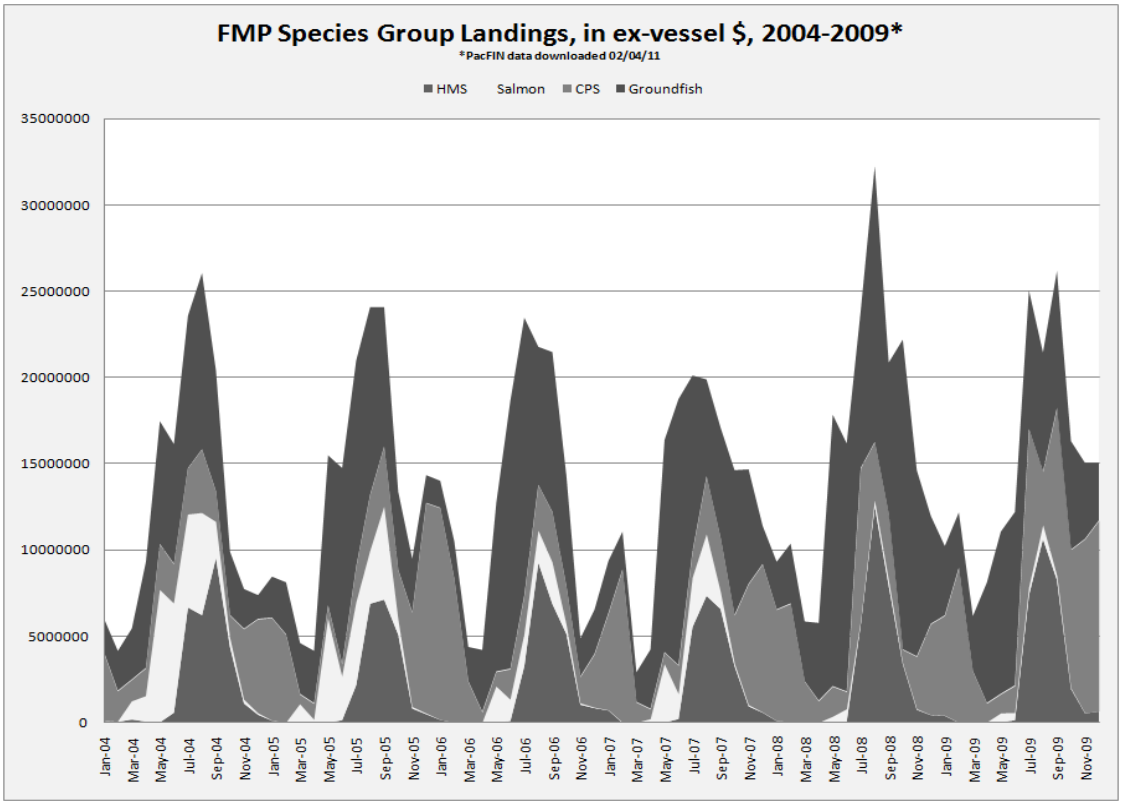
FMP Species Group Landings, in ex-vessel $, 2004-2009*
*PacFIN data downloaded 02/04/11
HMS
Salmon
CPS
Groundfish
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
Jan-04
Mar-04
May-04
Jul-04
Sep-04
Nov-04
Jan-05
Mar-05
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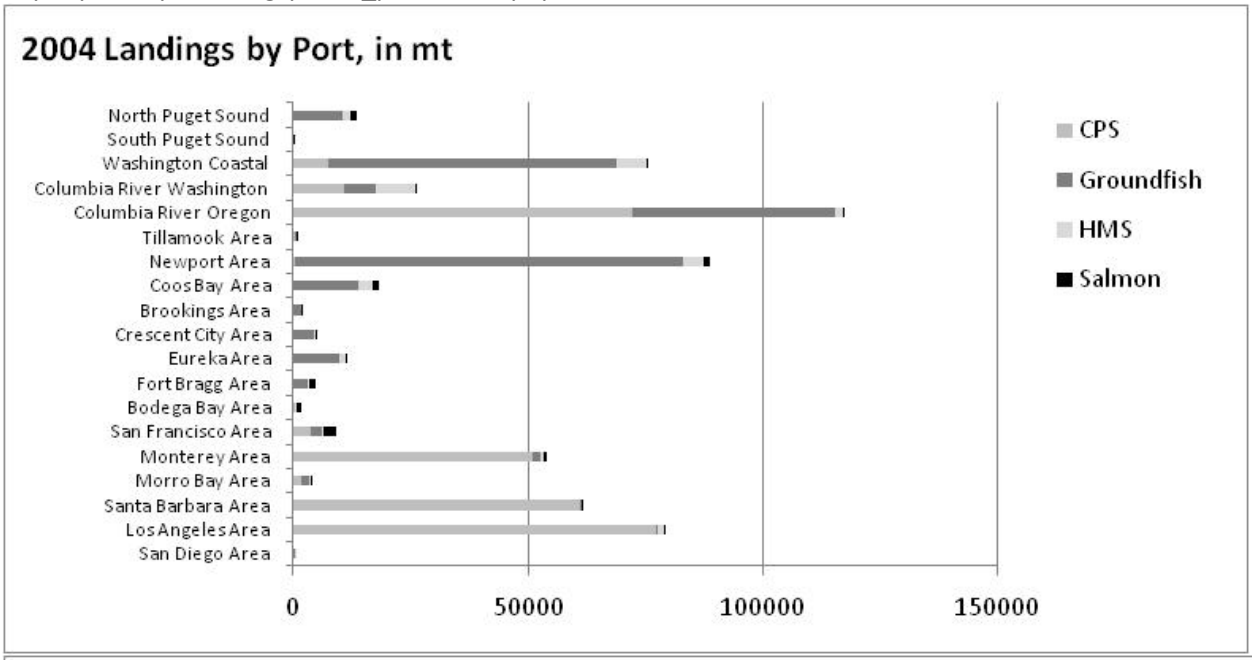
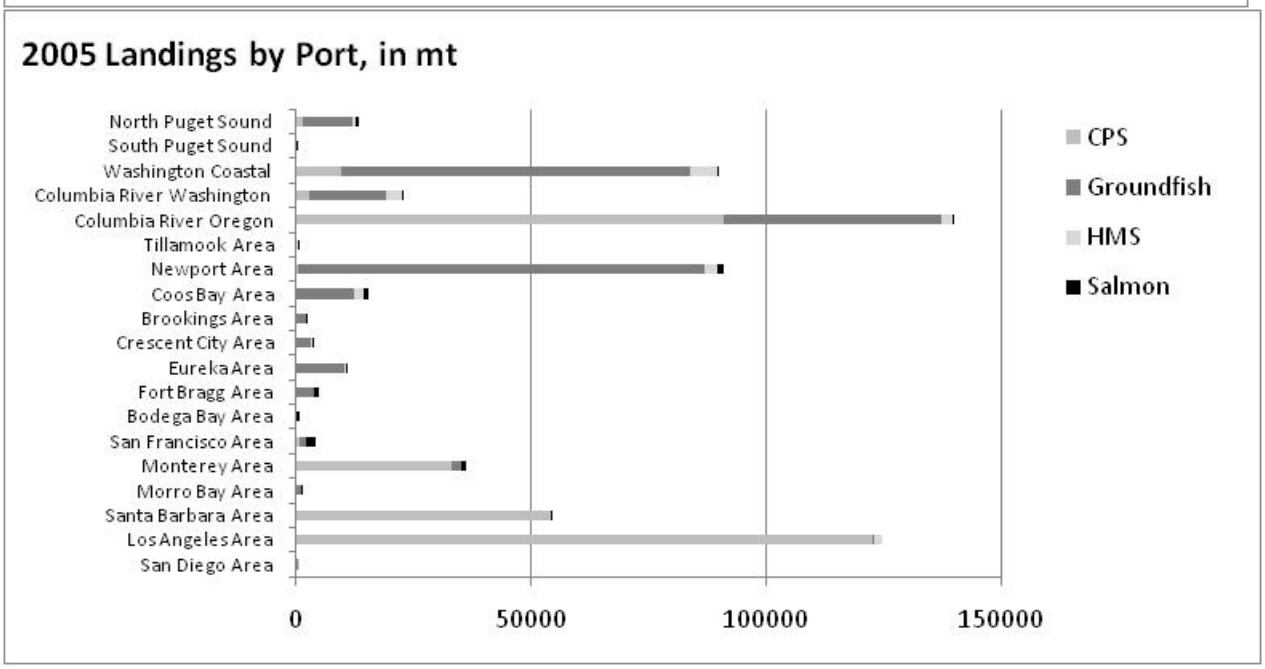
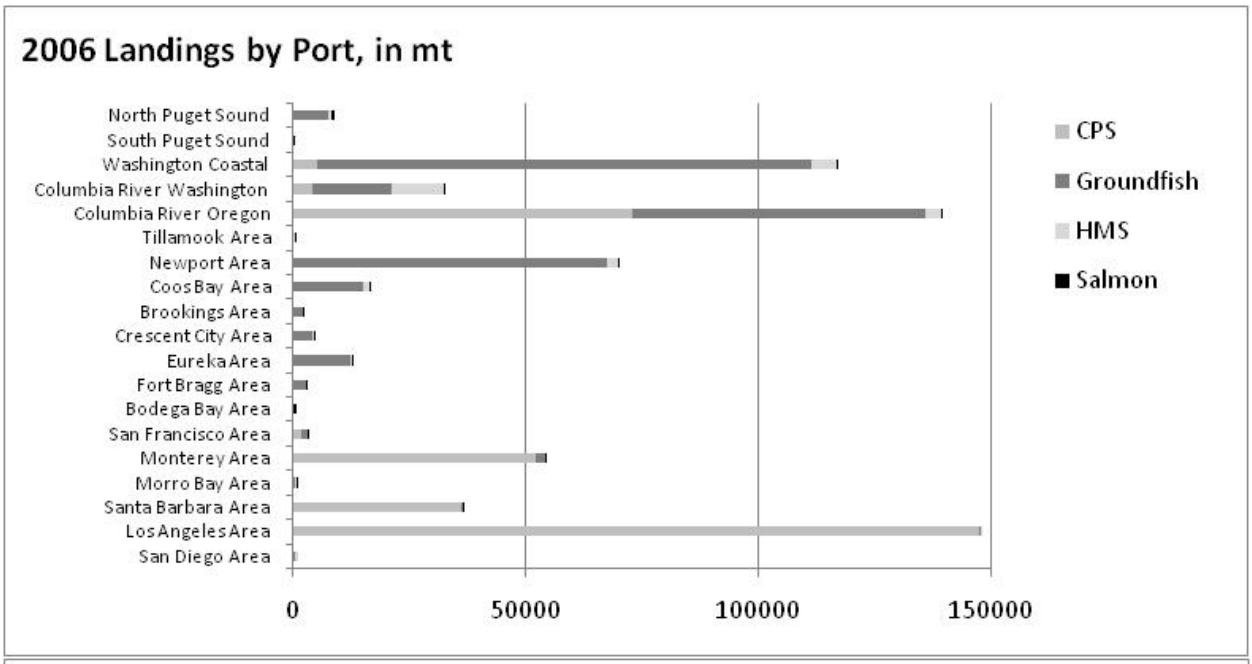
Sep-09
Nov-09

The following charts illustrate 2004-2009 FMP species group landings in metric tons and in ex-vessel revenue, separated by Pacific Fisheries Information Network (PacFIN) Port Group Areas. A list of individual ports aggregated into each Port Group Area may be found online at: http://pacfin.psmfc.org/pacfin_pub/codes.php






2006 Landings by Port, in mt
North Puget Sound
South Puget Sound
Washington Coastal
Columbia River Washington
Columbia River Oregon
Tillamook Area
Newport Area
Coos Bay Area
Brookings Area
Crescent City Area
Eureka Area
Fort Bragg Area
Bodega Bay Area
San Francisco Area
Monterey Area
Morro Bay Area
Santa Barbara Area
Los Angeles Area
San Diego Area
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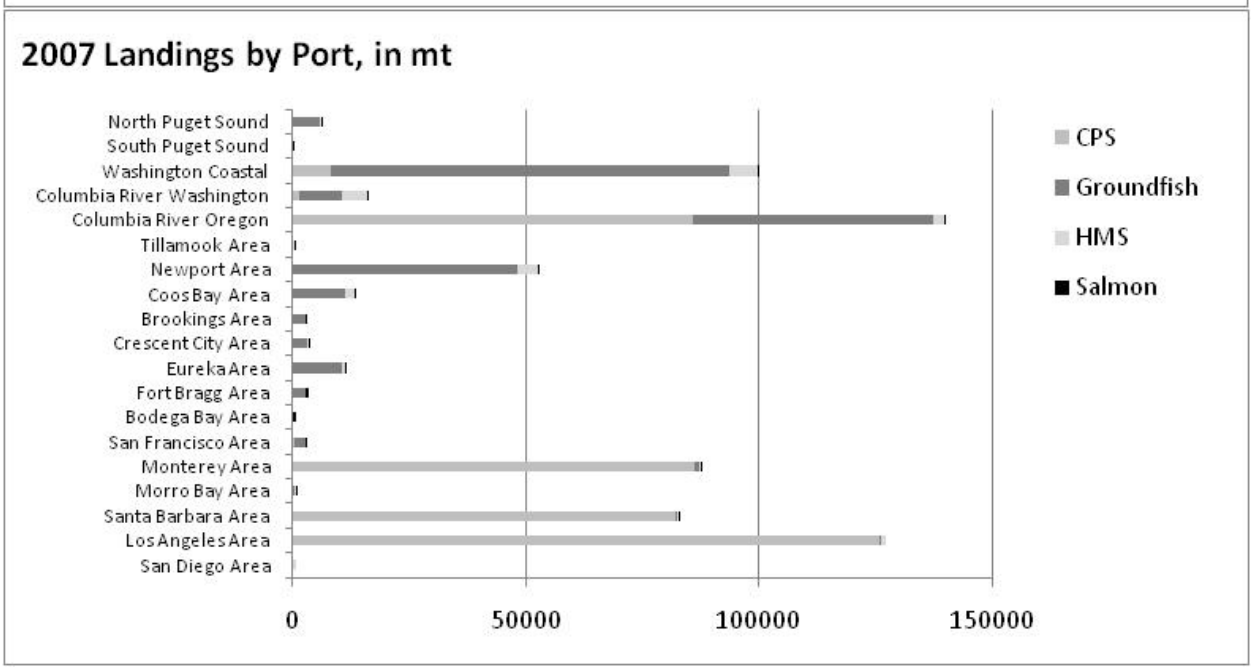
150000
CPS
Groundfish
HMS
Salmon


2007 Landings by Port, in mt
North Puget Sound
South Puget Sound
Washington Coastal
Columbia River Washington
Columbia River Oregon
Tillamook Area
Newport Area
Coos Bay Area
Brookings Area
Crescent City Area
Eureka Area
Fort Bragg Area
Bodega Bay Area
San Francisco Area
Monterey Area
Morro Bay Area
Santa Barbara Area
Los Angeles Area
San Diego Area
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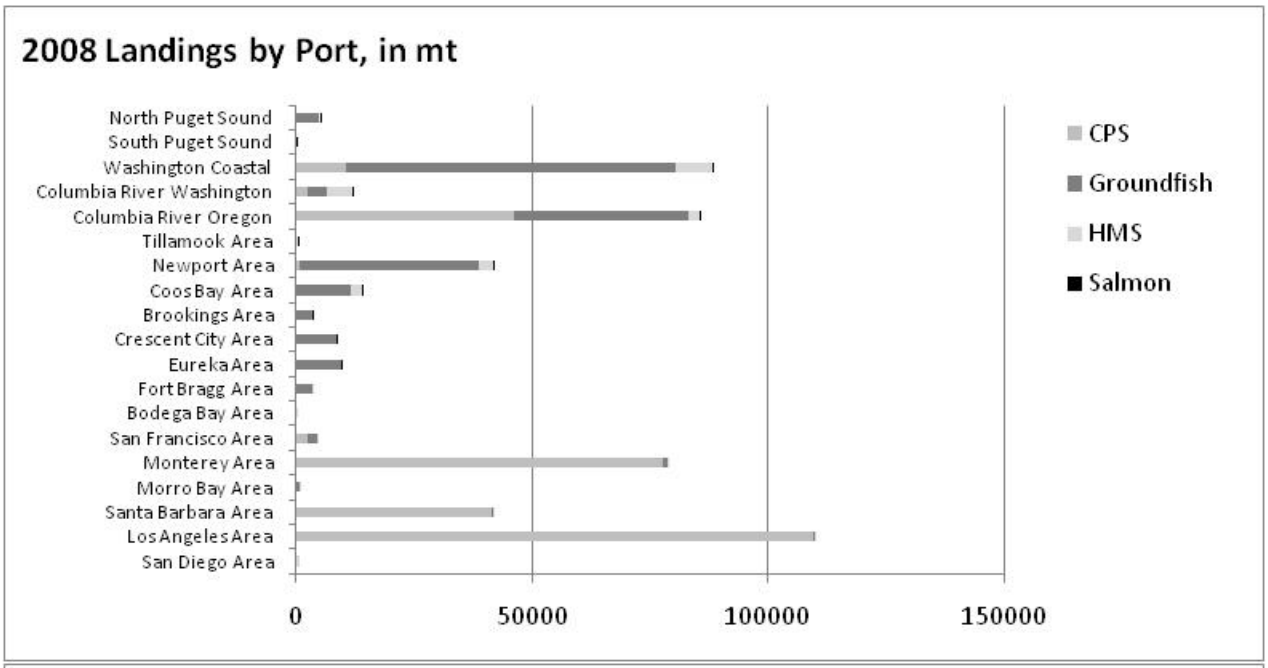
Salmon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North Puget Sound
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Columbia River Oregon
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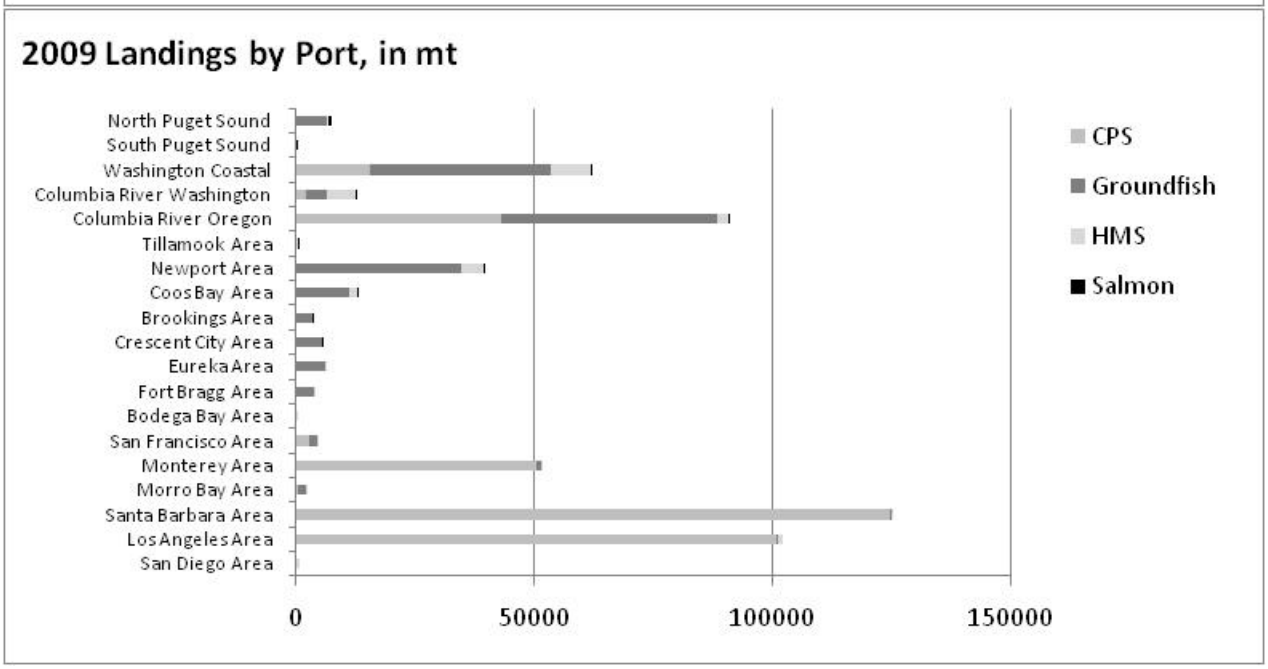
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Columbia River Oregon
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Coos Bay Area
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Eureka Area
Fort Bragg Area
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San Francisco Area
Monterey Area
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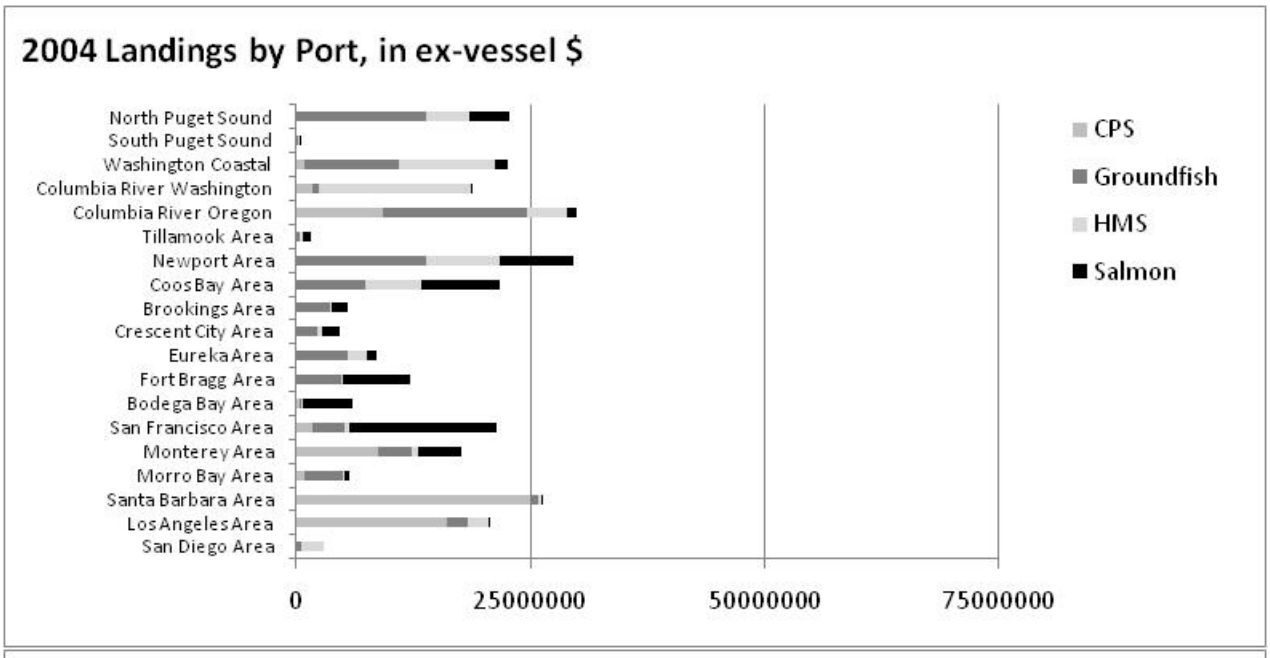
2004 Landings by Port, in ex-vessel $
North Puget Sound
South Puget Sound
Washington Coastal
Columbia River Washington
Columbia River Oregon
Tillamook Area
Newport Area
Coos Bay Area
Brookings Area
Crescent City Area
Eureka Area
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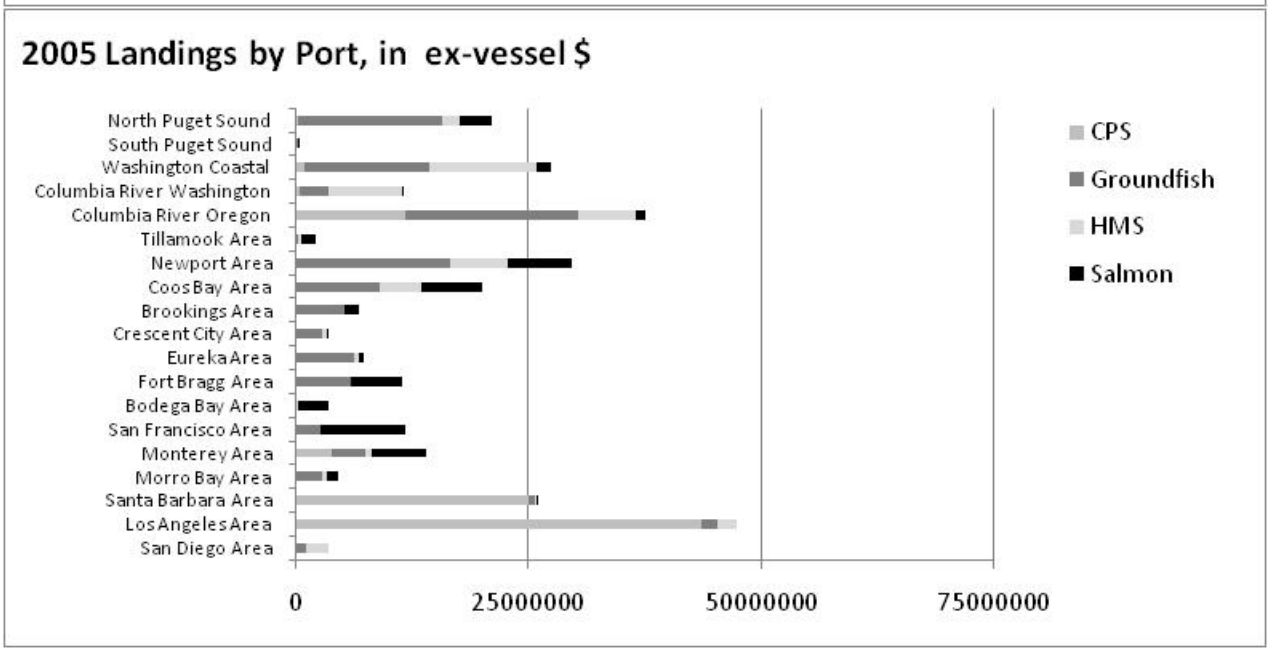
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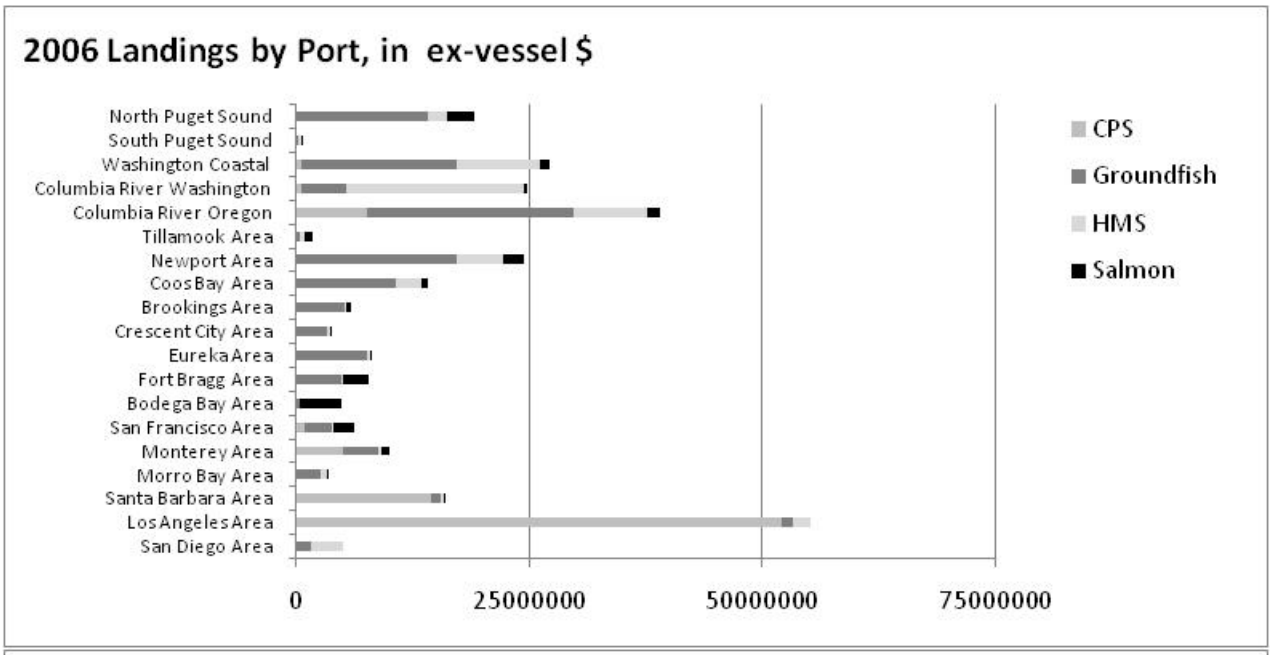
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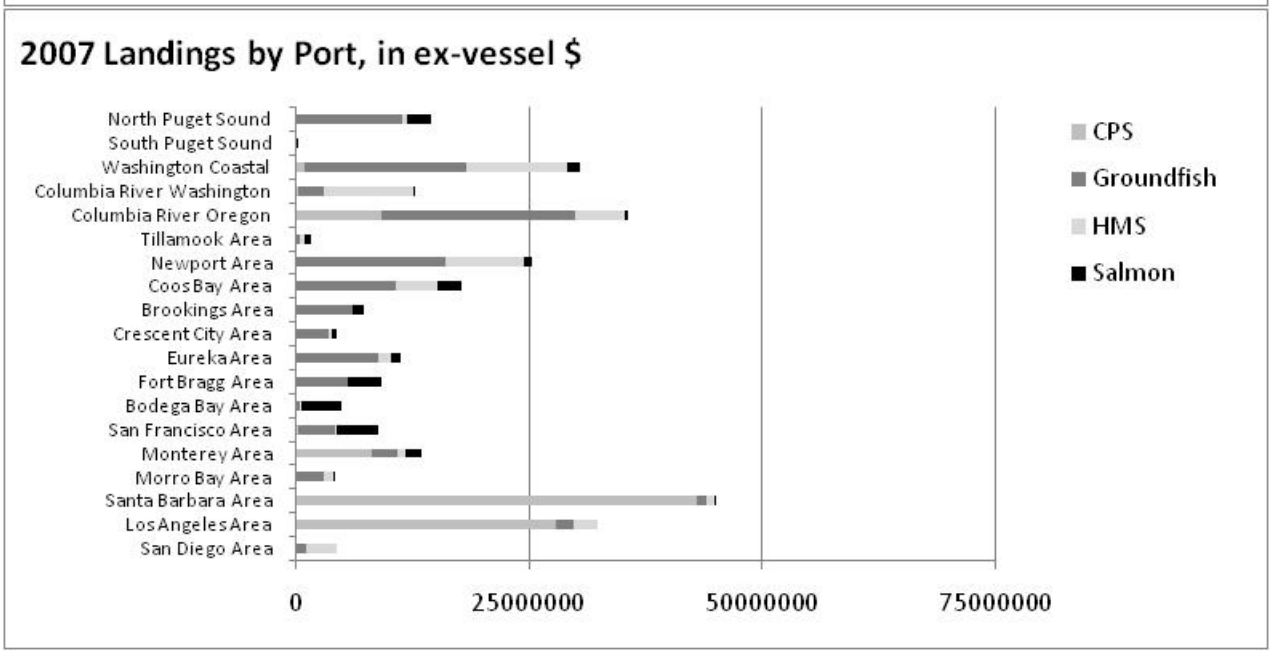
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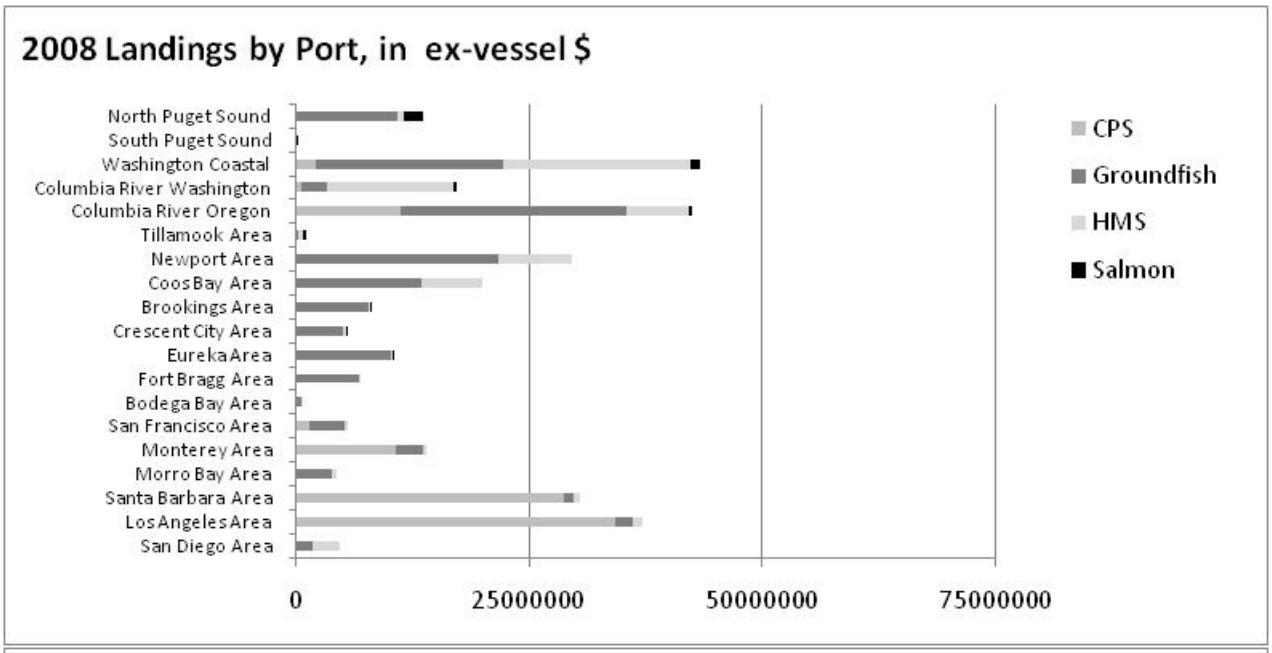
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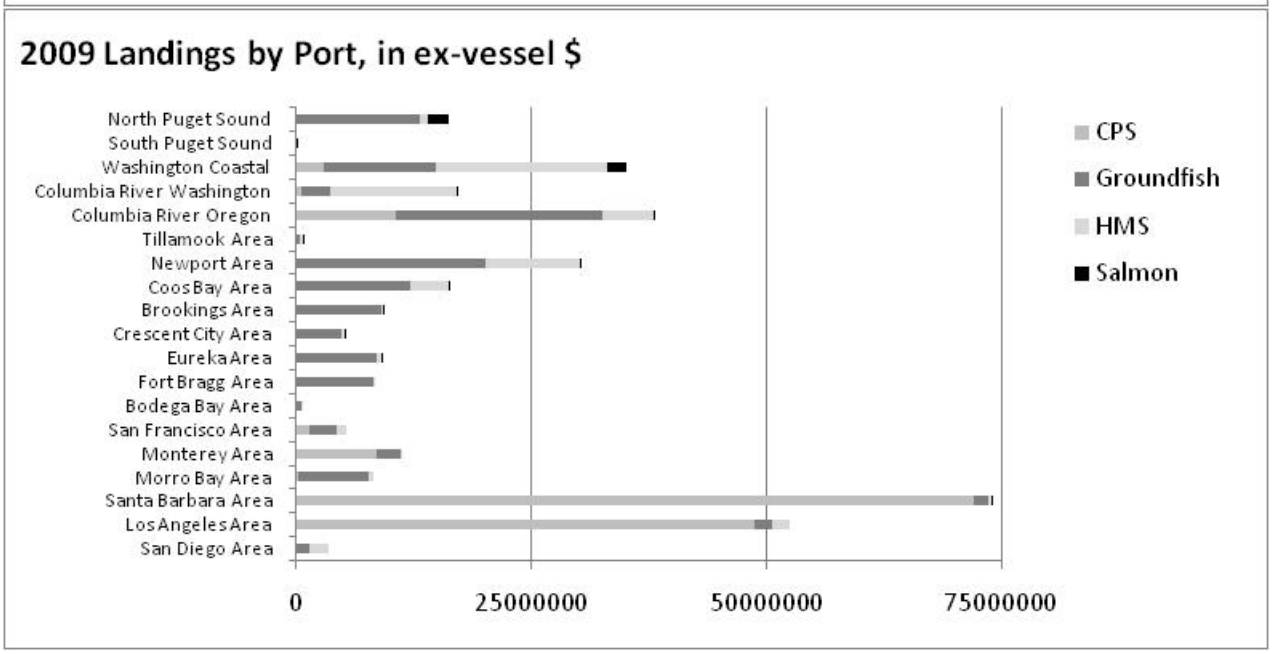
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Crescent City Area
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Fort Bragg Area
Bodega Bay Area
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PFMC
02/10/11

March 8, 2011
B. Enticknap, Oceana
Pacific Fishery Management Council
Agenda Item J.1. Ecosystem Fishery Management Plan

Draft Purpose and Need Statement

Within the California Current Large Marine Ecosystem, the Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS), in coordination with tribal co-managers and the four states, manage approximately 112 species and 18[1] recreational and commercial fisheries combined in four Fishery Management Plans (FMPs); Coastal Pelagic Species, Highly Migratory Species, Groundfish, and Salmon, plus Pacific halibut. These fisheries all take place within a complex and dynamic large marine ecosystem, including species that interact with each other in the marine food web, changing oceanographic conditions, protected species, and a variety of non-fishing human uses and activities outside of the Council's management responsibility and authority (e.g. shipping, hydrokinetic energy development, pollution discharge).

In order to advance the conservation and management of long-term sustainable fisheries that provide the greatest overall benefit to the Nation, including the protection afforded to the marine ecosystem, the Council and NMFS are proposing to develop an Ecosystem Fishery Management Plan (EFMP) for the California Current Ecosystem (CCE). The EFMP will provide analytical tools and structure necessary for accounting for ecosystem needs when setting Optimum Yield catch levels and managing fisheries. The EFMP will help ensure that management of any one of the Council's fishery groups (Coastal Pelagic Species, Groundfish, Highly Migratory Species, and Salmon) does not negatively affect the management potential of the other species groups, non managed species, or their habitats. The EFMP will identify key forage species in the CCE, will identify the value of the ecological services that such species provide, and will consider, and if appropriate implement, conservation and management measures that maintain their functional role as prey for managed species and all other components of the CCE. The EFMP will help keep the Council updated on current and potential effects on the CCE from human and natural causes (e.g. creation of dredge pile islands, industrial contamination, climate change, etc.). The EFMP will allow the Council and NMFS to improve decision making and advance precautionary, coordinated, and innovative approaches to ecosystem-based fisheries management.

This federal action would establish an EFMP to compliment the ongoing conservation and management of federally managed fisheries in the U.S. Exclusive Economic Zone off Washington, Oregon and California, as authorized by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and pursuant to NEPA and other applicable statutes and executive orders.

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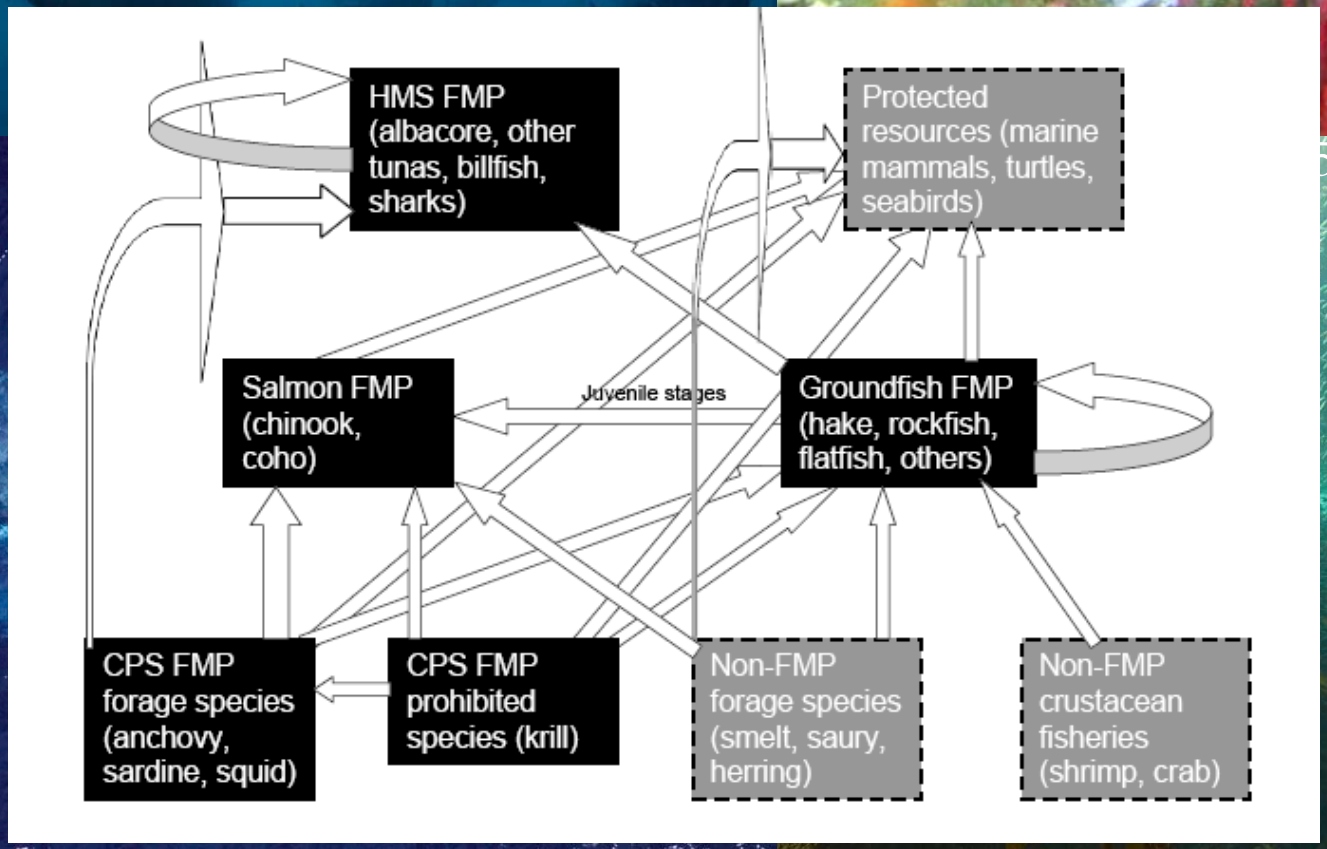
[1] Groundfish FMP – 89 species, 3 primary fisheries (groundfish trawl, non-trawl and recreational). Salmon FMP – three species, 5 fisheries (commercial and recreational ocean chinook and coho, pink salmon). HMS FMP – 13 species, 5 fisheries (commercial albacore, coastal purse seine, harpoon swordfish, drift gillnet, West Coast recreational). CPS – 6 species, 4 fisheries (commercial sardine, jack mackerel, Pacific mackerel, anchovy). Pacific halibut – managed by the International Pacific Halibut Commission, along with NMFS, and catch sharing by the PFMC (tribal, non-tribal, commercial and recreational).

"The overall objective of ecosystem based fishery management is to sustain healthy marine ecosystems and the fisheries they support"



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COASTAL PLEGIC SPECIES ADVISORY SUBPANEL REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN

Following recommendations made by the Pacific Fishery Management Council (Council) at the April, 2011 meeting, the Coastal Pelagic Species Advisory Subpanel (CPSAS) reviewed the Ecosystem Plan Development Team (EPDT) background documents, statements of the EPDT, Science and Statistical Committee (SSC) and Ecosystem Advisory Subpanel (EAS) and public comments pertaining to development of the Ecosystem Fishery Management Plan (EFMP). The CPSAS met via teleconference on May 11, 2011 to discuss the two major Ecosystem Plan-related Council actions scheduled for June:

- Provide guidance on whether the Ecosystem Plan should have regulatory authority and management unit species or not; and
- Adopt the purpose and need of the Plan.

The CPSAS commends the EPDT and EAS for the significant consideration and energy invested in developing a thoughtful and useful path forward to advance the Ecosystem Plan.
All members of the CPSAS are in agreement on some points. However, in some areas, there is not complete consensus. The following three sections present the topics of consensus, the majority statement, and a minority statement.

The entire CPSAS agrees that:

1) The development of the EFMP seems to have focused on forage, and the 'forage' issue seems to have centered on CPS and krill, yet each is only a segment of the biomass of their trophic level. In fact, although significant, managed CPS provide a small and temporally transitory percentage of the total forage consumed in the California Current Ecosystem (CCE). The CPSAS recommends that the Council include the entire forage pool when considering forage issues.

2) Any Ecosystem Plan, regardless of whether it is regulatory or non-regulatory in function, would provide the benefits of:
    a. Identifying trends in the ecosystem and fisheries that could help inform management in the four FMPs.
    b. Performing ecosystem assessments when new species are proposed to be included in an FMP (under Magnuson-Stevens Act section 305(a), "Gear Evaluation and Notification of Entry").

3) Any ecosystem model and Integrated Ecosystem Assessment developed for the purpose of evaluating ecological factors for CPS should include the entire CCE, particularly southern California (which is now missing) as well as information extending into Mexico and Canada, to the extent available.

4) Any new ecosystem plan should be reviewed every two years, to gauge its success and re-visit its function. This is particularly applicable should the Council decide to move forward first with a non-regulatory Fishery Ecosystem Plan (FEP).

The majority of the CPSAS agrees that:

5) The Council should proceed with the development of an Advisory FEP, without initial regulatory authority; and this plan should not be modified into an Ecosystem Fishery Management Plan (with potential regulatory authority) unless and until the ecosystem-based methodology is mature, peer reviewed and shown to be superior to the present management strategy.

6) The purpose and need statement from the September 2010 EPDT document (H.1.b) should be used as a basis for the EPDT purpose and need statement:

> *Ecosystem approaches to management are still about societal choice among competing objectives (Shepherd 2004). Fundamentally, ecosystem-based fishery management recognizes that fisheries both affect and are affected by the marine environment, and that what we do to address these effects via policy-making is a matter of societal choice. The purpose of the ecosystem approach is not to prescribe particular policy choices, but rather to promote better understanding of those policy choices. Ecosystem-based fishery management is meant to compliment current single-species approaches to fisheries management by providing additional information that may be used to expand the scope of these approaches into the future. Finally, ecosystem-based fishery management does not create additional mandates to protect the marine environment, but instead seeks to better understand fishery effects on the marine environment through improved information on ecosystem structure, processes and functions.*

7) The CPS FMP provides framework management that is precautionary, and designed to maintain a sufficient forage population to support ecosystem needs and fishery functions. Conservative benchmarks for both actively-managed and monitored stocks have been in place for a decade.

A minority of the CPSAS is of the opinion that:

8) The analysis accompanying development of the EFMP could consider multiple alternatives, including the conservation and management of forage species not currently in the existing FMPs and the value of the ecological services these species provide.

9) In addition, the EFMP could help the Council meet its requirements under National Standard One to describe the ecological factors taken into account when calculating Optimum Yield, such as "impacts on ecosystem component species, forage fish stocks, other fisheries, predator-prey or competitive interactions, marine mammals, threatened or endangered species, and birds" (50 CFR Sec. 600.310(e)(3)(iv)(C)). In addition, as described in the National Standard One guidelines, the EFMP could give "consideration… to managing forage stocks for higher biomass than B_{msy} to enhance and protect the marine ecosystem" (same citation).

10) The Council should continue development of an EFMP by adopting the purpose and need statement submitted by Oceana in March 2011, or amend it as appropriate, and initiate

the scoping process. The development of an EFMP, which addresses cross cutting FMP issues and forage species conservation and management would be best be prepared through a Programmatic Environmental Impact Statement and this would help the Council and NMFS fulfill obligations under the National Environmental Policy Act. The plan should not replace the existing FMPs, but advance fishery management under these FMPs by introducing new ecosystem science and new authorities to the current Council process.

PFMC
05/24/11

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

The Coastal Pelagic Species Management Team (CPSMT) met May 5-6, 2011, in La Jolla, California, and considered the Council's April 2011 request for input on the Ecosystem Plan Development Team's (EPDT) reports from September, 2010 and March, 2011. The CPSMT specifically considered whether the Ecosystem Plan should have regulatory authority and management unit species, and what primary functions and responsibilities the Ecosystem Plan should have.

The CPSMT fully supports development of an advisory Fishery Ecosystem Plan (FEP) as outlined by the EPDT in Table 5.1 Agenda Item H.1.b Attachment 1, September 2010. Adopting such a plan and establishing a Plan Team will benefit the Council's management of Coastal Pelagic Species (CPS) and other Fishery Management Plan (FMP)-managed fisheries. This alternative will advance Ecosystem-Based Management (EBM) in west coast fisheries and is the most viable alternative at this time.

The North Pacific Fishery Management Council (NPFMC) and South Atlantic Fishery Management Council (SAFMC) have developed advisory FEPs, and elements of those plans could be used by the Pacific Council as it develops its Ecosystem Plan. The CPSMT does not see a need for another regulatory FMP with management unit species and the attendant requirements of the Magnuson-Stevens Act (MSA) for such species at this time, but would not exclude the possibility of having the advisory FEP evolve into a regulatory FMP if a clear need for such a transition is established in the future.

A key component of an Ecosystem Plan is an ecosystem model. There is a variety of ecosystem modeling tools (Pacific Coast Ocean Observing System reports, Integrated Ecosystem Assessment, etc) which provide information and guidance to the Council and management teams. The CPSMT notes that predictions from modeling studies need to undergo quantitative evaluation to assess their performance, and that this process will take time.

The CPSMT recommends that major functions and responsibilities of an advisory FEP and its Ecosystem Team (E-Team) should be to:

- Provide the Council and it advisory bodies with regular updates that identify trends and changes in ocean conditions or other ecosystem indicators, and the likely effects of those conditions on FMP species, to inform Council decisions.
- Encourage the development of food web research programs that could evaluate the trophic interactions of forage and predatory components in the California Current Ecosystem (CCE), and disseminate information as appropriate.
- Respond to informational needs identified by the Council and its advisory bodies, and evaluate potential tradeoffs of management decisions.
- Broaden the scientific information available regarding cumulative effects of the Council's fisheries conservation and management actions on the ecosystem and its habitats, including Essential Fish Habitat (EFH) for species under management.
- Conduct ecosystem and economic assessments in response to proposals to add additional species to an FMP (under Magnuson-Stevens Act section 305(a), "Gear Evaluation and Notification of Entry").

The CPSMT notes that the Council manages its CPS fisheries conservatively, and that ecosystem and socioeconomic considerations are already incorporated into CPS management. Much attention has recently been focused on the "forage base" of the CCE and the predator populations they support.

Although CPS make up a portion of this forage base, a considerable fraction is also made up by the juvenile life stages of species managed under other Council FMPs, as well as species not currently under Council purview and/or not experiencing fishing. Similarly, some CPS such as Pacific and jack mackerel are part of the predator populations supported by the CCE as are the adult stages of many other species both within and outside of Council FMPs. It will be important that modeling efforts account for the differing roles of species at different life stages. The CPSMT has previously suggested that development of an Ecosystem Plan would be useful in creating the criteria and decisional framework to guide Council actions in a holistic ecosystem approach for monitoring and evaluating forage and predator "species" and their respective roles and relationships with all Council managed fisheries. This approach will assist the implementation of recent Council-approved amendments to the CPS and Groundfish FMPs, and likely benefit other Council-managed fisheries as well.

The CPSMT would like to thank the EPDT and the Ecosystem Advisory Subpanel for their hard work and perspective on developing an Ecosystem Plan and encourages the Council to take action to begin the development of an advisory FEP and form an E-team.

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ECOSYSTEM ADVISORY SUBPANEL REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN

At the March 2011 Pacific Fishery Management Council (Council) meeting, the Ecosystem Advisory Subpanel (EAS) requested a primary role in developing information to aid the Council in the plan development process and offered to build upon the solid foundation laid by the Ecosystem Plan Development Team (EPDT) and our prior recommendations. In response to Council guidance in March 2011 and to continue the benefits of ongoing creative collaboration between the EPDT and other Advisory Bodies, the EAS met April 20-21, 2011 to discuss alternative approaches to incorporating ecosystem management into the Council process, review the pros and cons of those alternatives, and develop guidance on a recommended approach. Additionally, the EAS met in a joint session with the Ecosystem-Based Management Subcommittee of the Scientific and Statistical Committee (SSC) on April 20, 2011 to discuss ecosystem science including the California Current Integrated Ecosystem Assessment (CCIEA).

This report provides EAS comments on ecosystem science in the Council process as well as specific EAS recommendations on the action items the Council is addressing at its June 2011 meeting; the ecosystem plan's purpose and need statement, regulatory authority, and management unit species (MUS).

Ecosystem Science in the Council Process and the CCIEA

The EAS received presentations from the CCIEA team and engaged in a discussion with the SSC subcommittee about application of ecosystem approaches in the Council process. The CCIEA could play an important role in the Council's ecosystem consideration process, including annual reports to the Council and, eventually, providing ecological information to the stock assessment process. We encourage continued pursuit of these analyses and offer the following suggestions to the CCIEA team as a way to support the Council's management needs:

1. Explain the multiple ways in which ecosystem analyses can be useful, provide examples to help inform both strategic (i.e., targeted outcomes) and tactical (i.e., tools to evaluate performance) decisions. Include examples, case-studies, and/or illustrations.

2. Compare and contrast the approaches of current stock assessment methodologies and the CCIEA processes in terms of framework, data availability, and uncertainty. For example, the CCIEA team presented a preliminary analysis of krill abundance and distribution as a tool for improving the predictability of juvenile salmon survival.

3. Use initially selected species, including forage species, in CCIEA analyses to illustrate the following: systems diagrams that show critical interactions that drive fishery productivity and ecosystem considerations that could enhance stock assessment value (e.g., reduction of uncertainty, improved assessment forecasts and trends, etc.).

4. Work with the SSC to create a framework to define questions, identify potential tools, review relevance and rigor of models, and assess results.

5. Incorporate socioeconomic factors into the ecosystem analysis process.

6. Engage Council and stakeholders (including fishing industry) at this early stage to provide meaningful input on the CCIEA process: objectives, ecosystem dynamics, species interactions, etc.

Purpose and Need Statement

This topic was briefly discussed at the April EAS meeting and the majority of the EAS determined that existing EAS recommendations to the Council remain relevant and are summarized below.

At its May 2010 meeting the EAS developed the following working definition of ecosystem-based fishery management (EBFM):

> *EBFM is a systems approach that looks at interactions of habitats and species to optimize ecosystem services in ways that encourage sustainability of the broader marine ecosystem and the health and resilience of fisheries, fish stocks, and fishing communities.*

At its February 2011 meeting, the EAS discussed the following principles and goals for the Ecosystem Fishery Management Plan (EFMP):

> *The EAS believes that an EBFM framework should provide tools for the Council to improve the precision, accuracy, and an improved understanding of the effect of fishery management decisions; to provide for a flexible and adaptive system able to be tuned to prevailing or forecasted environmental conditions; and an awareness of how these conditions drive fisheries.*

Building off this working definition and draft EFMP principles and goals, a majority of the EAS continues to recommend the following excerpt from the March 2011 EAS report (Agenda Item I.1.d, Supplemental EAS Report) regarding a draft purpose and need statement:

> *Specific to the purpose of and need for an EFMP, the EAS identified several specific items to be considered by the EPDT in developing the purpose and need statement, specifically: the EBFM document should provide a vehicle to (1) improve information and improve decision making; (2) identify gaps in information; (3) integrate across species-specific FMPs; (4) provide a nexus to regional and national ecosystem-related endeavors; (5) establish a platform or framework that enables management at the appropriate ecosystem scale for a species or complex of species, (6) create incentives for improved stewardship (through better linkages among fish stocks, the ecosystems that support them, and the fishermen and fishing communities that rely upon their continued health) and (7) encourage innovation by offering an alternative pathway for management of a complex of species that might yield a more robust portfolio of fishing opportunities (by looking across the array of species of interest to fishermen and fishing communities within an ecosystem).*

Regulatory Authority and Management Unit Species (MUS)

At its April 2011 meeting, the EAS reviewed the gaps and shortcomings of existing management tools and concluded that current species-specific FMPs can have limited utility in addressing ecosystem-based fishery considerations that cross FMPs and for non-FMP species.

The EAS reviewed a range of approaches to incorporate ecosystem management, including: a formal regulatory EFMP with MUS, a "guidance-only" or informational document, incorporation of ecosystem considerations into the existing FMPs, and other informational formats. The panel's discussion focused on options for developing tools that are focused and flexible.

The EAS had a long discussion regarding the form and function of an ecosystem plan and captured the identified pros and cons of three plan options in Table 1 at the end of this report.

The majority of the EAS felt that the plan should focus on concrete steps to incorporate ecosystem considerations in the existing FMPs and use a Fishery Ecosystem Plan to provide information and recommendations for action in existing FMPs and coordination across the FMPs. Accordingly, it passed the following motion:

EAS Motion:

> The EAS recommends that Council move forward with both Options A and B, described in Table 1:
>
> Option A. Incorporate ecosystem considerations into existing FMPs.
>
> Option B. Fishery Ecosystem Plan that would not have regulatory authority but would provide information and recommendations for actions in existing FMPs.
>
> After two years of application of these measures, we advise that the Council review the efficacy of these steps, the status of tools to enhance them, and remaining ecosystem needs to determine whether additional steps (including consideration of an EFMP with regulatory authority for non-FMP species) are needed to enhance ecosystem health and fisheries productivity.

A minority of the EAS supports Option A (incorporate ecosystem considerations into existing FMPs) and Option C (development of an Ecosystem Fishery Management Plan). In addition to incorporating ecosystem science and principles into the management process, an EFMP would provide the Council with the regulatory authority and ability to manage ecosystem components that are not specifically treated in the existing FMPs. This will help in developing conservation and management measures for forage species that form the base of the food web, and which are important to a wide variety of managed species. This type of EFMP framework would be best developed through a Programmatic Environmental Impact Statement.

Summary

In closing, the EAS thanks the Council for providing us the opportunity to evaluate the questions of what ecosystem plan approach best matches current Council need, the current state of California Current Ecosystem science, and provides flexibility now and into the future. The EAS believes that the Council has made important progress in developing and incorporating an understanding of ecosystem management concepts and applications. We believe that ecosystem understandings have value for the Council's policies. We recommend that the focus turn to development of the purpose and need of ecosystem fisheries management planning so that there is a shared foundation for further development efforts. Finally, we urge the Council to maximize stakeholder input during development and implementation of the Fishery Ecosystem Plan to facilitate understanding and acceptance of the process.

TABLE 1. Summary Comparison of Three Ecosystem Plan options (two pages).				
Options A,B,C	**Description**	**Pros**	**Cons**	**Notes**
Option A. Incorporate ecosystem considerations into existing FMPs	Incorporates additional ecosystem considerations into the existing FMPs and stock assessment TORs.	• Simple, easy to implement, less workload • Enables EBFM principles to be balanced with other FMP considerations • Builds on existing plans/practices • Adds guidelines within the existing framework • Meets NS1 requirements for ecological considerations • Increased information leading to Improved decision making	• Limited to species within existing FMPs • Does not integrate across FMPs • Duplication of effort by spreading similar tasks across several plans and teams • No linkage to national or regional ecosystem related external entities (i.e. West Coast Gov. Agreement, Marine Spatial Planning)	
Option B. Fishery Ecosystem Plan (FEP)	In addition to Option A adds an FEP, which would not have regulatory authority, but would provide information and recommendations for actions in existing FMPs. The FEP would include an annual report highlighting key Issues and providing management recommendations. Includes advisory groups (technical team, advisory panel) and specific Council Operating Procedures.	• Acknowledges/elevates the importance of EBM • Provides more coordination/integration across FMPs • Centralized effort to create the EBM context under which FMP decisions are considered • Provides more flexibility for management, less prescriptive, and not hard-wired • Provides a forum and explicit vehicles for EBM discussion/reporting/advice • Nexus to National/Regional EBM effort • Bolsters Council position on issues beyond its direct jurisdiction and provides mechanism to deal with exogenous issues • Maintains regulatory authority within existing FMPs to address EBM (no prescriptive management measures) • Provides vehicle for addressing ecosystem	• Lacks mechanism outside existing FMP authorities for turning information into conservation measures, link not explicit • Does not allow management measures for non-FMP species	

TABLE 1. Summary Comparison of Three Ecosystem Plan options (two pages).				
Options A,B,C	**Description**	**Pros**	**Cons**	**Notes**
		concerns to be addressed in existing FMPs		
Option C. Ecosystem Fishery Management Plan (EFMP)	Options A and B, plus management unit species, fishery management framework, and potential management measures outside existing FMPs. Not intended to supplant the current FMP authorities.	• Same pros as B • Designation of new MUS in into the Council process • Allows the Council to advance precautionary management approaches for new MUS • Raise the profile of new MUS for science and management which has the potential to provide additional resources for management • Provides a prescribed regulatory framework for taking action on new MUS	• Raises concerns about EFMP supplanting current FMPs, (which plans take precedence?) • Could erode or limit existing Council discretion under existing FMPs • MSA mandated contents of FMPs and SDCs, etc. for MUS apply • Requires the most of Council resources and is the most complex option • Requires decisions be based on information that may be unavailable or unattainable at present time	Need legal guidance on competing FMP authorities

GROUNDFISH MANAGEMENT TEAM REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN

The Groundfish Management Team (GMT) reviewed the Ecosystem Plan Development Team (EPDT) reports from September 2010 (Agenda Item J.1.c, Attachment 2, March 2011) and March 2011 (Agenda Item J.1.c, Attachment 1, March 2011), as well as Public Comment (Agenda Item J.1.e, Public Comment, March 2011) based on Council direction from the last meeting. We would also like to thank Mike Burner, Council staff, for providing a summary review on the development history of an Ecosystem Plan to date. We offer the following comments for Council consideration.

General Comments

It is difficult for us to comment on the timing for incorporating ecosystem considerations into the groundfish assessment and management process as proposed in the EPDT's March Report (Table 4.1) at this time. The Council is scheduled to make a decision on the schedule for 2013-2014 and beyond under a different agenda item (E.4) at this meeting. However, we will verify the timing of incorporation of ecosystem considerations into the groundfish process in September, based on Council actions at this meeting.

Ecosystem-based management must occur at biologically meaningful scales to be effective. The GMT recommends using the Ecosystem Plan to incorporate considerations of management actions and scientific information from outside the Exclusive Economic Zone (EEZ) (e.g. from Canada, Mexico, and inland waters) that might inform management within the Council's area of jurisdiction. Likewise, information from ecosystem modeling should be used to develop management strategies that are targeted to smaller geographic areas within the California Current as opposed to taking action throughout the Large Marine Ecosystem by default.

Overall the most important consideration in developing the Ecosystem Plan is identifying and describing those ecosystem services that are the highest priority within the Council's jurisdiction to provide the greatest benefit to the Nation. Identifying the most important services that the marine environment provides will focus the efforts of ecosystem modelers, the outputs of Integrated Ecosystem Assessments (IEAs), and development of policies within the Ecosystem Plan.

Purpose and Need

In discussing the Purpose and Need statement for an Ecosystem Plan, the GMT considered the potential benefits of an Ecosystem Plan to groundfish management and, in some respects, fisheries management in a broader sense. Regardless of whether the Plan has regulatory authority, other issues that were identified across Fishery Management Plans (FMPs) that the GMT acknowledges might benefit from policy coordination under an Ecosystem Plan are: spatial management; species designated as Ecosystem Component (EC) species under National Standard 1 (NS1); protected species; and better characterization of the human environment and cumulative impacts. Likewise, we see a benefit to including ecosystem considerations within the

assessments, environmental analyses of fisheries, and management under the groundfish FMP. This would come both from the IEAs conducted to inform the Ecosystem Plan as well as the expertise from those scientists being incorporated into existing FMP-specific processes. We broke these benefits down into three general categories: impacts to the environment; benefits to harvest specifications setting; and consistency in treatment across FMPs.

Impacts to the Environment

As part of the Groundfish process improvement efforts, the Council is considering how National Environmental Policy Act (NEPA) analysis and procedures can better integrate with the biennial harvest specifications and management measures. We recommend looking closely at how the ecosystem plan can inform this effort. We understand from the EPDT reports and the fisheries literature that ecosystem models such as the Atlantis model can serve to explore cumulative impacts to the marine environment from fishing and other activities. Such analysis gets to the core question asked by NEPA about significant impacts to the human environment.[1] The Council considers many actions and adjustments to prior actions each biennial cycle. The ecosystem plan and models could help shape a framework for determining which actions and adjustments are likely to raise new questions about significant impacts. This framework would then guide a programmatic approach to NEPA that best reflects the adaptive management principles on which the Groundfish FMP is based. Likewise this might provide an improved method of incorporating effects on the human environment and socioeconomic impacts.

It might also serve as a vehicle to better understand the ecosystem effects of current management measures that are targeted at individual stocks or management goals. For example while mesh size regulations are meant to reduce the discarding of juveniles for commercially important target stocks, there is also an effect on the species assemblage due to selectivity of larger sized stocks and faster growing individuals within those stocks.

Benefits to Harvest Specifications Setting

Under NS1 guidelines (50 CFR Section 600.310) the Council is to consider ecological factors, among others, in specifying Optimum Yield (OY) at a level below the estimated Maximum Sustainable Yield (MSY) for a fishery. Under Amendment 23, to the groundfish FMP, OY would be achieved by specifying Annual Catch Limits (ACLs) for major stocks or management units. Ecological considerations presented in IEAs and reported through an Ecosystem Plan could provide a standardized methodology for considering ecological factors for species within the groundfish FMP.

Under Section 4.6.2 of the FMP, in determining the time for rebuilding, the Council is required to consider, "Interactions between the stock or stock complex and other components of the marine ecosystem or environmental conditions." An Ecosystem Plan could provide for a consistent method for considering such interactions (e.g. based on the results of IEAs).

[1] E.g., Isaac C. Kaplan, Phillip S. Levin, Merrick Burden, Elizabeth A. Fulton. 2010. Fishing catch shares in the face of global change: a framework for integrating cumulative impacts and single species management. Canadian Journal of Fisheries and Aquatic Sciences, 67(12): 1968-1982.

Section 4.5.3 of the FMP states, "The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report." The Ecosystem Plan could serve as a source of scientific information to ensure that overfished and rebuilt thresholds are properly specified. For example, we recently revised those for flatfishes based on a meta-analysis of stock assessments that updated our understanding of their population dynamics. A more long-term and comprehensive look at population dynamics from an ecosystem perspective could help further refine our default harvest policies for all FMP species.

Consistency in Treatment across FMPs

In contrast to the "impacts to the environment" section above, in addition to a consistent way to look at how we are impacting the environment, an Ecosystem Plan could provide a consistent understanding of how environmental factors affect management unit species or stocks. This is particularly important for how environmental factors or other ecosystem considerations are included in stock assessments. For example Schirripa 2007 found sea surface temperature correlated to sablefish productivity. This relationship may have been due to temperature effects on prey abundance which could have similar effects on other stocks.

In addition to the consistent application of ecological considerations in the assessment of stocks across FMPs, we discussed (see "Benefits to Harvest Specification Setting" above) consistent application of those considerations in specification setting within the groundfish FMP for reducing MSY to OY. These considerations may even potentially be standardized across all Council FMPs based on information from ecosystem modeling and assessments presented in an Ecosystem Plan. The GMT notes, however, that it will be important to distinguish use of ecosystem science in assessments to estimate Overfishing Level (OFL) versus ecological considerations in setting the ACL, so that the same ecological considerations aren't counted twice.

Finally, if the Council wanted to designate EC species, an Ecosystem Plan could be used to develop some consistent treatment of those species in the various FMPs or it could serve as a central location to designate such species and develop standards for monitoring them.

Regulatory Authority

In general the GMT struggled with the question of whether the Ecosystem Plan should have regulatory authority without first knowing exactly what ecosystem objectives the Council wished to meet under the Plan. While we recognize that achieving management goals not otherwise specified in the Council's four existing FMPs was the primary impetus for developing an Ecosystem Plan, those other goals have yet to be explicitly stated. In particular the GMT discussed the fact that an Ecosystem Plan that was more advisory in nature (i.e. not specified as an FMP under the Magnuson-Stevens Act) would not have to comply with Section 303 requirements while still achieving any policy goals the Council may have that fall outside existing FMPs.

Such an advisory plan may still have regulatory authority at some point in the future to accomplish some of the suggestions that have been presented to the Council to date. For example, there have been proposals to protect forage species (i.e. similar to the krill ban under

the CPS FMP) or develop a comprehensive coral and sponge management policy under the auspices of an Ecosystem Plan. These are both cases where the Council may want to consider how to manage impacts to living marine resources that are not fishery targets. It is our understanding that development of such authority, while not subject to the same required provisions of an FMP, would still require the identification of specific policy goals, analyses of a range of alternatives to achieve those goals and their environmental impact, and then notice, comment, and rulemaking.

PFMC
05/24/11

SALMON ADVISORY SUBPANEL REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

The Salmon Advisory Subpanel (SAS) has discussed at length the presentation made by the Ecosystem Advisory Subpanel (EAS) re-ecosystem-based management. We have the following observations and recommendations to make to the Pacific Fishery Management Council (Council).

1. There is considerable concern regarding the potential regulatory actions that might accompany ecosystem-based management. These concerns range from the sheer complexity of dealing with multiple ecological interactions among species; the potential for conflict among different groups, including fishermen, communities, non-governmental agencies and management agencies, as well as the cost of overlaying yet another regulatory burden upon an already highly regulated community. We view ecosystem-based management as having the potential to be a useful tool in making management decisions, but not a regulatory mechanism.

2. While the SAS is supportive of continuing research on the California Current Ecosystem as it pertains to salmon, we point out that the salmonid life cycle interacts with at least three ecosystems, and, in the case of some of our far north migrating stocks, a fourth. These are extremely complex relationships and not well understood. We strongly believe that ecosystem-based management for salmon should include the estuarine and freshwater environments as well as the ocean, as identified in the Council's essential fish habitat (EFH) description. We bring to the Council's attention the curtailments of ocean salmon harvests in Oregon and California from 2006-2009 due to flow and temperature issues in the Sacramento and Klamath rivers which seriously reduced salmon populations. Separating out any part of the salmonid ecosystem from consideration in ecosystem-based management seems self-defeating.

3. We note that current research is at a very early stage, with untested assumptions and hypotheses that will require significant financial resources to support the future efforts necessary to underpin development of this potential management approach. We doubt that the current methodologies and models being developed are sophisticated enough for this kind of endeavor, and are concerned about the potential cost to the taxpayer to develop and operate this management tool. We support development of ecosystem-based management as a tool to supplement current management structures, recognizing that it will take a good deal of time to develop the technical tools and refine the concepts necessary to its successful implementation. We also are aware of the heavy workload that the Council is charged with, and believe consideration should be given as to how such a complex tool is to be developed and supported.

4. We are not comfortable with an ecosystem-based analysis that excludes protected species from the management arena. These may be avian (e.g., Caspian terns and double-crested cormorants) or marine mammals (e.g., orcas and sea lions), to name a few examples. But if study regarding ecosystem-based management is to be credible, it must include all parts of the ecosystem and not eliminate any part due to external pressures.

While we are, in principle, supportive of the concept behind ecosystem-based management, we also believe there are serious concerns that need to be addressed as noted above before it can take its place as a viable management strategy.

PFMC
05/24/11

SCIENTIFIC AND STATISTICAL COMMITTEE
ECOSYSTEM-BASED MANAGEMENT SUBCOMMITTEE

This is draft report to the Scientific and Statistical Committee (SSC) from its Ecosystem-Based Management Subcommittee (EMS). This report is considered a draft until reviewed by the full SSC at its June 2011 meeting.

A public meeting of the Ecosystem-Based Management Subcommittee of the Pacific Fishery Management Council's (Council's) Scientific and Statistical Committee (SSC-EMS of Subcommittee) was held on April 19-20, 2011 at the Pacific Fishery Management Council (Council) offices in Portland, Oregon. Members of the Ecosystem Plan Development Team (EPDT) and the Ecosystem Advisory Subcommittee (EAS) were in attendance, as well as several members of the public and agency representatives. Day two of the meeting was held jointly with the EAS and included a presentation by Dr. Phil Levin and Dr. Brian Wells of the California Current Integrated Ecosystem Assessment program at Northwest Fisheries Science Center (NWFSC) and Southwest Fisheries Science Center (SWFSC). The primary purpose this meeting was the development of recommendations for the June 2011 Council meeting on incorporating relevant ecosystem science considerations into fishery management. This report provides a summary of discussion points and recommendations developed by the subcommittee for SSC review and presentation to the Council.

Attendees

Subcommittee Members in Attendance
Dr. Ramon Conser, National Marine Fisheries Service, La Jolla, CA
Dr. Martin Dorn, National Marine Fisheries Service, Seattle, WA
Dr. Vladlena Gertseva, National Marine Fisheries Service, Newport, OR
Dr. Selina Heppell, Subcommittee Chair Oregon State University, Corvallis, OR
Dr. Peter Lawson, National Marine Fisheries Service, Newport, OR
Ms. Cindy Thomson, National Marine Fisheries Service, Santa Cruz, CA
Dr. Theresa Tsou, Washington Department of Fish and Wildlife, Olympia, WA

Subcommittee Members Absent
Dr. Todd Lee, National Marine Fisheries Service, Seattle, WA
Dr. André Punt, University of Washington, Seattle, WA

EAS Members in Attendance
Mr. Ben Enticknap, Oregon
Ms. Kathy Fosmark, California
Mr. Steven Fukuto, California
Mr. Don Maruska, California
Mr. Scott McMullen, Oregon
Mr. Dan Waldeck, Washington
Mr. Frank Warrens, Oregon

Others in Attendance
Mr. Steve Bodnar, Coos Bay Trawlers Association, Coos Bay, OR
Mr. Mike Burner, Council Staff, Portland, OR
Ms. Tanya Chesney, Oregon State University Graduate Program, Corvallis, OR
Ms. Yvonne deReynier, EPDT Chair National Marine Fisheries Service, Seattle, WA
Mr. John Field, EPDT Vice Chair, Santa Cruz, CA
Mr. Greg Krutzikowsky, CPSMT, Oregon Department of Fish and Wildlife, Newport, OR
Dr, Phil Levin, EPDT, National Marine Fisheries Service, Seattle, WA
Mr. Steve Marx, Pew Environmental Group, Portland, OR
Mr. José Montero, Oregon State University Graduate Program, Corvallis, OR
Mr. Corey Niles, EPDT, Washington Department of Fish and Wildlife, Montesano, WA
Mr. Tom Rudolph, Pew Environmental Group, Portland, OR
Ms. Cyreis Schmitt, EPDT, Oregon Department of Fish and Wildlife, Newport, OR
Dr. Brian Wells, National Marine Fisheries Service, Santa Cruz, CA

Meeting Objectives

1. Identify procedures, advisory bodies, and a framework for review of ecosystem condition reports, ecosystem models, and their incorporation into assessments, Council advisory materials, and strategic planning.
2. Recommend a review process and potential changes to Terms of Reference (TOR) documents for Fishery Management Plans (FMPs) to incorporate ecosystem data into stock assessments. Discuss development of a TOR for an Ecosystem Fishery Management Plan.
3. Identify critical data needs and workshops to review the state of ecosystem science as it may be applied to Council activities.
4. Meet with developers of the California Current Integrated Ecosystem Assessment (CCIEA) to discuss options for review of the structure and application of new models and evaluation tools.

General Considerations for Incorporating Ecosystem Science into Management

The integration of ecosystem considerations into fisheries assessment and management is a complex and evolving process. Ecosystem information, such as annual and decadal variability in physical processes that affect fish populations, the role of managed species in the food web, and cumulative effects of large- and local-scale events and human activities can provide valuable information for management, as discussed in the planning documents provided by the EPDT. Our discussion focused on the spectrum of ways that the information could be utilized in Council decision-making, and the level of scientific review that would be needed to assure that the tools and recommendations comply with the SSC's current standards for best available science. In general, the SSC is a review body; nevertheless, some novel aspects of ecosystem-based fishery management suggest a need for advice on *how* these considerations could be incorporated into Council activities, and over what time periods. At this stage, the recommendations are necessarily broad because there has not been an evaluation of the models or data that might be utilized.

“Ecosystem considerations” is a generic term that needs to be defined for each application or management context. There are two primary categories of ecosystem considerations that can be incorporated to west coast fishery management: variability in the physical environment that directly or indirectly affects the vital rates (growth, survival, productivity) of fish stocks, and trophic interactions that affect predators and prey. These may interact, and join the current ecosystem considerations of habitat and bycatch that have been of particular importance in FMPs since the Sustainable Fisheries Act of 1996. As employed by the North Pacific Council, these considerations can be evaluated as effects of the environment on the fishery and effects of the fishery on the ecosystem.

The Subcommittee identified several applications of ecosystem considerations to management, including general ecosystem evaluation, assessments, risk management, and reference points (Table 1). The level of review required for each application largely depends on the scientific information or tools that are used and whether the information is purely advisory, part of a longer-term strategy to reduce ecosystem impacts, or for tactical decisions such as annual harvest guidelines. As the specificity of recommendations based on ecosystem information increases (i.e., becomes more quantitative), the rigor of review and justification for modification of existing management guidelines should also increase. Some ecosystem models may be good tools to address particular management question, but lack sufficient data to parameterize the model reliably. It is the role of the SSC to establish minimum standards and best practices for adopting ecosystem-based tools and evaluations in the management process.

TABLE 1. Likely applications, value and suggested review bodies of ecosystem-based approaches to fisheries management. Note that applications that directly or quantitatively affect management decisions (tactical) require more intensive review than those that are advisory. Long-term, "strategic" applications are dependent on pre-determined management goals, and may require intensive review if they are likely to have a large effect on Council decision-making. MSE = Management Strategy Evaluation; IEA = Integrated Ecosystem Assessment (including applications of the Atlantis ecosystem model or similar approaches). Advisory body acronyms: ETT = Proposed Ecosystem Technical Team. SSC-EMS = Ecosystem Subcommittee of the Science and Statistical Committee. EAS = Ecosystem Advisory Subpanel. MT = Management Team (FMP-specific). STAT = Stock Assessment Team. STAR = External Science and Technical Review Team. STT = Salmon Technical Team. SSC-E = Economics Subcommittee of the SSC.

Application	Role	Potential "Value"	Outputs primarily Qualitative or Quantitative ?	Potential models	Suggested Review bodies
Ecosystem condition report	Advisory	Advice for setting OY, levels of precaution for ACLs; leading (1 – 4 yr) indicators of system change	Quantitative	Mostly statistical	ETT, SSC-EMS
Ecosystem status indicators for assessments	Varies, will be Advisory at first	Improve assessment	Qualitative	EBM (IEA), condition reports	ETT, EAS, SSC-EMS
Environmental drivers of recruitment, growth, etc.	Tactical (stock assessment)	Improve stock assessment, status determination criteria	Quantitative	Mostly statistical	STAT, STAR, SSC
Salmon escapement forecasts	Tactical	Improve predictions, set catch limits	Quantitative	Various; statistical correlations with environmental variables	STT, MT, SSC-EMS, SSC
Cutoffs or modifiers used in Harvest Control Rules	Strategic	Develop HCRs that consider ecosystem role or context, OY determination	Quantitative	Population model with MSE or EBM	STAT, SSC-EMS, STAR, SSC, MT
Cumulative effects evaluation	Strategic	Advice to long term planning, OY determination	Qualitative	EBM (IEA), MSE	ETT, EAS, SSC-EMS, possible STAR
Trade-offs of management approaches	Strategic	Cross-FMP effects on fisheries, communities	Qualitative	EBM (IEA) with MSE	ETT, EAS, SSC-EMS, SSC-E, possible STAR

***How* Can Ecosystem Considerations Become Part of the Council System?**

Much of the two day meeting focused on how to operationalize EBFM in the Council's current framework, concentrating on the review process for evaluating the scientific soundness of ecosystem tools and applications for fisheries management.

Advisory Committees
Regardless of whether the Council chooses to develop and adopt an Ecosystem FMP, or increase the use of ecosystem considerations in the existing FMPs, the SSC-EMS recommends that ecosystem information be reviewed and evaluated by a set of committees, similar to the Council's current ancillary bodies. This system will evolve over time, as new tools and applications are developed. Importantly, committees that are associated with evaluation of ecosystem information should coordinate review with the Technical and Management Teams of the affected FMPs, as well as the SSC when scientific information needs to be reviewed.

The following list of ancillary groups can serve as a starting point:

Ecosystem Plan Development Team - Provides initial guidance for the Ecosystem FMP and incorporation of ecosystem information into existing FMPs and stock assessments.

Ecosystem Technical Team (ETT)

Primary Duties:

a. Distill Ecosystem Status Report into FMP-specific implications (advisory information to Council – see below).
b. Identify best stocks for incorporation of ecosystem considerations in assessments.
c. Prioritize ecosystem-related research projects that could result in guidance for management, e.g., cross-FMP cumulative effects on species or habitats, forage fish harvest guidelines, identification of indicators of ecosystem status, development of tools for socioeconomic evaluation of effects on communities.
d. Serve as liaison between the Council and Science Center Integrated Ecosystem Assessment Teams.
e. Coordinate reviews and presentations of ecosystem information for the SSC and Council.

SSC Ecosystem Management Subcommittee (SSC-EMS)

Primary Duties:

a. Review work plans and products of the ETT
b. Determine when external review (STAR Panels) of models or products is needed, and lead those reviews.
c. Participate in Methodology Reviews that include ecosystem considerations.

SSC – review reports, products, and determine if "best available science" has been employed in evaluations.

Stock Assessment Teams (STATs) – should include at least one scientist with ecosystem expertise, assist with development of ecosystem considerations section of assessment.

Management and Technical Teams (MTs) – should review and provide feedback on management implications of ecosystem science products, as they affect each FMP.

Agencies

NMFS –

- Integrated Ecosystem Assessment Team – develops and runs models, evaluations.
- Provide support for consistent sampling of ecosystem indicators, including diet analysis and evaluation of ecosystem indicators.
- Summarize State of the California Current reports.

States and Tribes –

- Contribute to long term sampling or other monitoring that contributes to ecosystem-level evaluations.

Annual Ecosystem Report to the Council

A "State of the California Current" report should be developed for Council review each year, either at the November or April meeting. The purpose of this annual update is to provide information about the physical and biological conditions of the system in the previous year that have the potential to affect recruitment, distribution, or vital rates of managed stocks. Possible information to include would be El Niño/La Niña conditions, environmental indices such as the Pacific Decadal Oscillation, upwelling start and end time, extent of the hypoxic zone off the central coast, krill, copepod or crab larvae abundance, and marine mammal and seabird trends. Information in the report should be put in the context of Council management. Currently, a quarterly report of climate and ecosystem conditions in the Current available on-line at **http://pacoos.org/.** However, this report is highly technical and is not developed specifically for fisheries management applications; as such, it would need to be distilled and summarized to provide an update on the available science and ways it should be considered by the Council. The NPFMC has produced an annual Ecosystem Report (http://www.afsc.noaa.gov/refm/docs/2009/ecosystem.pdf) but the document is over 200 pages; any comparable report for the California Current would need to be summarized according to implications for each FMP to be useful for consideration in setting optimum yields (OYs) or prioritizing research needs.

Research and Data Needs

As new ecosystem-based tools are developed and adopted for Council use, the Research and Data Needs document will be refined. The goal should be to provide specific recommendations for prioritization of research or monitoring needed to improve the reliability and predictive power of ecosystem models.

SSC Review of Ecosystem Models and Products

Several products and tools have been introduced to the Council that can increase management focus on ecosystem processes. Depending on the application of those products (see Table 1), the SSC-EMS should evaluate the need for external review and reporting to the SSC, which in turn can provide recommendations to the Council about the applicability of the tools to particular management questions. Advice on model reliability and robustness to uncertainty will be an important consideration for all review bodies, including Technical Teams and Management

Teams. Modifications to existing TOR for each FMP may be needed as new ecosystem-based assessment tools are employed; if an Ecosystem FMP is developed, the SSC-EMS should draw up a TOR specific to that Plan and analyses or models that may be used under it, such as applications of Atlantis to cumulative effects modeling. The EFMP TOR authors can find guidance for best scientific practices related to evaluation of models and approaches to ecosystem-based management in two documents: *FAO Fisheries Technical Guidelines for Responsible Fisheries*. No. 4, Suppl. 2, Add. 1. Rome, FAO. (2008), and *Report of the 2nd National Ecosystem Modeling Workshop (NEMoW II): Bridging the Credibility Gap - Dealing with Uncertainty in Ecosystem Models.* U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-102 (2010).

As recommended in a recent update to the coastal pelagic species (CPS) TOR, incorporation of new tools or data that affect status determination, catch recommendations, or harvest guidelines should undergo methodology review. The SSC-EMS recommends that plausible mechanisms be provided before incorporating physical or biological factors in recruitment functions, parameter estimates, selectivity functions, catchability coefficients, or other components of a stock assessment. A sensitivity analysis that shows the effect of the ecosystem-based component should be provided, as well as model hindcasting to evaluate how previous assessment results might have been affected by the component. For example, a model to forecast salmon returns that relies on correlations of ecosystem indicators with salmon survival and age at spawning should include a plausible mechanism for the correlation and validation through hind-casting.

The value of ecosystem-based approaches and the effects of alternative management strategies that incorporate ecosystem considerations should be examined with a Management Strategy Evaluation (MSE) when feasible. MSE is a process that involves several steps and interacting models to demonstrate trade-offs in things that are affected by management (e.g., biomass, yield, probability of overfishing, status of ecosystem components) while explicitly considering uncertainty in biological processes, fishing behavior, data collection, and management response. MSE is gaining popularity as a tool to compare management options and identify which changes will most effectively achieve management goals.

Many ecosystem models are extremely complex, which may make MSE or even simple sensitivity analysis difficult. The SSC will need to consider “how high to set the bar” of review, given that very few single species models have undergone rigorous evaluations such as MSE. Nevertheless, it will be important to evaluate the trade-offs associated with adoption of new tools and strategies that include ecosystem considerations. All ecosystem-based models or status evaluations used to inform management can be evaluated for scientific rigor, and the SSC should retain its high standards for review even though the tools and applications may be novel.

Ecosystem effects reports for stock assessments

The North Pacific FMC and some eastern FMCs are adding a section of ecosystem considerations to single species assessments, even if ecosystem processes are not directly included in the assessment model. Such information may be valuable in subsequent assessments for identifying forcing factors that may have impacted the distribution or status of the stock. The scope and level of detail of a required ecosystem considerations component will evolve over time as new analyses and tools are reviewed. The NPFMC guidelines can serve as an initial template

(Box 1); each assessment would require at least a qualitative treatment of the items listed. The required section should focus on relevant data on ecosystem processes that may affect stock or parameters in the stock assessment in the future (including potential impacts of changes in other fisheries). It is expected that text on the basic ecosystem considerations for a stock would be consistent among assessments, but a timely condition report for some or all components would be a valuable addition. One component of the CCIEA that is currently under development is a species-specific "ecosystem report card" that could serve as a report for an assessment.

Box 1. Excerpt from the NPFMC's Stock Assessment and Fishery Evaluation Guidelines, outlining required components for the ecosystem considerations section of stock assessments.

Adding an ecosystem reporting component to stock assessments would require additional time and expertise. STATs could add an ecologist, oceanographer, or other scientist with expertise in ecosystem processes and the assessed stock to review and compile relevant data and help write this section of the assessment. Identifying collaborators for this role will also help the SSC-EMS and ETT to find the required expertise for methodology reviews.

Ecosystem Effects on the Stock

The following factors should be discussed:
Prey availability/abundance trends (historically, in the present, and in the foreseeable future). These prey trends could affect growth or survival of a target stock.

1) Predator population trends (historically, in the present, and in the foreseeable future). These trends could affect stock mortality rates over time.

2) Changes in habitat quality (historically, in the present, and in the foreseeable future). Changes in the physical environment such as temperature, currents, or ice distribution could affect stock migration and distribution patterns, recruitment success, or direct effects of temperature on growth.

Fishery Effects on the Ecosystem

The following factors should be discussed:

1) Fishery-specific contribution to bycatch of prohibited species, forage (including herring and juvenile pollock), HAPC biota (in particular, species common to the target fishery), marine mammals, birds, and other sensitive non-target species (including top predators such as sharks, expressed as a percentage of the total bycatch of that species.

2) Fishery-specific concentration of target catch in space and time relative to predator needs in space and time (if known) and relative to spawning components.

3) Fishery-specific effects on amount of large-size target fish.

4) Fishery-specific contribution to discards and offal production.

5) Fishery-specific effects on age at maturity and fecundity of the target species.

6) Fishery-specific effects on EFH non-living substrate (using gear specific fishing effort as a proxy for amount of possible substrate disturbance).

Application of ecosystem models to harvest control rules

Harvest control rules (HCRs) and status reference points used for management may benefit from incorporation of ecosystem considerations if the models or statistical analyses used to develop harvest guidelines are robust to uncertainty. Because of the role of forage fishes in marine food webs, and the current use of "cut-offs" for harvestable biomass in the sardine and mackerel assessments, an exploration of ecosystem considerations for CPS stocks seems to be an obvious place to start. Desirable model and analysis characteristics include: uncertainty evaluation, simulation consistency, and strong evidence that the alternative approach meets management goals better than the status quo. The effects of ecosystem-based control rules on the fishery and target stock can be evaluated with an MSE, although trade-offs in ecosystem response may be more difficult to model. Rigorous evaluation of ecosystem-based harvest control rules in an ecosystem context may not be possible with existing data, particularly on diet and distributions of predator and prey species.

Regardless of the model chosen or the issues raised, it was agreed that the appropriate review process is to have a review panel of SSC and outside experts delve into a detailed review which is presented to the full SSC for review. The Methodology Review TOR documents should be reviewed or updated to include review of ecological approaches to developing harvest control rules.

Review of Existing Science in Support of Ecosystem-Based Management

The group discussed a number of data deficiencies and model evaluation needs that should be prioritized as ecosystem information is incorporated into Council processes. This will require an update of the Research and Data Needs document.

Review of Model Structure, Parameterization and Assumptions
While specific applications of ecosystem considerations to Council operations will be reviewed individually, models such as Ecosim/Ecopath and Atlantis are likely to be used to explore a variety of questions the affect fisheries management. The SSC could benefit from a review of the basic model structure, data requirements, and critical uncertainties and assumptions of these models. The SSC-EMS recommends a workshop to review the state of the art in ecosystem science, particularly models that would likely be applied to west coast fisheries. The workshop should cover the following: What models are available, what data are available, what can/cannot be evaluated, which models are ready for intensive external review? Some of this has been done by the EPDT, and it would be prudent to hold such a workshop after specific applications of ecosystem-based tools have been explored by the Council or CCIEA Team.

Biological/Oceanographic Information needs
The SSC-EMS is concerned about scientific uncertainty in the CCIEA and modeling tools that have been presented to date. In particular, a time series of diet and trophic interactions is not available for the California Current, and ecosystem models are sensitive to the trophic relationships among species. Existing groundfish surveys could collect and analyze stomach samples to get the time series started, and the CCIEA Team is compiling data on diets of top-level predators such as seabirds and marine mammals. Oceanographic information is largely available, but exists at different spatio-temporal scales that may not match those that are relevant to West Coast fisheries. Evolving uses of Ocean Observation Systems to monitor physical conditions of the system should improve our ability to link fish population dynamics and distributions to oceanography, but the information most relevant to our fisheries may not yet be available.

Ecosystem Considerations in Socioeconomics
Good cross-FMP analyses were suggested by the Ecosystem Plan Development Team, including: (1) summary of cumulative bycatch in all FMP fisheries, (2) characterization of spatial/temporal patterns of fishing effort, (3) consideration of cumulative effects of management actions in terms of effort shifts between FMP fisheries and also between FMP and non-FMP fisheries. Some of these analyses could be done now, and can be prioritized with help from the ETT and SSC-EMS.

Coastal communities are best considered in terms of cumulative effects across FMPs, but the desired outcome of community 'well-being' is difficult to define and measure. "Vibrant" and

"resilient" are terms that are often used to describe desired community characteristics, but these terms are often ill defined and the resulting analyses tend to be qualitative and general. Currently there are few if any meaningful indicators of well-being. Without an operational definition of well-being there can be no good way to forecast how management actions affect community well-being. If we are to develop economic indicators to examine the trade-offs associated with ecosystem-based approaches to fisheries management, we need to develop better metrics for measuring community effects and socioeconomic impacts. For example, effort shifts could be evaluated by quantifying fishing patterns as changing predator responses to available prey, with the added drivers of markets and other social factors.

The SSC-EMS and SSC-ES recommend a workshop to develop guidelines on how ecosystem information can be included, developed, or reviewed for socioeconomic impacts; this will be a topic discussed at the National SSC meeting in October, 2011. Our workshop topics could include development of alternative definitions of community well-being, as well as measurable and meaningful indices of well-being that can be linked to Council actions. Workshop participants should include regulatory analysts, managers, economists and social scientists who are currently working on these issues, but also individuals with relevant expertise who have not been previously consulted (e.g., economic geographers), individuals who have had some success in considering community effects in other (non-fishing) resource management contexts, and/or individuals who have expertise on economic/policy issues associated with other coastal issues, such as harbor management. The SSC Subcommittees can work together on the scope and planning of this workshop.

California Current Integrated Ecosystem Assessment
Dr. Phil Levin (NWFSC) presented an overview of the CCIEA. The Assessment is a process involving multiple models and synthesis products that addresses "the science needed for a healthy California Current." Initiated after an external review of ecosystem science in 2006, its purpose is to organize the relevant science of ecosystem processes, assess the stressors and conditions of the ecosystem, and provide strategic advice to management. A current report has been distributed to the Council and is available at www.nwfsc.noaa.gov/publications/iea.pdf.

The CCIEA is not a single model, but rather a collection of models that are used as a toolbox.
The spatial scale of evaluations is generally the entire California Current but some analyses also try to look at how CC-wide indicators reflect upon more local conditions. Current status evaluations are based on the most recent 5-year period. Currently, salmon and 17 groundfish species representing different feeding guilds (trophic levels) are being modeled; seabirds and mammals will be added over the next year.

While the CCIEA can serve as an advisory document now, the IEA Team is particularly interested in working with the Council to develop or modify their existing ecosystem-based assessment tools to address particular questions posed by management. The IEA process to date has involved three primary approaches: collation of information on the effects of ecosystem components or stressors on particular species, evaluation of correlations between physical and biological conditions and recruitment (particularly salmon in the southern CC region, as presented by Brian Wells from SWFSC), and development and parameterization of the ecosystem model Atlantis for evaluation of indirect and cumulative effects of fisheries and

ecosystem change on the CC system. A current emphasis of the program is identification of indicators of ecosystem condition that can predict future change. All of these approaches and tools have the potential to benefit PFMC (see Table 1). Considerable interaction among the IEA team, SSC, EPDT, and EAS will be needed to accomplish the Council's ecosystems-based fishery management goals.

Sensitivity analysis is the first level of uncertainty analysis used for review of stock assessments – not only for this Council but throughout the fisheries world. Because of the large number of parameters, it is difficult (in some cases, impossible) to conduct comprehensive sensitivity analysis of a complex ecosystem model like Atlantis. This creates a level of scientific uncertainty and obscurity that could be problematic for review when the model is used for a prescriptive (tactical or strategic) application to fisheries management. The CCIEA Team is keenly aware of the need for scientific rigor and evaluation of the consistency of model results when parameter or model structure uncertainty is considered, and will work with the SSC on reasonable guidelines for sensitivity analysis in model and application review.

Tasks to meet short term implementation goals

The SSC-EMS reviewed recommendations by the EPDT for implementing ecosystem-based management, including a timeline for incorporation of ecosystem considerations into stock assessments and development of ecosystem status reports. The Subcommittee agrees with the general plan to gradually incorporate ecosystem considerations, starting with the next assessment cycle and upcoming methodology reviews for CPS stocks. Once the Council has determined if and when an Ecosystem FMP is to be developed, the SSC-EMS can begin work on a TOR for that Plan. Modifications to existing FMP TORs can begin as soon as the SSC Subcommittees will allow, and should include consultation with the SSC-EMS and each FMP Management Team. Finally, the SSC should discuss options for ecosystem workshops in 2012, including a model review workshop and development of socioeconomic indicators workshop.

Subcommittee Recommendations

- Incorporation of ecosystem considerations into management will continue to be an evolving process. All science can and will be reviewed and held to a high standard of scientific rigor, but the precise nature of those reviews will depend on specific applications (Table 1).
- The best framework for employment of an Ecosystem Fishery Management Plan is one of advisory and science teams, similar to the existing FMPs. This should include an Ecosystem Technical Team and an Advisory or Management Team. The SSC-Ecosystem Management Subcommittee expects to take a role as a bridge between these teams and the SSC. This framework may be valuable even if an Ecosystem FMP is not developed in the short term.
- Ecosystem information is available now to provide advice on physical processes, habitat, and food web dynamics that are affecting Council managed stocks. However, this information needs to be distilled into a useful product for Council review and discussion.
- An ecosystem considerations section should be added to all stock assessments, starting with the 2013 assessment cycle. The detail and length of the section will vary and evolve over time. Stock assessment teams should include a scientist with expertise in ecosystem processes and the affected stock to assist with this section development and stock assessment review.
- The SSC will need to modify Terms of Reference for each FMP to include review of ecosystem consideration sections of assessments and application of ecosystem processes in assessments and harvest control rules. The next revision of the Research and Data Needs document should explicitly include needs for ecosystem models.
- Workshops should be planned to discuss ecosystem models and their application to biological and socio-economic evaluations.
- The Council should identify an Ecosystem Technical Team to work with developers of the CCIEA to prioritize applications of the models to specific questions, such as cumulative effects evaluation and forecasting models for salmon.

The SSC-EMS thanks the EAS, EPDT and other meeting attendees for a fruitful discussion, and looks forward to continued collaboration on this important and evolving topic.

PFMC
05/24/11

SALMON TECHNICAL TEAM REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

The Salmon Technical Team (STT) endorses the consideration of ecosystem principles in managing ocean salmon fisheries. As described in the draft Ecosystem Management Plan (EMP), current management of salmon includes limited ecosystem considerations in forecasts of some stocks and through management constraints for protected resources. The STT and the broader scientific community, continue to explore the use of a variety of physical and biological ecosystem interactions in forecasting salmon abundance and establishing appropriate management objectives.

Though Council area fisheries impact salmon primarily within the California Current Ecosystem, because of their complex life history and migratory behavior, salmon stocks managed under the Council's Salmon Fishery Management Plan are also components of freshwater and estuarine ecosystems and, to a lesser extent, the Alaskan Gyre. They also provide important nutrient inputs to riparian corridors of terrestrial ecosystems. Ecological interactions in these other systems must also be considered in managing ocean salmon fisheries.

The Council currently administers four separate plans to manage fisheries for salmon, groundfish, coastal pelagics, and highly migratory species within the California Current Ecosystem. The idea of consolidating these plans into an all-encompassing EMP has a certain appeal. On the surface, it would appear that there may be an opportunity to eliminate redundancies, improve the coordination between FMPs, and streamline the management of all of these fisheries. However, except for limited interaction between fisheries for salmon and highly migratory species, these fisheries are largely independent, with different fleets operating in different times and areas, using different gears, with different ecological impacts, delivering to different markets, and having different data needs, and management timelines. Consolidating their management would be far more likely to encumber the process of managing all of these fisheries rather than streamline it.

Concepts of ecosystem management are relatively new and evolving. Ecosystem models, though highly complex, are gross oversimplifications of the actual systems whose behavior they attempt to explain. Yet they still suppose that we know much more about interactions and functionality of ecosystems than we really do. Evolution of these models is at a stage where they are still attempting to further our understanding of how ecosystems function, and the science has not matured to the point where it is capable of providing defensible quantitative advice. While the STT endorses the incorporation of ecosystem considerations into the management of salmon stocks and fisheries, we believe that it would be premature to incorporate regulatory authority in an EMP in the foreseeable future.

PFMC
05/24/11

ECOSYSTEM PLAN DEVELOPMENT TEAM REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN

The Ecosystem Plan Development Team (EPDT) wishes to thank the suite of Council advisory bodies for their many thoughtful comments on and insights into the Council's ecosystem fishery management planning process. Should the Council move forward with an ecosystem fishery management planning process, the ideas provided in those comments will be helpful in developing that process and any planning documents.

Plan Purpose and Need

The EPDT reviewed the advisory body and public comments received on drafting a Purpose and Need statement. Based on that review, and the EPDT's statement from its September 2010 report, the EPDT drafted the following revised statement, which is intended to be applicable to any planning document, regardless of whether that document has regulatory authority.

The purpose of an [ecosystem planning document] 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 FMPs and the California Current Ecosystem (CCE). An [ecosystem planning document] should provide a framework for considering policy choices and trade-offs as they affect FMP species and the broader CCE.

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

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

The EPDT refers the Council and the public to its March 2011 Discussion Document, particularly Section 4.2, "Science Questions for Future Considerations," for the EPDT's initial recommendations on scientific information and analyses the EPDT believes are important to informing the Council process on many of the science and research issues defined within the above *Needs* list.

Regulatory Authority

With regard to the Council's second task to "Provide guidance on whether the Ecosystem Plan should have regulatory authority and management unit species," the EPDT broadly sees three potential choices:

1. *Status quo*: This option would mean not moving forward with coordinated ecosystem fishery management planning at this time and risks derailing the forward progress the Council and its advisory bodies have already made in bringing more ecosystem science into the Council process. This option could result in uncoordinated and inefficient implementation of ecosystem considerations within the individual FMPs.

2. Advisory Fishery Ecosystem Plan (FEP): The benefit of this option is that, consistent with the EPDT's Purpose and Needs statement, above, it would foster coordinated progress to bring ecosystem science into Council decision-making processes. This option also has the benefit of focusing Council attention on the interactions across FMP species and between FMP and non-managed species. If the Council ultimately wishes to move toward new regulatory programs outside of its existing FMPs, this option would bring new scientific analyses into the Council process, and more time for the Council to evaluate that scientific information and determine whether it needs regulatory authority beyond that provided in its species-specific FMPs. The main cost associated with this option is a potential delay in implementing new regulatory programs for species that are currently outside the scope of existing FMPs. The EPDT also discussed the potential to draft an FEP that was initially structured to facilitate future conversion to an EFMP—should the Council decide to do so.

3. Ecosystem Fishery Management Plan (EFMP): This option would also foster coordinated progress on bringing ecosystem science into the Council process. An additional benefit of this option is that the Council would have regulatory authority to develop conservation and management measures for non-managed species that do not easily fit within current FMPs. However, for this process to be effective, the Council would need to define an initial list of species for as an EFMP's fishery management unit for potential regulation and the conservation objectives they wish to achieve for those species. The main cost of this option in the near-term is more focus on species-by-species management, at the expense of a broader ecosystem approach that explores interactions across FMP species and between FMP species and non-managed species.

The EPDT met with Mr. Judson Feder, NOAA General Counsel Southwest to request clarification on several issues concerning the need for regulatory authority that might be relevant to the Council's choice of ecosystem planning document. We list the most relevant questions below, with a paraphrasing of his answers provided in italics:

1. How could a fishery management plan prohibit all fishing activities or the removal of living marine resources (i.e. "no-take" regulations) in an area? Can this be achieved under the Council's existing authorities and FMPs? *Possibly, depending on the administrative record; must be related to the conservation and management needs of management unit species or*

their essential fish habitat, and must comply with the Magnuson-Stevens Act at §303(b)(2)(C) – see EPDT September 2010 discussion document at page 7.

2. May a fishery management plan have only ecosystem component species, and no fishery management unit species? *No.*

3. May a vessel fish in the US exclusive economic zone, or land a fish species on the West Coast, without a license or other permission if the species is neither an FMP species nor managed by a State? *Yes, unless otherwise prohibited by a State or Tribe, or by the federal list of fisheries at 50 CFR 600.725.*

Recommendations

Regardless of whether the Council chooses an FEP or an EFMP, the EPDT recommends the following next steps:

1. Continue to develop science and research plan in accordance with recommendations from EPDT's March 2011 report, comments of the SSC Ecosystem-Based Management Subcommittee and the SSC itself, and input from Council advisory bodies.
2. Upon adopting a Purpose and Need Statement and making recommendations on regulatory authority, the Council might provide guidance on a future EPDT report that would draft options for an outline and structure for the recommended planning document.

PFMC
06/11/11

GROUNDFISH ADVISORY SUBPANEL REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN (FMP)

The Groundfish Advisory Subpanel (GAP) received information from Mr. Mike Burner about prior Council consideration of development of an ecosystem plan. Mr. Burner also reviewed the reports from Council advisory committees. The GAP perceived a common theme amongst the various advisory bodies that there would be benefit to the Council process by inclusion of ecosystem-related information into the stock-specific Fishery Management Plans (FMPs), stock assessments, and Council decision-making. The advisory bodies also generally agreed that an ecosystem plan should be informational, should not supplant current FMP authorities, and should not create new regulatory authorities at this time. The GAP agrees with these recommendations.

The GAP discussed the North Pacific Fishery Management Council (NPFMC) Fishery Ecosystem Plan approach, which appears similar to the approach outlined by the Ecosystem Advisory Subpanel. The GAP believes that a structured approach similar to what is done by the NPFMC would provide the appropriate vehicle for bringing ecosystem-related information into the Pacific Council process.

Finally, the GAP highlights several issues that should be considered as the ecosystem plan is developed:

- Equal weight should be given to economic information as to biological information developed for and used by the ecosystem plan.

- Ensure that ecosystem information is distilled to a level such that it is easily understood by the Council and its advisory bodies. We should be able to understand the information presented and the value it adds to the Council process.

- Prioritize analysis and use of information that is readily available and known to be useful rather than reaching too far too fast, for example, information from the annual CalCOFI State of the California Current Ecosystem (CCE) Report and the developing CCE Integrated Ecosystem Assessment.

PFMC
06/10/11

HABITAT COMMITTEE REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

DRAFT (May 26 version)

As requested by the Council, the Habitat Committee (HC) reviewed the Ecosystem Plan Development Team's (EPDT's) draft Purpose and Needs Statement included in "Ecosystem Fishery Management Planning for U.S. West Coast Fisheries" (Sept 2010, Section 3.2) (referred to here as the Planning Document) and provides comments on whether the plan should have regulatory authority. The HC also reviewed and commented on the Discussion Document (March 2011).

The Habitat Committee commends the EPDT on these materials and for helping to advance understanding of the benefits of ecosystem based fishery management (EBFM).

Comments on the Purpose and Needs Statement (Planning Document)

The EPDT's proposed purpose statement, Section 3.2 of the September Planning Document, states: "The purpose of an EFMP is to guide expansion of the Council process from species-specific management programs to include ecosystem science and broader ecosystem considerations and management policies that coordinate Council management across its fishery management plans (FMPs) and the California Current Ecosystem (CCE)."

The Habitat Committee suggests the following wording:

"The purpose of an Ecosystem Fishery Management Plan is to incorporate ecosystem science, principles and management policies within the Council process to ensure healthy, sustainable fisheries and a productive, resilient CCE."

The HC recommends the needs statement of an EFMP (Section 3.2) be directed towards action by adopting the following language:

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

1. To provide information on climate and habitat conditions and ecosystem productivity to improve management decisions.

2. To ensure appropriate safeguards in fisheries management measures that adequately buffer against environmental and human-induced threats and uncertainties.

3. To address impacts from fishing and non-fishing activities.

4. To ensure conservation of habitat (physical, chemical, biogenic) structure, function and productivity necessary for all life stages of species in the CCE.

5. To ensure FMP management measures take into account the ecosystem needs of all CCE species (e.g., seabirds, marine mammals, marine invertebrates and biogenic habitat) to the extent practicable.

6. To coordinate information across FMPs within the Council process and during consultations between the Council and other managing entities.

Comments on Regulatory Authority and Management Unit Species:

The HC did not come to a conclusive recommendation on whether or not an ecosystem FMP should have regulatory authority, but does see great value in the regulatory "Umbrella Plan" as summarized in Table 5.1 of the Planning Document, "Umbrella EFMP with Selected Fishery Management Unit (FMU) and Ecosystem Component (EC) Species."

The HC supports the Umbrella Plan for the following reasons:

- A regulatory EFMP "Umbrella Plan" addresses species for which there is not a current or likely future fishery. This could include deep sea corals and sponges, forage fish, and other ecosystem component species that could be assessed and monitored to indicate ecosystem health.

- In terms of National Environmental Policy Act (NEPA) review, a regulatory EFMP would create a more proactive approach for impact analyses and would contribute to more holistic analyses by adding an ecosystem-wide focus. This would serve the Council's interests as marine spatial planning, offshore energy development, aquaculture development, and other competing interests emerge.

- Having a regulatory plan would strengthen the Council's ability to manage the water column and other areas for which there is no clear link to essential fish habitat (EFH) or habitat area of particular concern (HAPC).

The HC recognizes there are challenges with transitioning to any EFMP, whether regulatory or not, but believes that a regulatory approach offers clear benefits. The Council's advisory bodies could provide a more informed recommendation if the EPDT further developed an explanation of the differences between a Fishery Ecosystem Plan and the regulatory umbrella EFMP.

Comments on the Discussion Document (March 2011)

Existing ecosystem-based management measures contained in FMPs

The HC believes the EPDT has comprehensively summarized current ecosystem-based measures in its review of EFH provisions. However, the HC notes that not all management measures within an FMP necessarily align with ecosystem principles. The HC suggests that as part of the EFMP process, the Council consider a review of all the management measures within each existing FMP, as well as their goals and objectives, to align them more closely with the ecosystem management policy ultimately adopted by the Council.

Research and information needs

The HC found the Discussion Document's coverage of research and information needs (Section 4.2) to be comprehensive. However, Appendix A of this document includes additional recommendations for further consideration by the EPDT.

Input on NOAA's California Current Integrated Ecosystem Assessment (CCIEA) for science products to inform Council decisions

The HC provided input to the Council on NOAA's CCIEA in the HC's March 2011 report, and provides additional comments in Appendix B.

Desired direction for ecosystem fishery management policy; needed policy and science analyses

The HC focused on how consideration of EFH can be made more efficient and comprehensive through an EFMP and looked at the nexus between EBFM and EFH. These observations are in Appendix C.

Appendix A

Research and information needs

The HC found the Discussion Document's coverage of research and information needs (Section 4.2) to be comprehensive. However, the HC has a number of specific recommendations:

4.2.1 Cross-FMP needed future ecosystem considerations

- Bullet 1 (pg 19): Specifically note the CCIEA indicators (upwelling, sea surface temperatures, Pacific decadal oscillation, chl-a, zooplankton index) for correlation with fish production. Also note how these CCIEA indicators correlate with seabird colony success.
- Bullet 3 (pg 19): Examine ecological interactions with non-managed species for effects on these populations (i.e., affects on seabirds by harvesting forage fish species, with consideration for environmental stressors).
- Bullet 4 (pg 19): In order to assess bycatch data or discards, modifications of logbook programs are required.
- Bullet 10 (pg 19): Expand on how the Habitat Assessment Improvement Model (HAIP) can contribute. For example, incorporate habitat data into stock assessment models (using HAIP list of habitat characteristics, which includes most ecosystem components).
- Bullet 11 (pg 19): In addition to spatial scale, add geographic range (i.e., "sub-ecosystems within the CCE).
- Bullet 13 (pg 19): When assessing nearshore ecosystem affects, include state-managed species.

Section 4.2.2 Groundfish FMP needed future ecosystem considerations

- Incorporate HAIP recommendations for initiation of demonstration projects that incorporate habitat data into stock assessment models (using HAIP list of habitat characteristics which includes most ecosystem components).
- Incorporate into stock assessment the spatial structure of GF populations in response to climate change (spatial structure is identified as an ecosystem indicator in the CCIEA).
- When discussing recruitment being affected by environmental factors (p. 21), the document mentions that assessors considered decreased kelp habitat in southern California due to increased ocean temperatures as a contributing factor to declining numbers of blue rockfish. Because distribution data for submerged aquatic vegetation on a regional scale is often limited or non-existent, it may be appropriate to identify regional habitat monitoring programs as a research need that could improve the assessors' ability to identify these types of linkages.
- (Page 22) In the salmon FMP, the document mentions marine distribution and habitat use, which was identified as an obvious data gap during the EFH review. This data could be used for many purposes, such as avoiding the harvest of stocks of concern, refining EFH or designating HAPCs. However, the document only mentions satellites and electronic tagging. Genetic stock identification (GSI) should be included, especially given the efforts conducted off California and Oregon in recent years.
- Bullet 6 (p. 22): The quantity and timing of freshwater should also be included.

- Determine societal benefits by comparing short-term ecosystem conservative measures (i.e., reduce harvest of forage fish and top predator fish) vs. long-term gains in fish populations (i.e., increased biodiversity and abundance)?
- Incorporate seabird population and ecology information to develop seabirds as indicator species for ecosystem health, as well as to assess impacts to seabird prey species from fishing; see http://doc.nprb.org/web/05_prjs/516_final_report.pdf. Seabird ecologists with expertise in ecosystem effects include George Hunt (University of Washington)[1] or William Sydeman (Point Reyes Bird Observatory [PRBO]).
- Incorporate into stock assessment the spatial structure of groundfish populations in response to climate change (spatial structure is identified as an ecosystem indicator in the CCIEA).

[1] http://fish.washington.edu/people/hunt/

Appendix B

Input on NOAA's CCIEA for science products to inform Council decisions

The HC provided input to the Council on NOAA's CCIEA in the HC's March 2011 report and has the following recommendations to add:

- Consider how available invertebrate survey data (time series) could inform EBM. Incorporate seabird population and ecology information to develop seabirds as indicator species for ecosystem change, as well as to assess impacts to seabird prey species from fishing; see http://doc.nprb.org/web/05_prjs/516_final_report.pdf. Seabird ecologists with expertise in ecosystem effects include George Hunt (University of Washington)[2] or William Sydeman (PRBO).
- Examine ecological interactions of managed and non-managed species for effects on these populations (i.e., affects on seabirds by harvesting forage fish species, with consideration for environmental stressors).
- The CCIEA should consider how management of non-FMP species (state-managed Dungeness crab, pink shrimp) affects managed species and the ecosystem, if it already doesn't do so.

[2] http://fish.washington.edu/people/hunt/

Appendix C

Desired direction for ecosystem fishery management policy; needed policy and science analyses

The Habitat Committee focused on how consideration of EFH can be made more efficient and comprehensive through an EFMP and looked at the nexus between EBFM and EFH. The Habitat Committee shares the following observations:

An EFMP that integrates aspects of EFH review among the different FMPs may create efficiencies and provide a more holistic picture of the habitat issues affecting Council managed fisheries. For example, integrating non-fishing effects and conservation recommendations into a centralized document (an EFMP or a separate non-fishing impacts document) would be useful for consulting biologists, given the overlap among these threats. Similarly, combining gear effects and EFH maps into one document would also be useful. However, the Magnuson-Stevens Act requires each FMP to contain these sections. Looking across the FMPs could also help identify data gaps, priority habitats, and aid in leveraging funding to collect data (e.g., nearshore habitat mapping).

Combining EFH reviews for multiple FMPs raises several concerns. Although it could be more efficient in the long term, initially it would require significant funding, dedicated staff, and a phased application to make the transition from single EFH review to combined EFH review feasible and manageable. Such a phased approach should consider "lessons learned" from the separate EFH reviews. These lessons would give insights into the feasibility of doing separate or combined EFH reviews (including costs, staff and time). It is possible that only sections of EFH reviews should be combined (e.g., non-fishing effects).

PFMC
05/31/11

HIGHLY MIGRATORY SPECIES ADVISORY SUBPANEL REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

The Highly Migratory Species Advisory Subpanel (HMSAS) met with Mr. Mike Burner, Staff Officer for the Ecosystem Plan Development Team (EPDT), at the April 2011 Council meeting. The HMSAS also reviewed the two briefing papers developed by the EPDT (Agenda Item H.1.b, EPDT Report, Attachment 1, September 2010; Agenda Item J.1.c, EPDT Report, Attachment 1, March 2011). These reports contain a great wealth of information on the objectives of ecosystem-based fisheries management but can be difficult for the general reader to comprehend because of their length and the frequent use of many acronyms. The HMSAS has the following comments with respect to these reports:

1. The section on Regulatory Scope and Management Unit Species in the September 2010 report contains a lot of information that relates to what is happening at the Council level. The HMSAS would like more time to review and discuss its contents with assistance from Mr. Burner and/or the Chair of the EPDT. More generally, the HMSAS requests that it be kept informed of the work of the EPDT.
2. Information on ecosystem science in an Ecosystem Fishery Management Plan (FMP) could help the Council make informed decisions and recommendations on biological reference points and management measures for HMS. Specifically, the development of ecosystem indicators, status reports, and integrated ecosystem assessments could be positive outcomes from an Ecosystem FMP. The September 2010 report notes that "Both long- and short-term changes in distribution and abundance of individual species, subsequent changes in fishing grounds, shifts in fishing effort among species and changes in market demand, can all have major ecosystem effects." This underscores how an Ecosystem FMP could facilitate the delivery of relevant information to the Council.
3. Increasing the data used for establishing fish stock predictions can only be a healthy and positive action for our fisheries.
4. Increasing our understanding of the biological inter-connections is a key objective of ecosystem-based management. The Council should embrace and support this objective in relation to the goal of managing fisheries sustainability.

While the HMSAS believes an Ecosystem FMP could create a mechanism to provide useful ecosystem-related information to the Council, the HMSAS does not support an ecosystem plan that has a regulatory component. Regulatory authority could create another layer of bureaucracy that does nothing to benefit or sustain fishermen in their efforts to supply products to the consumer. Ecosystem-based management should only be incorporated into the Council process in a way that does not result in more paperwork, fees, and regulation.

The international aspect of HMS must be recognized when considering ecosystem-based management. Conservation measures are developed by the Inter-American Tropical Tuna Commission and Western and Central Pacific Fisheries Commission and the conventions for both these organizations recognize the role of the ecosystem in fisheries management. The Council will need to keep abreast of any ecosystem-related initiatives coming from these two commissions and insure the U.S. does not initiate measures not recognized by these regional fishery management organizations.

Finally, an Ecosystem FMP should not eclipse the current management framework in the HMS FMP.

PFMC
05/27/11

HIGHLY MIGRATORY SPECIES ADVISORY SUBPANEL REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

The Highly Migratory Species Advisory Subpanel (HMSAS) makes the following addition (underlined) to paragraph 2 of their list of comments on the Ecosystem Plan Development Team reports they reviewed:

2. Information on ecosystem science in an Ecosystem Fishery Management Plan (FMP) could help the Council make informed decisions and recommendations on biological reference points and management measures for HMS. Specifically, the development of ecosystem indicators, status reports, and integrated ecosystem assessments could be positive outcomes from an Ecosystem FMP. The September 2010 report notes that "Both long- and short-term changes in distribution and abundance of individual species, subsequent changes in fishing grounds, shifts in fishing effort among species and changes in market demand, can all have major ecosystem effects." This underscores how an Ecosystem FMP could facilitate the delivery of relevant information to the Council <u>but should only be utilized through the existing Highly Migratory Species FMP</u>.

PFMC
06/07/11

HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM REPORT ON ECOSYSTEM FISHERY MANAGEMENT PLAN

As the Council requested at its March meeting, the Highly Migratory Species Management Team (HMSMT) reviewed materials prepared by the Ecosystem Plan Development Team (EPDT) and Ecosystem Advisory Subpanel (EAS) and provides the following comments and recommendations on 1) the purpose and need for the Ecosystem Plan and 2) potential regulatory authority for the Fishery Ecosystem Plan (FEP).

Purpose and Need

The HMSMT concurs with the potential goals and objectives outlined by the EPDT on page 5 of their September 2010 report (Agenda Item H.1.b, Attachment 1). In general, integration and consideration of a greater set of factors affecting Council-managed species and fisheries may lead to improved decision-making and goal achievement.

The proposed geographic scope for the Council's Ecosystem Plan is the California Current Ecosystem (CCE). Compared to most Council-managed species groups, the CCE covers only a small portion of the geographic range for most Highly Migratory Species (HMS), though a few, such as common thresher shark, largely occur within the CCE.

Even though HMS and fisheries are not completely encompassed within the CCE, the HMSMT believes that Council management of HMS species and fisheries can benefit from an ecosystem approach. For example, an Ecosystem Plan could (1) greatly aid in the analyses of cumulative impacts and climate change implications; (2) help to monitor impacts to bycatch, non-target species, and related species that may be indirectly affected, such as prey and predator species; (3) include a comparison of essential fish habitat (EFH) for ecosystem component (EC) species and fishery management unit (FMU) species included in all U.S. West Coast FMPs; (4) consider overlaps, gaps, and cumulative impacts across fisheries from a broader, more holistic perspective when considering species-specific or FMP-specific management measures; (5) support Council positions before various decision-making bodies; (6) inform rulemakings; and (7) provide documentation for recurrent reporting needs such as National Environmental Policy Act (NEPA) analyses.

Regulatory Authority

The HMSMT recommends that the Council carefully consider how it might best use ecosystem information in its decision-making before granting any regulatory authority to an Ecosystem Plan. The Council should have a good understanding of the state of ecosystem information available for the West Coast, including variability in environmental, biological, and socio-economic information. Also, ecosystem models for the CCE are just being developed to integrate available information and evaluate policy strategies; like stock assessment models, these should be tested and evaluated by the Scientific and Statistical Committee before decisions are based upon their results. Another benefit from a test period would be the chance to learn what personnel resources will be needed and how long various activities or steps in the decision-making process will require for completion. Lastly, an opportunity to evaluate how to apply an ecosystem approach to Council decision-making can help minimize unintended consequences.

Therefore, at this time, the HMSMT recommends developing an informative "advisory FEP," as described in Table 5.1 of the September 2010 EPDT report, that would be updated regularly, perhaps annually, but which would lack regulatory authority. This FEP should establish a framework/process that will: 1) provide information to the Council on the current state of the CCE related to species managed under Council FMPs; and 2) introduce ecosystem considerations into Council decision-making.

In the short-term, this process would increase ecosystem-based planning during the development of regulations under the authority of the Council's current FMPs and amendments. Over the long-term, the Council's experience with considering ecosystem effects in decision-making could lead to authorities and processes that expand the scope for ecosystem-based regulatory actions.

Focusing on developing a framework (e.g., decision criteria) and decision processes emphasizes that FEP development is not primarily about producing a document. Instead, by documenting objectives and procedures it will create an organizing mechanism for ideas as they are developed and foster commitment by the Council to actively take ecosystem considerations into account in their decision-making.

If regulatory authority were immediately pursued, the HMSMT feels that the most appropriate format is the "umbrella EFMP with selected FMU and EC species" as described in Table 5.1 of the EPDT's September 2010 report.The characterization of HMS in the HMS FMP, including changes proposed under Amendment 2, includes 11 FMU species (albacore, bluefin tuna, yellowfin tuna, bigeye tuna, skipjack tuna, common thresher shark, shortfinmako shark, blue shark, swordfish, striped marlin and dorado), eight EC species (pelagic thresher shark, bigeye thresher shark, pelagic stingray, wahoo, common mola, escolar, lancetfishes and louvar), and nine prohibited species (white, basking and megamouth sharks, Pacific halibut and five species of Pacific salmon). Any of the HMS FMP EC or prohibited species could be considered for inclusion in an "umbrella EFMP" as well as a number of associated species taken in HMS fisheries that are not currently managed under the HMS FMP (with Amendment 2 changes) but were listed as monitored under the original FMP (for example, opah, bonito, several marlin species, Pacific saury, etc.). Forage species that are not currently managed under an existing FMP, such as Pacific saury, hake, barracudinas, pelagic red crab, jumbo squid and other cephalopods could be considered for inclusion in an EFMP. Management of many of these species, however, may be hindered by a lack of adequate information upon which to make sound decisions.

<u>Recommendations</u>

The HMSMT makes the following recommendations for the Council:

- Proceed with an ecosystem approach consistent with the goals and objectives outlined by the EPDT.
- Task the EPDT to lead work with Council advisory bodies to develop a framework/process to guide the Council's use of ecosystem information for the near term.
- Assign the EPDT or other entity to lead development of adescriptive report summarizing ecosystem information for the CCE.

- Consider how the information gathering function of the FEP might be designed and administered to support recurrent Council reporting requirements for management actions (e.g. NEPA analyses).
- Reassess the framework process and merits of developing an Ecosystem FMP with regulatory authority.

PFMC
05/27/11

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN (FMP)

The Scientific and Statistical Committee (SSC) reviewed the report prepared by its Ecosystem-Based Management Subcommittee (EMS) summarizing recommendations from a subcommittee meeting held on April 19-20, 2011. Dr. Selina Heppell, chair of EMS, presented the report to the SSC. The report provided recommendations on the potential ways of incorporating ecosystem science into single-species stock assessments, fishery management, and Council decision-making, with an emphasis on review processes that should be developed for ecosystem science tools and products.

The SSC endorses the report in general and makes the following recommendations:

- Incorporation of ecosystem considerations into management should continue to be an evolving process. All science can and should be reviewed and held to a high standard of scientific rigor, but the precise nature of those reviews should depend on specific applications.

- A possible framework for employment of an Ecosystem Fishery Management Plan (FMP) is one of advisory and science teams, similar to the existing FMPs. This should include an Ecosystem Technical Team and Advisory Team. Coordination with existing FMP teams is essential. This could be accomplished through joint appointment if time commitments are reasonable.

- A report on the state of California Current Ecosystem is available now to provide information on physical processes, habitat, and food web dynamics that are affecting Council-managed stocks. However, this information needs to be distilled into a useful product for Council review and discussion.

- A section on ecosystem considerations should be added to all stock assessments, starting with the 2013 assessment cycle. The detail and length of the section will vary and evolve over time. Stock assessment teams should include expertise in ecosystem processes to assist with this section development and stock assessment review.

- The SSC will need to modify Terms of Reference for stock assessment reviews to include reviews of ecosystem consideration sections of assessments and application of ecosystem processes in assessments and harvest control rules. Consideration of resources needed will be important to insure that STATs are not overcommitted.

- Workshops should be planned to discuss ecosystem models and their application to biological and socio-economic evaluations. Improved communication with developers of the California Current Integrated Ecosystem Assessment is desired to prioritize applications of the models to specific questions, such as cumulative effects evaluation and forecasting models for salmon.

COASTAL TREATY TRIBES' STATEMENT ON THE ECOSYSTEM FISHERY MANAGEMENT PLAN

The Hoh, Makah, and Quileute Tribes and the Quinault Indian Nation have long stressed the need for better ecosystem-based management. Single-species management that does not take into account regional differences in abundance and productivity of stocks, co-occurring species, or the environment in which they live have resulted in large-scale closures and restrictions to rebuild overfished species. The healthiest and most productive grounds are closed (based on bycatch rates) to reduce impacts without accurate assessments of the resources at biologically meaningful scales that would provide for sustainable fishing communities. The current coastwide management regime for groundfish does not make sense, particularly for long-lived sedentary rockfish species.

Likewise, policies that protect charismatic species for their own sake are a hindrance to maintaining healthy oceans. Making any one thing off limits without consideration of its role in the ecosystem or the impact of regulations throughout the biological community is a recipe for throwing the system out of balance. Protection of marine mammals should not be accomplished at the expense of endangered salmon. Every piece of coral is not sacred. Policies should focus on maintaining the health of ecosystems and the functional role of each part of the system – singling out some species as more important than others in our management strategies does not make sense.

Critical information is missing in order to properly understand and manage the ecosystem within and around the Coastal Tribes' combined usual and accustomed fishing grounds. The Tribes with our co-managers at Washington Department of Fish and Wildlife have developed an Ocean Ecosystem Initiative designed to collect some of this data, but to date it has not been funded. These data collection programs will not be cheap, but they are necessary if we are to understand the ecosystem and properly account for our impacts as fishermen and managers. Two primary goals of this Initiative are described briefly below.

Habitat Mapping

High resolution seafloor mapping has been completed in just a fraction of the EEZ off Washington. This is an area of complex geology and bathymetry resulting in an array of habitats types. Understanding the types and extent of these habitats is critical for developing a baseline that would put our ecosystem knowledge in context. This information should be incorporated into a widely-accessible coastwide GIS database to allow for development of maps that illustrate seabed geology, seafloor relief and substrate, geological hazards, habitat types, and bathymetry.

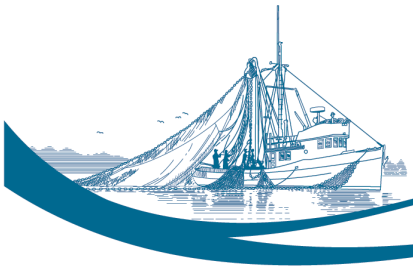
Visual Surveys

Several rockfish species are currently unsurveyed in their primary habitat. The Northwest Fishery Science Center trawl survey cannot access untrawlable high-relief rocky habitats where species such as yelloweye and canary rockfish reside. Low ACLs mean that extractive survey techniques cannot be developed without extensive fishery restrictions or closures. As such there is effectively no fishery-independent data source for these species. Assessment authors regularly

highlight this data need as well. Visual surveys would provide necessary abundance and distribution data from unsurveyed habitats to inform management of all the species that rely on these areas, particularly rockfishes and coral/sponge communities.

The Integrated Ecosystem Assessments (IEAs) being developed by NOAA are exciting new tools but they cannot be effective without the necessary data inputs to make them accurate. We need to understand the makeup of the ecosystem, the effects of current practices and management, and we must do so at meaningful geographic scales. Ecosystems need to be understood at spatial resolutions much smaller than the entire California Current and must include trans-boundary assessments (e.g. as with salmon, halibut, and whiting) of fishery resources. Fish don't recognize invisible borders and the ecosystem is not homogenous along the west coast.

It is premature to develop an Ecosystem FMP with regulatory authority right now. We must gather the baseline information necessary to understand our ecosystems first in order to effectively implement regional ecosystem-based management. However, this ecosystem plan needs to retain the flexibility to allow for development of smaller-scale regional fisheries management regulations as our understanding of the ecosystem evolves. The Coastal Treaty Tribes continue to stress the need for an Ecosystem Plan that will serve as a conduit for developing the information needed to manage fisheries in a more refined and comprehensive manner.



California Wetfish Producers Association
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Mr. Mark Cedergreen, Chair
And Members of the Pacific Fishery Management Council
7700 NE Ambassador Place #200
Portland OR 97220-1384

RE: Agenda Item H.1.c: Recommendations on Ecosystem-based Management

Dear Mr. Cedergreen and Council members,

The California Wetfish Producers Association (CWPA) represents the majority of coastal pelagic species 'wetfish' fishermen and processors in California. We have followed with interest (and growing concern) the progress of the Ecosystem-based Fishery Management (EBM) planning process, which is now facing concurrent and mounting pressure from certain groups within the environmental community to develop an explicit policy for 'forage' species in the California Current, and these groups are advocating ultimately for explicit allocations reserved for other marine life.

In light of the importance of these issues, and the challenges posed to CPS fisheries, which now appear to be the primary target of the 'forage fish' campaign, we asked Dr. Richard Parrish to review and comment on the background documents prepared by the Ecosystem Plan Development Team, advisory bodies and public comment. Now retired from the National Marine Fisheries Service, Dr. Parrish was the co-author of the original Coastal Pelagic Species Fishery Management Plan, a respected, knowledgeable scientist and participant in the evolution of the Council's management of fisheries.

I am attaching Dr. Parrish's report for reference, and will summarize here some key facts and recommendations.

Dr. Parrish concurs with recommendations of the SSC:

* *Building upon existing population models already used by the Council is a constructive and practical way to make progress on incorporating ecosystem considerations into management.*

* *Incorporation of ecosystem considerations into stock assessments should be considered judiciously. While ecosystem data may be informative, integration of such data directly into assessments also introduces additional sources of uncertainty. Ecosystem data should be considered in terms of whether they provide practical benefits such as improving forecasts. Complexity for its own sake does not generally lead to better assessments or better management.*

Dr. Parrish comments: *"The forage species issue has become a very important issue for Oceana and several other environmental NGOs. They have forced the discussion to center on two individual components of the California Current Ecosystem, krill and CPS species. While both components have considerable biomass, each is only a segment of the biomass of their trophic level."* [emphasis added]

Parrish questions (and so do we): Why is the forage species issue focused on CPS species?

> *"With hake it is likely that the forage produced by the 0, 1 and 2 year old hake exceeds that produced by either sardine or mackerel."*

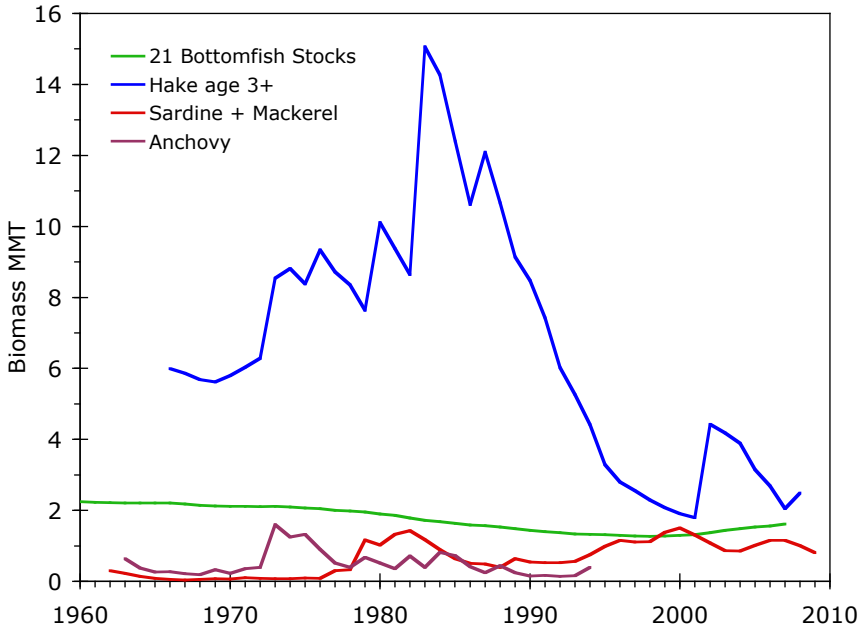

Figure 1. Comparison of biomass levels of hake, 21 bottomfish species, anchovy and the combined biomass of sardine and Pacific mackerel.

> *The vast majority of fish that die are eaten by something. It would be relatively simple to back calculate the biomass of forage expected from the adults in each of the single-species stock assessments. Based on this simple concept and the biomass levels shown in figure 1, it is obvious that the adult hake stock (M=0.23) provides much more forage than the entire sardine stock (M=0.4) or the Pacific mackerel stock (M=0.5). In addition, the bulk of the meso-pelagic fishes and bathy-pelagic fishes are forage species. Many neritic fishes and all of their juveniles are forage fishes. There is also a wide range of invertebrates that are forage species."*

Parrish comments: "*… an in depth analysis will show that CPS species provide a significant but small and temporally transitory percentage of the total forage consumed in the California Current Ecosystem.*

He recommends: *"One of the ecological principles that might be considered by the Council is that there is little science-based evidence that any particular component of the forage field is any more important than any other similar sized component."*

Further: "*There is little evidence that the highs or lows of either the sardine or mackerel population has had any discernable affect on the ecosystem functioning of the California Current. However, the brief extreme population outbreaks seen in the sardine, mackerel, anchovy and hake stocks are a part of the functioning of the California Current ecosystem and management policies should be designed to maintain these outbreaks."*

The current CPS FMP addresses the need to maintain a sufficient population of CPS due to their importance as forage, and has established precautionary benchmarks for both active and monitored stocks.
The harvest guideline for monitored stocks is capped at F 0.25, and for sardine the harvest rate is set even lower, at about net 10 percent of biomass, after subtracting the 150,000 mt 'cutoff'.

Of interest, the Marine Stewardship Council recently released for comment its revised policy for management of lower trophic level species, and the default guideline recommends retaining at least 75 percent of the stock in the ocean. The CPS FMP has managed coastal pelagic species according to that guideline for more than a decade!

In fact, in a paper published in Science magazine (July 2009) entitled "Rebuilding Global Fisheries", authors Worm, Hilborn et al reported the California Current Ecosystem has one of the lowest exploitation rates in the world, one of only two large marine ecosystems found to meet the authors' conservation target.

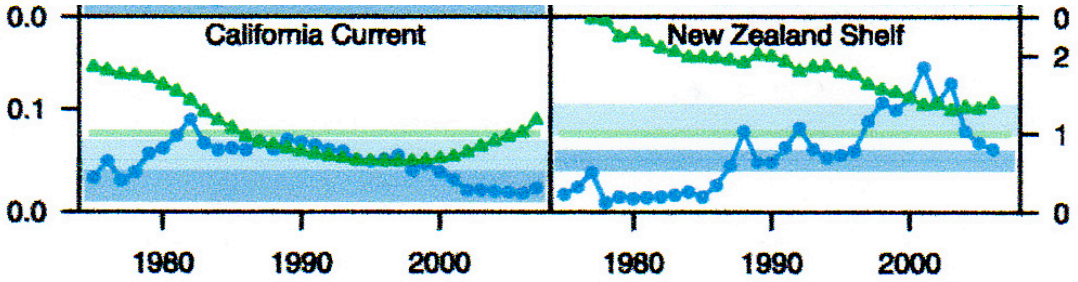

Figure 3. Green triangular line represents biomass trend; blue dotted line represents exploitation rate. Dark blue bar represents the conservation target.

Dr. Parrish made several recommendations for the further development of the EFMP:

- The EPDT should discuss the relative merits of science-based and philosophy-based ecosystem management and clearly point out where their methodology is based on data and where (due to lack of data) it must be based on philosophy.
- The EPDT should not group the individual CPS species into a common 'forage fish' box. The individual CPS species each have different geographical distributions, population fluctuations, food habits and predators (i.e. Pacific mackerel are a major predator of anchovy).
- Ecosystem modeling should base the unfished CPS and hake biomass and productivity on data that omits peak years that are the result of fortuitous recruitment caused by environmental conditions.
- Fully developed ecosystem models should be able to simulate the outbreak type of population fluctuations seen in the individual CPS and hake. A near steady-state model is very unlikely to prove to be an advance in fishery management for these species.
- Size is important. Abundant species should have several size/age categories each with its own characteristics (age 0-2 hake and mackerel are forage fish; age 3+ hake and mackerel are predators).
- Depth is important. Sardine and hake have very similar age- and season-dependent geographical distributions, but quite different depth distributions. This should result in quite different predator fields.
- Forage is what ecosystem models are all about. Considerable attention should be focused on developing valid estimates of the meso-pelagic, bathy-pelagic and neritic fish populations (including decadal temporal variability: CalCOFI larval data are a likely source of data for the southern half of the CCE.)
- Age structure, spatial and temporal resolution are as likely to be as important in the development of successful ecosystem fishery management models as are single box representations of phytoplankton, zooplankton, predators, winds and SST.
- The EPDT should closely examine the strengths and weaknesses of environmental-based single species models with good age, spatial and temporal resolution vs full ecosystem models with limited age, spatial and temporal resolution.

Regarding alternative ecosystem management plan formats:

> *"Two of the four alternative formats for EFMPs clearly are not desirable for the California Current Ecosystem. The Regional Omnibus EFMP was designed for discrete central Pacific island groups and would not be applicable to the California Current due to the large proportion of the exploitable biomass that annually migrates between northern feeding grounds and southern spawning grounds. The Coastwide Omnibus EFMP would create a huge amount of re-organization of the Pacific Council's activities and result in an overly complicated management framework.*
>
> *The two remaining EFMP formats have a single significant difference. Under the Advisory FEP all species would continue to be regulated under species group FMPs. In contrast, under the Umbrella EFMP 'select species that are important to the CCE as a whole would be within the EFMPs "FMU". The Umbrella EFMP is in my opinion a very strange beast. <u>The basic concept of ecosystem management is that the whole ecosystem is important</u>. If this is the basis of ecosystem management, how are some species or species groups more important than others? What criteria will be used to decide which species are important to the functioning of the whole ecosystem and which are unimportant? Will this decision be made before the models are finalized and peer reviewed or after? "*

Parrish commented further: *"I do not see the SSC deciding that species A is important to the functioning of the ecosystem and species B is not important.* ‘‘

Dr. Parrish offered concluding recommendations to the Council on how to proceed, with which we concur:

- The Council should concentrate its resources on developing the concepts, methodology and models that will be required for successful ecosystem-based fishery management.
- **The Council should proceed with the development of an <u>Advisory</u> Fishery Ecosystem Plan (FEP); and this plan should not be modified into an Ecosystem Fishery Management Plan [with potential regulatory authority] until the <u>ecosystem-based methodology is mature, peer reviewed and shown to be superior to the present management strategy</u>.** [emphasis added]

Re: Purpose and Need Statement, we offer the following thoughts:

The current trend and mandate in both federal and CA state fishery management are to consider management decisions in a broader, ecosystem-based, "big picture" context. An overarching purpose of an advisory FEP may be to provide fishery managers with coordinated, <u>integrated</u> information on oceanic cycles, marine life population status and trends, predator-prey interactions and other ecological considerations, which hopefully will lead to better understanding and improved fishery management decisions across existing FMPs.

Ecosystem-based information will be incorporated into complex models now in development, such as Atlantis, and trends reported in Integrated Ecosystem Assessments (IEAs). We point out that the draft IEA presented to the Council as an example of the type of information generated in this process extended only to Point Conception in California, and excluded the Southern California Bight, where as much as 80 percent of the market squid harvest is typically produced. We questioned this omission and learned that efforts are underway to incorporate southern CA. We hope the Council will ensure the entire CCE, including the Southern CA Bight and 0-3 mile state waters segment, is included in the IEA before using it to inform future management decisions.

A major focus of discussion to date appears to have settled on forage issues, thus it is critically important to

- Identify and attempt to measure or estimate <u>ALL</u> the major components of the forage pool (not only CPS and krill) and provide research impetus and mechanisms to monitor and evaluate trends in the unfished and juvenile stocks, i.e. y.o.y. rockfish, 0-2 year hake, shortbelly rockfish, copepods and many other forage species, as well as those that are targeted by fisheries (and specifically, CPS fisheries).

- Re: scope, the Council's management authority in the California Current Ecosystem does not extend into Canada and Mexico, nor does it include state waters; however most of the forage species in the CCLME extend into those areas, thus the FEP should make a substantial effort to obtain and integrate data from those areas into ecosystem models. Examples of such transboundary issues include but are not limited to Pacific sardine and hake biomass estimates, and the network of MPAs established in nearshore state waters in California etc.

The Ecosystem Plan Development Team and Ecosystem Advisory Panel have invested significant time and energy in developing preliminary recommendations for the purpose and need statement as well as goals and objectives of the ecosystem plan. The September 2010 EPDT document (H.1.b) contained a statement that encapsulates our perspective on EBM:

> *Ecosystem approaches to management are still about societal choice among competing objectives (Shepherd 2004). Fundamentally, ecosystem-based fishery management recognizes that fisheries both affect and are affected by the marine environment, and that what we do to address these effects via policy-making is a matter of societal choice. The purpose of the ecosystem approach is not to prescribe particular policy choices, but rather to promote better understanding of those policy choices. Ecosystem-based fishery management is meant to compliment current single-species approaches to fisheries management by providing additional information that may be used to expand the scope of these approaches into the future. Finally, ecosystem-based fishery management does not create additional mandates to protect the marine environment, but instead seeks to better understand fishery effects on the marine environment through improved information on ecosystem structure, processes and functions.*

In concluding these comments I would add one more thought from Dr. Parrish, along with my own observation:

From Dr. Parrish: "Fishery management, like any political process in the USA, is a slow business… Getting it right is far better than getting something now. Time scales in the ocean are even longer than in the Council. The Council requires data and peer-reviewed analyses before it changes things. … Some of us want to base ecosystem-based management on data and peer reviewed analyses."

And from me: This EBM planning process is unfolding at a time when the ocean is exhibiting amazing productivity! There is no crisis or emerging threat requiring action now to prevent ecosystem collapse. To the contrary, in 2010 CA experienced the most productive market squid fishery in a decade. PacOOS reports noted increasing abundance in species favoring cool oceanic conditions, including juvenile rockfish, hake, market squid and krill. Recent grey whale counts reported the highest northern migration on record. Existing laws provide authority to address future fishery development that might emerge (and at $4+/gallon fuel, expansion is highly unlikely!). Fishery management in the CCE is acknowledged as among the most precautionary in the world.

We encourage the Council to continue work on EBM planning, heeding the advice of the SSC, and the recommendations of Dr. Parrish and others who ask you not to rush this process, but take the time required to do it right.

Thanks very much for considering these comments.

Best regards,

Diane Pleschner-Steele
Executive Director.

Attachment: A Review of Ecosystem-based Fisheries Management: (A CPS Perspective)
By Richard Parrish, Ph.D

A Review of Ecosystem-based Fisheries Management: (A CPS Perspective)

by

Richard H. Parrish Ph.D

H1b 7.1 Philosophical guidelines or principles for implementing Ecosystem based management

> "Throughout the published literature it is commonly stated that ecosystem-based fisheries management will require a suite of research efforts and products before it can be successfully implemented. However, many of the more philosophical research efforts and associated publications on ecosystem-based management have addressed management more broadly, rather than on a laundry list of data sources, methodologies and models. This literature argues that broad principles could be adopted to guide management decisions regardless of the quantity and quality of data available to managers. In principle, an ecosystem-based approach to management could be adopted without abundant information, data and precise knowledge of ecosystem interactions, by simply making management decisions in the context of those principles."

The philosophical principles used to implement Ecosystem-based management in the Pacific Fishery Management Council are in my opinion the most important subject in the entire set of background documents.

We are on a path that started with traditional fishery management based on life history information, data on catch and effort, logic and beliefs. This is now generally known as Data Poor management. In the 1990s management evolved to single-species stock assessment methodology based on some improvements on the traditional information plus fishery independent surveys and most importantly time-series of the age or size structure obtained by monitoring the landings. This is now generally known as Data Rich management.

The above extract (7.1) exhibits the current misconceptions that have arisen from the terms ecosystem management and ecosystem-based management. Ecosystem management fishery management "will require a suite of research efforts and products before it can be successfully implemented ". It will also require changes in current law to allow the management of all trophic levels. In contrast, ecosystem-based fishery management does not require either science or knowledge, as described in 7.1 above.

To explain the two principal alternative approaches to ecosystem-based fishery management that are open to the Pacific Council I have developed the classification system listed in Table 1.

Table 1. Classification of Fishery Management Methodology.

Traditional Fishery Management	(Data Poor)
Single-species Fishery Management	(Data Rich)
Ecosystem Fishery Management	(Data Super Rich)
Ecosystem-based Fishery Management	
Type A	(Fishery Data Rich – Ecological Data Poor)
Type B	(Fishery Data Poor – Ecological Data Poor)
Type C	(Data Ignored)

Council Members are going to have to decide which Type of Ecosystem-based Fishery Management methodology they want to proceed with: Type A or Type C. Type B management is inappropriate for geographical regions that are already utilizing single-species fishery management (Data Rich).

The SSC report (J.1.s) on development of an Ecosystem Management Plan clearly points out the Type A methodology that a science team would use to develop an ecosystem-based fishery management framework.

In particular I note the following bullets from the report.

> ∗ Building upon existing population models already used by the Council is a constructive and practical way to make progress on incorporating ecosystem considerations into management.
>
> ∗ Incorporation of ecosystem considerations into stock assessments should be considered judiciously. While ecosystem data may be informative, integration of such data directly into assessments also introduces additional sources of uncertainty. Ecosystem data should be considered in terms of whether they provide practical benefits such as improving forecasts. Complexity for its own sake does not generally lead to better assessments or better management.

I note that Oceana has recently pointed out in numerous forums that the sardine control rule has been 'debunked' and it is the ecosystem portion of the control rule (SST) that has been brought into question. There is a long tradition in fisheries research that recognizes that correlations between environmental conditions and recruitment often break down.

> ∗ While stock assessment models currently used by the Council will continue to be relevant as the Council moves toward ecosystem-based management, additional tools (e.g., Atlantis, CCIEA) will also need to be evaluated. Atlantis is a complex model that includes many different modules (e.g., species interactions, stock assessment, fleet dynamics). Reviewing models such as Atlantis will require an interdisciplinary team of reviewers, adequate model documentation, and considerable review time. Procedures for reviewing such models need to be established.

While probably not intended, the 'will continue to be relevant' wording under-states the importance of singe-species assessments for fishery management in the next decade. Taken as a whole, the SSC report implies that single-species methodology will continue to be a major component of the Councils array of management tools. It is only the presence and continuation of the extensive array of single species assessments that will allow the Council to use Type A ecosystem-based management.

Type C ecosystem-based management is currently proposed by Oceana in the California Legislature (AB 1299)

> *7097 (3) The commission shall restrict the development of an emerging fishery, or the significant expansion of an established fishery, where forage species are a significant component of the catch, unless it finds that the available scientific information indicates that the development or expansion of the fishery would be unlikely to have a significant negative impact on the population of the forage species or the ecological services rendered by the forage species in the larger ecosystem.*

Does anyone at the Pacific Council know how to kill fish without reducing the population, presumably having a negative impact on the population?

THE CPS FORAGE SPECIES ISSUE

The forage species issue has become a very important issue for Oceana and several other environmental NGOs. They have forced the discussion to center on two individual components of the California Current Ecosystem, krill and CPS species. While both components have considerable biomass, each is only a segment of the biomass of their trophic level. Krill's present status as a 'sacred' crustacean points out the political prowess of the environmental NGOs but it does not explain why catching 100 MT of krill would have any more affect than catching 100 MT of copepods, mysiids or hake. Some of the CPS species are clearly forage species; however, adult jack mackerel and Pacific mackerel are no more forage species than adult hake or many of the rockfishes.

What is a forage species? According to legislation now progressing through the California Legislature (authored by Oceana), the definition of a forage species is either "a planktivorous fish or invertebrate species" or one of six named CPS species. According to this definition a wide range of fishes ranging from osmerid smelts to basking sharks are forage species. According to this definition a wide range of fishes including small benthic and neritic fishes such as rosy rockfish, white croaker, tomcod and cottids are not forage species because they eat benthic invertebrates. According to this definition filter feeding invertebrates like barnacles and sea anemones are forage species but shrimps and benthic worms are not. This definition also leaves a wide range of species that consume a mixture of plankton and neckton in limbo; are they forage species? Are the early life history and juvenile stages of predatory fishes such as lingcod forage species?

What is a forage species? This is a question that must have a good answer or ecosystem models will be worthless. One logical way to look at this is to let a lingcod decide; if it is 4-25 cm long it is forage.

Using a size-based definition rather than a food-habits or taxonomic-based definition completely changes the way forage species are viewed. With this approach some CPS species are forage fish for their entire life history and some cease to be forage fish about the time they reach sexual maturity. The early life history stages and early juvenile stages of all of the teleosts in the groundfish FMP are forage fish. Probably none of the fishes in the salmon or highly migratory species FMPs would be considered as forage fishes as their juvenile stages are largely resident in ecosystems outside of the geographical area managed by the Council.

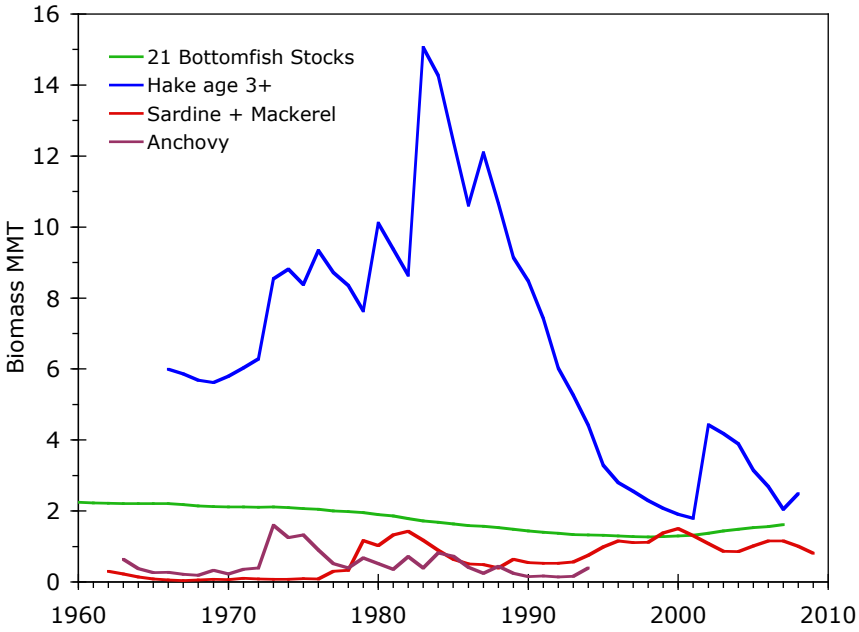

Figure 1. Comparison of biomass levels of hake, 21 bottomfish species, anchovy and the combined biomass of sardine and Pacific mackerel.

Why is the forage species issue focused on CPS species? Possibly because of the perceived abundance of CPS species; however, the combined biomass of the CPS species is not known for any single year and all of these species exhibit very large population fluctuations associated with decadal scale and/or El Nino physical forcing. Stock assessments of sardine and Pacific mackerel show that their combined biomass has averaged about 1 MMT since 1980 (Figure 1). At any one time it is unlikely that more than one or two of the CPS species will be at high biomass levels and there are periods (i.e. 1960s) when none of them were at high biomass levels. Based on the available information it appears that the unfished CPS total biomass would normally be between 2 and 4 MMT and total CPS biomass could be expected to occasionally be as low as 1 MMT and as high as 5 MMT. In comparison, the unfished biomass of 21 groundfish species (other than hake) with stock assessments is greater than 2.6 MMT and present biomass is about 1.6 MMT. Total groundfish biomass would be considerably higher. Hake stock assessments show that the biomass of age 3+ hake has varied between 2 and 15 MMT (Figure 1).

If a size-based definition of forage fish is used, biomass estimates would be based on the portion of a species biomass that lies within the defined size range. The hake biomass (age 3+) presented in Figure 1 would probably all lie outside of the 4-25 cm range mentioned above, as

would the great majority of the bottomfishes and Pacific mackerel biomass. However, if size dependent mortality rates were used it would be relatively simple to back calculate the biomass of forage expected from each of the single-species stock assessments. With hake it is likely that the forage produced by the 0, 1 and 2 year old hake exceeds that produced by either sardine or mackerel. I note that this back calculation should not be done using adult natural mortality rates.

Of course animals larger than 25 cm are forage for larger predators also, and an ecosystem-based fishery management plan should not be limited to a single size-component of the forage field. Natural mortality rates provide a very good estimate of the biomass of forage for a given population size of a given fish. The vast majority of fish that die are eaten by something. It would be relatively simple to back calculate the biomass of forage expected from the adults in each of the single-species stock assessments. Based on this simple concept and the biomass levels shown in figure 1, it is obvious that the adult hake stock (M=0.23) provides much more forage than the entire sardine stock (M=0.4) or the Pacific mackerel stock (M=0.5). In addition, the bulk of the meso-pelagic fishes and bathy-pelagic fishes are forage species. Many neritic fishes and all of their juveniles are forage fishes. There is also a wide range of invertebrates that are forage species.

The extreme fluctuations seen in CPS species in all of the world's four upwelling systems is well known. Hake also exhibit this type of population variability (Figure 1). The population simulations used in the design of the present sardine control rule give a good indication of the type of biomass variation that should be expected from CPS species. The first 300 years of the simulations using the MSY (option L) and the Council approved management options (option J) show that the sardine occasionally reaches very high biomass levels but these levels are only maintained for 1-3 years. In contrast the biomass falls below 1 MMT several times in a century and the periods of low biomass can extend for many decades (Figure 2).

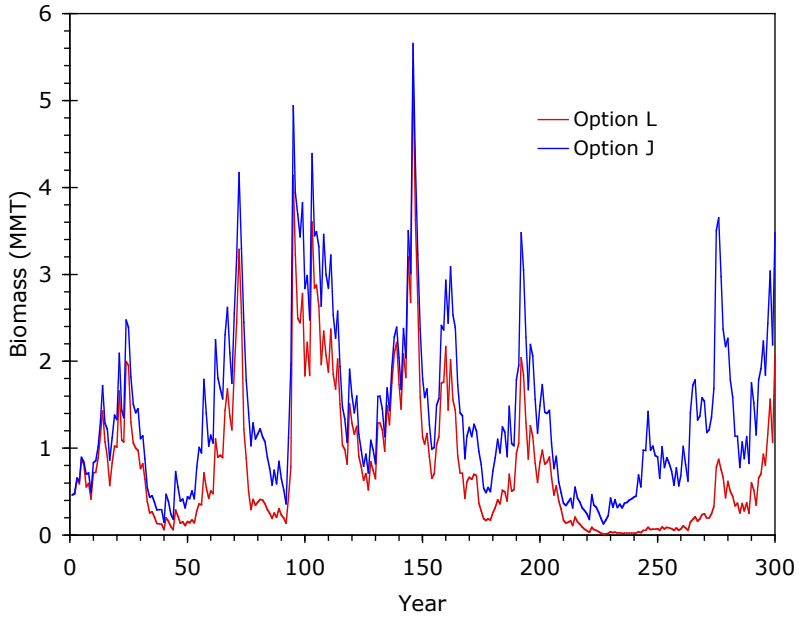

Figure 2. Biomass time series of sardine simulations using the MSY (E =0.12) and the Council approved (Option J) management options.

Stock assessments of the Pacific Mackerel population have the same type of variability with short lived population peaks and extensive periods of much lower biomass (Figure 21 from the 2009 CPS SAFE : Crone et al. 2009)

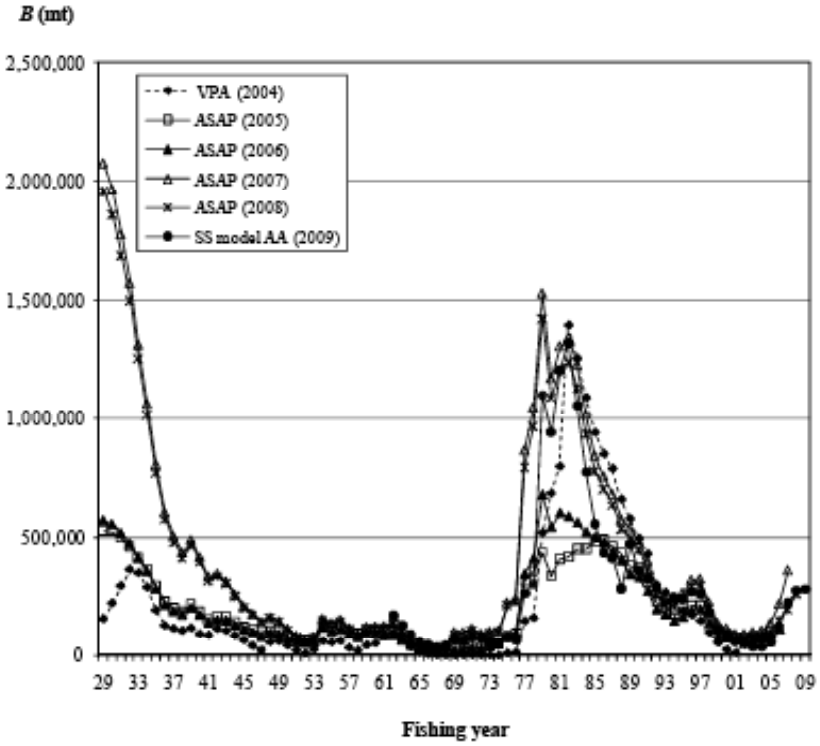

Figure 21. Estimated total stock biomass (*B* age 1+ fish in mt) of Pacific mackerel for historical assessment period (1994-09): VPA model-based assessments from 1994-04; ASAP model-based from 2005-08; and SS model-based currently (2009).

The above cursory glance at the forage 'problem' suggests that an in depth analysis will show that CPS species provide a significant but small and temporally transitory percentage of the total forage consumed in the California Current Ecosystem. One of the ecological principles that might be considered by the Council is that there is little science-based evidence that any particular component of the forage field is any more important than any other similar sized component.

There is little evidence that the highs or lows of either the sardine or mackerel population has had any discernable affect on the ecosystem functioning of the California Current. However, the brief extreme population outbreaks seen in the sardine, mackerel, anchovy and hake stocks are a part of the functioning of the California Current ecosystem and management policies should be designed to maintain these outbreaks. I note that during the analyses leading to the present sardine control rule we discovered that the simulation that had the highest population variance was the one with no fishery. Although very few people realize this, maintaining the sardine population outbreaks was an important part of our selection of a preferred control rule. The 200 TMT maximum catch was the most important factor used to accomplish this.

'Debunked' sardine control rule.

This brings us back to the 'debunked' sardine control rule. As mentioned above, a recent analysis (McClatchie et al 2010), discovered that the previously reported (Jacobson and MacCall 1995) relationship between 3-year average sea surface temperature (SST) at Scripps Pier and sardine recruitment ceased to be statistically significant when recent data were added to the original time series. Neither study included data from an extended cold period in the 1960s and 1970s, when the sardine population was at a very low level and there was an unbroken series of years with very poor recruitment (Figure 3). The newer study included no additional years when the 3-year average sea temperature was as cold as it was during the period of very low sardine biomass (i.e. 1950s, 60s and 70s). I suggest that before the SST term is removed from the sardine control rule, a re-analysis of the sardine biomass should be made including estimates of the biomass and recruitment that occurred during the missing data period. This has been done with the Pacific mackerel stock assessments (Figure 21). If the re-analysis shows that there is no significant relationship between sardine recruitment and sea surface temperature, obviously the control rule should be changed.

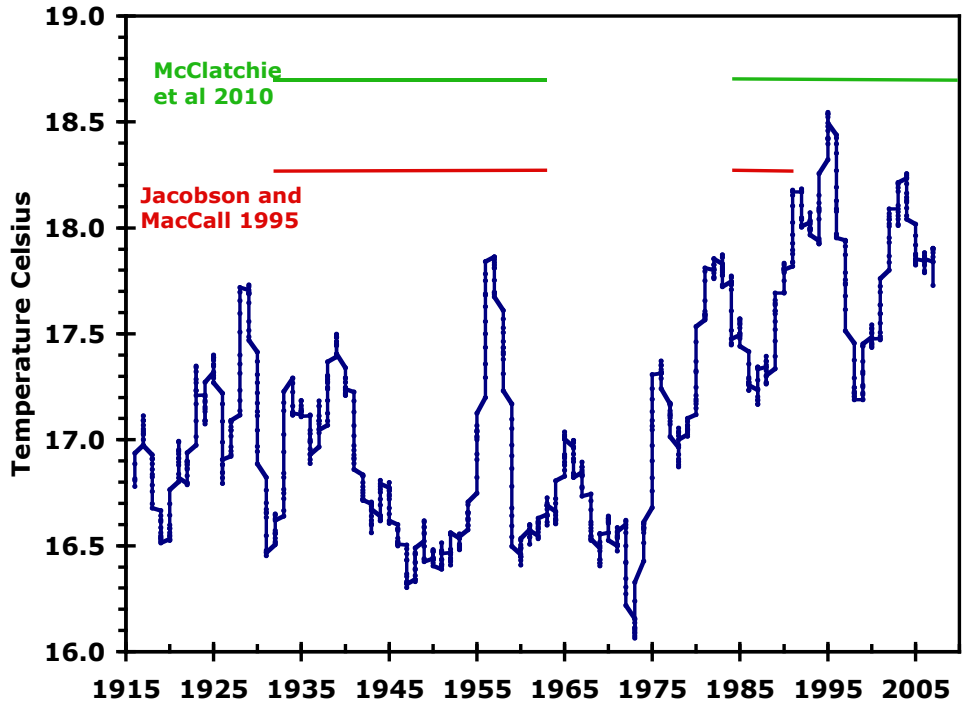

Figure 3. Scripps pier sea surface temperature (36 month running mean) showing data used in two sardine recruitment studies.

Larry Jacobson did the original sardine modeling that resulted in the present sardine control rule, and I did the model evaluations. I still have all of the outputs from the original sardine simulations. These results were used to make a comparison of the original options considered by

the Pacific Council, with an option with the sea surface temperature Fraction replaced by a Fraction = 0.15 (Table 2). This alteration results in a slight increase in the average catch (147 vs. 145 TMT) and a moderate decrease in the average biomass (1,825 vs 1,925 TMT). A comparison of the average depletion levels shows that the MSY option had an average depletion level of 46%. Option J (SST based Fraction) had an average depletion of 64%, and removal of the SST fraction results in an average depletion of 60%.

Table 2. Originally presented Management Policies with addition of a policy with the same maximum catch and cutoff but with a constant 15% fraction instead of a fraction based on sea surface temperature (i.e. 0.05-0.15%).

	Max. Catch	Stochastic MSY	Fishermen's Preferred	Option J SST	Option J minus SST
Maxcat	1000	50	50	150	150
Fraction	0.45	0.12	0.2	0.05-0.15	0.15
Cutoff	1000	0	400	200	200
Ave. catch	208	180	151	145	147
SD Catch	306	180	137	67	67
Median catch	16	128	103	182	193
Ave. Biomass	981	1408	598	1952	1825
Ave. Depletion	32%	46%	20%	64%	60%
% No catch	47%	0%	5%	0.5%	0.3%
% Years Bio. > 0.4 MMT	94%	84%	61%	96%	91%

Forage overview

The recruitment patterns seen in CPS species in the California Current (and other major current systems) strongly suggests that population fluctuations in CPS species are best described as population outbreaks. These outbreaks are caused by short periods of extremely good recruitment and they appear to happen only a couple of times in a century. This pattern suggests that outbreaks are the result of fortuitous combinations of several physical and ecological factors. This implies that regression analyses comparing recruitment success with single environmental variables are unlikely to produce a valid prediction of population outbreaks. Until we have observed say 10 of these outbreaks, statistical analyses are unlikely to be reliable enough for predictive purposes.

The population outbreak pattern in recruitment seen in CPS (and Pacific hake) is of great importance to the development of Ecosystem-based methodology. Present ecosystem models are 'tuned' to particular population sizes and productivities and it will be difficult to introduce outbreak type population fluctuations to these models.

Thus the 'base' ecosystem models should be tuned to reflect population sizes that exclude the very high biomass levels that have been observed in CPS and hake in the California Current. For example, the sardine model used to develop the present sardine control rule used a published spawner-recruit model that was fitted to a data series dominated by the 1930s outbreak of the

sardine population (Jacobson and MacCall 1995). This model produced an unfished (age 1+) biomass estimate of 3.050 MMT. The most recent sardine stock assessment (including data starting in 1981) predicts an unfished (spawning) biomass of only 1.034 MMT (Hill et al 2009).

Ecosystem modelers would be advised to use the recent, much lower, estimate of the unfished biomass, and assume that the higher earlier estimate was biased by the sardine population outbreak that dominated the short, earlier time-series

Single-species modelers of sardine would be advised to use Beverton and Holt or Cushing spawner-recruit models rather than a Ricker model (which predicts very low recruitment at biomass levels that historically produced strong recruitment).

I note that development and peer review of Type A ecosystem-based methodology based on the concepts presented in the SSC's report (J1d) should incorporate all of the above concepts on forage. Unfortunately information from very complicated simulation models is often not presented in a way that allows one to comprehend the importance of the various model components. For example, ecosystem models and food web models are often presented graphically with standing stock being the feature displayed. This type of presentation greatly emphasizes species or species groups that are long-lived and it greatly deemphasizes species that are short lived. A separate graphical presentation presenting the annual production of the components of the model gives an entirely different perspective. Given that it is primarily the basic productivity of the California Current ecosystem that we are all interested in preserving, care should be taken to 'display' the results of analyses in a way that annual production can be evaluated without visual bias from other factors.

The population simulations that were used to develop the sardine control rule are becoming out-dated. The CPS STAT should be tasked to develop a new simulation model for sardine; hopefully this model will have the strengths of the original model (statistically sophisticated temporal variability and the potential to simulate a very wide range of management options). The weakness of the original model was its biological simplicity. In particular, the model did not include age specific fecundity that is known to be a major life history feature in sardine (Butler et al 1993) and anchovy (Parrish et al 1986). It also lacked spatial resolution; this may be important due to the different age structure in the catch between different fisheries.

The Pacific mackerel control rule was grandfathered in and the exploitation rate is higher than that suggested in an early management simulation model (Parrish and MacCall 1978). Staff should be assigned to develop a simulation model for mackerel; this is particularly important now that a stock assessment has been developed that covers the whole 1929-2009 fishery. It is likely that the base simulation model could be the same for both sardine and mackerel with only the parameters changed to fit the biological rates of each species.

CPS CONSIDERATIONS FOR THE EPDT

Presently there is a popular tendency toward ecosystem-based management using philosophy in place of science, beliefs instead of analyses, and anecdotal information instead of time-series information. If the trends in population sizes of a wide range of groundfishes were similar to those that occurred during the 1980s and early 1990s, this approach might have some merit. Fortunately the introduction of singe-species stock assessments and the resultant Pacific

Council's actions during the late 1990s and 2000s have reversed the earlier trends, and most depressed groundfish stocks are recovering as fast as they could be expected to, given the low productivity of many of the individual species.

The EPDT should also consider that the ponderous changes in biomass observed in many of the groundfish stocks are completely different from what has been observed in the California Current CPS. Information from CPS (often the same species or sibling species) in other current systems confirms the patterns that have been observed in the California Current since the 1930s. Total unfished CPS biomass is likely to vary by at least a factor of four and the principal time scale is decadal. The unfished biomass of individual CPS species is likely to vary by a factor of at least eight and many of the species have an outbreak type of population increase that is most likely caused by a fortuitous combination of several ecological factors.

The classification of jack mackerel and anchovy as monitored species unfortunately resulted in a halt to any population analyses for these species. This is a problem for the EPDT as the quality of the biomass estimates will affect future ecosystem models. These stocks should be assessed periodically.

The importance of species and species groups in the food web needs to be evaluated in terms of both size composition and volume. The relative importance of different species is based on both the standing stock of the species and its annual productivity (or when viewed from a forage perspective, natural mortality rates specific to different life history stages). Assessment of early life history stages (primarily consumed by zooplankton), juvenile stages (consumed by a wide size range of predators) and adults (primarily consumed by larger predators) will be required for later generation ecosystem models. This applies to the groundfish FMP and to species not covered by FMPs (i.e. meso-pelagic and neritc species). It is likely that age 0-2 hake provide at least as much forage as the anchovy and sardine populations combined.

RECOMMENDATIONS

- The EPDT should discuss the relative merits of science-based and philosophy-based ecosystem management and clearly point out where their methodology is based on data and where (due to lack of data) it must be based on philosophy.
- The EPDT should not group the individual CPS species into a common 'forage fish' box. The individual CPS species each have different geographical distributions, population fluctuations, food habits and predators (i.e. Pacific mackerel are a major predator of anchovy).
- Ecosystem modeling should base the unfished CPS and hake biomass and productivity on data that omits peak years that are the result of fortuitous recruitment caused by environmental conditions.
- Fully developed ecosystem models should be able to simulate the outbreak type of population fluctuations seen in the individual CPS and hake. A near steady-state model is very unlikely to prove to be an advance in fishery management for these species.
- Size is important. Abundant species should have several size/age categories each with its own characteristics (age 0-2 hake and mackerel are forage fish; age 3+ hake and mackerel are predators).

- Depth is important. Sardine and hake have very similar age- and season-dependent geographical distributions, but quite different depth distributions. This should result in quite different predator fields.
- Forage is what ecosystem models are all about. Considerable attention should be focused on developing valid estimates of the meso-pelagic, bathy-pelagic and neritic fish populations (including decadal temporal variability: CalCOFI larval data are a likely source of data for the southern half of the CCE.)
- Age structure, spatial and temporal resolution are as likely to be as important in the development of successful ecosystem fishery management models as are single box representations of phytoplankton, zooplankton, predators, winds and SST.
- The EPDT should closely examine the strengths and weaknesses of environmental-based single species models with good age, spatial and temporal resolution vs full ecosystem models with limited age, spatial and temporal resolution.

ALTERNATIVE MANAGEMENT PLAN FORMATS

Two of the four alternative formats for EFMPs clearly are not desirable for the California Current Ecosystem. The Regional Omnibus EFMP was designed for discrete central Pacific island groups and would not be applicable to the California Current due to the large proportion of the exploitable biomass that annually migrates between northern feeding grounds and southern spawning grounds. The Coastwide Omnibus EFMP would create a huge amount of re-organization of the Pacific Council's activities and result in an overly complicated management framework.

The two remaining EFMP formats have a single significant difference. Under the Advisory FEP all species would continue to be regulated under species group FMPs. In contrast, under the Umbrella EFMP 'select species that are important to the CCE as a whole would be within the EFMPs "FMU". The Umbrella EFMP is in my opinion a very strange beast. The basic concept of ecosystem management is that the whole ecosystem is important. If this is the basis of ecosystem management, how are some species or species groups more important than others? What criteria will be used to decide which species are important to the functioning of the whole ecosystem and which are unimportant? Will this decision be made before the models are finalized and peer reviewed or after?

I suspect that those favoring Type C ecosystem-based management might see advantages with the Umbrella EFMP.

I do not see the SSC deciding that species A is important to the functioning of the ecosystem and species B is not important.

Development of ecosystem-based fishery management methodology is going to severely test the Pacific Council's resources. The last thing that the Council needs at this point is a reorganization of the present science and advisory committees and assignment of staff to the labor-intensive development of a new FMP.

RECOMMENDATIONS

- The Council should concentrate its resources on developing the concepts, methodology and models that will be required for successful ecosystem-based fishery management.
- The Council should proceed with the development of an Advisory Fishery Ecosystem Plan; and this plan should not be modified into an Ecosystem Fishery Management Plan until the ecosystem-based methodology is mature, peer reviewed and shown to be superior to the present management strategy.

.

Audubon California * Berkeley Conservation Institute, Pure Fishing * Earthjustice * Geoff Lebon * Hickman's Guide Service * Larimer Outfitters * Native Fish Society * National Coalition for Marine Conservation * Northwest Guides & Anglers Association * Northwest Sportfishing Industry Association * Oceana * Ocean Conservancy * Oregon Trout Unlimited * Orca Network * Pacific Rivers Council * Pew Environment Group * Port Orford Ocean Resource Team * Portland Chef's Collaborative * Wild Fish Conservancy * Wild Salmon Center

May 19, 2011

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

RE: H.1.c Ecosystem Fishery Management Plan

Dear Chair Cedergreen and Council Members,

We write to you to express our support for the Council's efforts to develop an Ecosystem Fishery Management Plan (Plan). If properly implemented, we believe the Plan can improve the management of fisheries, allow the Council to meet its federally mandated obligations, and contribute to a healthy ocean. In particular, we believe the Plan should protect the forage base of the California Current Ecosystem and have the management and regulatory authority to do so.

As likeminded fishing, conservation and eco-tourism organizations, we are concerned with the management of forage species and protecting the marine food web. Abundant forage stocks are critical for maintaining healthy populations of commercially and recreationally important predator species like salmon, tuna and groundfish as well as countless species of marine birds and mammals. In the last decade alone, lack of forage has been linked to failed salmon runs[1], declines in seabird populations[2], and marine mammal mortality events[3].

Consequently, we believe it is vital that forage species be managed in a way that explicitly accounts for the predation needs of other marine species. More forage in the ocean will help sustain bigger and healthier fish and populations of other marine species. All of the undersigned have a stake in maintaining strong and diverse coastal

[1] Thayer et al. 2010. Collaborative Fisheries Research in Support of Ecosystem-Based Salmon Management in Northern California. Final Report, California Sea Grant Project R/FISH-212PD.
[2] Warzybok, P.M and R.W. Bradley. 2009. Status of Seabirds on Southeast Farallon Island During the 2009 Breeding Season. Unpublished report to the US Fish and Wildlife Service. PRBO Conservation Science, Petaluma, California. PRBO Contribution Number 1707.
[3] Melin et al. 2010. Unprecedented Mortality of California Sea Lion Pups Associated with Anomalous Oceanographic Conditions Along the Central California Coast in 2009. CalCOFI Report, Volume 51, 2010

economies, so conservation of forage species is something we all agree upon. For these reasons, we urge the Council to develop a Plan that protects the marine forage base.

Specifically, we support developing an index of forage species abundance as one of the Plan's indicators of overall ecosystem health, which can then be assessed against established management benchmarks set by the Council. Toward this end, the Plan should identify all key forage species in the California Current Ecosystem, whether currently managed or not, and evaluate the services they provide as prey for other species. This information, in conjunction with the established benchmarks, can be used qualitatively and quantitatively to develop management measures and terms of reference that help ensure sufficient abundance of forage species while providing appropriate opportunities for sustainable management of existing forage species fisheries. Furthermore, we support designating forage species not currently targeted in a specific fishery as "Ecosystem Component" species and preventing the development of fisheries for those species unless and until they can be managed in a way that maintains the ecological services those species provide to the ecosystem.

Sustainably managed fisheries are essential to the health of the ecosystem as well as the fishing and coastal tourism industries. By ensuring adequate forage for the species we depend upon as fishermen, tourism business operators and stewards of the ocean, this Plan has the potential to greatly improve the management of our marine resources.

We appreciate the Council undertaking this endeavor and look forward to working with all stakeholders to maintain healthy oceans and productive fisheries.

Thank you in advance for your time and consideration.

Sincerely,

Anna Weinstein
Audubon California

Andrea Treece
Earthjustice

Jeff Hickman
Hickman's Guide Service

Bill Bakke
Native Fish Society

Jim Martin
Berkeley Conservation Institute
Pure Fishing

Geoff Lebon
F/V Halmia

Tom Larimer
Larimer Outfitters

Ken Hinman
National Coalition for Marine Conservation

Bob Rees
NW Guides & Anglers

Liz Hamilton
NW Sportfishing Industry Association

Ben Enticknap
Oceana

Kaitilin Gaffney
Ocean Conservancy

Tom Wolf
Oregon Trout Unlimited

Howard Garrett
Orca Network

John Kober
Pacific Rivers Council

Stephen Ganey
Pew Environment Group

Aaron Longton
Port Orford Ocean Resource Team

David Barber
Portland Chef's Collaborative

Kurt Beardslee
Wild Fish Conservancy

Guido Rahr
Wild Salmon Center

Pacific Fishery Management Council
Agenda Item H
Ecosystem Based Management

Scientists' Statement

Protecting the Forage Base of the California Current Large Marine Ecosystem

May 9, 2011

We the undersigned marine scientists, fishery scientists, and conservation biologists see a strong and urgent need to shift to an ecosystem-based approach to managing the forage base of the California Current Large Marine Ecosystem (CCLME). Forage species -- including herring, mackerel, anchovy, sardines, market squid, krill, lanternfish, and others -- play a crucial role in marine ecosystems as they transfer energy from plankton to larger fishes, seabirds, and marine mammals (Alder et al. 2008).

Removing forage species from the marine ecosystem can harm marine mammals and seabirds (Tasker et al. 2000, Furness 2002, Baraff & Loughlin 2000, Becker & Beissinger 2006). In fact, fisheries targeting forage species can even reduce the productivity of other commercial fisheries that consume those species as prey (Walters et al. 2005). Insufficient ocean food supply has been linked to the loss of Sacramento River fall Chinook salmon (Lindley et al. 2009), major seabird reproductive failures and population declines (Parrish et al. 2007), and marine mammal mortality events throughout the CCLME over the last decade.

Maintaining a healthy abundance of forage in our coastal marine systems is critical to the resilience of these systems in the face of global climate and oceanographic changes we will face in the coming decades (IPCC 2007). Therefore, management of forage species removal must take into account the multiple roles they play in marine food webs. At the same time, the growth of global demand for forage species for feed for farmed fish and livestock provides an increased financial incentive for the expansion of forage fisheries in order to supply these products, lending urgency to the need for action (Naylor et al. 2009).

In addition, it is also important to prevent development of emerging forage fisheries until we truly understand the ramifications on those species and their predators. Although many key forage species are currently unmanaged and do not yet have significant directed fisheries, fisheries could develop rapidly as aquaculture demand for fish feeds increases.

Forage fisheries management requires a precautionary approach given the important role forage species play for the productivity of California's wildlife and commercial and recreational fisheries as well as the multiple sources of uncertainty regarding these species' population sizes (NRC 2006). Until we understand the ramifications of fishing these species on their predators and surrounding ecosystem, it is imperative to manage forage species prudently by preventing significant expansions of existing fisheries for such species.

Ecosystem-based management is predicated on the explicit accounting of trophic relationships across different parts of the marine food web in the setting of harvest levels (Field & Francis 2006). To do this, managers must be able to calculate and provide for the needs of predators

when setting catch limits so that adequate prey is available for higher trophic levels. The science has progressed greatly on this topic in recent years, and new ecosystem models are being developed that can be used to directly answer these questions. In any case, fishery management can better incorporate what we do know about the ecological role of forage species into the way we manage them.

Management should recognize the critical role forage species play and provide guidance on how to account explicitly for the needs of predators when setting catch limits so that adequate prey are available for fish, birds, and mammals. Across state and federal jurisdictions governing the use of the CCLME, we see a strong need for a consistent ecosystem-based policy on forage species that accounts for the value of forage species in the marine food web. Such a policy should accomplish the following:

1. Formally recognize the important ecological role that forage species play in marine food webs;
2. Require that fishery regulations and harvest control rules for forage species explicitly account for the ecological services forage species provide in their respective ecosystems;
3. Prevent development of fisheries for new forage species until the potential population and ecological consequences of such fisheries are evaluated; and
4. Promote higher value uses of forage species landings, such as human consumption, over lower value uses, such as feed for farmed fish or livestock.

Designing and implementing precautionary science-based forage management in the CCLME could establish a model and precedent for practical implementation of this ecosystem-based management approach worldwide. Protecting the base of the marine food web will provide long-term benefits to the diverse and productive California Current Large Marine Ecosystem, users of ocean resources, and current and future generations.

Sincerely,

Daniel Pauly, Ph.D., Professor of Fisheries and Zoology
University of British Columbia, Vancouver, Canada

Paul Dayton, Ph.D., Professor
Scripps Institute of Oceanography, University of California, San Diego

Larry B. Crowder, Ph.D.
Steven Toth Professor of Marine Biology, Duke University
Science Director, Stanford University Center for Ocean Solutions

William F. Gilly, Ph.D., Professor
Hopkins Marine Station of Stanford University

Rashid Sumaila, Ph.D.
University of British Columbia, Vancouver, Canada

Ellen K. Pikitch, Ph.D., Executive Director, Institute for Ocean Conservation Science
Stony Brook University, Stony Brook, NY

David Ainley, Ph.D.
Former Director, PRBO Conservation Science, Marine Division
Senior Scientist, HT Harvey & Associates

P. Dee Boersma, Ph.D., Wadsworth Endowed Chair in Conservation Science
University of Washington

Steven G. Morgan, Ph.D., Professor
University of California, Davis

George L. Shillinger, Ph.D., Director, Marine Spatial Planning
Stanford University Center for Ocean Solutions

Healy Hamilton, Ph.D., Director, Center for Applied Biodiversity Informatics
California Academy of Sciences

Jason Scorse, Ph.D., Associate Professor and Chair, International Environmental Policy Program
Monterey Institute for International Studies

Richard Rosenblatt, Ph.D., Professor of Marine Biology Emeritus
Scripps Institute of Oceanography, University of California, San Diego

John Pearse, Ph.D., Professor Emeritus, Dept. of Ecology and Evolutionary Biology
University of California, Santa Cruz

Enriqueta Velarde, Ph.D., Seabird Ecologist
Instituto de Ciencias Marinas y Pesquerias, Universidad Veracruzana, Mexico

Fiorenza Micheli, Ph.D., Professor
Hopkins Marine Station of Stanford University

Steven R. Beissinger, Ph.D., A. Starker Leopold Chair in Wildlife Biology and Professor of Conservation Biology.
University of California, Berkeley

George N. Somero, Ph.D., David and Lucile Packard Professor of Marine Science and Associate Director
Hopkins Marine Station of Stanford University

Robert Warner, Ph.D., Professor of Ecology, Evolution, and Marine Biology.
University of California, Santa Barbara

Charles H. Peterson, Ph.D., Distinguished Professor of Marine Sciences, Biology, and Ecology.
University of North Carolina at Chapel Hill

Cynthia Klepadlo, Ph.D., Assistant Curator, Marine Vertebrates Collection
Scripps Institute of Oceanography, University of California, San Diego

Pamela Roe, Ph.D., Professor of Biological Sciences (Retired)
California State University Stanislaus

Jaime Jahncke, Ph.D., California Current Director
PRBO Conservation Science

Robert S. Steneck, Ph.D., Professor of Oceanography and Marine Biology
University of Maine

Villy Christensen, Ph.D., Professor, Associate Director, Fisheries Centre
University of British Columbia

Elliott Hazen, Ph.D., Research Oceanographer
University of Hawaii JIMAR

(Affiliations are for identification only, and do not imply endorsement by the signers' institutions.)

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Agenda Item H. 1

NATIONAL COALITION FOR MARINE CONSERVATION
4 Royal Street, S.E., Leesburg, VA 20175

May 19, 2010

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

RE: Purposes and Needs Statement and Regulatory Criteria for an Ecosystem Based Fishery Management Plan

Dear Council Members,

The National Coalition for Marine Conservation (NCMC) is encouraged by the progress the Pacific Council is making toward development of an Ecosystem Fishery Management Plan (EFMP). We commend the work done by the various panels and teams, and we urge the Council to adopt a Purpose and Needs statement and regulatory framework for the EFMP at the upcoming June 2011 meeting.

NCMC has submitted statements and testified before the council numerous times on conserving coastal pelagic species (CPS) as a vital component of the California Current Ecosystem. More recently we have testified regarding the developing EFMP. We believe this plan is essential to provide a context and a framework for conserving and managing marine fisheries in a way that considers and respects the broader food web each species is a part of. CPS, including sardine, mackerel and squid among others, are not only important to west coast-based fisheries; they are critical forage for numerous pelagic and near-shore predators, including fish, marine mammals and sea birds. As such, they must be managed in a way that carefully balances their contribution to both fisheries and predator needs.

Our keen interest and involvement in this subject dates back to my tenure as a member of the NMFS Ecosystem Principles Advisory Panel (EPAP). In our 1999 Report to Congress, we (the EPAP) recommended that the Councils develop Fishery Ecosystem Plans as "an umbrella document containing information on the structure and function of the ecosystem in which fishing activities occur, so that managers can be aware of the effects their decisions have on the ecosystem, and the effects other components of the ecosystem may have on fisheries."

In keeping with the vision of a fishery ecosystem plan as "a mechanism for incorporating ecosystem principles, goals and policies into the present fisheries management structure," the panel recommended that a key objective of FEPs should be to "(d)irect how that information should be used in the context of FMPs."

The overarching goal of the Pacific Council's EFMP should be to maintain ecosystem health and sustainability. To this end, a clear statement of *purpose* must be articulated and adopted at the outset in order to determine short- and long-term needs and to guide future actions. We suggest the following, as recommended by the EPAP:

> *The plan will 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.*
>
> *The plan will serve as a nexus for existing FMPs and provide a context for considering management actions with respect to all living marine resources, whether managed or not.*

The two primary categories of ecosystem considerations that can be incorporated into west coast fishery management are: environmental variability that directly or indirectly affects fish stocks; and trophic interactions that affect predators and prey.

The following recommendations focus on EFMP *needs* relative to protecting the integrity of the marine food web in general, and the California Current forage base in particular.

- The EFMP should provide the analytical tools and framework necessary to adapt to and account for ecosystem needs and maintain ecosystem integrity (e.g., productivity, species diversity, habitat diversity and integrity, and food web structure and function) within the fisheries management process. It should prescribe the use of multi-species models to determine the ecosystem effects of fishing and to facilitate *the application of research results directly to identified management needs*. The California Current Integrated Ecosystem Assessment should play a significant role in this process.

- The EFMP should provide guidance on incorporating ecological considerations, with an emphasis on predator-prey interactions, into single-species stock assessments.

- The EFMP should develop indicators of ecosystem status and establish management benchmarks for those indicators, both "healthy" states to be maintained and "unhealthy" states to be avoided.

- Priority should be given to developing an index of forage species abundance. This would entail monitoring and assessing the individual and collective status of CPS species, as well as other forage species not currently managed or monitored, and evaluating that status against established benchmarks.

- The EFMP should provide a framework for incorporating ecological considerations into the setting of harvest specifications and in the development of management reference points under existing FMPs. (We stress here that, because of the importance of CPS as forage in the ecosystem, the Council should continue its current efforts to incorporate ecological considerations into the CPS management plan while the EFMP is under development.)

- Information gathered, synthesized and analyzed in the EFMP should be used both quantitatively and qualitatively to inform management goals, objectives and decisions within fishery-specific FMPs.

With respect to the scope of the EFMP's regulatory authority, we return to the EPAP report and its recommendation that fishery ecosystem plans "contain regulations or management measures *which extend across individual FMPs*" and consider "management actions with respect to all living marine resources, *managed or not*." At the very least, the EFMP should have regulatory and management authority over forage species that qualify as "ecosystem component" species, i.e., those not actively managed or monitored under the CPS FMP and/or not the target of a regulated fishery. This authority could be used to postpone the development of a new fishery for a forage species until it can be managed in a manner consistent with the Council's ecosystem goals and policies as established in the EFMP.

The greatest benefit the EFMP can provide is a better understanding of the effects of fishing and fisheries management decisions on the ecosystem, and in return better inform and improve the Council's decision-making and ultimately its stewardship of west coast fisheries. We look forward to working with the Council to make this happen.

Thank you for considering our views.

Sincerely,

Ken Hinman
President

Ecosystem Fishery Management Plan

Ben Enticknap

and

Geoff Shester, Ph.D.

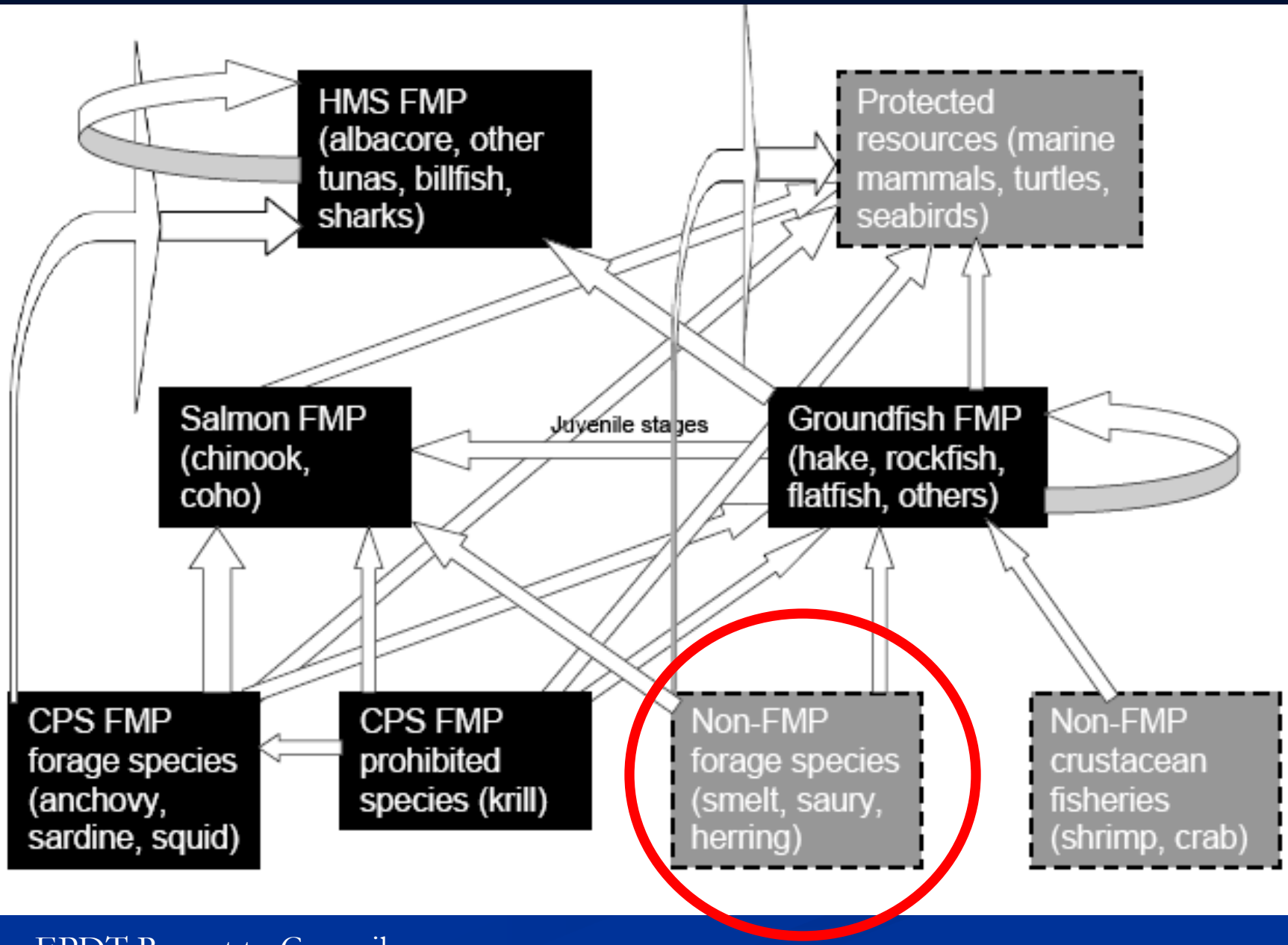
OCEANA | Protecting the World's Oceans

Pacific Fishery Management Council
Agenda H.1 Ecosystem Based Management

June 11, 2011

"The overall objective of ecosystem based fishery management is to sustain healthy marine ecosystems and the fisheries they support"

Pikitch et al. 2004. Ecosystem-Based Fishery Management. Science. 305: 346-347.



From EPDT Report to Council

The Need for an Ecosystem FMP: Legal Mandates

- MSA: Optimum Yield is prescribed as Maximum Sustainable Yield 'as reduced by any relevant economic, social, or ***ecological*** factor.' 16 USC 1802 Sec. 3(33)(B).

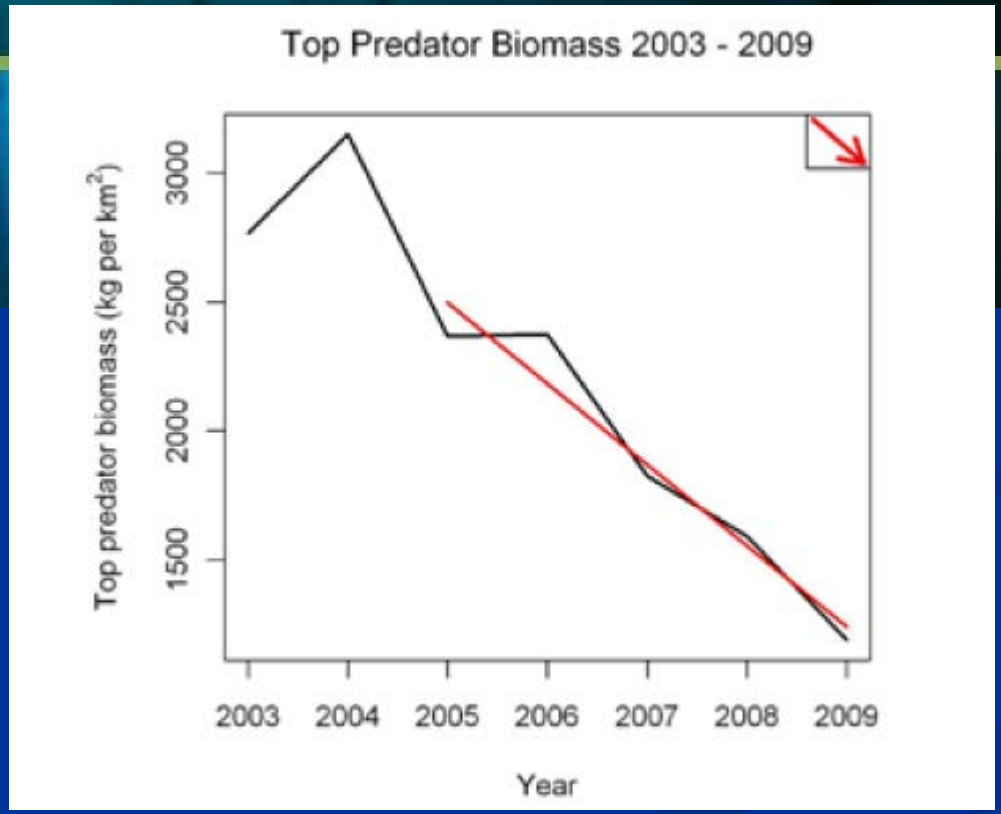
- NS1: FMPs must must address ecological factors in its OY specifications including:
  - "maintaining adequate forage for all components of the ecosystem"
  - "consideration should be given to managing forage stocks for higher biomass than Bmsy to enhance and protect the marine ecosystem" (600.310 (e)(3))

- EFH Final Rule: Essential Fish Habitat: "Loss of prey may be an adverse effect on EFH" (600.815 (a)(7))

February 2011

Integrated Ecosystem Assessment

The Science Needed for a Healthy California Current



Over 50% decline in top fish predator biomass from 2003-2009 based on NMFS Trawl Surveys

"*Declines in relative abundance of forage fish were recorded and related to changes in salmon and seabird populations and productivity*" p. 119

Data on Key Predators for Each Key Forage Species

Pacific sardine example

Predation parameters obtained from Field et al. [5].

	Share of sardine in diet	Consumption per unit biomass	Share of sardines taken	Production/ consumption
Salmon	0.01	5.82	0.129128	0.159794
Albacore tuna	0.05	7.3	0.030892	0.049315
Coastal sharks	0.05	2.8	0.042318	0.064286
Common murres	0.001	129	0.007019	0.000775
Gulls	0.001	122	0.001475	0.000984
Orcas	0.005	11.15	0.000337	0.001794
Toothed whales	0.05	28.85	0.453472	0.002426
Sea lions	0.01	16.38	0.011883	0.004518
Fur seals	0.01	39.03	0.014157	0.002332
Baleen whales	0.09	7.58	0.309318	0.004881

Hannesson & Herrick (2010)

The Forage Trade-Off

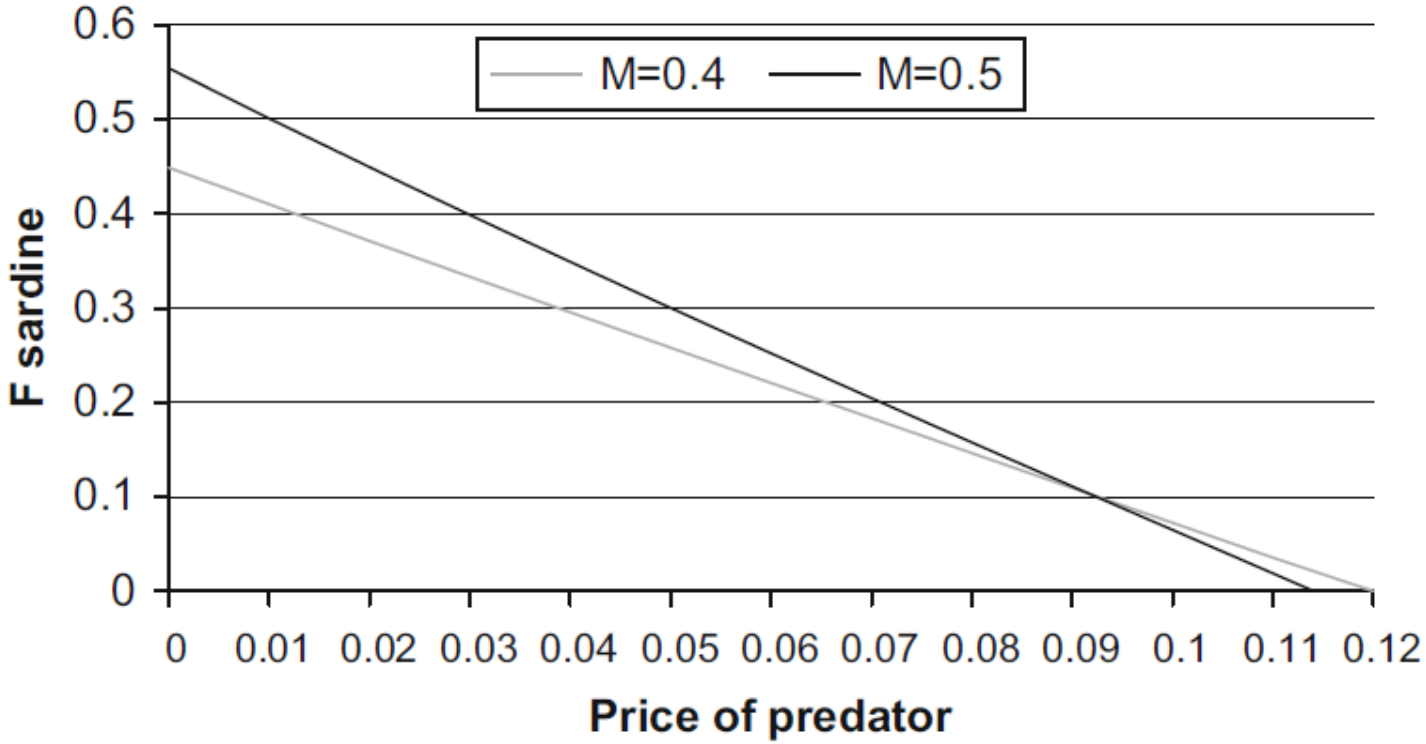


Fig. 3. How optimal fishing mortality of sardines changes with net price of predators, with a net sardine price of 0.02, for two different levels of natural mortality.

From Hanneson & Herrick. 2010. "The value of Pacific sardine as forage fish". *Marine Policy*.

Ecosystem FMP Objectives

- Initial focus should be on forage species
- E-FMP with specific regulatory authority, not merely advisory
  - Unfished forage species as "Ecosystem Component" species
  - Account for forage needs when setting ACLs
  - Prey as EFH across FMPs

Scientist Statement:

"We the undersigned marine scientists, fishery scientists, and conservation biologists see a strong and urgent need to shift to an ecosystem-based approach to managing the forage base of the California Current Large Marine Ecosystem."

– D. Pauly, L. Crowder, W. Gilly, P. Dayton, and 22 others

Pacific Coast SPORTFISHING MAGAZINE

"Forage is the heartbeat of the ocean, the life giving sustenance that keeps the thousands of species of large food and sport fish alive and robust. Nothing, no other category of fish, determines the fate of our favorite seafood as much as the availability of sufficient forage to keep them healthy and reproductive."

-Darrell Ticehurst, Chairman of the Board of Coastside Fishing Club

King County

Larry Phillips
Councilmember, District Four
Metropolitan King County Council

May 17, 2011

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

RE: Support for Ecosystem Fishery Management Plan

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I support the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that ecosystem considerations must be incorporated into fishery management in order to have long-term sustainable fisheries and a healthy ocean environment. For example, the 1999 "Ecosystem-based Fishery Management" report to Congress suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species, and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. While it may be difficult, it is vitally important to move forward with an ecosystem-based fishery management approach. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Larry Phillips, Councilmember
Metropolitan King County Council, District Four

King County Courthouse, 516 Third Avenue Room 1200, Seattle, WA 98104 206-296-1004
Fax 206-296-0370 TTY 206-296-1024 larry.phillips@kingcounty.gov www.kingcounty.gov/phillips

ROB HANDY

Lane County Commissioner
North Eugene District
Rob.HANDY@co.lane.or.us

May 18, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a County Commissioner from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Rob Handy

Lane County Commissioner

From the Desk of **STEVE BENNETT**
SUPERVISOR, FIRST DISTRICT
(805) 654-2703
FAX: (805) 654-2226
E-mail: steve.bennett@ventura.org

BOARD OF SUPERVISORS
COUNTY OF VENTURA
GOVERNMENT CENTER, HALL OF ADMINISTRATION
800 SOUTH VICTORIA AVENUE, VENTURA, CALIFORNIA 93009

May 17, 2011

Mr. Mark Cedergreen, Chair & Members
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

RE: Support for Ecosystem Based Fisheries Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Based Fisheries Management Plan.

Residents of Coastal California are keenly interested in sound long-term management of ocean fisheries. The economic and recreational benefits of sustainable fisheries are very important considerations to the residents and business owners of Ventura County. State adoption of Marine Protected Areas has laid the groundwork to for sound ecosystem based fisheries management, and these areas are already providing evidence of the benefits of broad ecosystem management.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Abundant

populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem Based FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Thank you for your work to date on Ecosystem Based management, and I respectfully encourage adoption and implementation of this scientifically sound approach to sustainable fisheries management.

Cordially,

Steve Bennett,
Supervisor, First District

Board of Wahkiakum County Commissioners

Lisa M. Marsyla District #1 | *Daniel L. Cothren* District #2 | *Blair H. Brady* District #3

May 23, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC Members:

I am a County Commissioner from Wahkiakum County, Washington, a fishing community. I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

In order to have a long-term sustainable fishery, and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. A 1999 report to Congress, suggested an "Ecosytem-based Fishery Management," management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend upon. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

I feel it is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, ground fish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a health ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing

64 Main Street, P.O. Box 586 Cathlamet, Washington 98612 (360) 795-8048 phone (360) 795-0342 fax

conservation and management measures as appropriate, and manage for a healthy forage base would be an important step forward.

Our oceans and fishing communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for taking the time to consider my input.

Sincerely,

Daniel L. Cothren
Wahkiakum County Commissioner
District No. 2

PETER SORENSON
Lane County Commissioner
South Eugene District
Peter.SORENSON@co.lane.or.us

May 5, 2011
WD bc/ps/11036/T

Mark Cedkgreen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220- 1384

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, 1 am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity upon which the fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FWs). It is equally important that the PFMC develop an umbrella Ecosystem PMP that can link ecological considerations across the four FMPs (salmon, ground fish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an

ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my perspective.

Very truly yours,

Pete Sorenson
Lane County Commissioner

THE PEW ENVIRONMENT GROUP

May 30, 2011

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

Dear Chair Cedergreen,

Thank you for this opportunity to offer our thoughts and concerns regarding the Pacific Fishery Management Council's (Council) development of an Ecosystem Fishery Management Plan (Plan).

Historical Perspective

The concepts being discussed with respect to the development of this Plan are not new or revolutionary. Ecosystem-based fishery management (EBFM) and its scientific underpinnings have been extensively reviewed and vetted within the Magnuson-Stevens Act context and process, with implications for management becoming clearer as the discussion and the scientific foundation evolves.

As early as 1998, the Ecosystem Principles Advisory Panel (EPAP), convened by the National Marine Fisheries Service at the request of Congress, produced a report which found that EBFM, "will contribute to the stability of employment and economic activity in the fishing industry and to the protection of marine biodiversity on which fisheries depend."[1] Since that time, the body of knowledge on EBFM has grown along with calls from government, fisheries managers and the fishing industry itself lauding its merits and advocating its implementation. For example, in 2005 the Pacific States Marine Fisheries Commission convened a panel of scientists to identify a process to help Regional Councils "move forward in incremental ways, from the existing management approaches that generally consider ecosystem interactions in an implicit and often peripheral way, to a management system that, over time, would incorporate explicit EBFM considerations into the fishery assessments themselves."[2]

The Council has an opportunity here to further establish itself as a leader in the management of marine resources. As an initial step in towards EBFM, we urge this Plan to begin to explicitly consider marine food web interactions and predator-prey

[1] National Marine Fisheries Service (NMFS). 1999. *Ecosystem-Based Fishery Management. A Report to Congress by the Ecosystem Principles Advisory Panel.* United States Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Silver Springs, Maryland.
[2] Pacific States Marine Fisheries Commission (PSMFC). 2005. *Strengthening Scientific Input and Ecosystem-Based Fishery Management for the Pacific and North Pacific Fishery Management Councils.* Suggestions from a panel discussion. July 19-20, 2005. Seattle, Washington.

relationships in the management of fisheries. To that end, this Plan should identify important forage species in the California Current Ecosystem and evaluate the ecological services they provide. It should further help develop mechanisms for the incorporation of ecosystem considerations into the management of existing forage fisheries and be given the authority to apply a precautionary approach to currently unmanaged and non-targeted forage fish species, including options to prohibit directed fishing on select forage species and also to suspend the development of new fisheries on select forage species until scientific knowledge and new management measures can be implemented to protect ecosystem structure and function and ensure sustainability.

Examples of EBFM

As ecosystem science has progressed and the implications for management have become clear, we have seen positive examples of ecosystem principles being incorporated into existing management. In particular with regard to protecting the forage base and the marine food web, we have seen leadership in the Pacific region.

In 1998, the North Pacific Fishery Management Council (NPFMC) amended the Gulf of Alaska and Bering Sea and Aleutian Island Groundfish Fishery Management Plans to identify a list of over 20 important forage species in 9 scientific families and prohibit directed fishing on those species. According to the National Marine Fisheries Service, this was "necessary to conserve and manage the forage fish resource off Alaska….a critical food source for many marine mammal, seabird and fish species."[3] In 1999, the state of Washington implemented a precautionary fish policy that "manages forage fish from an ecosystem-based approach rather than a single-species approach." This management plan further emphasizes that "the ability of forage fish to provide a source of food for salmon, other fish, marine birds and marine mammals will be a primary consideration."[4] In 2006, the Council adopted a prohibition on commercial fishing for all species of krill in West Coast federal waters through its Coastal Pelagic Species Fishery Management Plan (CPS FMP), citing krill as "one of the cornerstones of the entire marine ecosystem."[5] In 2009, the NPFMC again sought to enact precautionary forage policies through its implementation of the Arctic Fishery Management Plan which prohibited commercial fishing for all species in the Exclusive Economic Zone north of the Bering Strait.

These are solid examples of precautionary forage policies that do not create winners and losers, nor do they have significant negative impacts on existing major fisheries. In fact, we believe proactive and precautionary management of the forage base can help increase both the productivity and sustainability of all of our fisheries. Moreover, conservation groups are not alone in this view. The NPFMC's ban on new fisheries for

[3] 50 CFR 679. See also June 2004 PFMC Meeting. Exhibit G.4.a Situation Summary.
[4] Bargmann, Greg. (1998) Forage Fish Management Plan. A plan for managing the forage fish resources and fisheries of Washington. Washington Department of Fish and Wildlife. Olympia, WA.
[5] Please refer to June 2004 PFMC Meeting. Exhibit G.4.b. Letter from Monterey Bay National Marine Sanctuary to PFMC Chair Donald Hansen.

forage species is hailed in a commercial fishing industry sponsored study as one of thirteen "best practices in ecosystem-based fishery management."[6]

Ecosystem Indicators

As has been discussed by the Council, one of the objectives of this Plan will be to establish a suite of indicators of ecosystem status for the Council to monitor and utilize in the decision making process. We strongly feel that overall forage abundance and density is an appropriate indicator of ecosystem status. We further understand that the Council is seeking to work with the National Marine Fisheries Service's Integrated Ecosystem Assessment for the California Current Ecosystem to hone its scope of inquiry to issues important to the Council. As this process unfolds and as ecosystem science expands, we encourage the council to establish benchmarks of forage abundance against which the forage indicator may be measured. As noted above, we also believe this Plan should identify important forage species and evaluate the ecological services they provide to the ecosystem. This information should then be used, in conjunction, to develop conservation and management measures that protect and conserve the forage base. At the outset, we acknowledge that much of this information will be qualitative. However, as noted by the PSMFC's panel, "As models become refined and better understanding of species interactions is obtained (through data collection and field research programs), the implications of these changes for fisheries management may be better understood."[7]

Cross-FMP Issues (EFH, ESA, Cumulative Impacts & Forage Base)

As the Council's various advisory bodies have deliberated on the merits of EBFM and the implications it could have for their respective fisheries, there have been a suite of issues identified as pertaining to all the existing Fishery Management Plans (FMPs). Because these issues cut across all the FMPs, we believe they are best addressed within the context of an Ecosystem FMP. These issues include among others, essential fish habitat (EFH) and spatial management, Endangered Species Act listed and protected species, the cumulative impacts of all the Council's fisheries and conservation of the forage base upon which the other FMPs rely.

As the Council endeavors to develop management measures to protect EFH, we reiterate comments submitted by the Habitat Committee in March 2011 that supported developing an ecosystem indicator for forage species and recognized that "forage fish are key ecosystem component species and are an EFH component (as prey)."[8]

With regards to protection of the forage base as a cross-FMP issue, we'd like to remind the Council of comments developed by the Coastal Pelagic Species Management Team (CPSMT) in Amendment 13 to the CPS FMP. This amendment states, "The

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[6] 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] Pacific States Marine Fisheries Commission (PSMFC). 2005. *Strengthening Scientific Input and Ecosystem-Based Fishery Management for the Pacific and North Pacific Fishery Management Councils.* Suggestions from a panel discussion. July 19-20, 2005. Seattle, Washington.

[8] Please refer to March 2011 PFMC Meeting Agenda Item J.1.d, Supplemental Habitat Committee Report

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." This document goes on to state, "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."[9]

We wholeheartedly concur with the CPSMT that an Ecosystem FMP is the proper place to address ecosystem-wide forage base issues. However, as the Plan begins to identify policy tradeoffs and management scenarios are evaluated, we believe it should have the authority to implement management measures on cross-FMP issues like the forage base, rather than having to address those issues within the context of singles-species/species complex FMPs.

Optimum Yield & National Standard Guidelines

It should be objectively clear that the Plan will help the Council's existing FMPs come into compliance with the Magnuson-Stevens Fishery Management and Conservation Act, which requires that, "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry."[10] As you know, the statute defines OY to be Maximum Sustainable Yield as reduced by relevant economic, social and ecological factors.[11]

In regards to economic considerations, we believe the management of forage species should consider new scientific studies evaluating the economic value of forage species as forage for other recreationally and commercially important species relative to their economic value as commercially targeted stocks.

In regards to ecological considerations, the National Standard 1 Guidelines articulate that "consideration should be given to managing forage stocks for higher biomass than B_{MSY} to enhance and protect the marine ecosystem."[12] Among others, considerations under this section should include the relative contribution of a particular forage stock to the diets of key predators with respect to population trends and ocean conditions and the results of modeling analyses to identify the potential effects of alternative harvest strategies.

[9] Pacific Fishery Management Council. 2010. Amendment 13 to the Coastal Pelagic Species Fishery Management Plan. Please refer to March 2010 PFMC Meeting Agenda Item H.2.a.
[10] 16 USC 1851 § 301(a)(1)
[11] 16 USC 1802 § 3(33)(B)
[12] 50 CFR § 600.310(e)(3)(iv)(C).

Regulatory Authority

We believe it is appropriate and warranted for the Plan to be given management and regulatory authority to address cross-FMP issues and concerns such as the forage base of the California Current, cross-FMP essential fish habitat (including prey), the recovery of protected species, and the cumulative impacts of all the Council's FMPs on the ecosystem. To this end, we echo the sentiments of the PSMFC's panel that suggested steps to further EBFM considerations, including "developing indicators of ecosystem health and a program to monitor these indicators, developing decision rules based on the indicators and defining, evaluating and revising various management strategies to better meet goals."[13]

With respect to the forage base in particular, we believe that this Plan should be given the authority to implement conservation and management measures in order to establish a precautionary policy on new forage fisheries. Moreover, we believe that this view is consistent with the penumbra of scientific opinion, including the EPAP's recommendation to "change the burden of proof."[14]

Conclusion

In closing, we'd like to thank the Council for the sincere and deliberate process by which it has sought to develop an Ecosystem FMP. We believe a Plan that embodies the philosophy of adaptive management and evolves over time to incorporate peer-reviewed and rigorous ecosystem principles and management actions will greatly improve both the sustainability and productivity of our fisheries. As the Plan provides decision makers with a better understanding of fisheries impacts on the ecosystem, it will ultimately enable the Council to improve the management and stewardship of our oceans.

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
Senior Associate
Pacific Fish Conservation Program
Pew Environment Group

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[13] Pacific States Marine Fisheries Commission (PSMFC). 2005. *Strengthening Scientific Input and Ecosystem-Based Fishery Management for the Pacific and North Pacific Fishery Management Councils.* Suggestions from a panel discussion. July 19-20, 2005. Seattle, Washington.

[14] National Marine Fisheries Service (NMFS). 1999. *Ecosystem-Based Fishery Management. A Report to Congress by the Ecosystem Principles Advisory Panel.* United States Department of Commerce, National Oceanic and Atmospheric Administration, NMFS, Silver Springs, Maryland.

H-1.C

PETER SORENSON
Lane County Commissioner
South Eugene District
Peter.SORENSON@co.lane.or.us

Supplemental Public Comment 3
June 2011

May 5, 2011
WD bc/ps/11036/T

Mark Cedkgreen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220- 1384

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, 1 am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity upon which the fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FWs). It is equally important that the PFMC develop an umbrella Ecosystem PMP that can link ecological considerations across the four FMPs (salmon, ground fish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an

ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my perspective.

Very truly yours,

Pete Sorenson
Lane County Commissioner

COUNTY OF MARIN

THE BOARD OF SUPERVISORS OF MARIN

ADMINISTRATION BUILDING
3501 CIVIC CENTER DR. SUITE 329
SAN RAFAEL, CALIFORNIA 94903-4193
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FAX (415) 499-3645
TTY (415) 499-6172
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May 24, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As the Marin County Supervisor representing Marin County's coastal areas I am writing in strong support of the efforts of the Pacific Fishery Management Council (PFMC) to develop an Ecosystem Fishery Management Plan.

Marin County has long been an advocate for ecosystem based management for fishery management, in fact our County has worked hard to restore ecosystems supporting salmonids, through the FishNet 4C program and by improving all County policies and practices related to fisheries. These range from road maintenance and fish passage projects to the San Geronimo Valley Salmon Enhancement Plan which lays out a plan to support fish friendly land use practices in this important Coho Salmon watershed. Marin County has also actively engaged in California's Marine Life Protection Act implementation, in order to provide and protect sustainable fisheries.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of

the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. As local governments rise to the difficult and costly task of protecting fisheries through improved land use practices and policies, it is critical that our partners in fishery management also demonstrate leadership in ecosystem based management. Development of the Ecosystem FMP framework and including a focus on forage species will provide both direction and encouragement to other responsible agencies such as counties and cities, in addition to tangible benefits for fisheries.

Thank you for considering my input.

Sincerely,

Steve Kinsey

Steve Kinsey, Marin County Supervisor

County of Santa Cruz

BOARD OF SUPERVISORS

701 OCEAN STREET, SUITE 500, SANTA CRUZ, CA 95060-4069
(831) 454-2200 • FAX: (831) 454-3262 TDD: (831) 454-2123

JOHN LEOPOLD	ELLEN PIRIE	NEAL COONERTY	GREG CAPUT	MARK W. STONE
FIRST DISTRICT	SECOND DISTRICT	THIRD DISTRICT	FOURTH DISTRICT	FIFTH DISTRICT

June 3, 2011

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

RE: ECOSYSTEM BASED MANAGEMENT

Dear Mr. Cedergreen and PFMC Members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity on which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species, and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems, and leaving enough of them swimming in the ocean is one strategy that will pay off in the

long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

NEAL COONERTY, Supervisor
Third District

NC:ted

cc: Save Our Shores

1354A3

BOARD OF SUPERVISORS

COUNTY OF HUMBOLDT

825 5TH STREET

EUREKA, CALIFORNIA 95501-1153 PHONE (707) 476-2390 FAX (707) 445-7299

May 26, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

I am writing as Chair of the Humboldt County Board of Supervisors in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

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Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Mark Lovelace, Chair
Humboldt County Board of Supervisors

King County

Julia Patterson
Councilmember, District 5
Metropolitan King County Council

May 25, 2011

Mr. Merk Cedergreen, Chair
Pacific Fishery Management Council (PFMC)
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

RE: Ecosystem Based Management

Dear Mr. Cedargreen and PFMC Members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management", suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity upon which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

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Thank you for your consideration.

Sincerely,

Julie Patterson

Julia Patterson

King County Courthouse, 516 Third Avenue Room 1200, Seattle, WA 98104
206-296-1005 Fax 206-296-1050 julia.patterson@kingcounty.gov www.kingcounty.gov/patterson

King County

Larry Phillips
Councilmember, District Four
Metropolitan King County Council

May 17, 2011

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

RE: Support for Ecosystem Fishery Management Plan

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I support the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that ecosystem considerations must be incorporated into fishery management in order to have long-term sustainable fisheries and a healthy ocean environment. For example, the 1999 "Ecosystem-based Fishery Management" report to Congress suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species, and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. While it may be difficult, it is vitally important to move forward with an ecosystem-based fishery management approach. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Larry Phillips, Councilmember
Metropolitan King County Council, District Four

King County Courthouse, 516 Third Avenue Room 1200, Seattle, WA 98104 206-296-1004
Fax 206-296-0370 TTY 206-296-1024 larry.phillips@kingcounty.gov www.kingcounty.gov/phillips

ROB HANDY

Lane County Commissioner
North Eugene District
Rob.HANDY@co.lane.or.us

May 18, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a County Commissioner from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Rob Handy

Lane County Commissioner

From the Desk of **STEVE BENNETT**
SUPERVISOR, FIRST DISTRICT
(805) 654-2703
FAX: (805) 654-2226
E-mail: steve.bennett@ventura.org

BOARD OF SUPERVISORS
COUNTY OF VENTURA
GOVERNMENT CENTER, HALL OF ADMINISTRATION
800 SOUTH VICTORIA AVENUE, VENTURA, CALIFORNIA 93009

May 17, 2011

Mr. Mark Cedergreen, Chair & Members
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

RE: Support for Ecosystem Based Fisheries Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Based Fisheries Management Plan.

Residents of Coastal California are keenly interested in sound long-term management of ocean fisheries. The economic and recreational benefits of sustainable fisheries are very important considerations to the residents and business owners of Ventura County. State adoption of Marine Protected Areas has laid the groundwork to for sound ecosystem based fisheries management, and these areas are already providing evidence of the benefits of broad ecosystem management.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Abundant

populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem Based FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

Thank you for your work to date on Ecosystem Based management, and I respectfully encourage adoption and implementation of this scientifically sound approach to sustainable fisheries management.

Cordially,

Steve Bennett,
Supervisor, First District

KENDALL SMITH
Supervisor
Fourth District

UKIAH OFFICE PHONE: (707) 463-4221
UKIAH OFFICE FAX: (707) 463-7237
FORT BRAGG OFFICE PHONE: (707) 961-2696
FORT BRAGG OFFICE FAX: (707) 961-4359
EMAIL: smithk@co.mendocino.ca.us

COUNTY OF MENDOCINO
BOARD OF SUPERVISORS
501 Low Gap Road • Room 1010
Ukiah, California 95482

May 23, 2011

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

Re: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step forward.

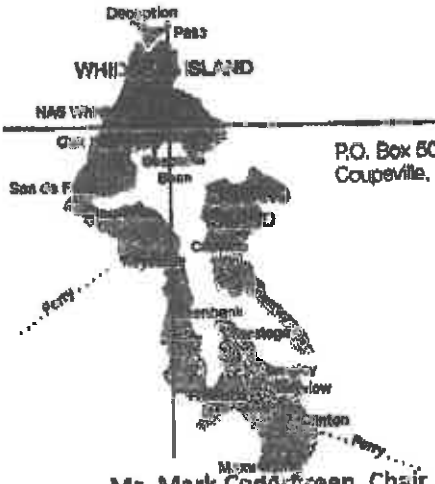
Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. There are significant challenges, but moving forward with an ecosystem-based fishery management approach is vitally important. Significant progress can be made now by developing an Ecosystem FMP framework and including a focus on forage species.

Thank you for your serious consideration.

Sincerely,

Kendall Smith

Kendall Smith, 4th District Supervisor
Mendocino County Board of Supervisors



Island County Board of Commissioners

P.O. Box 5000
Coupeville, Washington 98239-5000

Phone: (360) 679-7354
From Camano: (360) 629-4522
From S. Whidbey: (360) 321-5111
Fax (360) 679-7381
www.islandcounty.net

June 1, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC Members:

As a Commissioner of Island County, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

In order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. We simply cannot silo the many complex and interrelated biological functions of a healthy environment. I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

An integrated PFMC with existing Fishery Management Plans (FMPS) is crucial. It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species and highly migratory species).

Recognizing forge fish in the Ecosystem FMP while implementing conservation and management measures as appropriate, and managing for a healthy forage base would be an important step toward long term natural resource preservation and national solvency.

Our oceans and coastal communities are facing many challenges. We must plan for tomorrow today to avoid catastrophic ecological and costly failures.

I urge you to adopt an Ecosystem FMP framework and to include a focus on forages species.

Thank you for your consideration.

Sincerely,

Angie Homola
Island County Commissioner, District 2

BOARD OF SUPERVISORS

1055 MONTEREY, ROOM D430 • SAN LUIS OBISPO, CALIFORNIA 93408-1003 • 805.781.5450

BRUCE GIBSON
SUPERVISOR DISTRICT TWO

May 19, 2011

Mr. Mark Cedergreen, Chair
Pacific Fishery Management council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

RE: Regional Scale Ecosystem Based Management

Dear Mr. Cedergreen:

I write in support of the Pacific Fishery Management Council's (PFMC) work to develop an Ecosystem Fishery Management Plan. I am the District 2 Supervisor in San Luis Obispo County, representing the coastal communities near Morro Bay, California.

I particularly support ecosystem-based fishery management at appropriate regional scales, as fish stocks are not uniformly distributed over the waters managed by PFMC. I have been impressed with recent efforts by the Central Coast Groundfish Project and the San Luis Obispo Science & Ecosystem Alliance, who have developed innovative approaches to this issue.

It is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It has been long recognized that in order to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, "Ecosystem-based Fishery Management," suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend.

In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important.

Sincerely,

Bruce Gibson

BRUCE GIBSON
Supervisor, District Two
San Luis Obispo County

PAM SLATER-PRICE
SUPERVISOR, THIRD DISTRICT
SAN DIEGO COUNTY BOARD OF SUPERVISORS

June 2, 2011

Post-it® Fax Note 7671	Date 6/3	# of pages 2
To Peg Reagan	From Jackie Kohatsu	
Co./Dept.	Co.	
Phone # 541-247-8077	Phone # 619-531-5533	
Fax # 541-247-9521	Fax # 619-234-1559	

Mr. Mark Cedergreen, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 1-1
Portland, OR 97220-1384

RE: Ecosystem-Based Management

Dear Mr. Cedergreen and PFMC Members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

It has long been recognized that to have long-term sustainable fisheries and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. For example, the 1999 report to Congress, *Ecosystem-based Fishery Management*, suggests this management approach is likely to contribute to increased abundance of those species that have been overfished, to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend. I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

It is important the PFMC formally integrate considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, groundfish, coastal pelagic species, and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a healthy ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing conservation and management measures, as appropriate, and managing for a healthy forage base would be an important step forward.

County Administration Center • 1600 Pacific Highway, Room 335 • San Diego, CA 92101-2470
(619) 531-5533 • Toll Free (800) 852-7334
Email: pam.slater@sdcounty.ca.gov

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences ager the fact because they are not considered in the decision-making or directly monitored. I do not doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Pam Slater-Price

PAM SLATER-PRICE
San Diego County Board of Supervisors
District 3
PSP/sk

San Juan County Council

HOWARD "HOWIE" ROSENFELD
District #3
340 Court Street, No. 1, Friday Harbor, WA 98250
(360) 378-2898

June 3, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC members:

As a local elected official from a coastal county, I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

Our oceans and coastal communities are facing many challenges. Too often we hear about ecological consequences after the fact because they are not considered in decision-making or directly monitored. I don't doubt that it will be difficult, but moving forward with an ecosystem-based fishery management approach is vitally important. Big strides can be made now by developing the Ecosystem FMP framework and including a focus on forage species.

Thank you for considering my input.

Sincerely,

Howard Howie Rosenfeld

Board of Wahkiakum County Commissioners

Lisa M. Marsyla, District #1 | *Daniel L. Cochren, District #2* | *Blair H. Brady, District #3*

May 23, 2011

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

RE: Ecosystem Based Management

Dear Mr. Cedergreen and PFMC Members:

I am a County Commissioner from Wahkiakum County, Washington, a fishing community. I am writing in support of the Pacific Fishery Management Council (PFMC) work to develop an Ecosystem Fishery Management Plan.

In order to have a long-term sustainable fishery, and a healthy ocean environment, ecosystem considerations must be incorporated into fishery management. A 1999 report to Congress, suggested an "Ecosytem-based Fishery Management," management approach is likely to contribute to increased abundance of those species that have been overfished, contribute to the stability of employment and economic activity in the fishing industry, and to the protection of marine biodiversity which fisheries and our coastal economies depend upon. In order to move forward with ecosystem-based fishery management, I support the development of an Ecosystem Fishery Management Plan with the goal of maintaining and protecting ecosystem health and fishery sustainability.

I feel it is important that the PFMC formally integrate ecosystem considerations into the existing Fishery Management Plans (FMPs). It is equally important that the PFMC develop an umbrella Ecosystem FMP that can link ecological considerations across the four FMPs (salmon, ground fish, coastal pelagic species and highly migratory species) and manage ecologically important species that fall outside of the current fishery management structure. Specifically, I support an Ecosystem FMP that would address forage species that are important prey for fish in the existing management plans, but are not currently managed by the PFMC. Forage fish are vital for marine ecosystems and leaving enough of them swimming in the ocean is one strategy that will pay off in the long run. Abundant populations of forage species are essential for sustainable fisheries and a health ocean. Recognizing this in the Ecosystem FMP by including forage species, implementing