AMENDMENT 13

TO THE COASTAL PELAGIC SPECIES FISHERY MANAGEMENT PLAN

ADDRESS REVISED NATIONAL STANDARD 1 GUIDELINES

ENVIRONMENTAL ASSESSMENT

AND REGULATORY IMPACT REVIEW

RIN 0648-BA68

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CHAPTER 1.0 INTRODUCTION

The Pacific Fishery Management Council's (Council's) Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) includes harvest control rules for actively managed species (Pacific sardine and Pacific mackerel) that are intended to prevent overfishing while maintaining relatively high and consistent catch levels over the long-term. The CPS FMP's monitored stocks (northern anchovy, jack mackerel, market squid) are either state-managed or are currently harvested at low levels. The CPS FMP has a third category of prohibited harvest species that currently includes all West Coast species of euphausiids (krill). Background material on the history and status of CPS stocks and CPS fisheries can be found in the latest version of the *Stock Assessment and Fishery Evaluation* (SAFE) document which is posted on the Council's web page.

1.1 ORGANIZATION OF THE DOCUMENT

This document provides background information about, and analysis of, a proposed amendment (Amendment 13) to the CPS FMP to revise part of the FMP to ensure that it is consistent with guidelines to meet the objectives of National Standard 1 in the Magnuson-Stevens Fishery Conservation and Management Act (MSA). National Standard 1 states 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." The MSA is the principal legal basis for fishery management of U.S. fisheries in the Exclusive Economic Zone (EEZ) or on the high seas beyond the EEZ for vessels making landings at U.S. ports. The EEZ extends from the outer boundary of state waters at 3 nautical miles (nmi) to a distance of 200 nmi from shore.

In addition to addressing MSA mandates, this document is an environmental assessment (EA), pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended.

The document is organized in six chapters:

- The remainder of Chapter 1 describes the purpose and need for the proposed action and considerations that went into the development of this EA.
- Chapter 2 outlines different alternatives that have been considered to address the purpose and need. The Council and National Marine Fisheries Service (NMFS) will choose a preferred alternative from among these alternatives.
- Chapter 3 describes the components of the human environment potentially affected by the proposed action (the "affected environment"). The affected environment may be considered the baseline condition, which would be potentially changed by the proposed action.
- Chapter 4 evaluates the effects of the alternatives on components of the human environment in order to provide the information necessary to determine whether such effects are significant, or potentially significant.
- Chapter 5 details how this action meets 10 National Standards set forth in the MSA (§301(a)).
- Chapter 6 provides information on those laws and Executive Orders, in addition to the MSA and NEPA, that an action must be consistent with, and how this action has satisfied those mandates.

1.2 PURPOSE AND NEED

The proposed action is to revise relevant sections of the CPS FMP to ensure they are consistent with advisory guidelines published in Federal regulations at Section 600.310. The guidelines describe

fishery management approaches to meet the objectives of National Standard 1 found in the MSA, Section 301. National Standard 1 (NS1) states "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry." The Council is revising the CPS FMP to be consistent with revised NS1 Guidelines in order to more effectively avoid overfishing or stocks that may become overfished.

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) amended the MSA to include new requirements for annual catch limits (ACLs) and accountability measures (AMs) and other provisions regarding preventing and ending overfishing and rebuilding fisheries. National Marine Fisheries Service (NMFS) revised NS1 Guidelines in response to these changes in the MSA. The NS1 Guidelines were published in the Federal Register on January 16, 2009. These revisions to the NS1 guidelines address, among other things, new requirements "to establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability" (MSA Section 303(a)(15)). These mechanisms are required to take effect by fishing year 2011 for all fisheries and, therefore, these mechanisms are a primary focus of the proposed action. A stock or stock complex may not require an ACL and AMs if it qualifies for a statutory exception under the MSA. The NS1 Guidelines also discuss how stocks should be classified in the FMP. As part of this action the Coastal Pelagic Species Management Team (CPSMT) evaluated all the species and stocks identified in the FMP in light of available information on catch to consider possible reclassification.

1.3 SCOPING

1.3.1 COUNCIL PROCESS

The Council process, which is based on stakeholder involvement and allows for public participation and public comment, has been the principal mechanism for public scoping in developing the proposed action for Amendment 13 and the related range of alternatives.

The Council held scoping sessions at its March and November 2009 meetings on amending the CPS FMP to address the National Standard 1 guidelines. A complete record of the scoping comments received is available on the Council web site or by contacting the Council office. Scoping comments included recommendations to assess scientific and management uncertainty, include krill and other forage species as ecosystem components of the FMP, improve accountability of live bait harvest and overall fishery discards, and improve inseason harvest reporting. Additionally, the review of CPS harvest control rules has been identified by the Council as a high priority research need.

In November 2009, the Council supported alternatives proposed by Council staff regarding stock status determination criteria and alternative management frameworks. Specifically, the Council supported analyses of sector-specific ACLs and requested an analysis of annual catch targets (ACTs) to address management uncertainty and to buffer against overfishing. As additional guidance, the Council placed a higher priority on time-sensitive MSA requirements such as ACLs and acceptable biological catch (ABC) control rules and put a lower priority on the consideration of optional provisions such as including additional forage species in the CPS FMP and the development of mechanisms to streamline inseason management.

In March 2010, the Council reviewed a draft analysis of proposed alternatives and, for some, identified a preliminary preferred action and provided guidance on further alternative development and analysis. Also, the Council moved to not consider alternatives at this time that propose to remove species from the CPS FMP thus transferring them to state management. The

Council's preliminary preferred alternatives for Amendment 13 are noted in this document where applicable.

In June 2010, the Council took final action on Amendment 13 by adopting the preferred alternative described in Chapter 2.

This draft EA was prepared by the Council's CPSMT, Council staff, and NMFS staff. This report presents Amendment 13 alternatives derived from Council deliberations, Council Advisory Body recommendations, scoping comments, and Council staff to bring the CPS FMP into compliance with the reauthorized MSA.

CHAPTER 2.0 DESCRIPTION OF ALTERNATIVES

The alternatives are organized around the following topics:

1) Classification of stocks in the FMP as either "in the fishery" as management unit species (MUS) or ecosystem component (EC) species
2) Status Determination Criteria
3) Reference Points - Overfishing Levels, Acceptable Biological Catch, and Annual Catch Limits
4) Annual Catch Targets and Accountability Measures
5) Alternatives considered but rejected.

2.1 PROPOSED ALTERNATIVES

2.1.1 ALTERNATIVE 1: NO ACTION

Classification of stocks – All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established

Status Determination Criteria - Maintain existing status determination criteria (SDCs) for CPS FMP stocks.

Reference Points, Over Fishing Limit (OFL), ABC, ACL - Maintain the existing species-specific harvest control rules to specify management reference points for actively managed stocks and maintain the existing default harvest control rules for monitored stocks. No sector-specific ACLs developed.

Actively Managed Stocks - Maintain the existing harvest control rules to specify the new management reference points.

Overfishing Definition	(BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION.
ABC	
Harvest Guideline (HG)	

Monitored Stocks - Maintain the existing harvest control rules to specify the new management reference points. See Section 4.1.2.1 for additional considerations for market squid.

Overfishing Definition	STOCK SPECIFIC MSY PROXY*0.25
ABC	

Annual Catch Targets and Accountability Measures – No ACTs or accountability measures.

2.1.2 ALTERNATIVE 2

Classification of stocks – All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established.

Status Determination Criteria - Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy.

Reference Points, OFL, ABC, ACL –

Actively Managed Stocks - Modify existing harvest policy to specify the new management reference points with no additional buffering for scientific uncertainty.

OFL	BIOMASS * F_{MSY} * DISTRIBUTION
ABC	BIOMASS * F_{MSY} * DISTRIBUTION
HG	(BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION.
ACL	EQUAL TO HG OR ABC, WHICHEVER VALUE IS LESS

Monitored Stocks - Maintain the default harvest control rules as modified to specify the new management reference points. ACLs would be specified for multiple years until such time as the species becomes actively managed or new scientific information becomes available.

OFL	STOCK SPECIFIC MSY PROXY
ABC	OFL * 0.25
ACL	Equal to ABC or reduced by OY considerations.

Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.

Annual Catch Targets and Accountability Measures - Add ACTs and AMs to the FMP framework as a management tool and assess their applicability on an annual basis.

2.1.3 ALTERNATIVE 3

Classification of stocks All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category and no EC species are established.

Status Determination Criteria – Same as Alternative 2

Reference Points, OFL, ABC, ACL - Scientific Uncertainty Buffer –

Actively Managed Species - Modify the existing harvest control rules to include a buffer or reduction in ABC relative to OFL to account for scientific uncertainty.

OFL	BIOMASS * F_{MSY} * DISTRIBUTION
ABC	BIOMASS * BUFFER * F_{MSY} * DISTRIBUTION
ACL	LESS THAN OR EQUAL TO ABC
HG	(BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION.
ACT	EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS

Monitored Stocks - Modify the existing harvest control rules to include a buffer or reduction in ABC relative to OFL to account for scientific uncertainty. This reduction would be in addition to the precautions build into the default control rule. In practice either a BUFFER recommended by the Scientific and Statistical Committee (SSC) could be added to the ABC control rule as shown below, or a greater than 75 percent reduction from OFL could be instituted. ACLs would be specified for multiple years until such time as the species becomes actively managed or new scientific information becomes available.

OFL	STOCK SPECIFIC MSY PROXY
ABC	OFL * 0.25 * BUFFER
ACL	Equal to ABC or reduced by OY considerations.

Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.

Annual Catch Targets and Accountability Measures - Add ACTs and AMs to the FMP framework as a management tool and assess their applicability on an annual basis.

2.1.4 ALTERNATIVE 4

Classification of stocks All species currently in the actively managed and monitored species categories of the CPS FMP are "in the fishery" and krill are reclassified as an EC species and additional forage and/or bycatch species are added to the CPS FMP as EC species..

Status Determination Criteria –Same as Alternative 2

Reference Points, OFL, ABC, ACL – Same as Alternative 3

Annual Catch Targets and Accountability Measures - Same as Alternative 2.

2.1.5 ALTERNATIVE 5 (COUNCIL-PREFERRED)

Classification of stocks All species currently in the CPS FMP, including krill are included "in the fishery" in their existing category. Pacific herring (*Clupea pallasii pallasii)* and jacksmelt – (*Atherinopsis californiensis*) are added to the CPS FMP as EC species with the intent of monitoring the catches of these species and report landings in the annual Stock Assessment and Fishery Evaluation report, but to not develop status determination criteria or management measures for these stocks at this time.

Status Determination Criteria – Maintain existing SDCs for CPS FMP stocks and develop an MSY proxy for the Northern subpopulation of Northern anchovy. (Same as Alternative 2)

Reference Points, OFL, ABC, ACL – Scientific Uncertainty Buffer –

Actively Managed Species - Modify the existing harvest control rules to include a buffer or reduction in ABC relative to OFL to account for scientific uncertainty.

OFL	BIOMASS * F_{MSY} * DISTRIBUTION
ABC	BIOMASS * BUFFER * F_{MSY} * DISTRIBUTION
ACL	LESS THAN OR EQUAL TO ABC
HG	(BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION.
ACT	EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS

Monitored Stocks - Maintain the default harvest control rules as modified to specify the new management reference points. ACLs would be specified for multiple years until such time as the species becomes actively managed or new scientific information becomes available. In practice, the default 75 percent reduction from OFL to ABC would be used until such time as the SSC recommends an alternate value based on the best available science.

OFL	STOCK SPECIFIC MSY PROXY
ABC	OFL * 0.25
ACL	Equal to ABC or reduced by OY considerations.

Add sector-specific ACLs to the FMP framework as a management tool and assess their applicability on an annual basis.

Annual Catch Targets and Accountability Measures - Add ACTs and AMs to the FMP framework as a management tool and assess their applicability on an annual basis.

Ecological Considerations - Add language to specify that the Council will consider ecological factors in developing SDCs, ACLs, and ACTs for CPS.

2.2 ALTERNATIVES CONSIDERED BUT REJECTED

The following alternatives are not required by the MSRA or the NS1 guidelines, but were identified during the scoping of Amendment 13 as issues that may be addressed. At this time, the Council has determined that these alternatives will not be considered under Amendment 13.

2.2.1 IMPROVED INSEASON MONITORING

Several preseason and inseason accountability measures exist in the CPS fisheries. In March 2009, under the scoping period for this amendment, the CPSMT and the CPS Advisory Subpanel recommended several ways to improve the inseason monitoring and management of CPS fisheries. Recommended actions for consideration include:

- Improving inseason management flexibility to open or close the fishery faster by revising reporting requirements (e.g., processors faxing information daily), setting daily trip limits, and opened/closed days, and
- Exploring a shift in the start date of the Pacific sardine fishery from January 1 to July 1 to allow additional time for stock assessment work and the development of new fishery-independent indices of abundance.

Council has been receptive to the potential management improvements these measures could provide, but Council direction since March 2009 has consistently recommended focusing efforts on those aspects of Amendment 13 that are required to be in place by 2011 and only address these improvements to the FMP as time and workload allows. The CPSMT briefly discussed the merits of these alternatives, but has not had time to fully consider their implementation under this amendment. The Council has not elevated the priority of these optional alternatives and is no longer considering this action under Amendment 13.

2.2.2 STATE AND FEDERAL MANAGEMENT OF CPS

In recent years, the CPSMT has discussed the suite of stocks in the CPS FMP and their appropriate classification as monitored or actively managed species (e.g., moving Pacific mackerel to the monitored species category in light of multiple years of low harvest and diminished data series for assessing stock status, and potentially moving northern anchovy to the actively managed category). The CPSMT has also reviewed the science and harvest policies for market squid in recent years to determine the need, if any, to revise management. The CPSMT has discussed the costs and benefits of including two monitored species in the CPS FMP versus transferring management authority to the State of California. Commercial landings of market squid and jack mackerel occur almost exclusively in California and are either currently managed under a California State FMP (market squid) or have been landed at low and generally declining levels for many years (jack mackerel).

There are a considerable number of research and data needs identified for the CPS FMP and focusing available science and management resources on fewer FMP stocks may have benefits. Given the need to review stock classifications and reference points for Amendment 13, exploring Federal versus state management of CPS FMP stocks could be prudent at this time. At its November 2009 meeting, the Council directed the CPSMT to consider the following alternatives:

- Option 1, – All species, including market squid and jack mackerel remain in the CPS FMP and no species is transferred to state management.
- Option 2 – Remove market squid from the CPS FMP and Federal management and transfer that authority to the State of California.
- Option 3 – Remove jack mackerel from the CPS FMP and Federal management and transfer that authority to the State of California.

At its March 2010 meeting the Council moved for no further consideration of removal of species from the CPS FMP under Amendment 13.

CHAPTER 3.0 AFFECTED ENVIRONMENT

This chapter provides summary background material on CPS stocks and fisheries. Additional detailed information on CPS stocks and fisheries can be found in the latest version of the *Stock Assessment and Fishery Evaluation* document which is posted on the Council's web page.

3.1 FISH STOCKS

The CPS FMP specifies a management framework for northern anchovy, market squid, Pacific sardine, Pacific mackerel, and jack mackerel. In 2006, the CPS FMP was amended to include all krill species and to prohibit their harvest. This proactive Council recommendation was intended to protect krill's vital role in the marine ecosystem. No species in the CPS FMP are currently characterized as overfished or experiencing overfishing.

"Pelagic" species live in the water column as opposed to living near the sea floor. They can generally be found anywhere from the surface to 1,000 meters (547 fathoms) deep. Pacific sardine and Pacific mackerel are actively managed, meaning landings and markets are substantial enough to warrant annual assessment of stock status and fishery management. The three monitored species are either managed at the state-level or are landed in low numbers and are, therefore monitored for potential elevation to active management in the future.

Pacific sardine (*Sardinops sagax*) are small schooling fish. When the population of Pacific sardine is large, it is abundant from the tip of Baja California to southeastern Alaska and throughout the Gulf of California. In the north, sardines tend to appear seasonally. Sardines also form three (and possibly four) subpopulations. The northern subpopulation of sardines is most important to U.S. commercial fisheries. Sardines are taken by a wide variety of predators. More information on current Pacific sardine abundance and population trends is available in the current CPS SAFE Report. The report is available online or from the Council office. Although recent assessment results indicate stock abundance levels are in decline, Pacific sardine are at overfished levels and overfishing is not occurring.

Pacific (chub) mackerel (*Scomber japonicus*) range from Mexico to southeastern Alaska. They are most abundant south of Point Conception, California and usually appear within 20 miles offshore. The "northeastern Pacific" stock of Pacific mackerel is harvested by fishers in the U.S. and Mexico. Like sardines and anchovies, mackerel are schooling fish, and they may school with other pelagic species such as jack mackerel and sardines. They are also heavily preyed upon by a variety of fish, mammals, and sea birds. Recent assessments indicate an abundant population of Pacific mackerel, but have considerable uncertainty due to data limitations for this species. In response the Council has recommended relatively conservative management and overfishing is not occurring.

Northern anchovy (*Engraulis mordax*) are small, short-lived fish that are typically found in schools near the surface. They are found from British Columbia to Baja California and have recently appeared in the Gulf of California. Northern anchovies are divided into northern, central, and southern subpopulations. The central subpopulation used to be the focus of large commercial fisheries in the U.S. and Mexico. Most of this subpopulation is located in the Southern California Bight, between Point Conception, California and Point Descanso, Mexico. (The Southern California Bight is an indentation along the coast of southern California that includes coastal southern California, the Channel Islands, and a section of the Pacific Ocean.) Northern anchovy are an important part of the food chain for other species, including other fish, birds, and marine mammals.

Jack mackerel (*Trachurus symmetricus*) are a schooling fish that range widely throughout the northeastern Pacific. Much of their range lies outside the 200-mile U.S. EEZ. Small jack mackerel (up to six years of age) are most abundant in the Southern California Bight, where they are often found near the mainland coast and islands and over shallow rocky banks. Older, larger fish range from Cabo San Lucas, Baja California to the Gulf of Alaska, where they are generally found offshore in deep water and along the coastline to the north of Point Conception. Large fish rarely appear close to the southern shore. In southern California waters, jack mackerel schools are often found over rocky banks, artificial reefs, and shallow rocky coastal areas. Jack mackerel in southern California are more likely to appear on offshore banks in late spring, summer, and early fall.

Large predators like tuna and billfish eat jack mackerel, but adult jack mackerel are probably a minor forage source for smaller predators. Older jack mackerel probably do not contribute significantly to food supplies of marine birds because they are too large to be eaten by most bird species, and they school too deep for birds to reach them. They do not appear to be an important food source for marine mammals.

Market squid (*Loligo opalescens*) appear from the southern tip of Baja California to southeastern Alaska. They are most abundant between Punta Eugenio, Baja California and Monterey Bay, California. They are harvested near the surface, but they can appear to depths of 800 meters or more. They are important as forage foods to many fish, birds, and mammals, such as king salmon, coho salmon, lingcod, rockfish, seals and sea lions, sea otters, porpoises, cormorants, and murres. For more information on market squid life history, contact the Council office for a copy of the market squid Stock Assessment Review (STAR) Report.

Krill (*euphausiids*) are small shrimp-like crustaceans that serve as the basis of the marine food chain. They are forage for many species of fish managed by the Council, as well as by whales and seabirds. Although there is no fishery for krill in US waters, krill are fished in Antarctica, Japan, and off the West Coast of Canada. A krill harvest ban was first proposed for West Coast National Marine Sanctuary waters by the National Marine Sanctuary Program and was expanded to the entire EEZ by the Council in recognition of the importance of krill as a fundamental food source for much of the marine life along the West Coast. State laws prohibit krill landings by state-licensed fishing vessels into California, Oregon, and Washington, respectively. Thus, the action could provide for consistent Federal and state management.

Stocks in the CPS FMP are classified under the following management categories: actively managed; monitored; and prohibited harvest species (Table 3.1-1). The CPS FMP is based on a management framework designed to react quickly to changes in the fisheries and/or stocks, with the CPSMT providing advice on classification changes in accordance with fishery/stock dynamics.

Table 3.1-1 Stocks currently managed under the CPS FMP.

Management Category	Common Name	**Scientific Name**
Actively Managed	Pacific sardine	*Sardinops sagax*
	Pacific (chub) mackerel	*Scomber japonicus*
Monitored	Northern anchovy Central and Northern Subpopulations	*Engraulis mordax*
	Market squid	*Loligo opalescens*
	Jack mackerel	*Trachurus symmetricus*
Prohibited Harvest	Krill or Euphausiids All West Coast EEZ Species Eight dominant species First two species are common and are the most vulnerable to fishing.	*Euphausia pacifica* *Thysanoessa spinifera* *Nyctiphanes simplex* *Nematocelis difficilis* *T. gregaria* *E. recurva* *E. gibboides* *E. eximia*

3.2 THE CPS FLEET

During the 1940s and 1950s, approximately 200 vessels participated in the Pacific sardine fishery. In California, some present day CPS vessels are remnants of that fleet. CPS finfish landed by the roundhaul fleet (fishing primarily with purse seine or lampara nets) are sold as relatively high volume/low value products (e.g., Pacific mackerel canned for pet food, Pacific sardine frozen and shipped to Australia to feed penned tuna, and northern anchovy reduced to meal and oil).

In recent history, a fishery for Pacific sardine has operated off Oregon and Washington since 1999. This fishery targets larger sardine, which have typically sold as bait for Asian longline tuna fisheries. Beginning in 2006, this fishery has been expanding into human consumption markets.

Along the West Coast, other vessels target CPS finfish in small quantities, typically selling their catch to specialty markets for relatively high prices. In recent years, these included:

- Approximately 18 live bait vessels in southern California and two vessels in Oregon and Washington that landed about 4,000 mt per year of CPS finfish (mostly northern anchovy and Pacific sardine) for sale to recreational anglers.
- Roundhaul vessels that take a maximum of 1,000 mt to 3,000 mt per year of northern anchovy that are sold as dead bait to recreational anglers.
- Roundhaul and other mostly small vessels that target CPS finfish (particularly Pacific mackerel and Pacific sardine) for sale in local fresh fish markets or canneries.
- In Washington, albacore tuna vessels using lampara gear target northern anchovy for use as live bait in the tuna fishery.

3.2.1 LIMITED ENTRY FISHERY

The CPS limited entry (LE) fleet currently consists of 65 permits and 58 vessels. The LE vessels range in age from 4 to 68 years, with an average age of 33 years. Average vessel age has decreased by approximately two years since the initial fleet was established.

The capacity goal and transferability provisions established under Amendment 10 are based on calculated gross tonnage (GT) of individual vessels. Calculated GT serves as a proxy for each vessel's physical capacity and is used to track total fleet capacity. The fleet capacity goal established through Amendment 10 is 5,650.9 GT, and the trigger for restricting transferability is 5,933.5 GT (Goal + 5 percent). The 2009 LE fleet was 5,408.4 GT, well within the bounds of the capacity goal and not likely substantially different from current capacity.

3.2.2 NORTHERN FISHERIES

The Federal CPS FMP does not have permit restrictions for vessels operating north of 39° N latitude, but Oregon and Washington have developed state LE programs for CPS.

OREGON

The Pacific sardine fishery off Oregon started in 1935, but there are recorded landings of sardine in Oregon dating back to 1928. The catch dropped off in the 1940s with 1948 being the last year of directed fishery landings until 1999 when the fishery was revived. Pacific sardine was managed as a developmental fishery from 1999 to 2005. In 2004, the sardine industry asked ODFW to remove Pacific sardines from the developmental species list and create a LE system for the fishery. ODFW began work with the Developmental Fisheries Board and the industry to develop alternatives for

the fishery. In December 2005, the Oregon Fish and Wildlife Commission (OFWC) moved the Pacific sardine fishery from a developing fishery into a state-run LE fishery system. Twenty Oregon permits were initially established and made available to qualifying participants for the 2006 fishery. The OFWC amended an LE permit eligibility rule in August 2006, which resulted in an immediate addition of six permits for a total of 26 LE sardine fishery permits.

Although the primary CPS fishery in Oregon targets sardine, developmental fishery permits for harvesting anchovy have been issued since 1995. All developmental fisheries in Oregon have a limited number of permits available and landing requirements for permit renewal, but the number of permits and landing requirements differ by target species. In 2009 Oregon issued 4 of the 15 developmental fishery permits available for the anchovy fishery. Staffing for the developmental fisheries program was eliminated due to budget cuts for the 2009-2011 biennium and all developmental fisheries programmatic activities including permitting were suspended in December 2009. The Oregon Fish and Wildlife Commission moved the anchovy fishery to a Category C developmental fishery, those that are managed under a state or Federal FMP that has established permit and/or gear limitations. Because the Federal CPS FMP does not have permit restrictions for vessels operating north of 39° N latitude, the fishery for northern anchovy is now an open access fishery off Oregon, limited by legal gear under the CPS FMP and state regulations.

WASHINGTON

Pacific sardines are the primary coastal pelagic species harvested in Washington waters. The Pacific Northwest sardine fishery saw a rapid expansion of catch between the years 1999 to 2002 when landings increased from 771 mt to 37,923 mt. Landings into Washington were 4,842 mt in 2000 and increased to 15,820 mt in 2002. In response to this situation, WDFW engaged in an extensive public process to address management needs in the fishery. In 2003, following this public process, a formal Sardine Advisory Board (Board) was created, and the WDFW Director, in collaboration with the Board, advanced the sardine fishery designation from trial to experimental and the number of experimental fishery permits was capped at 25. The experimental fishery program continued through June 2009.

During the 2009 Washington State legislative session, WDFW proposed legislation to establish a commercial license limitation program specifically for the harvest and delivery of Pacific sardines into the state. The legislation was passed into rule in July 2009. The new rules established 16 licenses to be issued to holders of a 2008 sardine experimental fishery permit only with an exception for past participants of the experimental fishery that became ineligible because of loss of their vessel at-sea. These newly created sardine licenses can be sold. In addition, the new rule provides criteria for the issuance of temporary annual permits at the WDFW Director's discretion. In combination, the number of permanent and temporary annual licenses cannot exceed 25.

Pacific sardines are the targeted catch in the Washington fishery, but anchovy, mackerel, and squid can also be retained and landed. In 2009 landings for these other coastal pelagic species were as follows 0 mt of anchovies, 0 mt of jack mackerel, and 4.3 mt of mackerel.

Although of a smaller magnitude than the sardine fishery, other coastal pelagic species – primarily northern anchovy – have supported important baitfish fisheries on the Washington Coast (ocean, Columbia River, Grays Harbor and Willapa Bay). These fisheries, distinguished by gear type, include a live-bait lampara gear fishery, and a seine gear fishery that provides both live and packaged bait to recreational and commercial fishers. About two dozen baitfish-lampara gear licenses and a couple of baitfish-purse seine licenses are issued annually. Documented catch of anchovy has averaged about 108 mt a year since 1990. Actual catch has likely been higher; until recent years commercial fishers were not required to report anchovy caught for their own use. To

better account for this catch, the WDFW began in 2007 to require fishers to document all forage fish used for bait in another fishery on the fish receiving ticket for the target species

Except for herring, which is under a license limitation program, participation in baitfish fisheries is not limited. Other regulations include seasonal closures of Grays Harbor and Willapa Bay to protect out-migrating salmon. Harvest guidelines are not set, but in 2010 the WDFW adopted permanent rules restricting northern anchovy catch and disposition. The new rules limit the catch, possession or landing of anchovy to 5 mt daily and to 10 mt weekly. In addition, the rules limit the amount of anchovy taken for reduction (or the conversion of fish to products such as fish meal or fertilizer) to 15 percent of a landing by weight. These rules were intended to discourage the development of high-volume fisheries for anchovy and yet still accommodate traditional bait fishing activity.

3.2.3 California's Market Squid Fishery

In 2001, legislation transferred the authority for management of the market squid fishery to the California Fish and Game Commission (CFGC). Legislation required that the CFGC adopt a market squid fishery management plan (MSFMP) and regulations to protect and manage the resource. In August and December of 2004, the CFGC adopted the MSFMP, the environmental documentation, and the implementing regulations, which went into effect on March 28, 2005, just prior to the start of the 2005-2006 fishing season on April 1.

The goals of the MSFMP are to provide a framework that will be responsive to environmental and socioeconomic changes and to ensure long-term resource conservation and sustainability. The tools implemented to accomplish these goals include: (1) setting a seasonal catch limit of 107,048 mt (118,000 short tons [st]) to prevent the fishery from over-expanding, (2) maintaining monitoring programs designed to evaluate the impact of the fishery on the resource, (3) continuing weekend closures that provide for periods of uninterrupted spawning, (4) continuing gear regulations regarding light shields and wattage used to attract squid, (5) establishing a restricted access program that includes provisions for initial entry into the fleet, permit types, permit fees, and permit transferability that produces a moderately productive and specialized fleet, and (6) creating a seabird closure restricting the use of attracting lights for commercial purposes in any waters of the Gulf of the Farallones National Marine Sanctuary. Under this framework, the MSFMP provides the CFGC with specific guidelines for making management decisions. The CFGC has the ability to react quickly to changes in the market squid population off California and implement management strategies without the need for a full plan amendment. The MSFMP framework structure was also designed to achieve the goals and objectives of the MLMA and to be consistent with the management outlined in CPS FMP Amendment 10.

Under the restricted access program in the MSFMP, a permit is needed to participate in the fishery. Qualification for different types of permits and transferability options was based on historical participation in the fishery. In 2009, 83 vessel permits, 63 light boat permits, 21 brail permits, and zero experimental permits were issued. Of the 83 vessel permits issued, 70 vessels made commercial landings in 2009, as compared to 71 active permitted vessels in 2008. Fifty vessels made 90 percent of the landings (by volume) in 2009. Market squid vessel permits allow a vessel to attract squid with lights and use large purse seine nets to capture squid. Brail permits allow a vessel to attract squid with lights and use brail gear to capture squid. Light boat permits only allow a vessel to attract squid with lights (30,000 watts, maximum). Experimental non-transferable market squid permits allow vessels to fish in areas not historically targeted by the market squid fishery (north of San Francisco). Landings of 2 st or less are considered incidental and no permit is required.

3.2.4 TREATY TRIBE FISHERIES

Tribal fisheries on sardine may evolve in waters north of Point Chehalis, Washington. The CPS FMP recognizes the rights of treaty Indian tribes to harvest Pacific sardine and provides a framework for the development of a tribal allocation. An allocation or a regulation specific to the tribes shall be initiated by a written request from a Pacific Coast treaty Indian tribe to the NMFS Southwest Regional Administrator at least 120 days prior to the start of the fishing season.

The Makah Tribe sent a letter to NMFS expressing their intent to attain an allocation and to enter the Pacific sardine fishery in 2006. In response, the Council created the Ad Hoc Sardine Tribal Allocation Committee made up of state, Federal, and tribal representatives, to begin work on this issue. If a tribal allocation is established, the non-tribal allocation formula will likely be applied to the remainder of the harvest guideline after accommodation of the tribal fishery.

No tribal letters of intent have been received since 2006, and the Ad Hoc Sardine Tribal Allocation Committee has never met. Therefore, there is no anticipated Tribal allocation for 2011.

3.3 OTHER COMPONENTS OF THE FISHERY ECOSYSTEM

3.3.1 PROTECTED SPECIES AND BYCATCH

Bycatch and interactions with protected species are monitored trough dockside sampling, logbooks, and occasional observer programs when funding is identified. Interactions are reported annually in the CPS SAFE. NMFS has conducted consultations on sea birds, marine mammals, and fish stocks with no findings that fishing activities are likely to jeopardize protected species. Reporting requirements and/or conservation measures are in place to avoid increased interactions with sea otters and ESA listed salmon stocks.

To date, there have been nine consultations on the effects of CPS fisheries on endangered and threatened species. Most recently, NMFS SWR Sustainable Fisheries Division initiated a formal section 7 consultation with NMFS SWR Protected Resources Division (PRD) on the operation and prosecution of the Pacific sardine fishery. PRD completed a formal section 7 consultation on this action and in a Biological Opinion dated December 21, 2010, determined that fishing activities conducted under the CPS FMP and its implementing regulations are not likely to jeopardize the continued existence of any endangered or threatened species under the jurisdiction of NMFS or result in the destruction or adverse modification of critical habitat of any such species. Specifically, the current status of the Lower Columbia River Chinook, Snake River Fall Chinook, Upper Willamette Chinook, Puget Sound Chinook, Lower Columbia River coho and Oregon coast coho were deemed not likely to be jeopardized by the Pacific sardine fishery.

NMFS also initiated an ESA section 7 consultation with U.S. Fish and Wildlife Service (USFWS) regarding the possible effects of implementing Amendment 11 to the CPS FMP. USFWS concurred with NMFS and determined that implementing Amendment 11 may affect, but was not likely to adversely affect: the endangered tidewater goby, the threatened western snowy plover, the Santa Ana sucker, the endangered short tailed albatross, the endangered California brown pelican, the endangered California least-tern, the threatened marbled murrelet, the threatened bald eagle, the threatened bull trout, and the candidate Xantus's murrelet. Formal consultation, however, was deemed necessary on the possible effects to the southern sea otter. The resulting biological opinion (BO) signed June 16, 2006, concluded that fishing activities conducted under Amendment 11 and its implementing regulations were not likely to jeopardize the continued existence of the otter. As a result of this BO new reporting requirements and conservation measures were implemented within the CPS FMP to provide further protection for southern sea otters.

CPS vessels fish with roundhaul gear (purse seine or lampara nets of approximately one-half mile in total length). These are encircling type nets, which are deployed around a school of fish or part of a school. Roundhaul fishing results in little unintentionally caught fish, primarily because the fishers target a specific school, which usually consists of pure schools of one species. The tendency is for fish to school by size, so if another species is present in the school, it is typically similar in size. The most common incidental catch in the CPS fishery is another CPS species (e.g., Pacific mackerel incidental to the Pacific sardine fishery). If larger fish are in the net, they can be released alive before pumping or brailing by lowering a section of the cork-line or by using a dip-net. The load is pumped out of the hold at the dock, where the catch is weighed and incidentally-caught fish can be observed and sorted. Because pumping at sea is so common, any incidental catch of small fish would not be sorted at sea. Grates can be used to sort larger non-CPS from the catch. Grates are mandatory in Oregon to sort larger non-CPS from the catch. At-sea observers have recorded discard at one time or another since the year 2000 off the states of Oregon, Washington, and California. Bycatch is estimated and reported annually in the CPS SAFE.

3.3.2 ESSENTIAL FISH HABITAT

Essential fish habitat (EFH) for CPS is identified in Amendment 8 to the FMP (PFMC, 1998) and a detailed description of EFH for CPS may be found in Appendix D. In determining EFH for CPS, the estuarine and marine habitat necessary to provide sufficient production to support maximum sustainable yield and a healthy ecosystem were considered.

The specific description and identification of EFH for CPS finfish accommodates the fact that the geographic range of all species varies widely over time in response to the temperature of the upper mixed layer of the ocean, particularly in the area north of 39° N latitude.

CPS EFH is linked to ocean temperatures, which shift temporally and spatially, providing a dynamic definition of EFH. This definition is as follows:

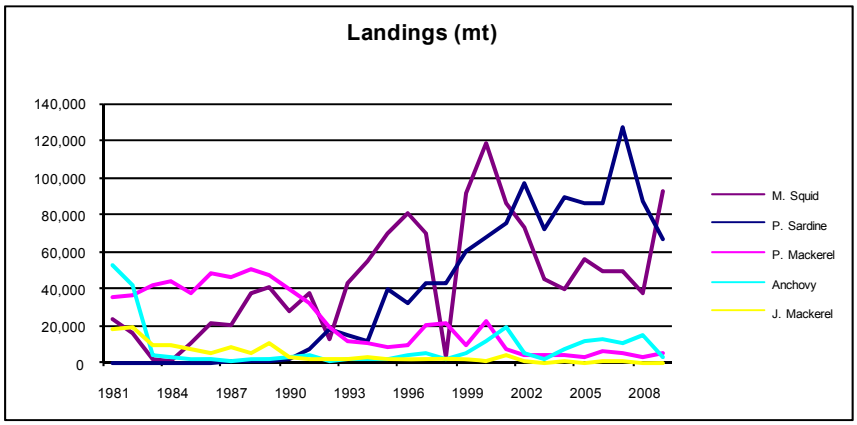
> *The east-west geographic boundary of EFH for each individual CPS finfish and market squid is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the exclusive economic zone (EEZ) and above the thermocline where sea surface temperatures range between 10^{0}C to 26^{0}C. The southern boundary of the geographic range of all CPS finfish is consistently south of the US-Mexico border, indicating a consistency in SSTs below 26^{0}C, the upper thermal tolerance of CPS finfish. Therefore, the southern extent of EFH for CPS finfish is the US-Mexico maritime boundary. The northern boundary of the range of CPS finfish is more dynamic and variable due to the seasonal cooling of the SST. The northern EFH boundary is, therefore, the position of the 10^{0}C isotherm which varies both seasonally and annually.*

3.4 SOCIOECONOMIC ENVIRONMENT

Washington, Oregon, and California landings of CPS totaled 168,198 mt in 2009, a 17 percent increase from 2008. Market squid landings, all in California, totaled 92,372 mt in 2009, up 142 percent from 2008. Pacific sardine landings of 67,050 mt in 2009 decreased 23 percent from 2008 (87,190 mt). The exvessel revenue from all CPS landings was $70.6 million in 2009, up 61 percent from 2008 (2008 converted to 2009 dollars).

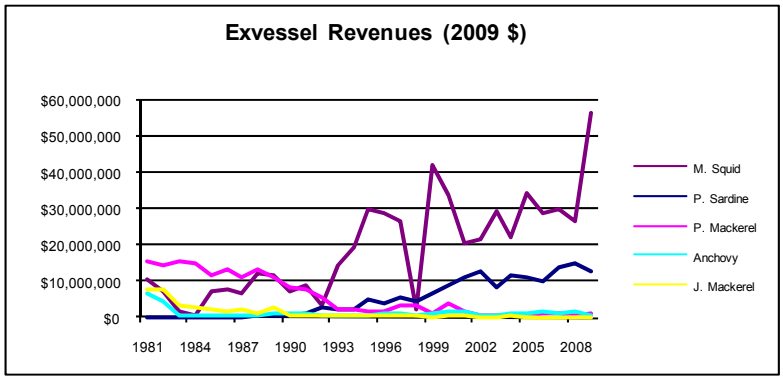
Market squid accounted for 55 percent and Pacific sardine 40 percent of total West Coast, CPS landings in 2009. Landings of Pacific mackerel increased 43 percent, and landings of northern

anchovy fell 76 percent from 2008 to 2009. Real exvessel market squid revenues (2009 $) increased 111 percent from 2008. The increase in market squid landings was accompanied by a 13 percent decrease in exvessel price from $702 to $611 per mt (2009 $). There was a 28 percent decrease in aggregate CPS finfish landings from 2008; exvessel revenue decreased 18 percent, while the overall finfish exvessel price increased 15 percent from 2008. In 2009, market squid made up 15 percent of total West Coast exvessel revenues, and CPS finfish accounted for almost 4 percent. Washington, Oregon, and California shares of total West Coast CPS landings in 2009 were 5 percent, 13 percent and 82 percent respectively.



California sardine landings were 37,543 mt in 2009 down 35 percent from 2008, 57,806 mt. Market squid ranked first in exvessel revenue generated by California commercial fisheries in 2009, with exvessel revenue of $56.5 million, $25.9 million greater than that for Dungeness crab, in second place. Landings of Pacific sardine ranked sixth highest in California exvessel revenues in 2009 at $5.6 million. California Pacific mackerel landings were 5,080 mt in 2009, up 44 percent from 2008. California landings of Northern anchovy were 2,668 mt in 2009, down 81 percent from 2008.

Oregon's landings of Pacific sardine decreased six percent in 2009, from 22,949 mt to 21,481 mt. Sardine generated $5.3 million in exvessel revenue for Oregon in 2009, 5 percent of the state's total exvessel revenues, ranking it fifth behind Dungeness crab in total exvessel revenues. Washington landings of Pacific sardine increased 25 percent from 6,435 mt in 2008 to 8,026 mt in 2009. With exvessel revenue a little more than 1 percent of the Washington total in 2009, sardine ranked 12th behind Dungeness crab in exvessel value.



Oregon landings of Pacific mackerel decreased from 58 mt in 2008 to 53 mt in 2009, and anchovy landings fell from 260 mt to 39 mt. Washington landings of Pacific mackerel decreased from 9 mt in 2008 to 4 mt in 2009 while anchovy landings rose from 109 mt to 810 mt.

In 2009, the number of vessels with West Coast landings of CPS finfish was 173, up from 149 in 2008. With the increase in vessels and a decrease in total CPS finfish landings, finfish landings per vessel, 438 mt in 2009, decreased 38 percent from 2008. Of the vessels landing CPS finfish in 2009, 14 percent depended on CPS finfish for the greatest share of their 2009 exvessel revenues. From 2008 to 2009, the number of vessels with West Coast landings of market squid remained unchanged at 166, with 51 percent of these vessels dependent on market squid for the largest share of their total 2009 exvessel revenue. Market squid landings were 557 mt per vessel in 2009, up 142

percent from 2008. Market squid total exvessel revenue shares for vessels that depend mainly on market squid, and finfish total exvessel revenue shares for vessels that depend mainly on CPS finfish have each averaged about 78 percent per vessel since 2000. In 2009 by far roundhaul gear accounted for the largest share of total CPS landings and exvessel revenue by gear in 2009, dip net gear was a far distant second.

The major West Coast processors and buyers of CPS finfish are concentrated in the Los Angeles, Santa Barbara-Ventura, Monterey and the Columbia River port areas of Oregon and Washington. The exvessel markets for market squid are mainly in the Los Angeles, Santa Barbara-Ventura and Monterey port areas.

In 2009, 70,800 mt of market squid were exported through West Coast customs districts with an export value of $95.5 million; a 105 percent increase in quantity, and a 90 percent increase in value of West Coast market squid exports from 2008. The primary country of export was China, 68 percent of the total, which received 47,944 mt, up 100 percent from the quantity exported to China in 2008. Ninety percent of market squid exports went to China and five additional countries: Japan (4,912 mt), Philippines (3,431 mt), Greece (3,063 mt) and Viet Nam (2,727 mt). Domestic sales were generally made to restaurants, Asian fresh fish markets or for use as bait.

In 2009, 60,956 mt, of sardines were exported through West Coast customs districts down 19 percent from 2008. Sardine exports were valued at $48.3 million in 2009, also down 19 percent from 2008. Seventy-six percent of sardine exports were in the fresh/frozen form, the balance were in the preserved form. Thailand was the primary export market in 2009, receiving 17,907 mt, a 31 percent increase in its imports from 2008, and representing 29 percent of total West Coast sardine exports in 2009. Japan was second with 15,770 mt, 26 percent of the total a 20 percent decrease from 2008, followed by Australia, Malaysia, and China accounting for 11 percent, 9 percent and 9 percent respectively. Together these five countries accounted for nearly 85 percent of total West Coast sardine exports in 2009.

3.5 STATUS DETERMINATION CRITERIA

Table 3.2-1 describes previous SDCs as specified under the CPS FMP. Some SDCs for monitored stocks are not specified and landings of these species are currently small and assessment data are often either dated or non-existent.

Table 3.2-1. CPS FMP specifications for Status Determination Criteria

	MSY	**MFMT**	**MSST**	**ABC**	**OY**
Pacific sardine	MSY control rule	Catch exceeding ABC	50,000 mt	Equal to MSY control rule calculation	Currently at or below MSY
Pacific (chub) mackerel	MSY control rule	Catch exceeding ABC	18,200 mt	Equal to MSY control rule calculation	Currently at or below MSY
N. anchovy Northern Subpop.	Not specified	Catch exceeding ABC	Unknown	25% of MSY Catch level	Not specified
N. anchovy Central Subpop.	Estimated at 123,000 mt	Catch exceeding ABC	50,000	25% of estimated MSY or 31,000mt 25,000mt in U.S.	Currently at or below ABC
Market squid	F_{MSY} resulting in egg escape-ment ≥ 30%	F_{MSY} resulting in egg escape-ment ≤ 30%	Unknown	F_{MSY} resulting in egg escape-ment ≥ 30% mt	107,049mt
Jack mackerel	Age/Area based potential yield	Catch exceeding ABC	Unknown	48,000mt 31,000mt in U.S.	Currently at or below ABC
Krill or Euphausiids	Not specified	Not specified	Not specified	Not specified	0

3.6 HARVEST CONTROL RULES FOR ACTIVELY MANAGED SPECIES

The following is a brief summary of the default harvest control rule for actively managed species. See the CPS SAFE document and Section 4.3 for additional background information.

The harvest control rule for actively managed species.

HARVEST GUIDELINE = (BIOMASS-CUTOFF) x FRACTION x DISTRIBUTION

where:

FRACTION is the fraction of the BIOMASS above the CUTOFF value that can be harvested, for Pacific sardine this is an environmental driven component that is based on sea surface temperature.

DISTRIBUTION is the percentage of the stock assumed to be in U.S. waters.

CUTOFF is the estimated biomass below which directed harvest is not allowed. If the CUTOFF is greater than zero, then the harvest rate (H/BIOMASS) declines as biomass declines. By the time BIOMASS falls as low as CUTOFF, the harvest rate is reduced to zero. The CUTOFF provides a buffer for the spawning stock that is protected from fishing and available for use in rebuilding if a stock becomes overfished. An additional parameter for Pacific sardine, MAXCAT (maximum catch per the HCR, regardless of BIOMASS), was set at 200,000 mt under Amendment 8 to the CPS FMP.

3.7 ADDITIONAL CONSIDERATIONS FOR MARKET SQUID

Market squid have a less than one year life cycle, and have not been determined to be currently subject to overfishing. Therefore, market squid are exempt from ACLs. The current management reference points and harvest specifications for market squid do not fit the default control rule. Market squid is a short-lived species, and the relationship between F_{MSY} and stock abundance is poorly understood. Amendment 10 to the CPS FMP established a minimum 30 percent egg escapement threshold as an F_{MSY} proxy, which serves as the harvest control rule. Results from egg escapement research provided general conclusions regarding this species' relatively high productivity and low vulnerability to fishing pressure, which support the above MSY-based management guidance. Although an ACL is not required for market squid, the California Department of Fish and Game implements an annual landings cap of 107,048 mt on the fishery. This cap is intended as an accountability measure and approaching or exceeding this harvest level could trigger the elevation of this species to the actively managed category.

Additional accountability measures currently in place for market squid include:

1. Temporal closures (weekend closures);
2. Spatial closures (marine protected areas, which include Channel Islands MPAs and new and proposed MPAs under the California Marine Life Protection Act);
3. Gear closures (i.e., Santa Monica Bay, leeward side of Catalina, lighting restrictions in Gulf of the Farallones Marine Sanctuary);
4. Gear restrictions for light shields and wattage limits;
5. Continued monitoring programs used to evaluate the impact of the fishery on the resource;
6. Restricted access program designed to limit fleet participation in order to maintain a moderately productive and specialized fleet; and

7. State management framework (Marine Life Management Act), which provides specific guidelines for making management decisions.

Other constraints that protect squid from overfishing include:

8. The population is utilized for commercial purposes within a fraction of the geographic range;
9. Fishing occurs within a limited portion of the depth range; and
10. Fishing pressure does not usually shift from traditional fishing areas to new areas when there is a decrease in availability of squid.

CHAPTER 4.0 ANALYSES OF THE ALTERNATIVES

4.1 DIRECT AND INDIRECT IMPACTS TO MANAGED SPECIES

No direct or indirect impacts to managed stocks (actively managed, monitored, or prohibited harvest) are expected under any of the alternatives. The intent of the action being taken is to amend the FMP to revise the framework used in developing management reference points and in doing so, adding further protection against overfishing. The action is not expected to have substantial direct or indirect impacts on managed stocks because specific harvest limits and management measures that may affect managed stocks are not specifically established under the range of alternatives considered. Additionally, the alternatives do not affect the spatial distribution or intensity of fishing activities therefore impacts will not occur based on changes in fishing practices.

4.1.1 ACTIVELY MANAGED AND MONITORED SPECIES

4.1.1.1 ALTERNATIVE 1 (NO ACTION) AND ALTERNATIVE 2

No new or additional reductions or buffers are included in the harvest control rules under the No Action alternative and Alternative 2. Rather these two alternatives rely on the precautions in the exiting harvest control rules, status quo, and therefore would not change the current conditions and would not result in any impacts. The existing management framework in the CPS FMP involves an annual assessment and management cycle designed to quickly respond to the dynamic nature of the managed stocks. Alternatives 1 and 2 do not propose the addition of new additional provisions to address scientific uncertainty in the harvest control rules and could be interpreted as less precautionary. However, as described in Appendix A the Councils' HCR for Pacific sardine is theoretically already robust to errors with respect to biomass estimation and utilizes a precautionary proxy for MSY. It is important to note that scientific uncertainty around biomass estimates (stock assessment error) was accounted for in all simulations used to evaluate the existing Pacific sardine HCRs. Determining the degree to which the provisions in the existing harvest control rules adequately buffer CPS stocks from overfishing is an important step in ensuring the amended CPS FMP meets the new NS1 requirements.

Appendix A contains two analyses completed by the CPSMT during initial scoping for this action, one on Pacific sardine and one on Pacific mackerel, that provide background on the development of the existing harvest control rules for actively managed species and an analysis of the potential need for additional buffering of these harvest policies due to scientific uncertainty in estimated biomass. As described in the NS1 guidelines, the SSC will review, and likely revise overtime, the methods used to evaluate scientific uncertainty when making recommendations on the appropriate buffer between OFL and ABC. The alternatives are designed to specify a framework for revision of the management reference points and harvest policies through the annual management cycle.

The simulations presented in Appendix A suggest that only under relatively rare and cooler ocean conditions for Pacific sardine or at relatively risk-averse policy determination by the Council, the existing HCRs in the CPS FMP adequately buffer the stock from overfishing due to scientific uncertainty. However, without the buffering mechanisms proposed under Action Alternatives 3-5, Alternatives 1 and 2 be slightly less risk adverse during years of poor environmental conditions for Pacific sardine or in years where, under the proposed annual framework, the Council chooses a substantially more risk-averse harvest policy.

4.1.1.2 ALTERNATIVES 3-5 (INCLUDING THE COUNCIL-PREFERRED ALTERNATIVE)

The primary effect of the Action Alternatives 3-5 is to formalize the procedures for accounting for uncertainty in managing the harvest of CPS resources with the intent of reducing the risk of overfishing. Under the Council-preferred alternative (Alternative 5) the annual management process could be used for the Council to formally consider policy choices under a P* mechanism or other buffering approach as recommended by the SSC to reduce management reference points to avoid overfishing due to scientific uncertainty. Through this process catch controls that would have direct or indirect impacts could be implemented.

Through the proposed framework under Action Alternatives 3-5, the Council would receive recommendation on the best scientific information available regarding uncertainty from its SSC and would choose a corresponding risk level before adopting annual harvest specifications. This annual assessment of scientific uncertainty coupled with the Council's risk policy choice would result in ABC levels that could not be exceeded. Under certain environmental conditions and/or risk policy choices, harvest strategies under Action Alternatives 3-5 would be lower than those under the No Action Alternative or Alternative 1. Therefore, Action Alternatives 3-5 could have potential beneficial effects on actively managed stocks by providing increased protection against overfishing.

Regarding monitored stocks, the existing default HCRs include a 75 percent reduction from MSY when considering ABC levels. Under all of the Action Alternatives, this buffer can be adjusted through the annual management cycles. Action Alternatives 3-5 perhaps more explicitly state that the magnitude of the precautionary buffer would be based on the advice of the SSC and could be adjusted as appropriate, but this mechanism is not substantially different from the existing management framework and will result in no direct or indirect impacts to monitored stocks. One exception could be the northern subpopulation of northern anchovy. Under all of the Action Alternatives, SDCs for this subpopulation, most notably an MSY–proxy, would be established leading the way to the establishment OFL, ABC, and ACL. This action would result in greater protective measures against overfishing of this stock resulting in beneficial impacts.

Unique to Alternative 5, the Council-preferred alternative is the addition of Council direction to add language to the CPS FMP to specify that the Council consider ecological factors in developing SDCs, ACLs, and ACTs for CPS. The Council did not provide explicit guidance on the application of this provision and it is anticipated that the process will evolve as new information, science, and modeling capabilities become available. The CPSMT has been expanding the SAFE chapter on ecosystem considerations and it is anticipated that the Council's E-FMP process will shed further light on ecological processes of importance to resource management (e.g., predator-prey relationships, habitat use and protection, oceanographic conditions, etc.). This aspect of Alternative 5 will likely have increasingly beneficial impacts to managed stocks as this new information leads to more informed decision making.

4.1.2 PROHIBITED HARVEST SPECIES

None of the alternatives will have direct or indirect impacts to prohibited harvest species (euphausiids or krill) in the CPS FMP. Under each of the alternatives, including the No Action alternative, krill harvest would remain prohibited in any fishery within the West Coast EEZ under the FMP and Federal regulation. The primary interest in determining the stock classification of krill was finding the most appropriate classification for this broad prohibition. Alternative 5 (Council-preferred) proposed to classify krill "in the fishery" as prohibited harvest species, in part, due to language in Section V Response to Comments of the final rule for the NS1 guidelines (74*FR*3178) which states:

"*If a stock contains one of the "in the fishery" characteristics, then it belongs "in the fishery", regardless of the management tools that will be applied to it (e.g., prohibition, bag limits, quotas, seasons, etc.). Also, if the intent is to prohibit directed fishing and retention throughout the exclusive economic zone (EEZ) for which a Council has jurisdiction, then the stock would, most likely, be identified in an FMP as "in the fishery" rather than as an ecosystem component of one particular FMP."*

4.2 Direct and Indirect Impacts on Protected Species and Essential Fish Habitat

4.2.1 Protected Species and Bycatch

Protected species will not be directly or indirectly affected by the alternatives, because the alternatives do not affect the spatial distribution or intensity of fishing activities. Protected species interactions are a function of the timing and location of the managed fisheries, which may be affected by management measures implemented pursuant to the CPS FMP or other applicable law, such as the MMPA and ESA. Therefore, the magnitude of effects described under previous amendments or consultations (see Section 3.3) will not change under any of the alternatives.

Bycatch species will not be directly or indirectly affected by the alternatives, because the alternatives do not affect the spatial distribution or intensity of fishing activities nor do they change the monitoring or disposition of bycatch. As noted in Section 2.2.1, incidental catch and bycatch in CPS fisheries is dominated by other CPS and that bycatch/incidental catch of non-CPS is extremely low. Action Alternative 4 and 5 (Council-preferred) propose adding new EC species to the CPS FMP. A primary role of EC species as specified in NS1 guidelines is to monitor fishery bycatch for its potential role in overfishing practices. The Council's primary intent of adding Pacific herring and jacksmelt is to continue the practice of monitoring the catches of these species and report landings in the annual Stock Assessment and Fishery Evaluation report.

4.2.2 Essential Fish Habitat

No direct or indirect impacts to EFH are expected under any of the alternatives, because the alternatives do not affect the spatial distribution or intensity of fishing activities.

4.3 Direct and Indirect Socioeconomic Impacts

The proposed action is not expected to have substantial direct or indirect socioeconomic impacts, because harvest limits and management measures influencing ex-vessel revenue and personal income are not established under the range of alternatives considered. Instead, the proposed action amends the FMP to revise the framework used in developing management reference points. Under the Council-preferred alternative (Alternative 5) the annual management process could be used for the Council to formally consider policy choices under a P* mechanism or other buffering approach as recommended by the SSC to reduce management reference points to avoid overfishing due to scientific uncertainty. Through this process catch controls that would have direct or indirect impacts could be implemented.

No new or additional reductions or buffers are included in the harvest control rules under the No Action alternative and Alternative 2. Rather these two alternatives rely on the precautions in the exiting harvest control rules and would not result in additional harvest restrictions or socioeconomic impacts.

There are minor potential impacts to West Coast fishing communities and fishery participants associated with Action Alternatives 3-5. The management framework under proposed Action

Alternatives 3-5 provides mechanisms for reductions in setting ABC and ACLs below MSY or OFL levels to account for scientific uncertainty. As described under Section 4.1, these reductions are most likely to occur at the lower bound of the temperature-driven MSY estimates for Pacific sardine or under relatively risk-averse policy choices for Pacific mackerel or Pacific sardine. While this may result in slightly lower short-term revenues to fishermen with the consequent economic effects to fishing communities, the change to the harvest specification framework should provide some longer term socioeconomic benefits associated with a reduced risk of overfishing due to uncertain estimation of appropriate MSY harvest levels.

4.4 CUMULATIVE EFFECTS

4.4.1 EXTERNAL ACTIONS AND ONGOING TRENDS

Actions are defined as regulatory and programmatic activities affecting the operational environment for FMP managed fisheries and the status of related resources. Trends are ongoing changes in baseline conditions that have occurred and may be reasonably expected to continue; these trends can be shaped by either environmental forces (e.g., climate affecting animal populations) or human behavior in the aggregate (e.g., consumption patterns). In identifying external actions that may combine with the effects of the proposed action it is important to consider their temporal aspect. An action may have occurred at some discrete time in the past but resulted in a permanent change in baseline conditions. Alternatively, an action that was initiated in the past may be continuing; this is common for the types of programmatic actions that have the greatest effect on the management system and managed resources. So, although CEQ regulations reference "past, present, and reasonably foreseeable future actions," from an analytical standpoint what is of interest is the net effect on baseline conditions prior to implementation of this action (FMP Amendment 13 and any pursuant regulations) and any ongoing effects of these actions because they continue to exist programmatically. While the direct and indirect impacts of the proposed action may be confined to changes to the management framework with respect to which species are actively managed and the framework for establishing management controls, cumulative effects result from the application of this framework and their combined, incremental impacts on the environment.

External Actions:

- Stock assessments: Stock assessments for actively managed CPS are prepared under the auspices of the Council according to a published terms of reference. Generally, the terms of reference are revised and full assessments are completed and peer reviewed every three years with updated assessments done in the interim years. The Council has recommended a two-year cycle for full assessments in recent years because of assessment uncertainty and the ongoing development of new abundance indices. NMFS agency scientists have taken the lead on recent assessments. Stock assessments provide information on stock status and are the basis for developing conservation measures.
- Conservation measures established by the Council.
- Harvest specifications and management measures established through an annual specifications process: The annual process has been discussed above in relation to direct and indirect effects but may be considered external to the proposed action. This process may be used to set catch limits relative to conservation, socioeconomic, and ecological objectives (e.g., OY) and related management measures.
- Protected species measures: Other applicable law (ESA, MMPA, and others) addresses incidental take of protected species in CPS FMP fisheries. These measures also indirectly affect fishing operations and thus the harvest of target species.

Ongoing Trends:

- Change in the use of ocean areas: habitat protection measures (e.g., MPAs) and offshore projects (e.g., wind and wave power, offshore aquaculture) limiting the area open to fisheries.
- Cyclical and ongoing climate change will affect stock productivity in the northeast Pacific: Cyclical events (ENSO, PDO) and long-term climate change affects the relative productivity of different marine organisms with attendant ecosystem effects.
- Changes in stock status of exploited species: Stock status is a function of fishing mortality and other, non-anthropogenic ("natural") sources of mortality such as climate forcing effects on stock recruitment and stock productivity, and trophic effects on growth and mortality. The status and migration of CPS stocks is dynamic and can fluctuate substantially with environmental conditions.
- Changes to coastal economies and land use: population increase in coastal areas and related growth in non-fishery-related economic activities and land use.
- Increased demand for protein affecting real prices: Population growth and rising living standards globally is likely to increase demand for fishery products. This could lead to price increases unless aquaculture increases supply at lower cost than wild-caught fish and consumers consider the two products substitutable.
- Increased consumer awareness affecting purchasing decisions: Certification and consumer awareness programs may affect buying decisions. Consumers may become more aware of or form opinions about how effectively a fishery is managed both in terms of the status of target stocks and the effect of a particular fishery on other resources (e.g., protected species). Consumer awareness may have a marginal effect on demand for specific products (based on source) over the long term.
- Changes in stock status of protected species: Additional species may be listed under the ESA or changed from threatened to endangered status, which could result in additional mitigation measures for CPS fisheries pursuant to section 7 consultations. Under the MMPA, revised estimates of a stock's potential biological removal (PBR) could prompt mitigation measures for groundfish fisheries. Conversely, if a population recovers it may be de-listed, allowing changes to mitigation measures.

4.4.2 MANAGED SPECIES

The purpose of the proposed action, in addressing revised NS1 guidelines, is to avoid overfishing and manage stocks to optimum yield. Annual stock assessments provide information on the status of actively managed stocks and landings (direct and incidental) of monitored stocks are tracked for changes in fishing pressure. The level of domestic fishing is partly a function of changes in global demand for fishery products. Conservation measures adopted by the Council are intended to manage fisheries against explicit or implicit targets or limits, e.g., F_{MSY}, but are not always effective. The proposed action would be primarily implemented through the existing annual process during which current reference points, including OY, would be evaluated and adjusted if needed. Harvest limits and related management measures could be implemented to address the relative impact of West Coast fisheries.

4.4.3 PROTECTED SPECIES AND ESSENTIAL FISH HABITAT

Protected species impacts are primarily addressed through the ESA, MMPA, and other applicable law. Management measures implemented through the annual CPS process, intended to achieve optimum yield (consistent with the harvest specifications framework of the proposed action), could

indirectly affect the spatio-temporal distribution of fishing effort. Moreover, the migration and abundance of CPS is closely related to oceanographic and ecological conditions that can also affect the spatio-temporal distribution of fishing effort. This in turn affects the likelihood of protected species interactions. During the fishing season, these affects could increase or decrease, depending on the distribution of fishing effort, which is difficult to predict. These potential changes are monitored and evaluated by state and Federal fishery managers to identify any significant change in effect, and to consider whether management actions are needed to decrease the likelihood of these interactions. However, the proposed action alternatives are unlikely to differ from No Action in terms of these effects.

CPS fisheries have limited effects on pelagic EFH and for many directed fisheries the gear rarely contacts the sea floor. The proposed action does not affect the spatial distribution or intensity of fishing activities.

4.4.3 SOCIOECONOMIC ENVIRONMENT

Coastal communities are affected by ex-vessel revenue due to commercial fishery landings. Recreational fisheries provide both market and non-market benefits, and for CPS, are most affected by the quality and availability of CPS as bait. Catches and landings may be affected by changes in the status of the resource and management measures that may constrain or improve commercial and recreational fishing opportunity. In addition, commercial and recreational fisheries are often an important part of a community's social and touristic identity. Coastal development can compete with existing fisheries infrastructure for waterfront access and real estate.

The action alternatives are unlikely to differ substantially from No Action in terms of cumulative socioeconomic impacts. Under all the alternatives (including No Action) achieving optimum yield could require constraining fishing opportunity through the implementation of management measures.

CHAPTER 5.0 CONSISTENCY WITH MSA NATIONAL STANDARDS

An FMP or plan amendment and any pursuant regulations must be consistent with ten national standards contained in the MSA (§301). These are:

National Standard 1 states that 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 proposed action directly addresses National Standard 1 through the revised Guidelines at 50 CFR 600.310. Proposed amendments to the CPS FMP will make the FMP consistent with these guidelines.

National Standard 2 states that conservation and management measures shall be based on the best scientific information available.

The preferred alternative allows for more explicit and consistent consideration of the best scientific information available by allowing the Council to periodically evaluate numerical estimates of MSY, OY and SDC based on the most recent stock assessments or other available information.

National Standard 3 states 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.

The proposed action adds two EC species to the CPS FMP, Pacific herring and jacksmelt. The evaluation in this EA shows that these two species are landed in minimal amounts in CPS fisheries and continued monitoring of these small amounts of catch is sufficient to ensure their conservation at this time. Should catch trends change substantially the Council may consider whether to actively manage them through a subsequent FMP amendment.

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

The proposed action does not include proposal to allocate or assign fishing privileges.

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

The proposed action does not directly affect utilization nor does it allocate fishing opportunity.

National Standard 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

The proposed action does not directly implement management measures, which are established and adjusted through the existing annual process described in the CPS FMP. Nothing in the proposed action would modify this process in a way that would limit the Council's ability to consider differences among fisheries and fishery resources when considering management measures.

National Standard 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

The proposed action is necessary to ensure the CPS FMP is consistent with revised National Standard 1 Guidelines and does not duplicate other measures implemented under the CPS FMP or the Council's other FMPs.

National Standard 8 states 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.

This EA evaluates the socioeconomic effects of the proposed action and found that the effects under the preferred alternative do not differ from No Action.

National Standard 9 states that 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 proposed action implements the EC species designation described in revised National Standard 1 Guidelines. As described in this EA, the EC species designation is intended to facilitate monitoring of bycatch and bycatch mortality.

National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The proposed action does not include any measures affecting the safety of human life at sea.

CHAPTER 6.0 OTHER APPLICABLE LAW

6.1 OTHER FEDERAL LAWS

6.1.1 COASTAL ZONE MANAGEMENT ACT

Section 307(c)(1) of the Federal Coastal Zone Management Act (CZMA) of 1972 requires all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The Council's preliminary preferred alternative would be implemented in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of Washington, Oregon, and California.

6.1.2 ENDANGERED SPECIES ACT

The analysis in this EA finds that species listed under the Endangered Species Act are not likely to be affected by the proposed action.

6.1.3 MARINE MAMMAL PROTECTION ACT

The MMPA of 1972 is the principle Federal legislation that guides marine mammal species protection and conservation policy in the United States. Under the MMPA, NMFS is responsible for the management and conservation of 153 stocks of whales, dolphins, porpoise, as well as seals, sea lions, and fur seals; while the U.S. Fish and Wildlife Service is responsible for walrus, sea otters, and the West Indian manatee.

The analysis in this EA finds that marine mammals are not likely to be affected by the proposed action.

6.1.4 MIGRATORY BIRD TREATY ACT

The MBTA of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished the populations of many native bird species. The MBTA states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource. The MBTA prohibits the directed take of seabirds, but the incidental take of seabirds does occur.

6.1.5 PAPERWORK REDUCTION ACT

The purposes of the Paperwork Reduction Act (PRA) are to minimize the burden of information collection by the Federal Government on the public; maximize the utility of any information thus collected; improve the quality of information used in Federal decision making, minimize the cost of collection, use, and dissemination of such information; and improve accountability. The PRA requires Federal agencies to obtain clearance from the Office of Management and Budget before collecting information. This clearance requirement is triggered if certain conditions are met. "Collection of information" is defined broadly. In summary it means obtaining information from third parties or the public by or for an agency through a standardized method imposed on 10 or more persons. Collection of information need not be mandatory to meet the trigger definition. Even information collected by a third party, if at the behest of a Federal agency, may trigger the clearance requirement. Within NMFS the Office of the Chief Information Officer is responsible for PRA compliance. Obtaining clearance can take up to 9 months and is one aspect of NMFS's review and approval of Council decisions.

The proposed action, as implemented by any of the alternatives considered in this EA, does not require collection-of-information subject to the Paperwork Reduction Act.

6.1.6 REGULATORY FLEXIBILITY ACT

The purpose of the Regulatory Flexibility Act (RFA) is to relieve small businesses, small organizations, and small governmental entities of burdensome regulations and record-keeping requirements. Major goals of the RFA are; (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. An initial regulatory flexibility analysis (IRFA) is conducted unless it is determined that an action will not have a "significant economic impact on a substantial number of small entities." The RFA requires that an IRFA include elements that are similar to those required by EO 12866 and NEPA. Therefore, the IRFA has been combined with the RIR and both are substantially based on the analyses contained in this EA document.

A combined IRFA/RIR will be prepared for any regulations developed to implement the FMP amendment.

6.1.7 EXECUTIVE ORDERS

EO 12866 (REGULATORY IMPACT REVIEW)

EO 12866, Regulatory Planning and Review, was signed on September 30, 1993, and established guidelines for promulgating new regulations and reviewing existing regulations. The EO covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. Section 1 of the EO deals with the regulatory philosophy and principles that are to guide agency development of regulations. It stresses that in deciding whether and how to regulate, agencies should assess all of the costs and benefits across all regulatory alternatives. Based on this analysis, NMFS should choose those approaches that maximize net benefits to society, unless a statute requires another regulatory approach.

E. O. 12866 is intended to enhance planning and coordination with respect to both new and existing regulations; to reaffirm the primacy of Federal agencies in the regulatory decision-making process; to restore the integrity and legitimacy of regulatory review and oversight; and to make the process more accessible and open to the public. These proposed specifications are exempt from review under E.O. 12866.

The National Marine Fisheries Service prepares a Regulatory Impact Review (RIR), which includes an analysis of the economic effects of the preferred alternative actions. One of the purposes of the RIR is to comply with the requirements of E.O. 12866. The RIR is intended to assist the Council in recommending and NMFS in selecting the regulatory approach that maximizes net benefits to the nation. The RIR is contained within the sections of this document and key elements of the RIR are cited below:

● Description of the management objectives: Section 1.2, Purpose and Need

● Description of the fishery: Section 3, Affected Environment

● Statement of the problem: Section 1.2, Purpose and Need

● Description of each alternative: Section 2, Description of Alternatives

● Economic Analysis: Section 3.4 Socioeconomic environment and Section 4.3 Direct and Indirect Socioeconomic Impacts

EO 12898 (ENVIRONMENTAL JUSTICE)

EO 12898 obligates Federal agencies to identify and address "disproportionately high adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States" as part of any overall environmental impact analysis associated with an action. NOAA guidance, NAO 216-6, at §7.02, states that "consideration of EO 12898 should be specifically included in the NEPA documentation for decision-making purposes." Agencies should also encourage public participation—especially by affected communities during scoping, as part of a broader strategy to address environmental justice issues.

The environmental justice analysis must first identify minority and low-income groups that live in the project area and may be affected by the action. Typically, census data are used to document the occurrence and distribution of these groups. Agencies should be cognizant of distinct cultural, social, economic, or occupational factors that could amplify the adverse effects of the proposed action. (For example, if a particular kind of fish is an important dietary component, fishery management actions affecting the availability, or price of that fish, could have a disproportionate effect.) In the case of Indian tribes, pertinent treaty or other special rights should be considered. Once communities have been identified and characterized, and potential adverse impacts of the alternatives are identified, the analysis must determine whether these impacts are disproportionate. Because of the context in which environmental justice is developed, health effects are usually considered, and three factors may be used in an evaluation: whether the effects are deemed significant, as the term is employed by NEPA; whether the rate or risk of exposure to the effect appreciably exceeds the rate for the general population or some other comparison group; and whether the group in question may be affected by cumulative or multiple sources of exposure. If disproportionately high adverse effects are identified, mitigation measures should be proposed. Community input into appropriate mitigation is encouraged.

In support of environmental analyses supporting Council groundfish actions, 2000 census data have been analyzed to identify coastal communities that may be considered low income and/or having a large minority population (PFMC 2004, Appendix A, Section 8.5) and "communities of concern" because their populations have a lower income or a higher proportion of minorities than comparable communities in their region. As discussed in that analysis (PFMC 2004, page 299) the demographic characteristics of ports in urbanized areas may not accurately reflect what groups will be affected by fishery actions. Fishery participants make up a small proportion of the total population in these communities, and their demographic characteristics may be different from the community as a whole. However, information specific to fishery participants is not available. Furthermore, different segments of the fishery-involved population may differ demographically. For example, workers in fish processing plants may be more often from a minority population while deckhands may be more frequently low income in comparison to vessel owners. Because of the limited scope of the proposed action it is unlikely to disproportionately affect low income or minority populations.

EO 13132 (FEDERALISM)

EO 13132, which revoked EO 12612, an earlier Federalism EO, enumerates eight "fundamental Federalism principles. The first of these principles states Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people. In this spirit, the EO directs agencies to consider the implications of policies that may limit the scope of or preempt states' legal authority. Preemptive action having such Federalism implications is subject to a consultation process with the states; such actions should not create unfunded mandates for the states; and any final rule published must be accompanied by a Federalism summary impact statement."

The Council process offers many opportunities for states (through their agencies, Council appointees, consultations, and meetings) to participate in the formulation of management measures. This process encourages states to institute complementary measures to manage fisheries under their jurisdiction that may affect Federally-managed stocks.

EO 13175 (CONSULTATION AND COORDINATION WITH INDIAN TRIBAL GOVERNMENT)

EO 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. At Section 302(b)(5), the MSA reserves a seat on the Council for a representative of an Indian tribe with Federally-recognized fishing rights from California, Oregon, Washington, or Idaho.

Tribal fisheries on sardine may evolve in waters north of Point Chehalis, Washington. The CPS FMP recognizes the rights of treaty Indian tribes to harvest Pacific sardine and provides a framework for the development of a tribal allocation. An allocation or a regulation specific to the tribes shall be initiated by a written request from a Pacific Coast treaty Indian tribe to the NMFS Southwest Regional Administrator at least 120 days prior to the start of the fishing season.

The Makah Tribe sent a letter to NMFS expressing their intent to attain an allocation and to enter the Pacific sardine fishery in 2006. In response, the Council created the Ad Hoc Sardine Tribal Allocation Committee made up of state, Federal, and tribal representatives, to begin work on this issue. If a tribal allocation is established, the non-tribal allocation formula will likely be applied to the remainder of the harvest guideline after accommodation of the tribal fishery.

No tribal letters of intent have been received since 2006, and the Ad Hoc Sardine Tribal Allocation Committee has never met. Therefore, there is no anticipated Tribal allocation for 2011 and the proposed action does not affect fish stocks or fisheries in which Tribes have a substantial participation.

EO 13186 (RESPONSIBILITIES OF FEDERAL AGENCIES TO PROTECT MIGRATORY BIRDS)

EO 13186 supplements the Migratory Bird Treaty Act (MBTA) (above) by requiring Federal agencies to work with the USFWS to develop memoranda of agreement to conserve migratory birds. NMFS consults with USFWS and the protocols developed by this consultation may guide agency regulatory actions and policy decisions. The EO also directs agencies to evaluate the effects of their actions on migratory birds in environmental documents prepared pursuant to the NEPA.

CHAPTER 7.0 RESPONSES TO COMMENTS ON DRAFT ENVIRONMENTAL ASSESSMENT

On June 8, 2011, NMFS published a notice of availability of Amendment 13 to the CPS FMP in the *Federal Register* (76 FR 33189) and requested public comments on the Amendment and draft EA. Additionally, NMFS published a proposed rule to implement Amendment 13 in the *Federal Register* (76 FR 37761) which solicited public comment. Within the public comments received from Earthjustice and Oceana on Amendment 13 and its implementing regulations NMFS received comments related to the draft EA and the NEPA review for this action. In summary, this comment stated that an Environment Impact Statement (EIS) should have been prepared instead of an EA, that a wider range of alternatives should have been analyzed, and that proper scoping or a process for providing public comment did not occur.

The analysis in this EA shows that the implementation and adoption of Amendment 13 will not significantly adversely impact the quality of the human environment. Therefore an EIS is not necessary to comply with NEPA for this action.

With regard to the range of alternatives, NMFS believes a reasonable number of alternatives were analyzed based on the nature of this action. Additionally, the alternatives analyzed were all reasonable alternatives and were all explored and objectively evaluated. NMFS evaluated all reasonable alternatives that meet the purpose and need of the action.

The public had several opportunities to provide input on the development of the proposed action and EA. The Council process, which is based on stakeholder involvement, allows for scoping and public comment on fishery management proposals during Council, subcommittee, and advisory body meetings. Meetings of the Council and its advisory bodies constitute the scoping process, involving the development of alternatives and consideration of the impacts of the alternatives. Specifically the public had opportunity to provide input into this action and EA during the March and November 2009, and March and June 2010, Pacific Council meetings. Additionally, NMFS published a federal notice on June 8, 2011 that announced the availability of the Amendment and draft EA and comments on the draft EA were accepted until August 8, 2011. The public had 60 days to submit comments on the EA. The Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act do not require that a draft EA be made available for public comment.

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APPENDIX A

TO THE

ENVIRONMENTAL ASSESSMENT FOR

AMENDMENT 13 TO THE FISHERY MANAGEMENT PLAN FOR U.S. WEST COAST FISHERIES FOR COASTAL PELAGIC SPECIES TO ADDRESS REVISED NATIONAL STANDARD 1 GUIDELINES

Analyses of the development of the existing harvest control rules for actively managed species

Analyses of the development of the existing harvest control rules for actively managed species

This section is comprised of two analyses completed by the CPSMT during initial scoping for this action, one on Pacific sardine and the other on Pacific mackerel. These two analyses provide background on the development of the existing harvest control rules for actively managed species and an analysis of the potential need for additional buffering of these harvest policies due to scientific uncertainty in estimated biomass. As described in the NS1 guidelines, the SSC will review, and likely revise overtime, the methods used to evaluate scientific uncertainty when making recommendations on the appropriate buffer between OFL and ABC. The alternatives are designed to specific a framework for revision of the management reference points and harvest policies through the annual management cycle.

The following two sections analyze the impacts of the Alternatives to the two species in the Actively Managed category of the CPS FMP. In general, the Alternatives are arranged to build off the existing harvest policies by adding additional buffering for scientific uncertainty and by adding new accountability measures such as ACTs to the CPS FMP management framework. Alternatives 3, 4, and 5 (Council-Preferred) would add a mechanism for identifying and buffering against scientific uncertainty while utilizing the best available science on an annual basis to avoid overfishing. This new management framework is not anticipated to have adverse impacts to managed species relative to Alternative 1 and will likely have positive impacts as estimates of biomass, harvest levels, and uncertainty improve through the annual management cycle.

PACIFIC SARDINE

The harvest control rule (HCR) in the CPS FMP was first implemented for northern anchovy and Pacific mackerel management in the early 1980s (Huppert et al 1980; MacCall et al. 1985; Jacobson and Thomson 1989). The HCR formula for Pacific sardine is specified:

HARVEST GUIDELINE = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION, where:

HARVEST GUIDELINE is the target harvest level for each management year;
BIOMASS is the population biomass of sardine ages 1 and older;
CUTOFF is the threshold below which fishing is prohibited; typically CUTOFF is the overfished threshold but it is 150,000 mt for sardine, 3x the overfished level;
FRACTION is the temperature-dependent exploitation fraction;
DISTRIBUTION is the average portion of the coastwide biomass in U.S. waters, assumed to be 87 percent;
MAXCAT is the maximum allowable catch regardless of biomass. MAXCAT is 200,000 mt for Pacific sardine.

Simulations for evaluating management options for sardine are fully documented in Amendment 8 to the CPS FMP, Appendix B (PFMC 1998). The FRACTION term of the HCR has also been referred to as F_{MSY}, however this is somewhat of a misnomer for sardine because FRACTION levels explored along with other variables (e.g., CUTOFF, MAXCAT) were in some cases lower or higher than 'true' F_{MSY} values. Jacobson and MacCall (1995) examined the relationship between sea surface temperature (SST) and sardine productivity, and their analysis formed the theoretical basis for the temperature-based control rule currently used for management (PFMC 1998). In developing management options for Amendment 8, the relationship between SST and F_{MSY} was reexamined using new simulations that included: 1) time series extended through 1997; 2) different assumptions regarding spawning stock biomass (SSB) (age 1+ instead of age 2+) and age at

recruitment (age 1 instead of age 2); and 3) limited SST from 16.6 °C to 18.1 °C. The relationship from Amendment 8, currently used for management, is described by a second order polynomial equation (Figure 1A), where '*T*' is the 3-season SST at SIO pier.

It is important to note that scientific uncertainty around biomass estimates (stock assessment error) was accounted for in all simulations used to evaluate the sardine HCRs. Amendment 8, Appendix B states:

> *"Simulated biomass estimates used to set quotas in the model were imprecise. Measurement errors for biomass estimates used in the simulations to set quotas were lognormally distributed with arithmetic scale CV equal to 60%. Recent sardine biomass estimates for 1997 had an arithmetic scale CV of about 50% (Hill et al. 1998), so a CV for errors in biomass estimates from stock assessments of 50% was assumed in simulations."*

The Councils' HCR for Pacific sardine is theoretically already robust to errors with respect to biomass estimation. The simulations accounted for scientific uncertainty by applying a CV of 50 percent to biomass in each run, with biomass errors being randomly drawn from a normal distribution with a mean of zero. A CV of 50 percent is higher than that estimated in the SSC's analysis for sardine (CV_{within} = 41%; SD_{within} = 0.39).

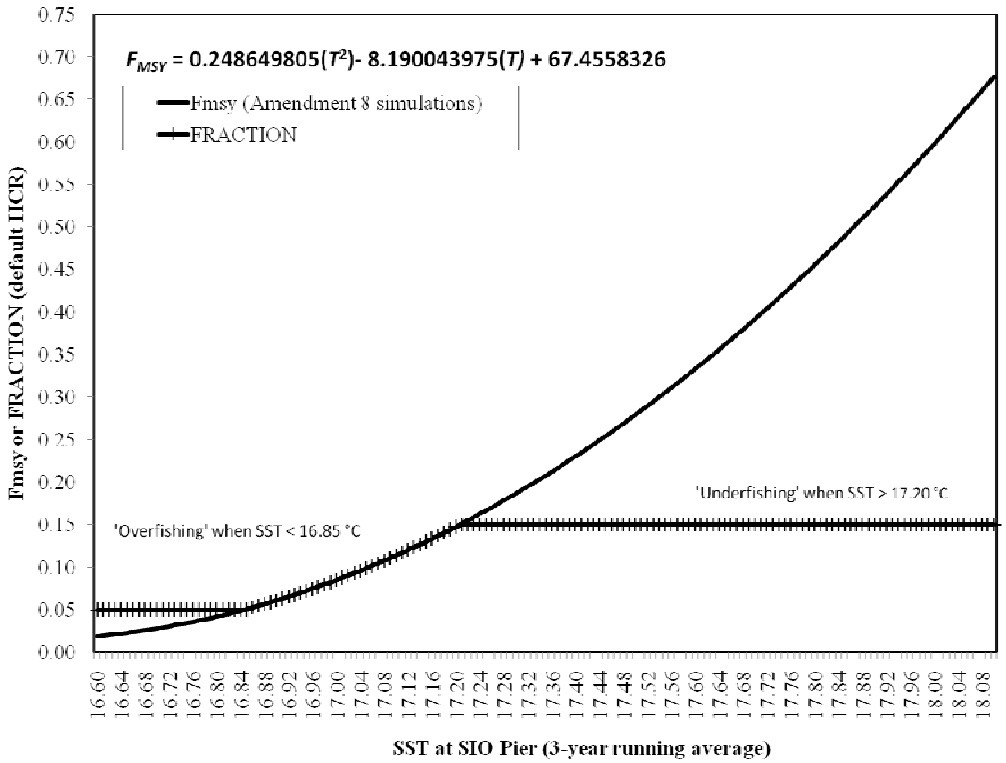

Figure 1A. Relationship between SST (°C) at SIO pier and FMSY for Pacific sardine (solid line). Harvest 'FRACTION' in the PFMC's HCR policy, bracketed between 0.05 and 0.15, is represented by the segmented line. Simulations included SSTs from 1916-19 through 1994-97.

The upper range of FRACTION chosen by the Council was capped at 15 percent, so the control rule currently in place is already more conservative than F_{MSY} when temperature exceeds 17.2 °C. Conversely, the lower bound for FRACTION (5 percent) actually specifies harvest at a rate higher

than F_{MSY} when temperatures are lower than 16.85 °C, a policy that is inconsistent with the NS1 goal of preventing overfishing (Figure 1A).

Accounting for Uncertainty in Pacific Sardine Stock Assessments (P^* and the ABC/OFL 'Buffer')

The revised NS1 guidelines require FMPs to define an OFL, ABC, and ACL for each managed stock. In this plan amendment, each of the new NS1 parameters is compared to HG, the default management approach which includes OY considerations. For Pacific sardine, the values are defined under Alternatives 3-5 as:

OFL = BIOMASS * F_{MSY} * DISTRIBUTION
ABC = BIOMASS * BUFFER * F_{MSY} * DISTRIBUTION
HG = (BIOMASS - CUTOFF) * FRACTION$_{(0.05\text{-}0.15)}$ * DISTRIBUTION
(HG upper bound 'MAXCAT' = 200,000 mt)
ACL = HG or ABC, whichever amount is less

In November 2009, the SSC's Groundfish and CPS Subcommittees presented an approach to account for uncertainty in biomass estimates, both within and among stock assessments. Their approach was further refined and documented for the March 2010 Council meeting (Agenda Item E.4.b., Supplemental SSC Report 1). Three full sardine assessments (Conser et al. 2004, Hill et al. 2007, and Hill et al. 2009) were examined in their analysis, with the following estimates of variation: σ_{total}=0.206; σ_{within} =0.39 (see SSC report Table 2). On first principles variance within cannot be greater than total variance, so the SSC considered σ_{within} = 0.39 to better represent biomass uncertainty for Pacific sardine. Applying σ = 0.39 to the normal probability distribution, a range of uncertainty buffers was obtained, where P^* is the probability of overfishing, and 'Buffer' is the corresponding ratio of ABC/OFL applied to BIOMASS (Table 4.1-1, Figure 4.1-2).

Table 1A. Uncertainty buffers for various P* values when σ = 0.39. See also Figure 4.1-2.

P^*	Buffer (ABC/OFL)
0.50	1.00000
0.45	0.95217
0.40	0.90592
0.30	0.81504
0.20	0.72020

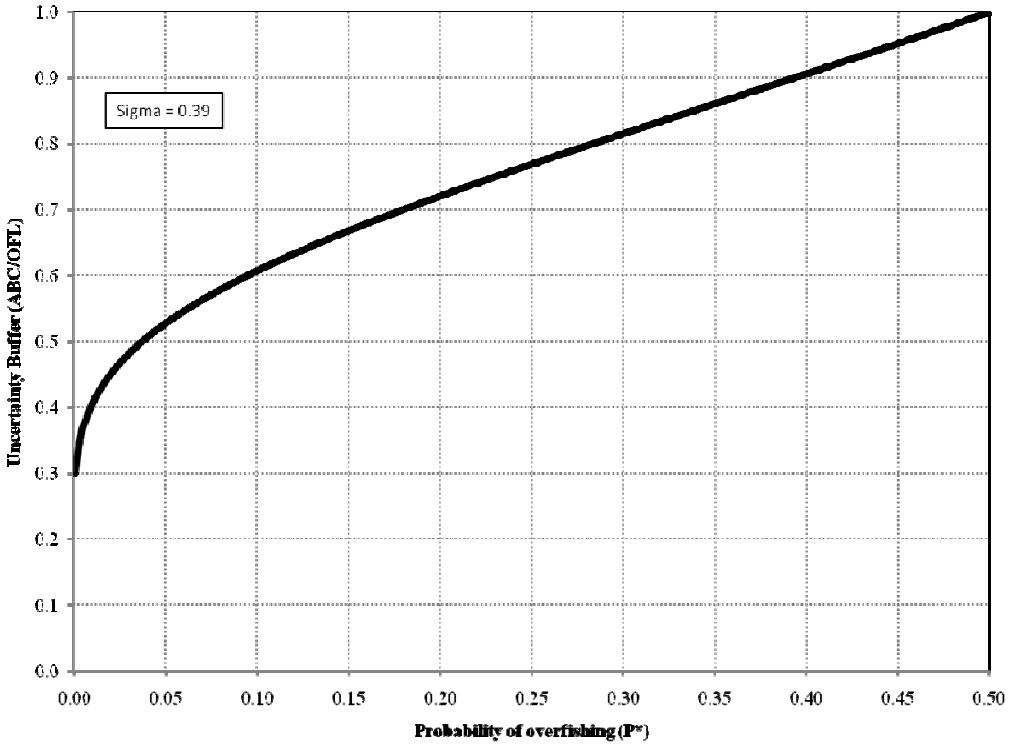

Figure 2A. Relationship between the probability of overfishing (P*) and uncertainty buffers (ABC/OFL) for Sigma=0.39.

Application of the Uncertainty Buffer to Pacific Sardine

Impact of a scientific uncertainty buffer on Pacific sardine harvests will depend upon three factors: 1) the *P** policy chosen by the Council, 2) biomass, and 3) SST. To determine potential impacts of a scientific uncertainty buffer, ABC was calculated for a range of biomass, SST, and *P** policies. Resulting ABCs were compared to default HGs obtained for the same biomass and SST values. ACL is defined as being equal to ABC or HG, whichever value is less, so when the buffered ABC is less than the calculated HG a reduction in catch would occur (negative change from status quo).

The *P** approach proposed by the SSC and implemented herein addresses uncertainty in biomass estimates derived from stock assessment models. As the SSC noted in their March 2010 report (Agenda Item H.2.b), it is quite likely that there is uncertainty in the SST-dependent F_{MSY} function, especially for warmer SSTs. An analysis of uncertainty around F_{MSY} was not practicable for this plan amendment, and there is ongoing research to better define the relationship between the environment and sardine productivity and develop a new index for management. In the interim, the CPSMT recommends constraining the range of temperatures used to calculate OFL and ABC to a some intermediate range of values. One approach currently recommended by the CPSMT and SSC could be to limit OFL and ABC calculations to the interquartile range of SSTs used in the Amendment 8 simulations, which spanned 3-season averages from 1916-19 through 1994-97. The lower quartile SST for this period was 16.61 °C, with a corresponding F_{MSY} of 0.0200. The upper quartile SST was 17.33 °C, with an F_{MSY} of 0.1985.

The relationship between SST and catch (OFL, ABC, HG) is summarized for four biomass levels (high, medium, current, and low) in Figures 4.1-3a-d. During warm conditions (generally, SST > 17.20 °C), default HGs are lower than buffered ABCs. During cooler conditions (e.g. SST < 16.8 °C), default HGs are higher than buffered ABCs and the OFL, so catch reductions would be necessary to

prevent overfishing. The temperature threshold below which catch reductions would occur depends upon both biomass and the *P** policy chosen by the Council. The relationship for current biomass and SST is displayed in Figure 4.1-3c. The HG used for 2010 management (72,039 mt) is well below ABC for buffer policies considered for this analysis, so no catch reduction would occur under present conditions.

The relationship between biomass and catch (OFL, ABC, HG) is summarized for quartiles of SST observed at SIO pier from 1919-1997 (Figures 4.1-4a-c). Under warm conditions, characterized here as the upper quartile of SST (17.33 °C), the default HG is lower than buffered ABC at all biomass levels so no reductions in catch would occur due to application of a *P** policy (Figure 4.1-4a). At median SST (16.98 °C), the buffered ABC is less than the HG at higher biomasses and can be higher than HG at lower biomasses, depending upon the *P** policy of choice (Figure 4.1-4b). For example, when *P** = 0.45 the HG is lower than ABC when biomass is less than 535,000 mt. For P* = 0.40, the HG is lower than ABC when biomass is less than 475,000 mt (Figure 4.1-4b). Under cool conditions (lower quartile SST = 16.61 °C), the buffered ABC is less than HG when biomass is greater than 200,000 mt (Figure 4.1-4c), so catch reductions would occur in most cases.

Assessing catch reductions under a *P** policy for Pacific sardine is a multidimensional problem in that potential impacts will vary with biomass, SST, and the *P** policy of choice. Catch reductions for a range of biomass and SST are displayed in Figures 4.1-5a-d and summarized in Tables 4.1-2a-d. Impacts for *P** policies of 0.45, 0.40, 0.30, and 0.20 are displayed and tabulated on separate pages. Catch reductions are defined as the difference between HG and ABC when ABC is less than HG. As summarized above, impacts of the scientific uncertainty buffer are greatest under highest biomass and coldest SST conditions. Much of the impact under any given *P** policy can be attributed to the application of 'true' F_{MSY} rather than bounding the harvest FRACTION at 5 percent for lower temperatures. The oddly-shaped three-dimensional surfaces shown in Figures 4.1-5a-d are due to interactions between BUFFER, CUTOFF, MAXCAT, and FRACTION vs. F_{MSY} in the calculation of ABC and HG. Catch reductions are averaged for a range of SST and biomass categories in Tables 4.1-2a-d.

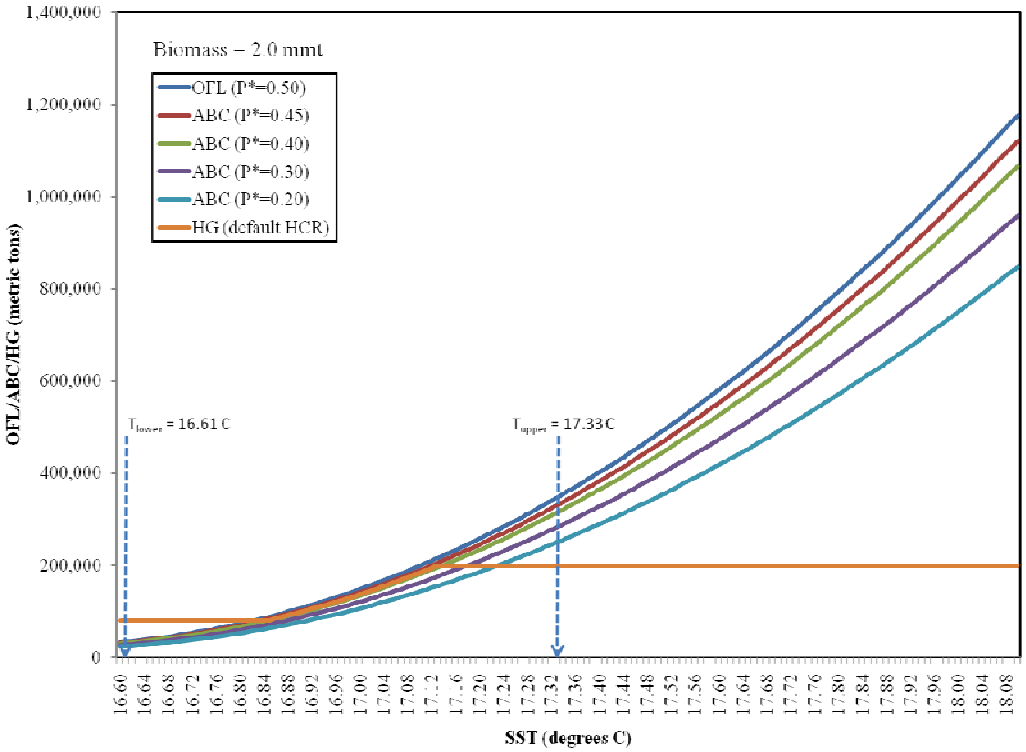

Figure 3A-a. Relationship between SST and catch (OFL, ABC, HG) when biomass = 2.0 mmt..

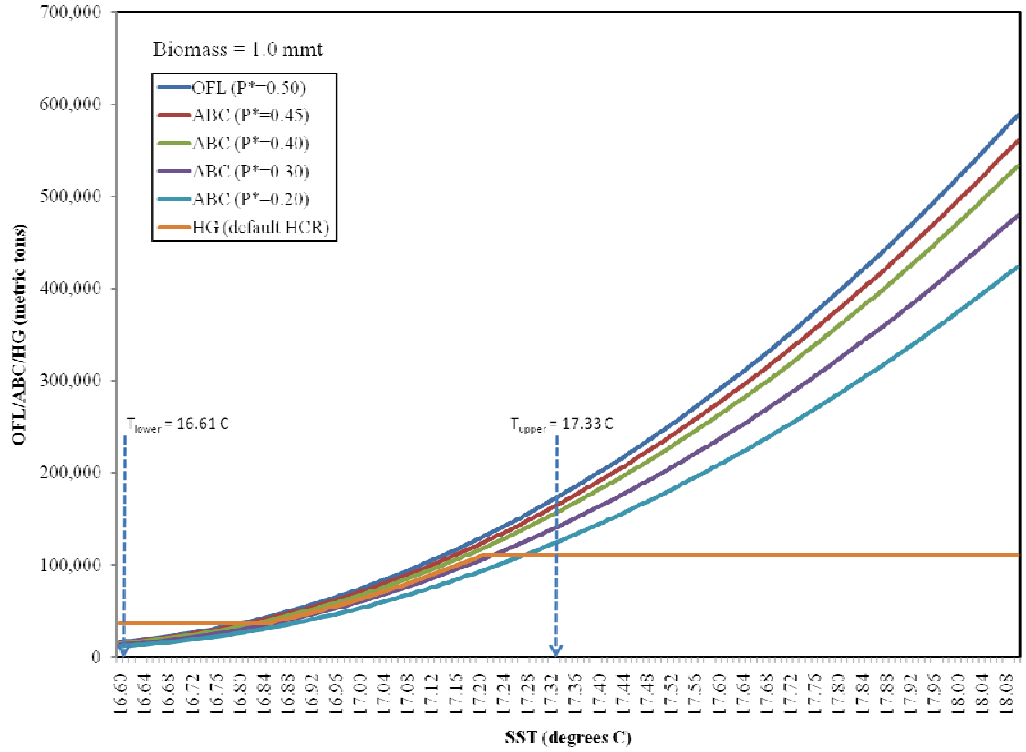

Figure 3A-b. Relationship between SST and catch (OFL, ABC, HG) when biomass = 1.0 mmt..

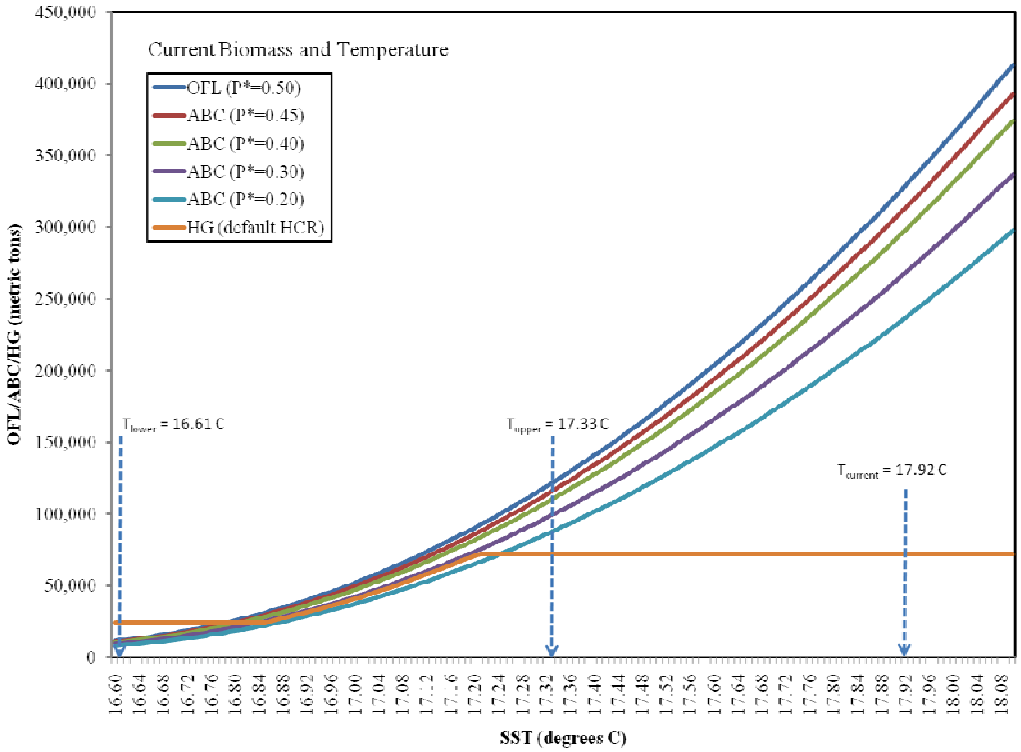

Figure 3A-c. Relationship between SST and catch (OFL, ABC, HG) when biomass = 0.702 mmt (2010 management).

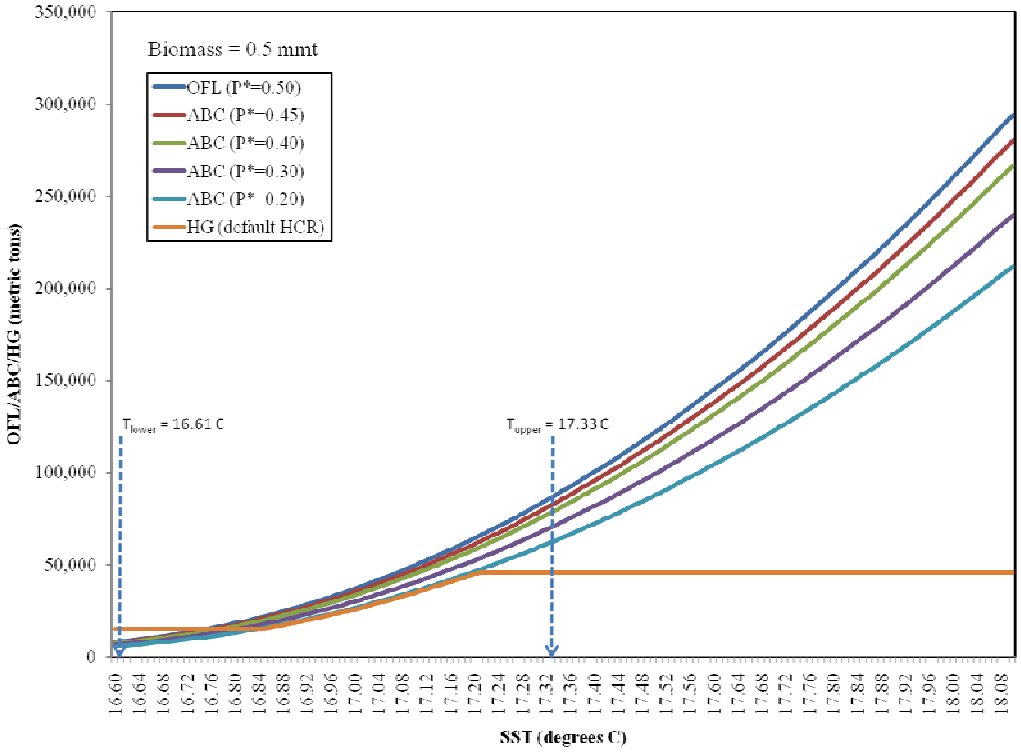

Figure 3A-d. Relationship between SST and catch (OFL, ABC, HG) when biomass = 0.5 mmt..

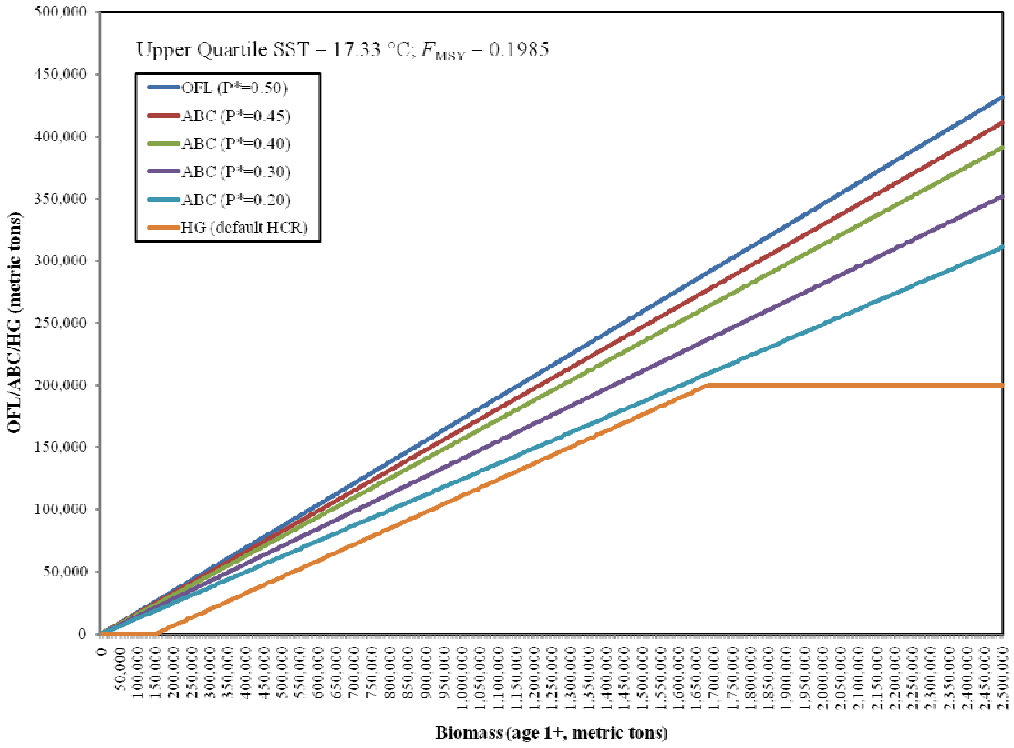

Figure 4A-a. Relationship between biomass and catch (OFL, ABC, HG) for the upper quartile of SSTs observed from 1916 to 1997.

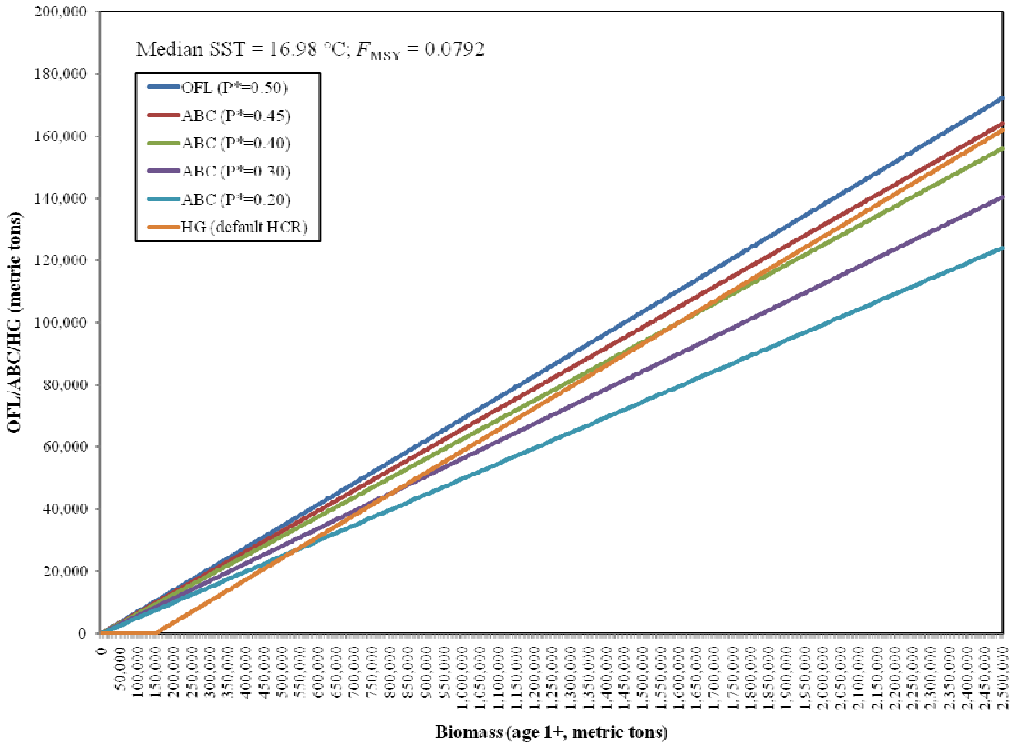

Figure 4A-b. Relationship between biomass and catch (OFL, ABC, HG) for the median of SSTs

observed from 1916 to 1997..

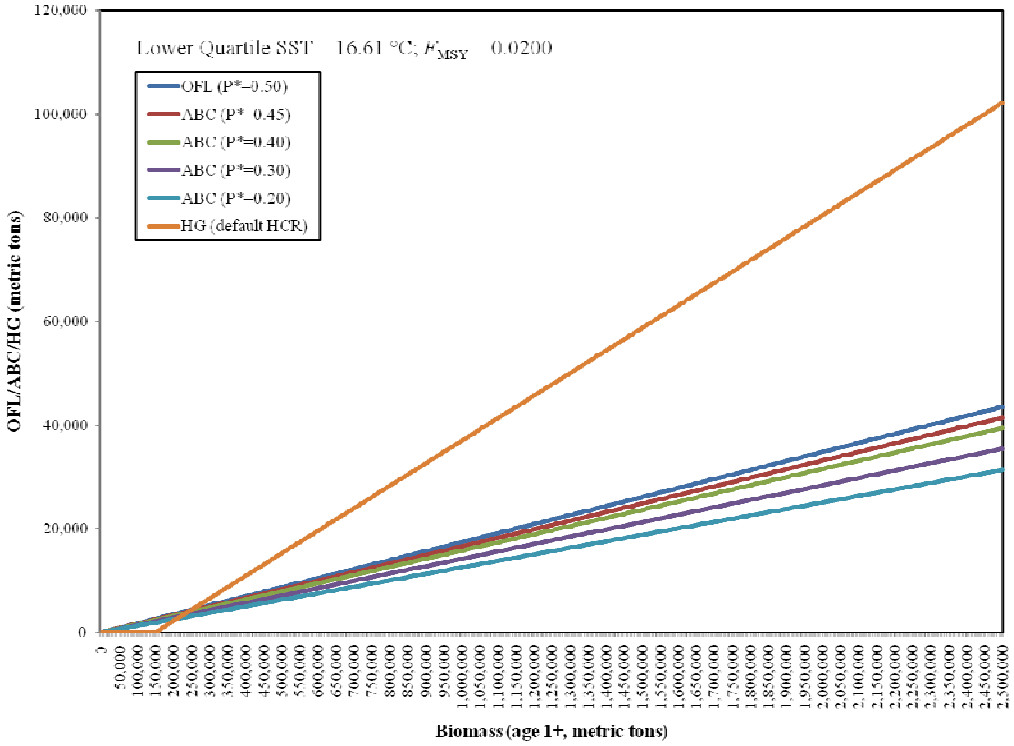

Figure 4A-c. Relationship between biomass and catch (OFL, ABC, HG) for the lower quartile of SSTs observed from 1916 to 1997.

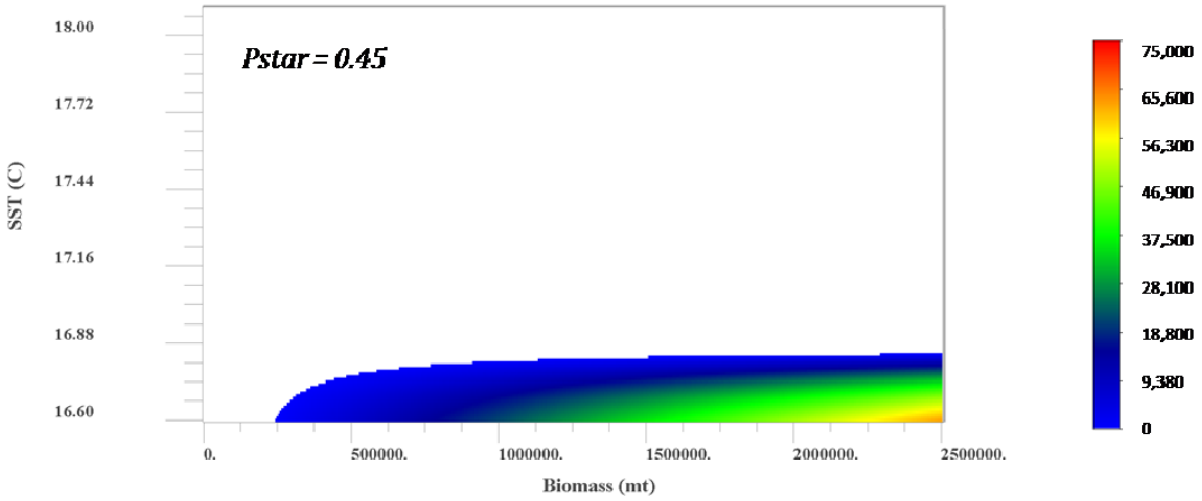

Figure 5A-a. Impact of scientific uncertainty buffer (for *P**=0.45) on sardine catch (mt) for a range of biomass and SST values.

Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 3A. Impact of scientific uncertainty buffer (for *P**=0.45) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.1-5a above).

Catch reductions occur when HG is greater than buffered ABC. Reductions are averaged for each biomass and SST category.

Pstar = 0.45	Biomass range (million metric tons)				
SST range (°C)	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.50
17.31-18.10	0	0	0	0	0
17.20-17.30	0	0	0	0	0
17.10-17.19	0	0	0	0	0
17.00-17.09	0	0	0	0	0
16.90-16.99	0	0	0	0	0
16.80-16.89	0	61	781	1,988	3,330
16.70-16.79	193	5,018	12,688	20,389	28,128
16.60-16.69	1,359	11,946	24,301	36,656	49,073

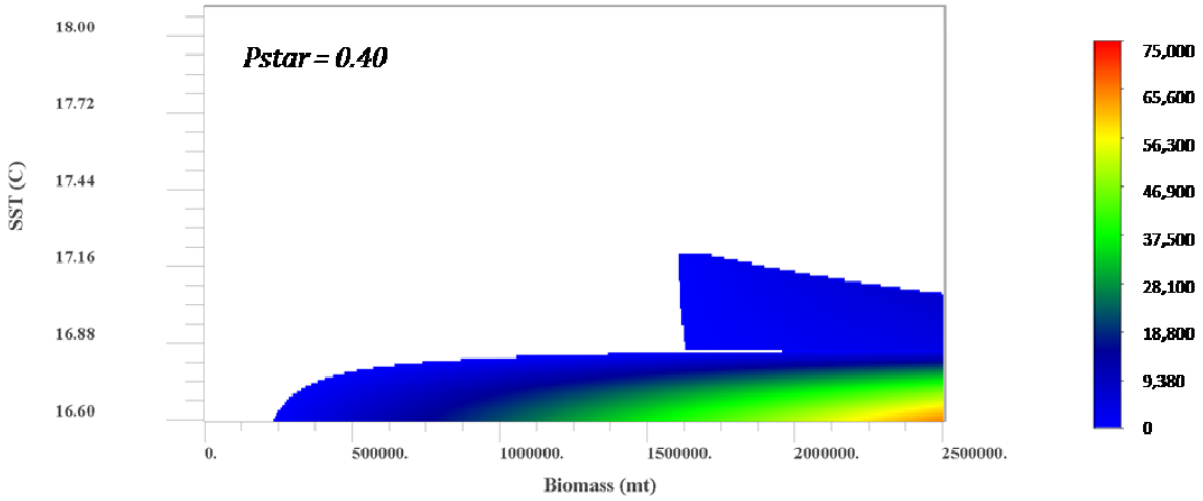

Figure 5A-b. Impact of scientific uncertainty buffer (for *P**=0.40) on sardine catch (mt) for a range of biomass and SST values.

Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 5A. Impact of scientific uncertainty buffer (for *P**=0.40) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.1-5b above).

Catch reductions occur when HG is greater than buffered ABC. Reductions are averaged for each biomass and SST category.

Pstar = 0.40	Biomass range (million metric tons)				
SST range (°C)	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.50
17.31-18.10	0	0	0	0	0
17.20-17.30	0	0	0	15	0
17.10-17.19	0	0	0	1,147	428
17.00-17.09	0	0	0	1,296	4,387
16.90-16.99	0	0	0	949	3,827
16.80-16.89	0	229	1,581	3,742	6,683
16.70-16.79	288	6,012	14,391	22,774	31,199
16.60-16.69	1,521	12,628	25,440	38,251	51,127

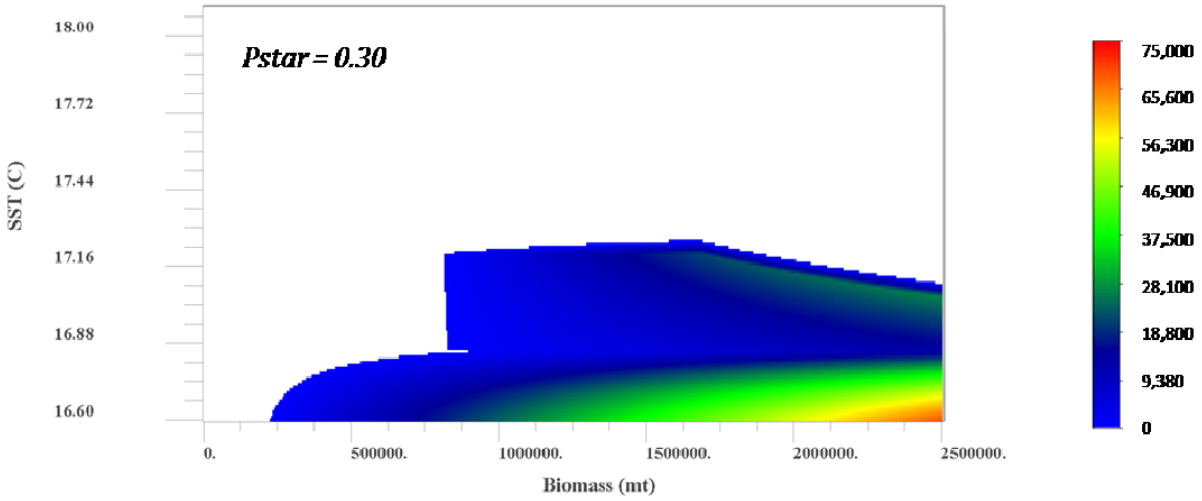

Figure 5A-c. Impact of scientific uncertainty buffer (for *P**=0.30) on sardine catches (mt) for a range of biomass and SST values.

Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 6A. Impact of scientific uncertainty buffer (for *P**=0.30) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.1-5c above).

Catch reductions occur when HG is greater than buffered ABC. Reductions are averaged for each biomass and SST category.

Pstar = 0.30	Biomass range (million metric tons)				
SST range (°C)	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.50
17.31-18.10	0	0	0	0	0
17.20-17.30	0	130	2,681	3,238	0
17.10-17.19	0	720	9,033	17,452	5,427
17.00-17.09	0	546	6,846	14,688	21,126
16.90-16.99	0	399	5,009	10,747	16,513
16.80-16.89	1	1,169	5,608	10,592	15,601
16.70-16.79	558	8,012	17,736	27,460	37,233
16.60-16.69	1,853	13,969	27,677	41,385	55,162

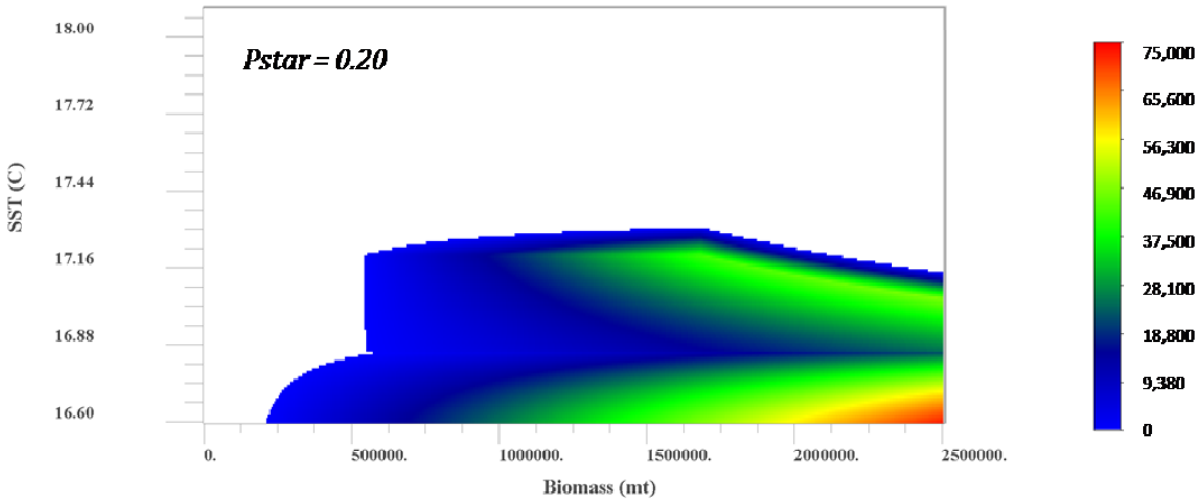

Figure 5A-d. Impact of scientific uncertainty buffer (for *P**=0.20) on sardine catches (mt) for a range of biomass and SST values.

Catch reductions occur when HG is greater than buffered ABC (colored areas). White areas represent cases where HG is less than buffered ABC (i.e. no impact on catch from status quo).

Table 7A. Impact of scientific uncertainty buffer (for *P**=0.20) on sardine catch (mt) for a range of biomass and SST values (per Figure 4.1-5d above).

Catch reductions occur when HG is greater than buffered ABC. Reductions are averaged for each biomass and SST category.

Pstar = 0.20	Biomass range (million metric tons)				
SST range (°C)	0.00-0.49	0.50-0.99	1.00-1.49	1.50-1.99	2.00-2.50
17.31-18.10	0	0	0	0	0
17.20-17.30	0	2,726	13,036	15,352	368
17.10-17.19	0	6,665	22,271	35,980	19,787
17.00-17.09	0	5,051	16,880	28,743	39,222
16.90-16.99	0	3,696	12,350	21,030	29,753
16.80-16.89	45	3,729	10,768	17,821	24,908
16.70-16.79	952	10,105	21,228	32,352	43,531
16.60-16.69	2,214	15,368	30,012	44,656	59,373

Scientific Uncertainty in Biomass Estimates and OY Considerations in the Pacific Sardine HCR

Development of the current HCR for Pacific sardine was part of Amendment 8. The options explored are detailed in Section 4 of Appendix B to Amendment 8. The analyses included 1,000 year simulations for each of the options under consideration. It is important to note that these analyses are theoretically robust to scientific uncertainty errors in biomass estimates because they included CV for errors in biomass of 50 percent which is higher than that recently estimated by the SSC (Agenda Item E.4.b March, 2010). In addition to accounting for scientific uncertainty in biomass estimates, the analysis of potential HCRs and parameters were evaluated for OY considerations. The determination of OY is a decisional mechanism for resolving the Magnuson-Stevens Act's conservation and management objectives, achieving FMP objectives, and balancing the various interests that comprise the greatest overall benefits to the Nation. Several performance measures were utilized to evaluate potential HCRs and parameter values for OY considerations of ecological, social, and economic reasons for CPS fisheries. Appendix B states that in evaluating OY performance measures "biological factors and sustainability are most important". It is recognized that species in the CPS FMP (especially anchovy and sardine at the time of Amendment 8, and euphausiids after Amendment 12) are important as forage for fish, mammals and birds; therefore, measures of CPS biomass were deemed to be key performance measures and were given a higher priority than catch when the Council adopted the current HCR. Thirteen HCR/parameter combinations were evaluated. The sardine HCR that was recommended and ultimately adopted sought to maintain the sardine stock biomass at levels well above those of a single-species MSY based management strategy.

Similarly, social and economic factors were important considerations in evaluating OY for CPS fisheries, thus options for maintaining fishing opportunity and biomass were evaluated. The OY performance measures for ecological, social and economic consideration included:

- Average midyear biomass
- Median biomass
- Average log midyear biomass
- Percentage of years with biomass above 400,000 mt
- Average catch
- Standard deviation of average catch
- Percent of years with no catch
- Average log catch
- Median catch

The results of these simulations were not used to find the "optimal" combination of parameter values in any given HCR, but rather to find HCRs and parameter values that give good results for most of the performance measures. It was noted that results of the simulations should not be regarded as precise, nor were they useful for predicting exact quantities. Indeed uncertainty in results from the model simulations was noted as one of the primary factors in making it difficult to choose among several of the HCRs; the other factor was uncertainty regarding the relative importance of the OY performance measures to policy makers.

Briefly, the average midyear biomass and percentage of years with biomass above 400,000 mt were utilized to give an indication of the relative availability of sardine as forage for marine predators under the different HCRs and parameter values. Midyear biomass and median biomass are also measures of fishery performance over both the long and short term as are average log catch and median catch. Average log catch and average log biomass were used as measures of the degree to

which the HCRs were risk averse. These performance measures and their specific uses in evaluating HRCs are discussed more fully in Appendix 4. Table 4.1-3 is adapted from Appendix 4 and displays the modeled performance measures for the 13 HCR scenarios. The Council adopted Option J, the option with relatively low risk, high mean biomass, and low average catch.

When selecting alternatives for further analysis from among the infinite options for the HCR and the parameters for CUTOFF, FRACTION, and MAXCAT, higher priority was placed on biomass than catch (as measured in terms of average and median) because sardine are a key forage species in California Current Ecosystem.. Yet for social and economic reasons, options with high parameter values for CUTOFF (i.e. 1,000,000 mt) and FRACTION (95 percent) were modeled, but not included in the final set of options. Also, for social and economic reasons, the MAXCAT values were selected to allow substantial harvest and revenues when sardine are abundant without risk to the stock, without generating extreme variability in harvest, and without encouraging overcapitalization. Fisheries biologist Dr. Richard Parrish, who evaluated simulation model outputs for Amendment 8 wrote in a letter to the Council in May 2008 (Agenda Item G.1.d June 2008), "The rationale for the CPSMT's recommended HCR was dominated by a concern for maintaining the sardine stock at population levels well above that which would occur with a single-species, MSY-based management strategy. In fact, the principal basis for the present [HCR] was to maintain a large population of sardine due to their importance as forage." Clearly, OY considerations were of primary importance even in selecting the range of options for further analysis. The options that were fully examined are listed below (Table 8A).

Table 8A Adapted from Amendment 8 App. B, Table 4.2.5-1. 1/

Option	A	B	C	D	E	F	G	H	I	**J**	K	L 2/	M 3/
Control Rule Parameters													
FRACTION (%)	20	F_{MSY} (10-30)	20	F_{MSY} (10-30)	F_{MSY} (10-30)	F_{MSY} (5-25)	F_{MSY} (5-15)	F_{MSY} (5-15)	F_{MSY} (5-25)	F_{MSY} (5-15)	F_{MSY} (10-30)	12	8.8
CUTOFF	50	50	100	100	100	100	100	100	100	150	50	0	0
MAXCAT	400	400	400	400	300	400	400	300	300	200	200	Infinite	Infinite
Performance Measure													
Average Catch	151	159	165	171	165	177	179	169	169	145	141	180	170
Std. Dev. Catch	137	140	140	143	113	143	133	105	112	67	72	180	153
Mean Biomass	936	964	1,073	1,091	1,280	1,216	1,543	1,665	1,400	1,952	1,516	1,408	1,784
StdDev Biomass	27	27	29	28	34	32	39	42	37	49	43	39	43
Mean Log Catch	4.33	4.46	4.44	4.54	4.64	4.62	4.77	4.80	4.70	4.76	4.65	4.72	4.77
Mean Log Biom	6.24	6.37	6.50	6.59	6.75	6.74	7.06	7.15	6.89	7.34	6.87	6.89	7.24
Yrs. Biomass>400	61%	64%	70%	73%	79%	81%	90%	92%	84%	96%	79%	84%	93%
Years No Catch	5%	2%	7%	4%	3%	2%	1%	0%	1%	0.5%	1%	0%	0%
Median Catch	103	104	119	121	148	131	140	156	158	182	188	128	127
Median Biomass	598	600	700	748	898	850	1,248	1,349	1,048	1,648	1,099	1,500	1,049

1/ **Option J adopted** Overfishing Definitions for all Options: Overfishing Rate is Catch > ABC, Overfished threshold is 50,000 mt.
2/ Stochastic F_{MSY}
3/ Determ. Equil. F_{MSY} in a Stochastic Model

After examination of the simulation results and evaluating the OY considerations for 13 options the Council chose the following HCR for Pacific sardine:

$$HG = (BIOMASS - CUTOFF_{(150{,}000\ mt)}) * FRACTION_{(0.05\text{-}0.15)} * DISTRIBUTION$$
(HG upper bound 'MAXCAT' = 200,000 mt)

This HCR was the most conservative HCR considered and resulted in the highest biomass (both mean and median), the highest percentage of years with a biomass >400,000 mt. This HCR also

produced nearly the lowest percentage of years with no catch and highest median catch of the HCRs considered. It is clear the HCR for sardine was selected for OY considerations. This HCR has been in place since 2000 and has served well as a management target for Pacific sardine.

The new NS1 guidelines state, "The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing." The CPSMT and SCC have had ongoing discussions about quantifying the degree to which the current sardine HCR adequately prevents overfishing given the scientific uncertainty in biomass estimates resulting from stock assessments. In November 2009 the SSC proposed a method for quantifying scientific uncertainty in biomass estimates, both within and among stock assessments, and refined their approach for the March 2010 Council meeting (Agenda Item E.4.b., Supplemental SSC Report 1). The SSC suggested that Sigma = 0.39 be utilized to characterize scientific uncertainty in biomass estimates for sardine, and that the CPSMT calculate OFL and the resultant ABCs as a function of P*, SST, and biomass.

The HCR for sardine is unique in that it incorporates an environmental variable, SST. There is evidence that sardine stocks go through extended periods of approximately 60 years of high and low biomass and have done so for approximately 2,000 years, even in the absence of fishing (Baumgartner et al. 1992). Environmental factors are thought to play a key role in these biomass fluctuations but the mechanism(s) driving the fluctuations are not presently well understood. Sea surface temperature (SST) was one environmental factor identified to have a relationship with sardine productivity (Jacobson and MacCall, 1995). The relationship between SST, sardine productivity and F_{msy} was reanalyzed during the development of the current sardine HCR . SST measured at Scripts pier in California was incorporated in the HCR as a determinate of the FRACTION term in the temperature-based sardine HCR. Upper and lower bounds of FRACTION, 0.15 and 0.05, were placed on the temperature-dependent F_{msy} values (PFMC 1998). In the simulation experiments, temperature data and reproductive success were related functionally and autocorrelated such that years of good and bad recruitment occurred on a decadal time scale. Additionally a weak 60-year temperature cycle was incorporated into the simulation work. It was noted during the development of the sardine HCR that refining the nature of the relationship between environmental factors and sardine productivity was a topic for further research. The SSC also noted that uncertainty exists in the SST relationship. Research on the relationship between environmental factors and sardine productivity is still ongoing. If and when a better environmental index is identified the sardine HCR can be modified without an amendment to the FMP.

In comparing the HCR, the CPSMT utilized the following formulas for OFL and the P* buffered ABC:

OFL	BIOMASS x F_{msy} x DISTRIBUTION
ABC	(BIOMASS x BUFFER) x F_{msy} x DISTRIBUTION

The full analysis revealed scenarios in which P* buffering would be required during regimes with lower SSTs; where the HCR would need additional buffering at low temperatures. Temperatures at Scripps pier have been relatively warm during the period that the HCR has been in effect. A comparison of the result of the HCR output with proposed calculations for OFL and ABC for the time period may be helpful in examining how well the HCR accounts for both scientific uncertainty and OY considerations.

Table 9 presents historic biomass estimates and management output of the HG for the years 2000-2010 and compares these results to the proposed calculations for OFL and the resulting ABC values under various P* choices. The CPSMT recommended constraining the use of the temperature derived F_{msy} to values below the upper quartile of SST values examined (F_{msy}=0.1985 at SST = 17.33^{o}C) when used to calculate OFL and an ABC buffered for scientific uncertainty in biomass estimates using the P* method proposed by the SSC (Table 4.1-4). The current HCR has not exceeded the ABC even at P* buffer levels = 0.20 (20 percent chance of overfishing) during the time it has been in place. Note also that OFL and ABC calculations for some years exceed the MAXCAT of 200,000 mt that is part of the HCR, again demonstrating the OY considerations that are part of the current HCR. Given these analyses the CPSMT concluded that the current HCR has prevented overfishing and should continue to serve as the annual management target or ACT under the new NS1 guidelines unless the ABC calculated using the P* approach falls below the output of the HCR.

Table 9A. 2000 – 2010 Harvest Guideline (HG) output of current Pacific sardine Harvest Control Rule, Overfishing Limit (OFL), and Acceptable Biological Catch (ABC) at various P* values to buffer for scientific uncertainty at varying levels using Sigma = 0.39.

OFL and ABC are calculated using temperature dependent F_{msy} from Jacobson and MacCall (1995) constrained to values below the upper quartile value of sea surface temperature examined.

Management Year	Biomass from Stock Assessments	Fmsy (contrained)	Fraction	HG from HCR	OFL	ABC for P*=.45	ABC for P*=.40	ABC for P*=.30	ABC for P*=.20	ABC(P*=0.20) - HG
2000	1,581,346	0.1985	0.15	186,791	273,091*	260,029*	247,398*	222,580*	196,680	9,889
2001	1,182,465	0.1985	0.15	134,737	204,206*	194,439	184,994	166,436	147,069	12,332
2002	1,057,599	0.1985	0.15	118,442	182,642	173,906	165,459	148,861	131,539	13,097
2003	999,871	0.1985	0.15	110,908	172,673	164,414	156,428	140,735	124,359	13,451
2004	1,090,587	0.1985	0.15	122,747	188,339	179,331	170,620	153,504	135,642	12,895
2005	1,193,515	0.1985	0.15	136,179	206,114*	196,256	186,723	167,991	148,443	12,264
2006	1,061,391	0.1985	0.15	118,937	183,297	174,530	166,052	149,394	132,010	13,073
2007	1,319,072	0.1985	0.15	152,564	227,797*	216,902*	206,366*	185,664	164,059	11,495
2008	832,706	0.1985	0.15	89,093	143,804	136,926	130,275	117,206	103,568	14,475
2009	662,886	0.1985	0.15	66,932	114,477	109,002	103,707	93,303	82,446	15,514
2010	702,024	0.1985	0.15	72,039	121,236	115,437	109,830	98,812	87,314	15,275

*Note that OFL and some ABCs are greater than the MAXCAT value of 200,000 mt used in the HCR.

PACIFIC MACKEREL

As is presented for Pacific sardine above, the general form of the harvest control rule (HCR) in the Coastal Pelagic Species Fishery Management Plan (CPS-FMP) was first implemented for management of northern anchovy and Pacific mackerel in the early 1980s (Huppert et al. 1980; PFMC 1983, 1990; MacCall et al. 1985; Jacobson and Thomson 1989). The formula for Pacific mackerel is:

HARVEST GUIDELINE = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION, where

HARVEST GUIDELINE is the target harvest level for each management year;
BIOMASS is the population biomass of fish ages 1 or older;
CUTOFF is the threshold below which fishing is prohibited (also the overfished threshold = 18,200 mt);
FRACTION is an F_{MSY} proxy (an exploitation fraction = 30 percent); and
DISTRIBUTION is the distribution of the stock, on average, in USA waters (70 percent).

MacCall et al. (1985) conducted an analysis for evaluating management options for Pacific mackerel in the early 1980s (pertinent statistics and discussion are also presented in *Amendment 8 to the CPS-FMP*, Appendix B (PFMC 1998). Since the inception of the HCR, the HARVEST term has been defined as a Harvest Guideline (essentially equivalent to an ABC), but is more akin to an ACL in terms of the required statistics stipulated in the 2006 Magnuson-Stevens Reauthorization Act. The CUTOFF parameter is intended "to provide a buffer of spawning stock biomass that is protected from fishing and available for use in rebuilding if a stock becomes overfished" (PFMC 1998). The FRACTION term has also been referred to as F_{MSY} (i.e., a proxy for the fishing level that produces MSY). However, it is important to note that the F_{MSY} parameter in this regard should not be considered a strict MSY-based term, given it is based on analysis that considered a suite of exploitation rates in combination with a fixed CUTOFF value and alternative models of stock-recruitment (S/R) compensation, with the current F_{MSY} = 30 percent based largely on qualitative decisions concerning the 'best' rate for management over a long-term horizon.

The following sections describe important aspects of the simulation that addressed management options for the Pacific mackerel stock (MacCall et al. 1985).

The fishery opened from 1929-69, closed from 1970-76 (due to low estimated abundance), and re-opened in 1977 (due to increased abundance). Fishery harvest was substantially higher during the 1980s and 1990s than during the 2000s. Pacific mackerel population dynamics (biology, distribution, abundance, etc.) are highly variable, which necessarily hinders robust model development, as well as long-term (equilibrium-based) recommendations regarding appropriate exploitation strategies. The temporal pattern of reproductive success was cyclical, with high points in a recruits per spawning biomass trend following a 5-10 year cycle. The historical relationship between spawners and recruits (S/R) was also highly variable, with strong recruitment years happening rarely, approximately every 50 years or so. The most recent strong recruitment period occurred in the 1970s and early 1980s. Recruitment strength was much less variable when spawning biomass exceeded 100,000 mt.

Abundance (age-specific) estimates using cohort analysis for the time period 1929-84 assumed F to be 0.3-0.5/year and the selectivity (i.e., availability to the fishery) of the oldest (age 4) and plus (age 5) age groups was assumed to be fully and equally available to the fishery (i.e., F-ratio = 1). The *potential productivity* of the stock was investigated via simulations involving alternative S/R models and results generated from the cohort analysis. In other words, simulated average SSB estimates were compared to historical estimates.

The overall simulation preserved the history of reproductive success, and two null models (i.e., 'states of nature') were considered. One assumed constant reproductive success (based on historic reproductive

success without modification), and one assumed a constant recruitment (based on historical recruitment estimates used without modification). Other elements of the simulations included:

- The two extremes provide a reasonable bound for the estimated productivity of the stock;
- Intermediate compensation was represented as a suite of modified Ricker S/R relationships;
- Average harvests were compared over a 40-year time frame, given the HCR and suite of alternative S/R compensation assumptions; and the comparison ultimately examined the set of harvest formulas consisting of various FRACTIONS, given a CUTOFF = 18,144 mt;
- The average annual yields were consistent between FRACTIONS from 0.2 to 0.25 (however, see additional sensitivity analysis below);
- The influence of different assumed models of compensation (S/R) was minimal;

Sensitivity analysis considered HARVEST in concert with varying CUTOFFs and FRACTIONs, and included the following elements:

- Estimated HARVEST (via yield isopleths) indicated higher CUTOFFs required higher FRACTIONs to maximize yield;
- Standard deviation of estimated HARVEST increased with larger FRACTIONs, but nearly independent of the range of CUTOFFs considered;
- Resource 'collapse' was not associated with positive CUTOFFs, which inherently protected the stock's ability to rebound from low abundance levels;
- FRACTIONS between 0.2 to 0.3 were the most robust in terms of similarities in estimated simulated SSB and the historical average;

Examination of the management strategy required consideration of *both* interacting components of the policy (the HCR and the abundance estimates used to implement it).

- In terms of the CUTOFF, "there is little reason to change the present *cutoff* level of 18,144 mt (i.e., currently, 18,200 mt is used), given this level provides sufficient protection from severe depletion while allowing a fishery in nearly all years";
- In terms of the FRACTION, "it is more amenable to change, given the simulations indicated that a higher *fraction* is likely to increase average yield up to a maximum of about 29,000 mt/year at a *fraction* of 0.28";
- In terms of a harvest policy adopted in other fisheries globally, such as $F_{0.1}$ (as the proxy for F_{MSY}), would translate to a $FRACTION_{0.1} = 0.24$;
- In terms of bottom-line advice, "the effective *fraction* must be considered to be somewhat larger than the nominal *fraction* wording of the official management policy" (i.e., at that time 0.20).

An HCR has been in place since 1978, with an initial FRACTION of 20 percent. This initial HCR was not based on extensive fishery analysis, yet provides a perspective for the evaluation of the formula in concert with a range of alternative management measures. Between the late 1980s and early 1990s, the California Department of Fish and Game (CDFG) increased the FRACTION from 0.2 to 0.3 and added the DISTRIBUTION parameter to the overall HCR, i.e., strictly state-based (California) management law transitioned to Federal law in the late 1990s.

Based on the above analysis and recent stock assessment efforts, the CPSMT generally supports the current form of the HCR as a reasonable exploitation strategy that provides stable yields to the fishery, while not jeopardizing the long-term sustainability of the stock. However, further deliberations will likely be necessary to ensure consensus is realized as methods/policies are developed to meet the new requirements.

Application of the uncertainty buffer to Pacific mackerel was generally similar to that presented above for Pacific sardine, with the exception that a fixed FRACTION (F_{MSY} proxy) was employed in the HCR (as

stipulated in the current FMP for this species) and related uncertainty analysis. Tables 4.1-5 and 4.1-6 and Figures 4.1-6 and 4.1-7 are based on guidance from the Scientific and Statistical Committee (SSC) for addressing scientific uncertainty and stipulations in the MSRA. Finally, Table 4.1-5 provides a useful summary of catch reductions pertaining to a suite of 'probability of overfishing' (*P**) levels and estimated biomass (*B*), based on the current HCR for Pacific mackerel, i.e., catch is reduced when the HG (default HCR) is greater than the buffered ABC, otherwise, no reduction in catch is required.

Table 10A. Probability of overfishing (*P**) and associated 'buffers' for Pacific mackerel.

Based on σ-total = 0.411 (SSC 2010).

P*	**Buffer (ABC/OFL)**
0.50	1.0000
0.45	0.9497
0.40	0.9011
0.30	0.8061
0.20	0.7076

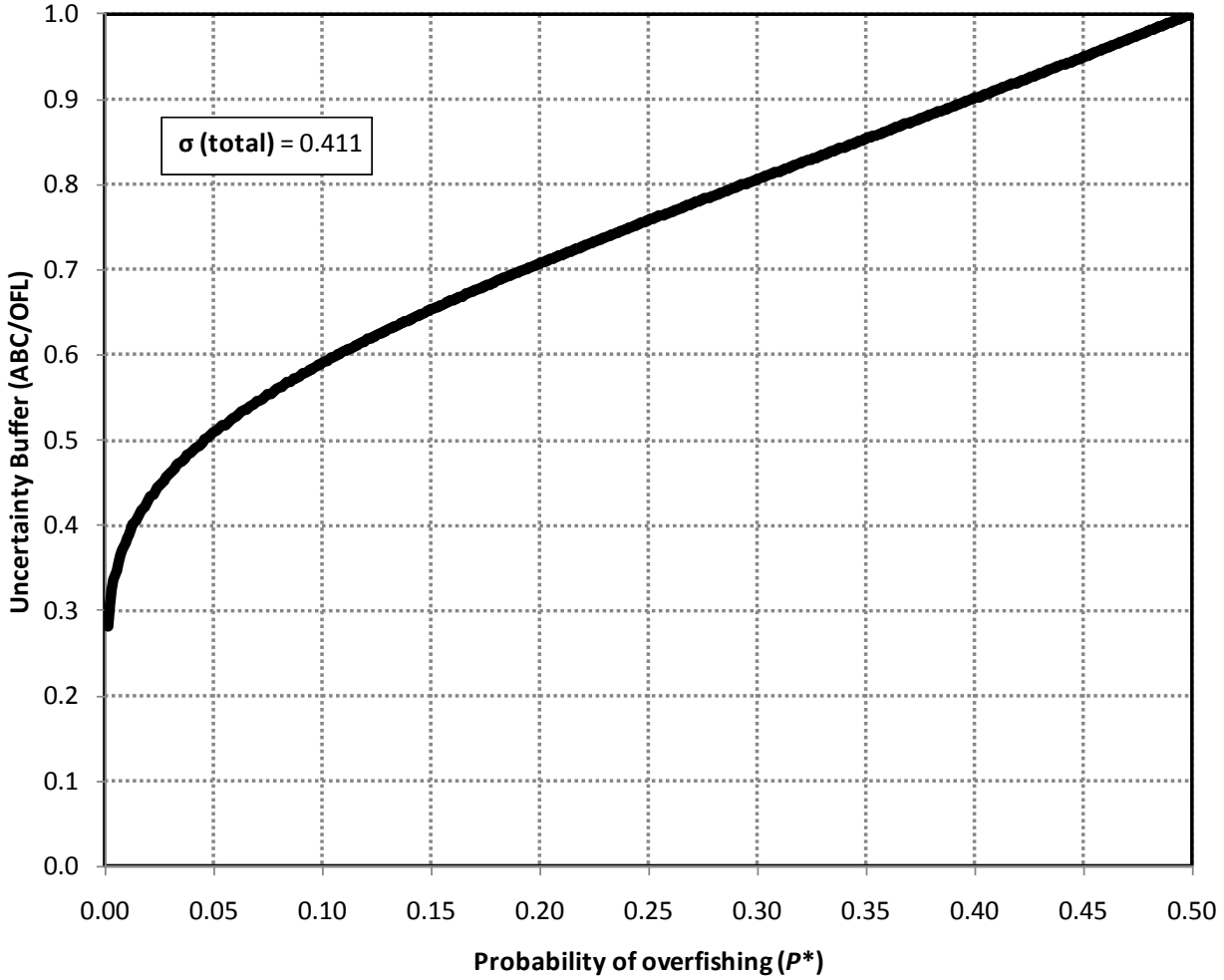

Figure 6A. Relationship between Probability of overfishing (*P**) and associated 'buffers' (ABC/OFL) for Pacific mackerel. Based on σ-total = 0.411 (SSC 2010).

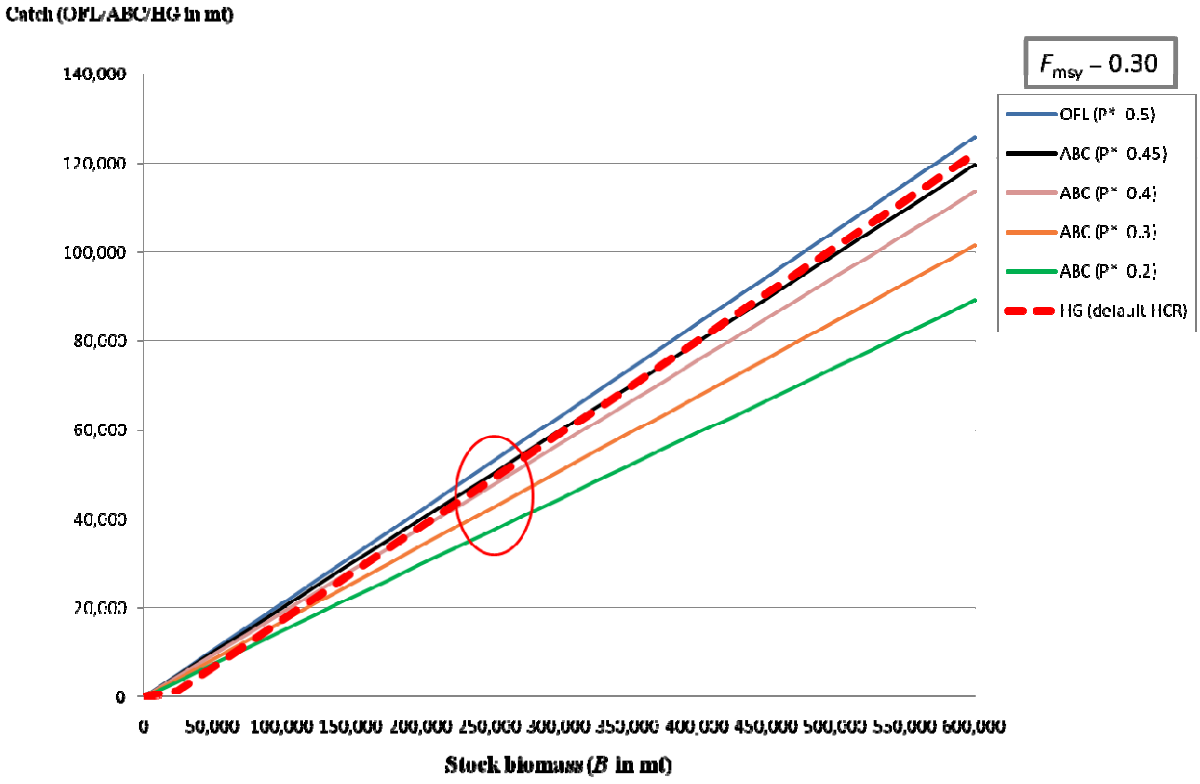

Figure 7A. Relationship between stock biomass (*B* in mt) and catch (OFL, ABC, HG in mt) across a range of probability of overfishing (*P**) levels, based on a FRACTION (F_{MSY} proxy) equal to 0.3. Recent estimated biomass (*B*) is denoted by red oval.

Table 11A. Impact of probability of overfishing values (*P**) on Pacific mackerel catch (mt) for different biomass (*B*) values.

Catch reductions occur when the HG is greater than the buffered ABC, otherwise, catch reduction is zero (e.g., for *P**=0.40 and *B*=300,000 mt, the catch reduction=2,408 mt). Recent levels of *B* are presented in bold (200,000 to 300,000 mt).

	B (1,000s mt)				
*P**	100	**200**	**300**	400	500
0.50	0	0	0	0	0
0.49	0	0	0	0	0
0.45	0	0	0	406	1,463
0.40	0	331	2,408	4,485	6,561
0.30	250	4,321	8,393	12,464	16,536
0.20	2,319	8,460	14,601	20,741	26,882