

PACIFIC COAST FISHERY ECOSYSTEM PLAN

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

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LIST OF ACRONYMS AND ABBREVIATIONS

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

Contents

1	Introduction.....	1
1.1	Purpose and Need	1
1.2	How this Document is Organized.....	1
1.3	Schedule and Process for Developing and Amending the FEP and the Ecosystem Initiatives.....	2
1.4	State-of-the-Ecosystem Reporting.....	3
2	Objectives	4
3	California Current Ecosystem Overview	6
3.1	Geography of the Ecosystem	6
3.1.1	General Description and Oceanographic Features of the CCE	6
3.1.2	Major Bio-Geographic Sub-Regions of the CCE	8
3.1.3	Political Geographic and Large-Scale Human Demographic Features of the CCE	12
3.2	Biological Components and Relationships of the CCE	15
3.2.1	Biological Components	15
3.2.2	Species Interactions.....	27
3.3	CCE Abiotic Environment and Habitat	31
3.3.1	Geological Environment.....	33
3.3.2	Water Column Temperature and Chemical Regimes	37
3.3.3	CCE Vegetation and Structure-Forming Invertebrates	38
3.3.4	Human Effects on Council-Managed Species' Habitat.....	43
3.4	Fisheries of the CCE	51
3.4.1	Historical CCE Fisheries	51
3.4.2	Current Fisheries	56
3.4.3	Fishing Communities.....	82
3.5	Fisheries and Natural Resource Management in the CCE.....	88
3.5.1	Council Fisheries Management	90
3.5.2	Tribe and State Fisheries	102
3.5.3	Multi-State, Multi-Tribe and State-Tribal Entities.....	118
3.5.4	International Science and Management Entities	120
3.6	Sources for Chapter 3.....	126
4	Addressing the Effects and Uncertainties of Human Activities and Environmental Shifts on the Marine Environment.....	134
4.1	Changes in Fish Abundance within the Ecosystem	135
4.1.1	Direct and Indirect Effects of Fishing on Fish Abundance	135
4.1.2	Direct and Indirect Effects of Non-Fishing Human Activities on Fish Abundance.....	139
4.1.3	Environmental and Climate Drivers of Fish Abundance.....	141
4.2	Changes in the Abundance of NonFish Organisms within the Ecosystem.....	143

4.2.1	Direct and Indirect Effects of Fishing on Non-Fish Abundance	143
4.2.2	Direct and Indirect Effects of Non-Fishing Activities on Non-Fish Abundance	150
4.2.3	Environmental and Climate Drivers of Non-Target Species.....	150
4.3	Direct and Indirect Effects of Fishing on Biophysical Habitat	152
4.3.1	Commercial Fisheries with Mobile Fishing Gears	153
4.3.2	Commercial Fisheries with Fixed Fishing Gears	155
4.3.3	Recreational Fisheries	156
4.4	Changes in Fishing Community Involvement in Fisheries and Dependence Upon Fisheries Resources.....	157
4.4.1	Direct and Indirect Effects of Fishery Resource Availability on Fishing Communities.....	158
4.4.2	Costs of Participating in Fisheries	161
4.4.3	Environmental and Climate Drivers for Fishing Communities	161
4.5	Aspects of Climate Change Expected to Affect Living Marine Resources within the CCE	165
4.5.1	Temperature.....	165
4.5.2	Ocean pH.....	166
4.5.3	Oxygen	167
4.5.4	Upwelling, Phenology, and Changes in Existing Climate Patterns.....	168
4.6	Sources for Chapter 4.....	170
5	PFMC Policy Priorities for Ocean Resource Management.....	178
5.1	Species of Particular Interest to the Council.....	178
5.1.1	Anadromous Species	178
5.1.2	Species protected through an overfished species rebuilding program.....	179
5.1.3	Species dependent upon a fixed habitat type.....	180
5.1.4	Species and locations with tribal treaty rights to fishing.....	181
5.1.5	Internationally-managed species	181
5.2	Fish Habitat.....	182
5.3	Fisheries	182
5.3.1	Communities with a Dependency on Fishery Resources	183
5.3.2	Tribal Fishing Communities.....	184
5.3.3	Brief Duration Fisheries	184
5.3.4	Location-Constrained Fisheries.....	185
5.4	Ecosystem Structure and Function.....	186
5.5	Sources for Chapter 5.....	187
6	Bringing Cross-FMP and Ecosystem Science into the Council Process.....	188
6.1	Bringing More Ecosystem Information into Stock Assessments.....	188
6.2	Annual Reports on Ecosystem Indicators	189

1 Introduction

1.1 Purpose and Need

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

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

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

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

1.2 How this Document is Organized

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

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

In November 2009, the Council appointed two new ad hoc advisory bodies, the Ecosystem Plan Development Team (EPDT) and the Ecosystem Advisory SubPanel (EAS). From 2010 through early 2013, these advisory bodies, with direction from the Council and in cooperation with its permanent committees, developed a draft FEP for public review, released in February 2013. At its April 2013 meeting in Portland, Oregon, the Council adopted a final FEP, providing instructions for the document's last revisions and for the Council's future discussions of ecosystem science and cross-FMP policy issues.

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

Appendix A to the FEP is an Ecosystem Initiatives appendix that: 1) provides the Council with a process by which it may consider ecosystem-based management initiatives to address issues of interest to the Council that may cross authorities of two or more of its FMPs; 2) provides a fleshed-out example FEP Initiative 1 that the Council has decided to consider in 2013 and beyond, to protect unfished lower trophic level (forage) fish species within the U.S. West Coast Exclusive Economic Zone (EEZ); and 3) provides additional potential cross-FMP initiatives for review and consideration by the Council and the public.

Each year at the Council's March meeting, the Council and its advisory bodies will:

- review progress to date on any ecosystem initiatives the Council already has underway;
- review the list of potential ecosystem initiatives provided in Appendix A to the FEP and determine whether any of those initiatives merit Council attention in the coming year;
- if initiatives are chosen for Council efforts, request background materials from the appropriate entities;
- in March 2015 and in each subsequent odd-numbered year, assess whether there are new ecosystem initiative proposals that could be added to the appendix; and
- in March 2018, assess whether to initiate a review and update of the FEP.

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

1.4 State-of-the-Ecosystem Reporting

In support of its ecosystem-based management processes, the Council has requested that NMFS, in coordination with other interested agencies, provide it with an annual state-of-the-ecosystem report at each of its March meetings, beginning in March 2014. The Council asked that the report:

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

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



Oregon coast. Photo credit: NOAA

2 Objectives

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

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

1. Improve and integrate information used in Council decision-making across the existing FMPs by:
 - a. Describing the key oceanographic, physical, biological, and socioeconomic features of the CCE and dependent fishing communities;
 - b. Identifying measures and indicators, and informing reference points to monitor and understand trends and drivers in key ecosystem features;
 - c. Identifying and addressing gaps in ecosystem knowledge, particularly with respect to the cumulative and longer-term effects of fishing on marine ecosystems;
 - d. Examining the potential for a science and management framework that allows for managing fish stocks at spatial scales relevant to the structure of those stocks.
2. Build toward fuller assessment of the greatest long-term benefits from the conservation and management of marine fisheries, of optimum yield, and of the tradeoffs needed to achieve those benefits while maintaining the integrity of the CCE through:
 - a. Assessing trophic energy flows and other ecological interactions within the CCE;
 - b. Assessing the full range of cultural, social, and economic benefits that fish and other living marine organisms generate through their interactions in the ecosystem;
 - c. Improving assessment of how fisheries affect and are affected by the present and potential future states of the marine ecosystem.
3. Provide administrative structure and procedures for coordinating conservation and management measures for the living marine resources of the U.S. West Coast EEZ:

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



Kelp and sardines. Photo credit: CDFW

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

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

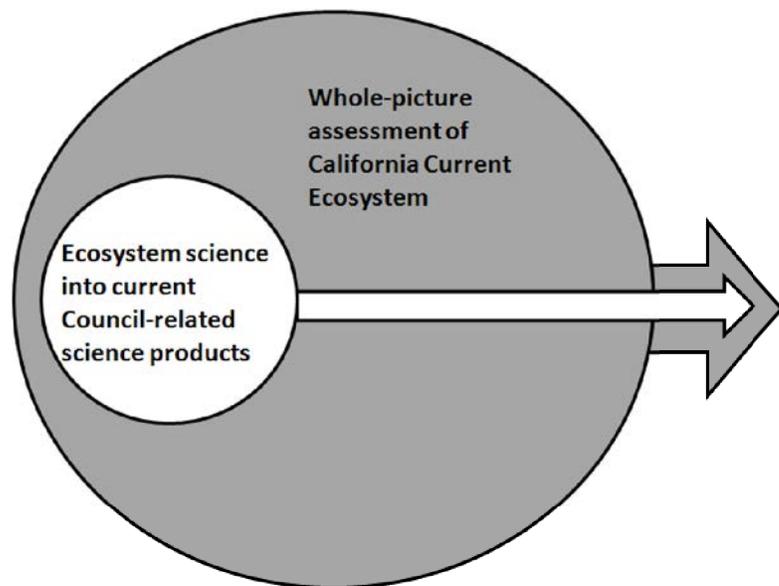


Figure 6.1: Two-part process to bring ecosystem science to the Council

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

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

6.1 Bringing More Ecosystem Information into Stock Assessments

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

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

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

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

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

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

6.2 Annual Reports on Ecosystem Indicators

In November of 2012, the EPDT, in collaboration with the California Current IEA Team, provided the first iteration of a Report on the State of the CCE to the Council and its advisory bodies (Agenda Item K.3.a, Supplemental Attachment 1). This report was the result of an EPDT recommendation for bringing additional ecosystem information into the Council process, through the regular delivery of a synthesis of environmental, biological, and socio-economic conditions that may act as either drivers or indicators of impacts to the productivity, distribution, or socioeconomic conditions of managed fish populations and their associated fisheries. Based on the Council’s recommendation, the report was limited to 20 pages in length,

and recognized that several additional sources (many of which included greater technical details) on the state of the CCE are in existence, including: the CalCOFI State of the California Current report, PaCOOS quarterly summaries, and the emerging California Current IEA. The intent of the November 2012 Report was to focus on clear, straightforward explanations of the trends and indicators most relevant to Council-managed fisheries, particularly with respect to how and why such indicators were relevant to Council consideration.

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

Although some of the selected indicators in the first report were more intuitive than others, and some that the EPDT or other advisory bodies had suggested for inclusion were not available for the first report, the report was generally well-received by advisory bodies and should serve as a template for future efforts. The Council and its advisory bodies also offered considerable advice for improving future reports, which should guide the development of and indicator choices for the March 2014 report called for in Section 1.4 of the FEP. As the SSC noted, “The report is an important first step in providing the Council family with an ecosystem perspective on West Coast fish stocks, fisheries, and coastal communities... The report will likely evolve over time, depending on which indicators are available and best suited to addressing ecosystem concerns identified by the Council” (Agenda Item K.3.c, Supplemental SSC Report). If the state of the ecosystem report becomes a routine product for informing the Council on CCE status and trends, it should help the Council improve its capabilities to bring ecosystem considerations into its decision-making processes.



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